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FROM THE PRIVILEGED MARGIN
TO AN AVERAGE CENTRE

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FROM THE PRIVILEGED MARGIN
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(MAN AND THE UNIVERSE IN THE COPERNICAN REVOLUTION)*

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SUMMARY — Belief that the Copernican revolution has deprived man of his central position in the world is a typical half-truth. The Medieval world model was, in a sense, “anthropoperipheral”; insignificance of man was, from very beginning, build in into its architectonic design, but — strangely enough — the model was made almost entirely out of anthropomorphic elements.

The origin of modern science initiated a gradual elimination of the “cognizing subject” from the scientific method. What really counts in the sciences are neither sensory perceptions nor personal convictions but *interindividual* (or *intersubjective*) exchange of information. The contrast between interindividual character of science and fundamentally individual aspects of religion has introduced a *strangeness* between them, and strangeness could be more disastrous than open hostility.

* The paper is dedicated to Professor Olaf Pedersen; it was delivered at the International Symposium “New Perspectives on Early Science», Aarhus (Denmark), 25-27 April 1990.

As time passed new philosophical interpretations, substitutes of a synthesis, grew around science. They created an atmosphere in which the worship of God was gradually replaced by the worship of man. We can risk a statement that the Medieval world was anthropoperipheral but anthropomorphic, whereas the modern world, proud of its freedom of anthropomorphic elements, transformed into an anthropocentric structure.

Both philosophico-theological and scientific literature from before and after the Copernican revolution testify to the above indicated processes.

1. *A Dream for the Overture*

It is a commonplace to assert that the Copernican revolution has spoiled man his central position in the world and that as a result of this revolution the geocentric universe has been replaced by the world satisfying what is often called the Copernican principle. According to this principle the world presents (statistically) the same image irrespectively of the place from which it is viewed. The Copernican ideological revolution¹ has doubtlessly introduced one of the most drastic changes into the image of the world ever enforced by a scientific achievement. Consequences of the "Copernican shift" are felt till the present days. Copernicus himself in his *De Revolutionibus* hardly touched upon such philosophical (or ideological) issues. These aspects of the Copernican revolution were developed much later by others, mainly by imputing to Copernicus views, never shared by himself.

¹ It was Karl Popper who has distinguished between *scientific revolutions* and *ideological revolutions*. Scientific revolution is "a rational overthrow of an established scientific theory by a new one", whereas ideological revolution comprises "all processes of 'social entrenchment' or perhaps 'social acceptance' of ideologies which incorporate some scientific results". The Copernican revolution was for Popper a scientific revolution as far as it overthrew a dominant scientific theory, and an ideological revolution in so far as it changed man's view of his place in the Universe. See, K. R. POPPER, *The Rationality of Scientific Revolutions*, in: *Problems of Scientific Revolution* (The Herbert Spencer Lectures, 1973), ed. R. Harré, Oxford 1975, p. 88.

If the essence of the Copernican revolution consisted in moving the observer from the Earth to another (typically located) celestial body, it is Kepler who should formally by attributed the authorship of this revolutionary shift. In his *Somnium seu Astronomia Lunaris*² he, for the first time, looked at the Universe from a celestial body other than the Earth. No wonder that the first space travel had to be undertaken to the nearest celestial body — the Moon. *Somnium* was, in a sense, the work of Kepler's life. Yet when a student in Tübingen, he wrote down some ideas concerning the problem of how the motions of various celestial bodies would appear to an inhabitant of the moon, "who directly comprehends by his senses the proper motion of his dwelling place just as little as we inhabitants of the earth do that of ours".³ Later on, his imagination, doubtlessly stimulated by Plutarch's *De Facie in Orbe Lunae*,⁴ from time to time returned to the subject of the voyage to the Moon. Finally, during the pauses in the printing of the *Ephemerides* (which started in the beginning of 1630, the year of the astronomer's death), Kepler attended to printing of his *Somnium*. The supervising of the printing was completed by Jacob Bartsch, Kepler's last student and his son-in-law. The work appeared in 1634.

Dreams had already a good position in the philosophical literature. At the end of Cicero's *Republic* the story is told called *Somnium Scipionis*. In a dream Scipio Africanus Major carried Scipio Africanus Minor up to a height. "Scipio now noticed that the stars were globes which easily outstripped the Earth in size. Indeed the Earth now appeared so small in comparison that the Roman Empire, which was hardly more than a point on that tiny surface, excited his contempt".⁵

² *Kepler's Somnium: the Dream or Posthumous Work on Lunar Astronomy*, translated by E. Rosen, Madison 1967.

³ M. CASPAR, *Kepler*, New York 1959, p. 362.

⁴ *Plutarch's Moralia: Concerning the Face which Appears in the Orb of the Moon*, vol. XII, translated by H. Cherniss, Loeb Classical Library, London 1957.

⁵ C.S. LEWIS, *The Discarded Image*, Cambridge 1988, p. 26.

Somnium Scipionis was very influential in the Middle Ages, and the doctrine that Medieval thinkers read out of it was the insignificance of the Earth as compared with cosmic standards.⁶ The message of Kepler's *Dream* was different. "The purpose of my *Dream* — wrote Kepler — is to use the example of the moon to build up an argument in favor of the motion of the earth, or rather to overcome objections from the universal opposition of mankind".⁷

Friendly spirits take the hero of the story to Levania (name given by Kepler to the Moon) and show him its inhabitants and its geography, but first of all the celestial phenomena observed from it. "Here [Kepler] attends to all the phenomena which are presented by the sun, the earth, the planets as regards their motions, their light and their sizes for the dwellers of the moon, both on the side turned toward us and on that turned away. The alternation of day and night, the length of periods of time, seasons, the alternation of heat and cold — all these he includes in his consideration".⁸ Numerous footnotes supplement the story with tedious calculations and details making out of it something more than a piece of literary art.

Kepler's conclusion is that «Levania seems to its inhabitants to remain just as motionless among the moving stars as does our earth to us humans». ⁹ The entire work should be regarded as supporting the Copernican theory "not only by putting the Earth in motion by also by regarding the moon as an Earth".¹⁰

The imaginary voyage of the Earthly observer to the Moon, in such a detailed way described by Kepler, triggered one of the most far-reaching processes in the history of human culture. Not only Western philosophy but also Western theo-

⁶ More about it see, C.S. LEWIS, *op. cit.*, pp. 23-28.

⁷ *Kepler's Somnium*, p. 36.

⁸ M. CASPAR, *Kepler*, p. 364.

⁹ *Kepler's Somnium*, p.17.

¹⁰ S.J. DICK, *Plurality of Worlds*, Cambridge 1984, p. 78.

logy and its relationship to science will be strongly affected by this process. However, to understand its scope and its significance we must go back to the times when the earth still occupied its central position in the Universe.

2. *Laughter from the Spheres*

In describing the Medieval (or pre-Copernican) image of the world I shall follow, albeit in a selective way, analyses of C. S. Lewis presented in his *The Discarded Image*.¹¹ Although in the author's intention it is only "an introduction to Medieval and Renaissance literature", one can learn more from it about the Medieval cosmological views than from many professional textbooks of the subject. I shall not be interested in cosmological speculations of philosophers and astronomers but in what is called by Lewis the Model. "This is the medieval synthesis itself, the whole organisation of their theology, science, and history into a single, complex, harmonious mental Model of the Universe".¹² This Model is present in the works of arts and literature rather than in philosophical or scientific treatises of those times. In every period philosophical or scientific treatises help "to provide what we may call a backcloth for the arts". This backcloth is highly selective. It borrows from science and philosophy only those elements that seem to be intelligible to a layman and appeal to his imagination and emotion. "Thus our own backcloth contains plenty of Freud and little of Einstein. The medieval backcloth contains the order and influences of the planets, but not much about epicycles and eccentrics".¹³ Such a backcloth has always an enormous inertia, it dies more laboriously and more slowly than do scientific models.

¹¹ See, ref. 5.

¹² *Ibid.*, p. 11.

¹³ *Ibid.*, p. 14.

C. S. Lewis considers the Model as an achievement to be set beside *Summa* of Aquinas and Dante's *Divine Comedy*. All three are supreme works of art in which "we see the tranquil, indefatigable, exultant energy of passionately systematic minds bringing huge masses of heterogeneous material into unity".¹⁴ Of all three perhaps the Model was, in a sense, a central work, "that in which most particular works were embedded, to which they constantly referred, from which they drew a great deal of their strength".¹⁵

There is no doubt that the Model was geocentric, but it was neither geometric nor anthropocentric. Alanus ab Insulis, in his *De Planctu Naturae*, expressed this clearly. He compared "the sum of things to a city. In the central castle, in the Empyrean, the Emperor sits enthroned. In the lower heavens live the angelic knighthood. We, on Earth, are 'outside the city wall'".¹⁶ How, therefore, the Model could be geocentric? "Because, as Dante was to say more clearly than anyone else, the spatial order is the opposite of the spiritual, and the material cosmos mirrors, hence reverses, the reality, so that what is truly the rim seems to us the hub".¹⁷ Chalcidius, the author of the *Commentarius* to Plato's *Timaeus* (widely read in the Middle Ages), gave another unexpected answer to the question of why the Earth is central. "It is so placed in order that the celestial dance may have a centre to revolve about — in fact, as an aesthetic convenience for the celestial beings".¹⁸ "To be geocentric" in our present meaning implies spherical symmetry which is a geometric concept; in the Medieval intuitions our central position in the Universe was only indirectly related to geometry, and geometry decisively broke down when it was incompatible with ascribing to the humanity a lower place in the cosmic hierarchy. "The

¹⁴ *Ibid.*, p. 10.

¹⁵ *Ibid.*, p. 12.

¹⁶ *Ibid.*, p. 58.

¹⁷ *Ibid.*, p. 58.

¹⁸ *Ibid.*, p. 55.

Medieval Model is, if we may use the word, anthropoperipheral. We are creatures of the Margin".¹⁹

It is only from the perspective of distant centuries that the Copernican revolution looks like a degradation of man. For the Medievals, man was never an important element of the cosmic order. Lucan, a Roman author of the first century (A. D. 34-56), in his *Pharsalia* describes how the soul of Pompey ascends to the heavens. The ascension is similar to that of Scipio in Cicero's *Dream*. When Pompey had arrived "to the great frontier between air and aether ... he looked down and saw the mockeries done to his own corpse, which was having a wretched and hugger-mugger funeral. They made him laugh".²⁰ This motive reappears in the later literature: Boccaccio uses it for the soul of Arcita, and Chaucer for the soul of Troilus. "I think — concludes C. S. Lewis — that all three ghosts — Pompey's, Arcita's, and Troilus' — laughed for the same reason, laughed at the littleness of all those things that had seemed so important before they died; as we laugh, on waking, at the trifles or absurdities that loomed so large in our dreams".²¹

The Medieval Model was "anthropoperipheral". Insignificance of man was, from the very beginning, built in into its architectonic design, but — strangely enough — it was made almost entirely of anthropomorphic elements. The main stuff out of which the model was composed were elements of human imagination.²² Even if this imagination sometimes worked in a seemingly geometric framework (the centre of the

¹⁹ *Ibid.*, p. 58.

²⁰ *Ibid.*, p. 32-33.

²¹ *Ibid.*, p. 34.

²² One can speak of "characteristically medieval type of imagination": "It is not a transforming imagination like Wordsworth's or a penetrative imagination like Shakespeare's. It is a realising imagination. Macaulay noted in Dante the extremely factual world-painting; the details, the comparisons, designed at whatever cost of dignity to make sure that we see exactly what he saw. Now Dante in this is typically medieval". *Ibid.*, p. 206.

world, celestial spheres, etc.), it violated — with no hesitation — all geometric standards if they did not fit the imaginative scheme. The main methodological rules according to which the Model was devised were rules of esthetics. The perfection principle, inherited from Platonic and Neoplatonic philosophy but strongly rearranged by the Christian sense of beauty and moral righteousness, dominated the entire edifice leaving no place for the principle of simplicity which later on had to play so an important role in modern science. The tendency to order and classify everything could be thought of as only a feeble shadow of future mathematical modeling of natural phenomena. Our laws of nature were anticipated by various “sympathies, antipathies, and strivings inherent in matter itself”.²³ Of course, the Model was supposed, by its creators and its users, to be coherent, but a suitably trained imagination was able to compose even contradictory elements into an apparently coherent whole (as we have seen, the humankind occupied simultaneously central and peripheral position in the world). There was negligible, if at all, empirical control over the Model and over consequences it could imply. Just as it is no empirical control over the work of art. It is enough if it is beautiful, inspiring or exciting metaphysical emotions. The Medieval Model of the World fulfilled all these functions. And even more — it was a “locus theologicus” of those times. In the following sense.

To all historians of ideas Whitehead once gave an ingenious advice: «When you are criticizing the philosophy of an epoch, do not chiefly direct your attention to those intellectual positions which its exponents feel it necessary explicitly to defend. There will be some fundamental assumptions which adherents of all the variant systems within the epoch unconsciously presuppose. Such assumptions appear so obvious that people do not know what they are assuming because no other way of putting things has ever occurred to

²³ *Ibid.*, p. 92.

them. With these assumptions a certain limited number of types of philosophic systems are possible, and this group of systems constitutes the philosophy of the epoch”.²⁴ In this sense, the Medieval Model, or at least some of its elements, constituted the “philosophy of the epoch”. As a background conceptual system it was also omnipresent in the Medieval theology. A separate study would be needed to show its all penetrating, and consequently not easily detectable, action.²⁵ Even the great theological plan preserved in almost all theological treatises of the Middle ages: God - Creation - Redemption - Sacraments - Eschatology, reflects a cosmic order into which the “economy of salvation” is harmoniously inscribed.

There were two main sources of the Medieval Model: Greek philosophy and Christian faith. Just in this order: first the pagan philosophy, and then the religious belief. Elements of the first, very selectively inherited from Antiquity, were a backbone of the Model; elements of the second provided a normative framework rather than a stuff out of which the Model was constructed. The Greek philosophy reached the Middle Ages through a very casual selection of texts, often only pieces of the originals. A general collapse of culture, a great gap in the evolutionary chain of development during the Dark Centuries separating the Antiquity from the Middle Age, created a great reverence for any scrap of written material. Let us once more quote C. S. Lewis: “If, under these conditions, one has also a great reluctance flatly to disbelieve anything in a book, then here there is obviously both an urgent need and a glorious opportunity for sorting out and tidying up. All the apparent contradictions must be harmonised. A Model must be built which will get everything in without a clash; and it can do this only by becoming intricate,

²⁴ A.N. WHITEHEAD, *Science and the Modern World*, Collins - Fontana Books, 1975, p. 65.

²⁵ Such a study has been undertaken by N.M. WILDIERS, *Weltbild und Theologie vom Mittelalter bis Heute*, Zürich, Einsiedeln, Köln, 1974; especially Part I.

by mediating its unity through a great, and finely ordered, multiplicity".²⁶

3. *Without Thinking about Thought*

The Copernican revolution certainly struck a serious blow to the Medieval Model. This is especially true if by the Copernican revolution we understand not only the work of Copernicus himself but also all these processes to which it gave a powerful momentum. To these processes belong:

- (1) unification of the "earthly physics" and the "physics of heavens",
- (2) deherarchization of the Universe,
- (3) geometrization and infinitization of space,
- (4) mathematization of science,
- (5) its mechanization, and
- (6) increasing of the role of controlled experimentation in science.

All these processes were many times subject to a thorough analysis²⁷ and there is no need to repeat it here. Let us notice that to these six major processes I have not included the one commonly attributed to the Copernican revolution, namely depriving the humankind of its privileged central position in the Universe. As we have seen, people of the Middle Ages did not attach a great significance to the central position of the Earth, and before the geometrization of space had been completed such a position could be understood in manifold (also metaphorical) ways. Of course, I do not deny that the realization that the earth had been degraded

²⁶ The Discarded Image, p. 11.

²⁷ Some aspects of these analyses I have presented in a talk at the Leningrad Symposium on the Anthropic Principles, 28-30 November 1989: "Anthropic Ideology Throughout the Ages", to appear in *Historia et Theoria Scientiarum*. See also references to original works therein.

to the role of an average planet had enormous impact on imagination of people, but this came much later as a result of all the above enumerated processes. And this was but a part of a more complicated pattern of radically changing man's relationship to science and the Universe.

I am inclined to ascribe a predominant role in this pattern to the mathematization of science. The process itself was by no means a new one. For a long time it was present in astronomy; it created an Archimedean tradition in the so-called classical sciences (optics, acoustics, statics...). In the Antiquity and in the Middle Ages it was paralleled and often dominated by a mystical approach to numbers and to mathematics in general. The intensification of this attitude in the fifteenth century could be regarded as a presentiment of what had to come. In the works of Galileo and Newton a method of a dialogue with nature in the language of mathematics was finally established. Again, there is a host of fine analyses of this phenomenon, and I shall not try to summarize them here. I want only to stress out some of its features directly connected with the present topic.

Experimentation with nature and the mathematical method of constructing models of natural phenomena not only begun to eliminate anthropomorphic approach to the world but also turned out to be possible owing to the gradual elimination of the "cognizing subject" from the scientific method. It is not only that "nature can be thought of as a closed system whose mutual relations do not require the expression of the fact that they are thought about".²⁸ The point is that the precondition for the success of the modern scientific method was that Galileo and Newton had "to think about nature without thinking about thought".²⁹ I do not claim that the mathematical-empirical method will never be able to think about its own thinking about nature. In fact, there are symp-

²⁸ A.N. WHITEHEAD, *The Concept of Nature*, Cambridge, 1971, p. 3.

²⁹ *Ibidem*.

toms that this begins to be the case. Gödel's theorems in metamathematics seem to imply that thinking about our mathematical inquiries is an important limiting factor, and some interpretations of quantum mechanics pretend that thinking about quantum processes is indispensable for them to be measurable. I insist only on saying that the elimination of the "conscious subject" from the scientific method was a precondition for the *classical* science. Taking into account all subtleties of the functioning of the Universe was simply too difficult (both in fact and in principle) for the young science to deal with. Simplifications, idealizations, and step by step approximations are *sine qua non* conditions of the scientific method, and at first stages of its development these conditions had to be very restrictive. Elimination of man was but a part of the idealization strategy being a crucially important component of the scientific method. It is a source of constant astonishment that the strategy of idealizations, even such a crude one as getting rid of the thought that the world is being thought about, works, and works so efficiently. However, it does, and it is, so to speak, an empirically corroborated fact.

I think that it is not Galileo or Newton but Descartes who, as a symbolic personage of this process, stands at the crossroads. His strict dichotomy: "extended matter" for physics, and "conscious substance" for philosophy did not create modern physics, but it did separate modern philosophy from physics to come.

It is interesting to notice that with this "elimination of man" from the scientific method another important process coincides, namely that of "arithmetization" of human life by a clock measured time. With the invention of mechanical clock, "time was no longer associated just with cataclysms and festivals but rather with everyday life".³⁰ The process had begun within the mercantile class but it soon spread among other strata of the society. As put by Lewis Mumford: "Time-

³⁰ G.J. WHITROW, *Time in History*, Oxford, 1988, p. 110.

keeping passed into time-saving and time-accounting and time rationing. As this took place, Eternity gradually ceased to serve as measure and focus of human actions".³¹ The timeless Medieval world with everything (human beings included) at the assigned place irreversibly vanished. Personal existence began to be regarded "as being essentially based on the present moment".³²

Husserl³³ accused the classical science of "treason of the human cause". I do not think he was right. One cannot blame a train that it does not fly; flying is not its business. However, Husserl's objections might be regarded as justified as far as they reflect a dangerous split the successes of modern science have made in the consciousness of many modern people.

4. *Strangeness at the Crossroads*

One of the main symptoms of this split was a separation of ways of science from those of religion. The Medieval Synthesis seemed to be irreversibly lost. With certain external or "institutional" aspects of this separation I have dealt in my talk at the Castel Gandolfo Seminar,³⁴ now I would like to focus on a heart of the matter.

In the previous section I have turned attention of my reader to an "elimination of a human subject" from the scientific method. Some philosophers (including Husserl) claim that when analysing the scientific method one must ultimately

³¹ After Whitrow, *ibid.*

³² *Ibid.*, p. 170.

³³ In his *Die Krisis der europäischen Wissenschaften und die transzendente Phänomenologie*, Hamburg, 1982.

³⁴ Scientific Rationality and Christian Logos, in: *Physics, Philosophy, and Theology: A Common Quest for Understanding*, eds. R.J. Russell, W.R. Stoeger and G.V. Coyne, Vatican Observatory, Vatican City State, 1988, pp. 141-150, especially sections 3 and 4.

take into account the fact that after all this method is actually executed by human individuals and that everything in the sciences is basically dependent on our sensory perceptions. In a sense, this is trivially true. (However, in a sense only, because what if we ask which are the sensory data in a modern accelerator experiment giving a long series of numbers on its computer outputs?) If we want to go beyond trivial statements, we must say that there are neither sensory perceptions nor personal convictions that really count but *interindividual* (or *intersubjective*) exchange of information. Doing science is perhaps the only human activity that has succeeded in developing such a high degree of practically identical understanding of scientific theories and methods by people of a very different cultural background. The key feature of this "practically identical understanding" is that it does not require of (moreover, it is not concerned with) having a similar insight into a given theory or method; its essence consists in enabling people a fruitful cooperation and contributing to a common stock of results.

On the other hand, religion, from its very meaning (*re-ligare*), is an intimate *nexus* between an individual and God. I do not want to imply that religion has no social or institutional aspects; it certainly has, and they seem indispensable for its full authenticity, but they become empty and senseless with no reference to this basically individual *nexus*. Moreover, religion is an answer to the existential problems of man, and these problems are always intimately individual; they do not primarily concern any information exchange between people, but a "drama of existence" that always engages the deepest layers of the human personality.

This contrast between interindividual character of science and fundamentally individual character of religion has introduced a *strangeness* between science and religion. A strangeness could be more disastrous than open hostility. A strange thing very often means a contemptible thing. I think this is one of the main reasons of the split between ways of science and ways of religion in modern times.

In the Middle Ages a real conflict between religion and the image of the world was *a priori* excluded, since the image of the world had been constructed with the aim to provide a background for both the religious doctrine and the existential drama of man. The human drama inscribed into the cosmic architecture of the Model remained in harmony with the universal design.

In the world dominated by the modern sciences a conflict between science and religion was potentially present from the very beginning: by eliminating the human existential problems from the domain controlled by the scientific method these problems were sentenced to insignificance.

The fact, very often alluded to by historians of science and historians of theology, that the Medieval image of the world had so strictly coalesced with Christian theology that the collapse of the former seemed to denote the collapse of the latter, is but a secondary effect. The old image of the world acquired such an enormous "theological inertia" since the new image was able to offer only strangeness when a synthesis was looked for. One had to wait more than two centuries, till philosophical reflection on the scientific method is mature enough, to comprehend that methodological differences need not be equivalent to the mutual exclusion, and that a respect of competence combined with tolerance could be better than premature syntheses.

However, before this happened, new philosophical interpretations, substitutes of a synthesis, accumulated around science. After a relatively short period of the so-called *physico-theology*, which on the one hand can be thought of as a posthumous child of the Medieval Synthesis and on the other hand as an expression of a religious fascination with new scientific achievements, positivistic, materialistic, and finally atheistic interpretations took over. All these interpretations created an atmosphere in which the worship of God was gradually replaced by the worship of man. One could risk a statement that the Medieval world was anthropoperipheral but anthropomorphic, whereas the modern world, proud of its

freedom of anthropomorphic elements, transformed into an anthropocentric structure. Man has become its quasi-absolute value.

5. *Cosmotheoros*

In the last decades of the seventeenth century the possibility of intelligent life on other planets excited public interest. A treatise *The Plurality of Worlds* written by Bernard le Bovier de Fontenelle³⁵ and published in 1686 gained enormous publicity and became a first best-seller popularizing the new science (in fact, more Cartesian than the Newtonian one). Only a little less popular was a treatise written by Christiaan Huygens bearing the title *Cosmotheoros or Conjectures concerning the Celestial Earths and their Adornments (Kosmotheoros, sive, de terris coelestibus earumque ornatu conjecturae)*.³⁶ I think the work by Huygens closes, in a sense, a period opened by Kepler's *Dream* or, better, these two works form a kind of parentheses comprising a process that in a meantime has reached a certain maturity. Both works were published posthumously, and both could be thought of as comments to purely scientific accomplishments of their authors. Kepler had undertaken his journey to the Moon "to build up an argument in favour of the motion of the Earth",³⁷ Huygens, the other way round, used the Copernican theory to render a similarity more probable between other planets and our Earth. Other planets must have a vegetation and animals since without them "we should think them below the earth in beauty and dignity; a thing that no reason will permit".

³⁵ *Entretiens sur la pluralité des mondes*, ed. Alexandre Calame, Paris, 1966.

³⁶ All quotations in this section come from the English translation: *The Celestial Worlds Discover'd: or, Conjectures concerning the Inhabitants, Plants and Productions of the Worlds in the Planets*, London, 1698 (Facsimile reprint, London, 1968).

³⁷ *Kepler's Somnium* ..., p. 36.

Huygens' method of reasoning is always the same, and best expressed in the following sentence: "... from the nature and circumstances of that planet which we see before our eyes, we may guess at those that are further distant from us".

Huygens criticized Kepler's story about the Moon's inhabitants, "but he carried out for the planets much the same program that Kepler had for the moon".³⁸ He described astronomical phenomena in a detailed way as they are seen from each of the planets (Jupiter with its many moons and Saturn with its spectacular rings provided Huygens with especially rich possibilities).

Kepler was yet unable to break down with the old Medieval cosmic harmony. Although he destroyed perfect circular orbits of the planets, he tried to replace them by symmetries of Euclid's regular solids into which the planetary orbits could be inscribed or onto which they could be circumscribed. Under Huygens' pen the old world annihilated completely. Cosmographical mystery of Kepler "is nothing but an idle dream taken from Pythagoras or Plato's philosophy". To replace this "private design" Huygens proposes another picture: "What a wonderful and amazing scheme have we here of the magnificent vastness of the universe! So many suns, so many earths, and every one of them stocked with so many herbs, trees and animals, and adorned with so many seas and mountains!".

And what about ourselves, our planet, our Sun? The new picture of the world compels Huygens to conclude "that our star has no better attendance that the others". Here we have the modern cosmological principle stated for the first time in its full. We occupy an average place in the Universe. This will be a paradigmatic statement for about three hundred years to come, it will remain unchallenged until the stronger versions of the present anthropic principle. In the Medieval Model we were creatures of the margin acquiring all our signi-

³⁸ S.J. DICK, *op. cit.*, p. 130.

ficance from the Spiritual Centre of Everything; in the modern world we are just average, and being average we have no hope for anything else anywhere in an infinite vastness of average places. We have made the Modern World on our own image and similitude.

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