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On Comenius' Concept of 'Spritus' in his *Physicae Synopsis*

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Essai sur le Concept 'Esprit' de Comenius dans son écrit "Physicae Synopsis"

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Résumée

Il serait très surprenant pour tout le monde de savoir que après la Physique de Comenius, les grenouilles (*ranae* en latin), étant spontanément générés dans les nuages, puis tombent avec la pluie. Une telle génération spontanée, une idée extraordinaire et désavouée aujourd'hui, est faite en vertu de 'esprit' (spiritus), selon Comenius (*Physicae Synopsis*, la première édit., 1633). Cet esprit universel est aussi dit 'spiritus vitae', i. e. esprit de la vie, étant non seulement un formateur de tous les espèces des organismes, mais aussi un principe génératif de pierres, minéraux et metaux. Il est impossible, par contre, de penser que dans les écrits — "Janua" seconde, "Atrium" et "Schola Ludus" — qui sont décrits, selon Comenius, à Sárospatak en Hongrie (1651 - 54), les chapitres concernant les phénomènes naturels seraient écrits par Comenius lui-même. Car leur auteur ou auteurs n'a pas la conception de la 'ubiquitas' ou d'omniprésence du esprit, et le concept 'spiritus' dans *Janua seconde* est, franchement parlant, différent de celui dans *Physicae Synopsis*.

Mots-Clés : *Physicae Synopsis de Comenius, esprit (spiritus), propriété littéraire*

Key Words **:** *Physicae Synopsis by Comenius, spirit (spiritus), authorship*

Preface

Most people would be amazed at the following sentence of Comenius' : Frogs fall from the heaven with the rain. They are, he insists, formed in the clouds by virtue of 'spirit.' In this case are the frogs "spontaneously" generated, whereby the spirit is the former (plasmator) which is to transform the material (e. g., of the frogs) into the specific form of a thing. Those who believe that Comenius is a religious and pious, but at the same time scientific, would not want to attribute this astounded opinion to Comenius. Whether he is scientific or not ? — this question could be solved at the end of this paper. It is more important to answer how he reached this opinion.

The concept 'spirit' appears almost everywhere in the

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book "Physicae Synopsis" (hereafter PhS or *Physica*) of Comenius. The concept Comenius makes so frequently use of is *originally* introduced from his interpretation of Mosaic creation myth, neither based on his experiments nor observations on the natural phenomena, nor induced from some theories of other physicists.

Though Comenius owed his theory to his contemporary physicists, such as Sennert,[1] his point of view was already pre-fixed or pre-determined by the creatio-"myth" related in the first part of *Genesis*. This "myth" is, I should warn you, not simply a myth for Comenius, but a real story.

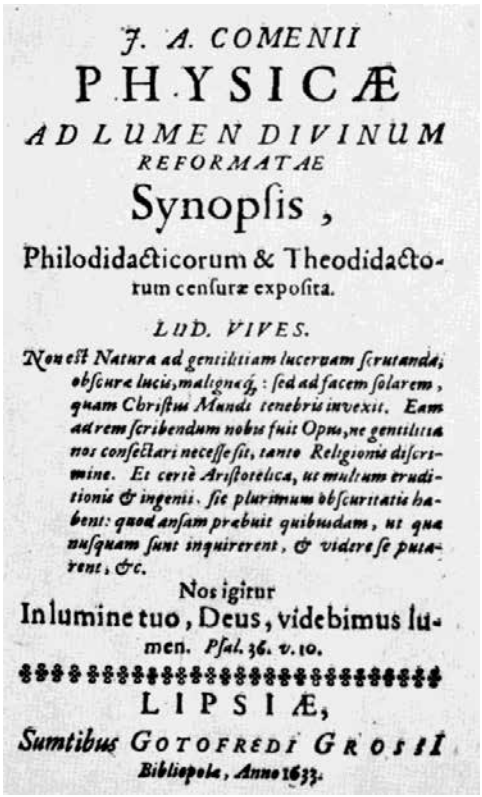
J. A. COMENII
PHYSICÆ
AD LUMEN DIVINUM
REFORMATAE
Synopsis,
Philodidacticorum & Theodidactorum censuræ exposita.
LUD. VIVES.
Non est Natura ad gentilitiam luceruam scrutanda, obscuræ lucis, malignæq; : sed ad facem solarem, quam Christus Mundi tenebris invexit. Eam adrem scribendum nobis fuit Opus, ne gentilitia nos confectari necesse sit, tanto Religionis discrimine. Et certè Aristotelica, ut multum eruditionis & ingenii, sic plurimum obscuritatis habent: quod ansam prebuit quibusdam, ut quæ nusquam sunt inquirerent, & videre se putarent, &c.
Nos igitur
In lumine tuo, Deus, videbimus lumen. Psal. 36. v. 10.
LIPSIÆ,
Sumtibus GOTOFREDI GROSII
Bibliopola, Anno 1633.

Fig. 1 The title-page of the *Physicae Synopsis* [2]

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In our paper the books or treatices often cited or referred to are described in the following abbreviations.

(1) the books or treatices of Comenius or the ones who are supposed to be written by Comenius.
- Atrium : *Latinitatis Atrium* (in : ODO, pars III.)
- CC : *Consultatio Catholica*.
- COO : Comenii Opera Omnia (Akademia-Ausg.)
- DM : Didactica Magna (in : ODO, pars I.)
- Janua I : The First Janua linguarum (1631)
- Janua II: The Second Janua linguarum (in : ODO, pars III.)
- ODO : Opera Didactica Omnia (1657)
- PhS : *Physicae Synopsis*.
- Sch-L : *Schola ludus* (in : ODO, pars III.)

(2) the books or treatices of other authors
- Červ. : Červenka, Naturphilosophie des J. A. Comenius.
- OL. : Campanellae *Opera Latina*.
- Reber : J. Reber's translation of Comenius' *Physicae Synopsis* and of his other Treatices concerning natural phenomena.

(3) the abbreviations or symbols often used in our paper :
- ca. : circa (= nearly)
- cap. : caput (= chapter)
- L. : Liber (= Book)

(3) the abbreviations or symbols which represent the act or scene of the the drama, *Schola Ludus* :
- Act. : Actus (= act)
- Pars : (= Part)
- Sc. : Scena (= scene)

1. Existence of the Spirit and its Functions

The spirit, Comenius argues, *does* exist ; in effect does it exist everywhere. But this omnipresent spirit is said to be 'invisible and insensible' (invisibilis et insensibilis ; PhS, cap. 2, § 2). If so, how could we confirm its existence ? But someone might argue that the spirit is only a presumptive thing unless its existence and its phenomena is experientially affirmed.

Even if the spirit is not perceived by observations or experiments, Comenius might allege, it can be permitted

that its existence be supposed from its effects (esp. biological phenomena or similar ones), which itself does not conflict with the scientific argumentation. In fact, Descartes presupposed the existence of *vortices* of the invisible particles to explain the movements of the celestial bodies ; Lavoisier presupposed the the existence of *caloriques* to explain the thermal phenomena.[3] Though these suppositions were equally rejected as false, the suppositions themselves were not quite unscientifc. But Descartes neglected to disprove the non-existence of the vortices,[4] and Lavoisier also neglected to refute R. Boyle's contention that the heat is not a thing but a phenomenon that is brought about by a kind of movement.[5] Both Descartes and Lavoisier did not try to refute the most probable objections to their own opinion. Neither did Comenius disprove the most probable objection that the omnipresent spirit does not exist. This kind of attitude toward the different arguments of others are not scientific (*wissenschaftlich* in German), for every other possible 'suspect' have to be disprouved as 'innocent.' Otherwise you would be censured for your unfounded arrestation.

In his last edition of *Physicae Synopsis* Comenius appended supplementary chapters, *Addenda*, with about 100 pages added (1663). In this *Addenda* did a number of 'spiritus' appear ; one of his contentions in this supplement is to confirm the existence of 'spirit.' He tried to make himself understood on his argument of 'spiritus,' so that he cited many sentences from Bible, Aristotle, Plato, Cicero, and others [6] ; and from the contemporary opinions consonant with his theory. But he never referred to the results of modern experiments or observations. Therefore you cannot expect a scientific argumentation from this *Addenda*.

In the *Mundus Materialis*, i. e. the fouth grade of *Pansophia* (in *Consultatio Catholica*, vol. I) Comenius, frequently referring to the last edition of *Physicae Synopsis*, reaffirmed the existence and workings of the spirit :

> Spirituum totum Mundum plenum esse, motus, generationes, Corruptiones, Alterationesque rerum omnium ostendunt. (CC. I, p. 305)

namely : That the whole world is full of Spirits, which is approved by the motions, generations, corruptions and alterations of all the things.[7]

The relationship between the spirit and motions has to be analysed from another standpoint and is not treated fully in this paper. Here we will discuss the spirit as a life-principle, for the generation and corruptions are attributed to the existence and functions of the spirit. To speak straightforward, matters get more vivid if they are full of spirits, reversely, they will corrupt or disappear if they are want of spirits. In effect did Comenius say like this :

> Spiritus enim in omni re (carne, pomo, grano, ligno etc.) agitando se emollit partes, ut aut novam concipiat vitam, aut evolet, resque putrefieri sinat. (PhS, cap. 3, § 5, p. 103)

namely : For Spirit makes parts of a matter softer by agitating itself in everything (meat, apple, grain, wood, etc.), so that it may receive a new life, otherwise if the spirit flies away, it may be putrefied.

This sentence enables us to make sure that the spirit is not quite omnipresent. The spirit can fly away from the matter ; then it will putrefy or become extinct. In a putrefied thing is there a small portion of spirit or no spirit. But Comenius seldom discussed the extinction of spirits and its causes.

In another passage of the same book did Comenius write so :

> quo quid plus habet spiritus, eô plus vigoris et durabilitatis (cap. 2, § 2)

The more something has more spirit, the more vigorous and durable it becomes. So Comenius allowed the various quantity of the spirit ; but he did not enquire this variety at all. He should have answered about this variety, if he had insisted that his view is a rational but not imaginary one.

1. 2. Spirit as a Life-Principle

The spirit is said to inhere in some materials (quibusdam materiis inesse) or to inhabit them (materias inhabitare) (PhS, cap. 2, et *passim*). The spirit, Comenius insists, agitate itself (se agitare) and the matter that it inhabits so that the matter may vivifiy itself (vegetare). In reality, there are more vivid beings on the one hand, on the other less. In what conditions are they vivified or not ? Some rational explications will be postulated. How could the omnipresent spirit, originally being always active in vivifying things, become less powerful in vivifying ? If it exists everywhere, it is inconceivable that every being may get perishable or putrefiable.

His original conception is that the matters which God created first was amorphous (informis) and void (inanis), and that it was the light and the spirit also created by God that gave these shapeless matters some forms or shapes and life. In other words, this conception, as a starting point of his views, had been determined ; therefore it was not an essential question for him what the four elements constituting the whole material world are, or whether the fire is one of them or not, or whether it is aether or not.

The spirit, according to Comenius (PhS, cap. 5, § 17), inhabits the matter, providing life for it and promoting its development on the one hand, it flies away (evolare) or departs from the matter according as the vapour exhales upward (exhalare) on the other, whereby the matter will be divested of vivacity. Are its movements due to its own willing, or can they be controlled by a human action in a certain way ?

If we cannot control it, we humans, who wish to maintain or increase our own liveliness, cannot but pray for its graceful action. In his *Physica Synopsis*, as long as we know, Comenius gives just one way to control the spirit : that is, to prevent putrefaction, in other words, to keep the spirit from getting away from the matter. No other ways to control the spirit are mentioned at all. Then let's examine this one way.

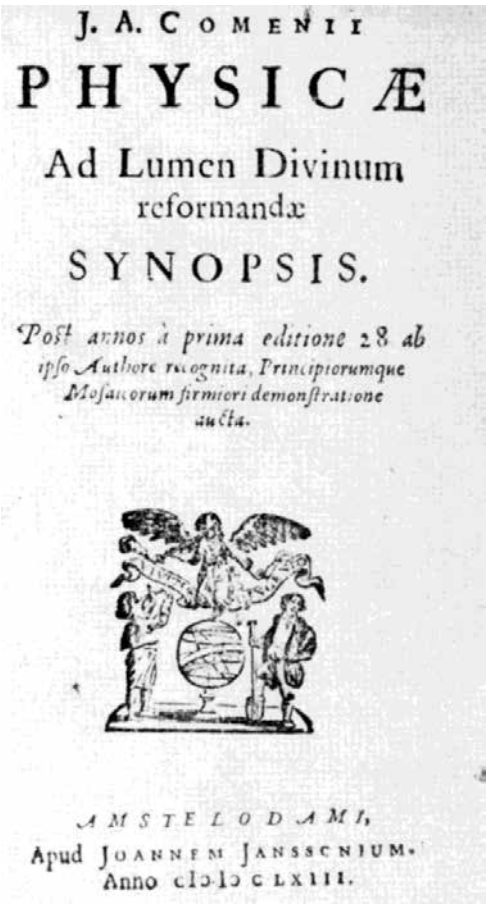
J. A. COMENII
PHYSICÆ
Ad Lumen Divinum
reformandæ
SYNOPSIS.
Post annos à prima editione 28 ab
ipso Authore recognita, Principiorumque
Mosaicorum firmiori demonstratione
aucta.
AMSTELODAMI,
Apud JOANNEM JANSSONIUM.
Anno clɔ lɔ c LXIII.

Fig. 2 The title-page of *Physicae Synopsis* (the last edition, in 1663, Amsterdam)

Comenius spoke of three types of the prevention of corruption (putrefactio, putredo) : the cold (frigus) [8], salt (sal) [9] and drying (arefactio). The *frigus* is thought to be rather 'cooling' than a cold thing. The *sal* (whose constituents are sometimes not easily identifiable) seemed to be used as the sea salt. The cause of the *arefactio* is heat. By looking into his view on the prevention of corruption, you will be able to catch a glimpse of his own microscopic world.

First, the way how putrefaction is prevented was stated so : 'for the cold closes the small paths (pori) of a body, so that its spiritous parts may not be allowed to get out or exhale'.[10] The *pori* (the plural of *porus*) can be here

interpreted as 'exits', namely the ways-*out*, not the ways-*in*. That is, they are not considered to be the passages through which things are allowed both to enter into and to get out ; they can just get out. The above sentence teaches us that these passages of a body would enable the spirits to 'get out' (egredi) or (as vapours) to 'exhale' (exhalare) through themselves, if the cold were to be kept away from it.

As for the salt, it is, Comenius argues, with the help of it that a body is prevented from getting rotten.

> sal materiae partes intus constringat et velut vinculis detineat, ne hiare et spiritum emittere possint (ibid.).

— The salt constricts the parts of matter inward and detains them with strings, so to speak, so as not to leave their mouths open and let the spirit out of it. In this way the matter should be kept from putrefaction. Here also the process is depicted with the spacial representation by which the small passages are regarded as the loopholes and they could enables the spirit to be passed out without being shut up by the salt.

The *arefactio* or drying-up, according to Comenius, makes it possible the the matter cannot get rotten, with the wet parts liable to be putrefied being removed by heat.

However, the ways of the prevention are at best negative, as long as they don't positively contribute the promotion or maintenance of liveliness. They can play just a negative role, i. e. can only hinder the corruption. If you look for in the *Physica* the positive way how a body can get more vivid and valiant, it may be the tepid heat. The spirit(s) will become, Comenius thinks, more vivified with the tepid or moderate temperature (calor moderatus ; ibid. § 7). For example, he cotinues, the 'matrix' or womb in which the spirit inheres makes it more vivid with the tepid heat given. Thereby the matrix isn't limited to the animal or human uterus. For We are told in this way :

> Ad generationem tria requiruntur : *semen, matrix et calor moderatus*. Haec tria in generatione animalium, plantarum, metallorum, lapidum, meteororum denique necessaria sunt, … (PhS, cap. 5, § 7 ; italics mine)

namely : three conditions are required for the generation : *seed,* [11] *matrix and moderate heat*. these three are the requirements for the generation of animals, plants, metals, stones and lastly meteors. The animals have semens (sparms) or wobms ; but what do such inorganic substances as metals have as semens ? Indeed did Comenius assign the earth (terra) as matrix, but he didn't mention anything about the semens of them. He continued to say so :

> Sunt autem quot generationes, tot matrices seu gremia : meteororum matrix est *aër* ; lapidum, metallorum et plantarum *terra* ; animalium *uterus*. (italics, Comenius' ; ibid. § 9)

i. e. : There are so many kinds of matrices or wombs as the number of kinds of generations ; the matrices of stones, metals and plants are the earth ; those of animals uteri. The semens (semina) of plants may be the ordinary seeds ; but what are the semens of stones and metals ? Comenius remained silent.

Anyway he wanted to say that the semens where the spirit inheres are generated in the matrix with its warmth and by virtue of the spirit. So it would be possible that every sort of generation takes place anywhere in the world of nature. Immediately from this *Weltanschauung* arises his animistic standpoint of view — and his theory of spontaneous generation. This we will soon discuss in the next chapter.

1. 3 Stones, minerals and metals 'grow' — spiritus naturalis

As is shown above, Comenius has an idea that even stones and metals 'grow' (crescere) ; to explain this 'vital' phenomenon, he presuppose the spirit indwelling in them. In his *Addenda* to the "Physicae Synopsis" (1663), Comenius referred to the inner might (interna virtus) which is to be acknowledged in stones, plants and animals, and he explained this sort of might (or power) in the following sentence :

> quâ [= hac virtute interna] generatur, crescit, saporem et odorem ac medicandi vim à se spargit. (*Addenda*, cap. 2, § 46)

namely, 'owing to this might they are generated, spring forth, and what is more, they give out flavour, odour and medical power from themselves'.

So the spirit or spirits are to be immanent in such inorganic things as stones, minerals and metals ; by virtue of them, according to Comenius, is each of these things to acquire its specific shape and property ; in the inorganic world the spirits function as a kind of life-principle. It is in this sense that stones or metals are said to be 'growing from the earth' (terrâ crescentia) and their generation is also a biological phenomenon (PhS, cap. 2, § 2). But how could Comenius elucidate or prove the process of this phenomenon ?

In his *Addenda*, besides, the material world of Comenius acceded much more to the animistic world [12)] : the spirits inherent in metals have 'reason' (ratio) to greater or lesser degree according to their grades of order. That their spirits have 'reason' — is established, he adds, by the fact that they have 'order' (ordo) or 'subtlety' (subtilitas) in some degree (Add. cap. 4, § 20).

1. 4 The vital principle of Plants — spiritus vitalis

The spirit inherent in plants is considered to be the most primordial form of omnipraesent 'principle of life,' for Comenius says concerning this plant-spirit in this way :

> spiritus *ille universalis* (spiritus vitae) vim suam manifestiùs exserere incipit materiae portiunculam tam molliter sibi praeparando, ut ad munia vitae sequacem habeat. (PhS, cap. 9, § 4 ; italics mine)

namely, '*that universal* spirit of life begings to develop its own power more explicitly by preparing for itself so softly the tiny material portions that it may make them obedient to the functions of life.' But the spirit does not exist everywhere in the plant, but does in some parts of it, and differentiate itself according to its functions. They are nutrition, augmentation and generation. Each of them is carried out by virtue of the spirit. But Comenius couldn't explain the way plants are generated, esp. their seeds are formed.

Before concentrating our discussion on the generation of plants, we have to ascertain that at the time of Comenius, people have no idea about the pollination from which various 'seeds' arise. It is his following phrase that evidently gives proof of this :

> In Plantarum generatione nonnisi unum reqviritur semen (matricem et fomenta Terrâ ministrante) qvia *Plantae sexu carent*, unum idemque (planta sexu indiscreta) formatur semper. (italis mine ; CC. I, Pans. gr. IV, cap. 6, p. 350 [541])

— Just one things is required for Plants to be generated : that is the semen (whereby the Earth warmed as if poultriced serving to the matrix) , for *they lack two sexes* ; one and the same thing (they are not sexually discriminated) should always be formed. The 'Earth' here is considered to be the *matrix* from which they spring forth. As the pollination was not discovered then, neither *stamens* or *stamina*, namely the pollen-bearing male part of flower, nor the *pistils*, female reproductive plant part, were referred to.

Therefore the origin of seeds are never searhed for. They are thought to be latent in the plants, not appearing as a result of reproductive working. They existed from the very first, as Comenius thought, and become manifestly visible by virtue of the spirit :

> Primò enim, cùm spiritus semini inclusus ab excitato calore diffundere sese et tumescere incipit, necessariò seminis corticula rumpitur, ... (PhS, cap. 6, § 6)

The seed does not become visible and larger, Comenius insists, for it grows bigger for itself, but for the spirit, included in the seed, starts to enlarge itself with the help of heat and swell up ; after that the exterior husk of this seed

will be broken up.

How could we acertain the existence of the spirit(s) and their action ? Anybody can submit a certain hypothesis, but this hypothesis have to be verified in a way, ex. gr. convincingly by the empirical facts. Otherwise it would remain a mere hypothesis.

1. 5 *Spiritus animalis*

While the animal spirits were also discussed in the *Second Janua*, other kinds of spirits were not. Besides, this treatise explicitly shows that the origin of these spirits is in brain ; so they are not derivatives of the universal spirit. The same is true of the other treatises written in the Saros-Patak period, that is, *Atrium* and *Schola Ludus*. In the *Second Janua* any further explanation weren't discussed ; namely, the animal spirits were distributed via nerves thoughout the animal or human body.

In his *Physicae Synopsis* Comenius also said that the animal spirits are produced in {throught} brain. Is their origin the same as in the *Second Janua* ? Then, the theory of Comenius would be entirely inconsequent. For in his initial conception Comenius delineated the scheme in which the universal spirit or *anima viae* (spirit of life) is first created, then it is differentiated into the natural spirit, next into the vital spirit (spirit of plants), and then into the animal spirit, lastly into the mental spirit (spiritus mentalis) [13]. Each actual spirit is regarded as a specialized one of the universal spirit. This will be self-evidently confirmed by this sentence :

> quemadmodum terra, aqua, aër, aether eadem mundi materia sunt, densitatis solùm gradu differentes: ita spiritus naturalis, vitalis, animalis et hic mentalis idem ille spiritus mundi sunt, puritatis solùm et perfectionis gradu differentes. (PhS, cap. 11, § 11)

Compare this sentence with the following one in the *Second Janua* :

> SPIRITUS autem fiunt è dupuratissimo Sangvine, & diffundunt se per corpus totum, ad illud vivificandum & vegetandum : *Naturalis* diffluit ex *Hepate*, per *Venas* : *Vitalis* dissultat *ex Corde*, per *Arterias* ; *Animalis* dimanat è *Cerebro*, per *Nervos*. (§ 234)

The *Spiritus* (plural) here are the human spirits, but neither the spirit of the inorganic entities (ex. gr. metals), nor of the plants. They are regarded as those humours, each of which is generated in its own organ ; so they have not to do with any some spirit existing anywhere in the world.

1. 6 The spirits differentiated

As long as we read the first chapter of the *Physica*, there seems to be just one 'spirit' ; if so, how could we understand the enormous variety of natural phenomena by this 'one' spirit ? This orignal and universal is, as Comenius had to concede it, to be differentiated or divided into various species of spirit. In the long run, there seems to be a enormous number of specific spirits in the world. Every thing is generated or formed by its own spirit — his science of *Physica* is completed here, and does not go any further. The existence and functions of spirits are determined by God's edict, so to speak. The following sentence is so decisive that any further investigation of nature would be superfluous.

> Unus enim idemque spiritus universi in multas postea particularitates jussu Dei diductus est (PhS, cap. 2, De spiritus seu animae mundi naturâ, § 3).

namely : 'For one and the same spirit of universe is later divided away into many particularities by the command of God.

First of all, this 'unus idemque spiritus' is broadly classified into 'spiritus naturalis,' 'spiritus vitalis' and 'spiritus animalis.' Thereafter they are differentiated into individual species of spirit. To confirm this, for example we will discuss the 'spiritus naturalis' here.

As was mentioned above, Comenius insists that the natural spirit is immanent (spiritus naturalis inest) in stones or minerals ; Comenius supposes the metamorphoses of natural spirit according to the shapes of properties of them :

‘There are so many species (of natural spirits) as the number of forms of minerals. — cujus tot sunt formae, quot mineralium species ; PhS, cap. 8, § 64.

Moreover, this idea was emphasized in the *Addenda* : as matters are differentiated into the lowest rank of the infinite varieties, the spirit is also differentiated into the infinite individual forms (particulares infinitae formae) — Add. cap. 4, § 23.

But actually, various stones or minerals are formed by such causes as external pressure, thermal degeneration, crystallisation, etc. By Comenius, however, without taking account of other possible causes, their formations or properties were all explained by way of the functions of spirits. So further investigation would be impossible and superfluous.

2 The Spirit and Generatio Spontanea

The expression ‘verminare’ is found in Comenius (de Calore et Frigore, cap. 12, § 17) [14]. This intransitive verb means ‘to have worms’ [15], which connotes ‘(sua) sponte’, i. e. spontaneously or voluntarily. The theory of spontaneous generation was thoroughly denied by the experiments by Louis Pasteur, but at the Comenius’ time it firmly survived. Before discussing the Comenius’ theory should we trace its history.

2. 1 Aristotle on the spontaneous generation

It is true that the theory of spontaneous generation is treated in some of his writings concerning physical phenomena, but there are not so many relevant passages in them. In his *Metaphysics* Aristotle slightly refers to the animals and plants ‘spontaneously’ (απο ταυ’τοματου) generated, or growing ‘without sperms’ (ανευ σπερματος) (1032a). In his ‘History of Animals’ (Historia animalium, = HA) are the examples of this sort of generation enumerated : insects or worms breeding from rotten mud or withered trees, parasitic worms are spontaneously generated in the animal or human bowels (551a), some of the stripes mullets or eels are also generated in the water (569a ; 570a) ; what is more, some of the plants taking nutrition from the earth, or from the inner part of the other plant — which is referred to as a parasitic plant, mistletoe in his *Generation of Animals* (715b30). Aristotle thought that most of the organisms are generated by way of copulation, in other words, from the seeds or sperms. As for the eels, the ovaries or testes can not be found out in them, so their generation is considered to be spontaneous ; He clealy insists that each grasshopper or locust derives from the same one, namely from its own parents ; so do cicadas and other kinds of insects (550b) ; for it is evident from the observations that they copulate with each other, likewise is it evident they cannot generate for themselves or spontaneously.

If we can define the spontaneous generation as ‘generation without parents,’ it is very probable that Aristotle thought so, for if an egg of an animal or its act of egg-laying is observable, he may have concluded that there is no possibility of spontaneous generation. He pointed out, for examples, that after a pair of grasshoppers copulated, the female one laid eggs, inserting her ovipositor into the earth (556b10 ff.). In this case, it is impossible, he put it, that the generation without parents be inconceivable (HA, L. 5, cap. 28 ; 555b20 ff.).

We can easily see butterflies or frogs copulating ; but ordinarily the copulation of mice is difficult to be observed. But in his HA (L. 5, cap. 3) Aristotle spoke of the copulation of frogs, as for butterflies, the derivation such an animalule as maggot from its imaginal insect, though he did not described the egg-laying after the oopulation ; this animalcule, he adds, grows to be a caterpillar ; the caterpillar metamorphses into a pupa, finally into a butterfly. As to the generation of mice, their production being a most astonishing thing when compared with other animals borh for the number of young produce and the speed of it, Aristotle denies the spontaneous generation of them, for he was told that a female mouse having got shut up in a jar of millet seed while pregnant, begot 120 young mice after a short while the jar was opened (ibid., L. 6, cap. 37 ; 580b).

Whether there exists a copulatory organ or not, is a crucial point, by which we can judge if the generation is

spontaneous, Aristotle took it for granted (ex. gr. in HA). Because we could not find out such organs in some tiny fish (aphýē αφυη), so that they were deemed to be spontaneously generated or to breed from the mud or sand, in large quantities besides (HA, L. 6, cap. 1, 569a30 ff.). But Aristotle could not explicate the process or the cause of the generation of this kind ; some animals or plants can, he supposes, generate themselves by taking nutrition from the leaf mold or rotten materials ; as for the eels, nutrition is acquired from the rain-water, and so on (ibid., 570a10 f.).

2. 2 Campanella's 'generatio spontanea'

As Červenka insisted, it seems true that the theory of Comenius on the spontaneous generation was borrowed from Campanella (Červ., 184). But while in the former this generation is always accompanied by the action of spirit, not always in the latter, for it was the warmth that plays a principal role of this generation. In his *de Sensu rerum* (OL, vol. I) did Campanella point out this sort of generation of worms from the dead body (L. 4, cap. 9, pp. 295 – 299). His theory appears to have been based on many empiric facts or observations, the truth is that it was not scientific, in other words, it ignored other possibilities of investigations. How could we explain the process of generation only by way of the actions of heat or cold ? (cf. Červ., 63).[16)]

Reber and others also indicated that Comenius's theory of generation depended on the Campanella's (Reber, 123) ; for this view of Campanella see the following passage in his De Sensu rerum (Liber 2, cap. 5, 'Spontaneae generationes') :

> Caro putrescens, in loco praesertim calido vermes producit, & vrinae calor in puluere pulices, & vnctuosus sudor humanus pediculos. (p. 57)

namely : the meat being putrefied produces some worms especially in a warm spot, likewise the warmth of urines produces fleas in the dust, the human greasy sweat, lice. Campanella considered the warmth (calor) as a kind of life-principle, besides, he thought it rather a matter of element than a phenomenon, so did Comenius.

Comenius and Campanella approach each other when the latter speaks like this :

> Patet ergo calorem producere animalia, & non ex materiae gremio, sed ex materia attenuata & calore constitui animam. (ibid. p. 58)

I. e. : It is apparent that the warmth produces (small) animals, and *anima* is constituted of the attenuated matter and the warmth, not of the womb of matter. This mystical *anima* resembles the universal spirit of Comenius, which is similarly mystic. The anima is no doubt regarded as a life-principle :

> fila & funiculos lineos intra tepentes aquas in insecta animalia transire vidimus non semel. Vere ergo omnia animae sunt plena ; quoniam omnibus inest calor.

that is : We have often observed that in the tepid water a cord or rope is transmuted into some small animals. In effect, therefore, everything is full of 'anima' ; for in it does the warmth inhere. Thus is the animistic natural world unfolded in Campanella.

2. 3 Comenius' conception of 'spontaneous generation'

As is stated in the Preface above in our paper, Comenius asserted the spontaneous generaton. But it was argued for not only in his *Physicae synoptica* but also in the *Addenda* and other papers of his.

First we will examine his extraordinary view, i. e. the fall of such small animals as frogs from the cloud with rain.

> Decidunt quandoque cum pluvia lumbrici, pisculi, ranae etc., quos verisimile est intra nubem è collectis ejusdem naturae vaporibus vi admixti spiritûs vivi subitò progenerari (PhS, cap. 8, § 28).

those animals Comenius thought to fall from the clouds with rain are roundworms (lumbrici), small fish and frogs. He continues, it is probable that they are often 'suddenly' (subitò) generated forth in the clouds from the vapour of

similar nature which is mixed with vivid spirit. How could he, however, affirm this probability. It may be possible that an exceedingly violent storm can fling such small animals as frogs or fish up from a march or swamp or the like, and they fall from the sky ; We can reasonably explain the falling of small water animals in this way.

Comenius continued to assert that the spirit contained in the water of cloud cause small animals to be generated :

> primitùs *jussu Dei* reptilia et pisces ceu *momento* produxerant aquae. (ibid. ; italics mine)

This phrase will be translated in this way : 'At the start *by the edict of God* had the water had produced reptiles and fishes, so to speak, *in an instant*'. You could interpret this in the following way : the spirit, initially contained in the water, causes the matters (also contained there) to be gathered and form an animal, in which occasion the action of the spirit is determined by a kind of divine dispensation ; an ordinary generation takes some time, but a spontaneous one takes place *in a moment*. Who and where in the world could see the instantaneous generation ? If this kind of miraculous event were to take place owing to the infinite power of God, what would the divine action be for ?

Notice that such expression of Comenius like 'jussu Dei' or the like never appeared in the *Second Janua*. The same is true of the *Atrium* and the *Schola Ludus*.

In the tenth chapter of his *Physica*, Comenius refers to the spontaneous generation of worms, mice and various kinds of insects. Though he seemed to mention a generation from 'seed' (semen), therefore not-spontaneous one, this seed have to be considered to be formed spontaneously with the aid of spirit.

> vermes nempè, mures et insecta varia (id quod fit vel è semine eorundem animalium sparso, vel è spiritu universi in materiam aptam illapso). (PhS, cap. 10, § 61).

The ordinary seed cannot be scatterd in the world, but is laid in a particular confined space ; so the 'seed' mentioned in the above sentence is not an ordinary one, but exists anywhere or is scatted everywhere in the world. And Comenius had to explain the process by which the universal spirit is put into the proper material, but he never did. Joseph Reber, who translated the *Physica* into German, commented here : 'Auch hier wieder die unrichtige Vortstellung der generatio spontanea' (Reber, 279, Anm. 192). Reber also acknowlegded the absurd (unrichtig) theory of this sort.

3 Problems on Authorship

We have discussed who actually wrote the articles in the *First Janua* (*LL.*), which was first published in 1631, in an essay [17] of mine published last year. The question of authorship does not concern merely who wrote the whole of a treatise or the part of it. Moreover, even if he was not the writer, but if he presented its plot or conception to the actual writer(s) and proofread it before publishing, he might be regarded as its *author* (in the original sense). Otherwise he would be thought to be 'false' writer, for it was ghostwritten.

The Preface of the *Janua* of the first edition, whose author must be Comenius, told us that the understanding and the language should always advance in parallel with each other (§ 21). [18] Now let's look into the typical sentence which would contradict with the didactical principle of his.

> Orichalcum est Cadmiâ tinctum aes, fundi tantùm potest ob friabilitatem. (cap. 10, § 100)

I myself barely managed to understand this sentence, consulting the bulky dictionary of Latin. Those technical terms are mostly derived from Greek words and were also rarely used in the classic Latin. What is worse, the real objects corresponding to those things would be difficult to be presented to the students in the class-room. For whom on earth is the sentence written ? How could the students learn the words and things 'COMPENDIOSÈ, JUCUNDÈ, SOLIDÈ' ? — these mottos were put on the

title page of the *Didactica Magna*. How old is the boy (puer) (sometimes mentioned in the Preface of the *First Janua*), who is to read the sentence of this kind ?

The first pages of the *Second Janua* showed its bird's-eye picture, so to speak. It was called the *Table*, 'Tabula,' — see the **Fig. 3** below, which depicts the whole conception of Comenius' *Pansophia*. The part of the *Table* treating the subjects of the natural things or matters and their phenomena, especially of their *generation* — this part corresponds in some degree with the whole plot of the *Physicae Synopsis*. Accordingly the Table was delineated by Comenius himself, otherwise by a certain person who knows the whole idea of that *Pansophia*. Especially the subtitles of the chapters II to XIX in the *Second Janua* correspond to a considerable extent with his conception of the *Physicae Synopsis*.

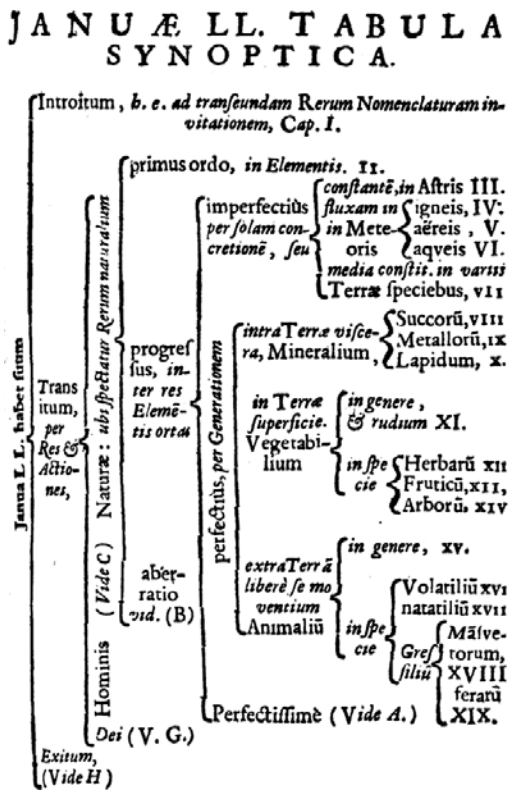

Fig. 3 The synoptical Table of the *Janua linguarum* (excerpt) [19]

Nonetheless, the individual articles which deal with the *generations* (generationes) of natural things were not described in accord with the *Tabula*. Actually the writer(s) of these chapters almost ignored the whole idea of the *Tabula*, for they discussed it very rarely or not in the least. In the *Second Janua* the generation of the metal is referred to in the following way :

> Quando Mineralis liqvor (percolatus multifariam) conduratur in tantam soliditatem, ut non liqvescat nisi acerrimo igne, mox tamen rursum consistat, confit inde *Metallum,* flexile ac ductile. (Janua II, cap. 9, § 63)

I. e. : When the mineral liquor (percolated from many sides) is hardened in such a way into a solid thing that it will not be liquefied unless it is exposed to the most violent fire ; but it gets more solid again, thence does the metal arise, a flexible and ductile matter.[20] The generation is here explained in a simply mechanical way : first the raw materials are melted with strong heat, then they are cooled to form the metal. Compare this article with the following sentences in the *Physicae Synopsis* :

> *Mineralia sunt concreta terrea è vaporibus subterraneis progenita : ut glebae, succi concreti, metalla et lapides.* (italics Comenius' ; PhS, cap. 8, § 55)

The metal (one of the minerals) is, alleges Comenius, generated in the way the earth-substance in a vaporous state is transformed into solid and metallic one. What is the cause of this transformation ? He soon adds in this way :

> *Vis, quae mineralibus inest, vocatur* spiritus naturalis : *cujus tot sunt formae, quot mineralium species.* (italics Comenius' ; PhS, cap. 8, § 64)

'The power which inheres in minerals is called natural spirit ; there exist so many forms of spirit as the number of the species of minerals'. Here also it the spirit the former

(*formator* or *plasmator*)[21] ; it is, furthermore, differentiated into the indivisual specific spirits, as is shown in the previous chapter in our paper.

It is impossible to find out the articles in the *Second Janua*, the Atrium and the Shola Ludus the thought of Comenius that a natural thing having a certain shape or a consistency is formed from vapours. This thought is proper to Comenius, which is extensively developed in the eighth chapter (De vaporibus) of the *Physicae Synopsis* ; but the authors of the treatises written in the time of Sáros Patak never regarded the thought of this sort. As for the spontaneous generation, the authors did not accept the conception of Comenius.

In the *Second Janua*, only one exmple of spontaneous generations was treated. It was on the grass, which is said to grow spontaneously (sponte or sua sponte) ; We have no other examples at all that ; here nor worms nor insects were regarded as the organisms that are generated for themselves. The same thing holds true also in the *Atrium* and the *Schola Ludus*.

Let's look into this example in the *Second Janua* :

> … *spontè nascens Gramen,* viridans solum, non sementans : … (cap. 12, § 85)

The grass (gramen) is here said to come into being for itself or spontaneously (spontè) and to become verdurous, besides, never to give birth to any seeds. Moreover, any kind of activity of the spirit is not mentioned. It is inconceivable that Comenius wrote this phrase or he had somebody write it. The similar phrase appears in the *Atrium* (cap. 12, § 85) and the *Schola Ludus* (Pars I, Act. 4, Sc. 2). It is probale that these phrases of a very similar content were written by one writer, however not by Comenius, and if not by one, other two writers rewrote the original sentence or added a little to it.

Another example of the spontaneous generation is found out in the *Second Janua* (cap. 15, § 129), the *Atrium* (cap. 15, § 129) and the *Schola Ludus* (Pars I, Act. 5, Sc. 1), except that the expression 'spontaneous' is not used there. We will discuss the relevant passage in the *Schola Ludus* :

> Ex quarum rerum pinguedine gignuntur (hoc est, unde materiam et vitam primo accipiunt) [vermes] ex iisdem nutrimentum quaerendo easdem eradunt. (Pars I, Act. 5, Sc. 1)

namely : They (= the worms) seek those substances from which they have arisen (id est, from which they receive its material and life) and bite at the same substances, taking nutrition from them. This complex sentence is difficult to be translated, but its content is not so complicated : such small animals as worms are born from the matter (containing some nutrition), and they can live on them and grow. This sort of opinion can be traced back to Aristotle, as is shown above in our paper (2. 1), but cannot .

From this Table (Tabula) we are permitted to expect the 'Generatio' of various natural things, such as stones, minerals or metals as well as plants and animals (including humans). However, the generatios of inorganic things and plans were never mentioned at all, except their characteristics or classifications. Who wrote the articles ? It is evident that Comenius did not. So far, to our regret, we can produce just the negative answer. But a positive answer will be given in the near future.

Conclusion

If we were to allow the spontaneous generation of some animals after the manner of Comenius, and decided to be scientific or critical concerning the generation in general, we should employ the Aristotle's criteria by which we can judge whether a generation is spontaneous or not. The most decisive criterion would be the presence of genitals. If we could not find out any genital organs in some animals, it would be more probable that they may be generated spontaneously. Therefore those who want to argue for the spontaneous generation of the frogs would be asked to inquire whether they have the genital organs or not. Comenius should also have done so, if he had alleged his theory to be scientific.

The question of this sort, however, were passed over by

Comenius ; what is worse, he alleged for the spontaneous generation without experientially giving any evidences.

Lastly we would like to point out the fact as the problem of authorship. Such treatises as the *Second Janua*, the *Atrium* and the *Schola Ludus* , which Comenius said were written in the perid of Sáros Patak,[22] are all large books. Comenius arrived at Sáros Patak in the end of 1650, and returned to Lissa in June 1654, so the length of his stay in Sáros Patak was too short to write a great number of pages. If the treatises (in all fifteen) contained in the Third Part of the *ODO* had been written for three and a half years, several collaborators would have been needed, for all the treatises contained more than 1060 pages. The *ODO*s were large-sized books, each page of which is equivalent to more than four pages in the ordinary book. Those treatises contained pages so :

The *Second Janua* [23] — 120 pages
The *Atrium* — 164 pages
The *Schola Ludus* [24] — 210 pages

Anyway, these treatises were not completed without the help of several collaborators. If Comenius had not written anything but supervised them as an editor to complete these works, he could have been regarded as the author of them. But, as we have already seen, the articles in the *Second Janua* concerning natural things at least were not in harmony with the *Tabula* (**Fig. 3** above), which is also the whole plan of the *Pansophia* of Comenius. When he wrote the *Mundus materialis* in his *Pansophia* (the fouth Grade), he developed his thought in accordance with the last edition of his *Physicae Synopsis*, referring to it, for example :

> Plura de Vaporibus vide in Synopsi Physic. Amstelod. pag. 83. 84. etc. (CC. I, 327 [495]) [25]

As the *Physicae Synopsis* was published in Amsterdam in 1663, and Comenius sometimes cited or referred to it in the *Mundus materialis*, reaffirming its ideas or reinforcing them further. On the contrary, he never cited or referred to the *Second Janua*, for he did not considered this treatise as his own.

Notes.

1) Cf. Červ. 64, 65, etc.

2) The first edition was published in 1633, Leibzig. The figure is cited from COO, vol. XII, at the end of the volume, not paginated.

3) Cf. Lavoisie, *Traité élémentaire de la Chimie*, 1789, Paris, I. Partie, cap. 1 ff.

4) Cf. Descartes, Principia Philosophiae, III, § 30 ; He also neglected to refute Harvey's theory in his *Discour de la Méthode* (5e Partie).

5) Cf. Diderot's Encyclopédie, vol. 2, p. 24, on the article 'Chaleur.'

6) Cf. *Addenda*, cap. 2, § 8 : Hoc idem Platonici omnes, hoc Pythagorici, hoc Trismegistus, hoc antiquissimi quique docuerunt.

7) Cf. : Implevit ergò Deus spiritu vitae totam suam massam, super qvam ille se agitando eam subigeret, et inde Creaturarum varietatem produceret. (CC. I, p. 305 [452]).

8) The word 'frigus' can mean twofold : a cold matter or a phenomenon of becoming cold. *Frigus* can be considered as an entity, as is *calor*, but Comenius did'nt know it is a kind of energy, not a thing. In Comenius' time *calor* is an entity ; he often regarded it as a transfomated heat-principle or fire-principle (ignis), sometimes as heat-phenomenon.

9) The word 'Sal' is to be understood in a wider sense, for in many cases it can not be our common salt, whose constituents can be specified, like a chemical symbol, *NaCl*.

10) In latin : quod frigus corporis poros obstruit, ne spirituosae partes egredi et exhalare possint.

11) For the word 'semen,' it is, one should note, not the seed obtained from pollination or sexual reproducction. In classic Latin also the word 'semen' is used in a wider sense..

12) Confer the following expression of Červenka : die 'Lehre der Beseeltheit der Welt' (Červ. 92).

13) The *mental spirit* is said to be the purest and most perfect one (PhS, cap. 11, § 11) , but anything more than this was not mentioned by Comenius. So we will not treat this subject in our paper.

14) This booklet was published in 1659 in Amsterdam : *Disquistiones de caloris et frigoris natura*.

15) The verb 'verminare' was rare in the classic latin, which Seneca used in his famous treatise *Vita Beata* (cap. 17 *fin*.)

16) Červenka' own words : … es war wahrscheinlich auch Campanella, der ihn zu den Erwägungen über die Wärme und Kälte, die Hauptprinzipien seiner Lehre, bewogen hat (Kap. 2, § 4). It is true that Comenius owed much to Campanella, but Comenius borrowed solely those ideas from the latter whch were in harmony with his original thought.

17) Kozo Takahashi, Die des Comenius' Kosmologie in seiner Naturkunde, in : Bulletin of Hachinohe Institute of Technology, vol. 35, 2016, pp. 1 – 18, esp. pp. 16 - 17.

18) Januae Tabula synoptica, in : ODO, pars III. p. 473

19) Cf. DM, cap. 19, § 45 : Verba non nisi Rebus, conjuncta doceantur et discantur.

20) In the Schola Ludus this kind of generation is described more in detail as follows : Subterranei ignes percolant Minerales liquores multifariam : frigoraque rursum ibidem acerrima, et per secula durantia, condurant eos in tantam soliditatem, ut non liquescant nisi acerrimo igne. (Sch.-L., P. 1, act . 3, sc. 3)

21) Addenda, cap. 2, § 29 : [Deum primitùs creavîsse] *neque formas seu figuras, sed formatorem seu plasmatorem perpetuum, SPIRITUM VITAE,* quem *spiritum Dei* Moses appellavit, … (italics Comenius').

22) ODO, Pars III, p. 2.

23) It is most probably certain that the *Second Janua* was published in 1652 in Sáros Patak. Cf. COO, vol. 15-1, p. 482.

24) Comenius said in the Dedication of the *Schola Ludus* that this book was written in April,1654 (ODO, Pars III, p. 836). But this voluminous book, I presume, was not published in a completed form.

25) This sentence would be translated as follows : 'About the vapours see many articles in the *Synopsis Physicae*, p. 83, 84, etc'. Note that 'vapor' (vapour) is the key-concept of Comenius, and it is thought to be a primitive form of material (like an Aristotelian hyūlē, 'υλη), from which arises a sensible, seizable object. But in the *Second Janua* 'vapour' is nothing but the water-vapour or the exhalations dissipated from other materials (§ 49) .

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要　旨

コメニウス自然学においては「精気」は世界に“遍在”するかのように書かれているが、 実際は生命性に満ちたところに“偏在”している。ただし動植物といった生命的存在の領域に限らず、言わば“無機物の”領域にも精気が満ちているとされる。石、鉱物、金属の“生成” (generatio) は、コメニウス自然学によれば、精気の働きに依拠している。各々の精気は「普遍的精気」の分化したものとして論じられている。

サーロス・パタク時代 (1651 – 54 年) に書かれたとされる 3 著作、つまり『言語の扉』(第 2 版)、『アトリウム』(Atrium) そして『演劇としての学校』(Schola Ludus) の自然学を扱った諸章は、コメニウスが書いたものではない。上で述べたようなコメニウス自身の思想はこれらの著作では垣間見ることができないからである。そこで論じられている「精気」はいわゆる“動物精気”またはその変種に限られ、その起源も特定の臓器や脳髄に求められているのである。

キーワード : コメニウスの『自然学綱要』, 精気 (spiritus), 第2版『言語の扉』、執筆者