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Ageing in the Seventeenth and Eighteenth Centuries

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Argument

At the end of the seventeenth and beginning of the eighteenth century, ageing was specifically a medical issue. Indeed, on the one hand, ageing is a normal process of living; on the other hand, old age often entails specific pathologies. Is it really possible to dissociate old age from pathology? If so, how can we think of old age and explain both the necessity and the normality of it? If not, what is the cause of this dysfunction? Modern medical controversies argue along the lines of the respective partisans of *iatromecanism* (Descartes), empirical medicine (Sydenham), and animist medicine (Stahl). Furthermore, it progressively appears that the issue of aging must also be addressed within the social field, where old age is affected by sanitary, economic, and strategic conditions. Indeed, doctors, economists, and philosophers (Graunt, Petty, Leibniz) even tried to assess old age quantitatively with new methods of arithmetic. Thus, in this paper, we want to draw what constitutes the systems of knowledge of old age as a medical category located at the borderlines between epistemological, practical, and social challenges.

Since the 1970s when ageing in the population of western economies became recognized as a trend, the elderly have drawn more and more attention from politicians, economists, and physicians. In this context, sociologists and historians have broadened our understanding by studying the mental and social category of ageing throughout history. Their contributions focus on how ageing was perceived and processed and how it was represented through myths, biblical exegesis, Pythagorean arithmetic, cosmology, and astrology. Looking at ageing from the sociological and historical perspective of mental attitudes we can observe how the modern representation of old age began to be constructed in the seventeenth century. Political, economic, and social history offer a record of how old people were perceived as a specific category by quantified studies and institutions established in the seventeenth century. Far from being natural or self evident, our modern perception of ageing is the result of a complex history that intertwines scientific, social, cultural, and moral issues. The modern period crystallizes an important moment for the social and scientific construction of the old man or woman in a context characterized by the emergence of the notion of the State, the Reformation with its Anglican and Catholic reactions, and the Scientific Revolution, particularly its medical and mathematical dimensions.

If we examine the historiography of old age we find that between 1650 (the year Descartes died) and 1716 (the year Leibniz died) there was a lack of medical theory

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regarding ageing. Those seven decades were agitated by intensive discussions about physiological "models" (Duchesneau 1998); however, as far as we know, no study of history or philosophy of science was concerned with scientific questionings or analysis regarding old age.[1] This historiographical absence is as astonishing as it would be today if we were to deal with ageing without asking physicians, therapists, and theoreticians to participate in our debate. That is why it seems urgent to understand the medical rationality that was operating in the process legitimizing the category of old age at the end of the seventeenth and the beginning of the eighteenth century.

Analyzing the scientific controversies of the time enables us to review the medical debates that took place during the modern period, because there was neither a consensus on the meaning of getting older, nor how to cure the pathologies associated with it. As a philosopher, scientist, and political adviser, Leibniz offers a prism for observing the networks of the practical and theoretical debates on this topic in the Republic of Letters. Accordingly, on the medical side, Leibniz participated in the controversies that interested several medical schools in France, in the Netherlands, in England, and in the Germanic lands. By criticizing famous physicians such as Descartes, Sydenham, or Stahl, Leibniz tried to establish theoretical and practical conditions for requiring that modern medicine would take care of poor people, particularly old ones (Leibniz 2004; Carvallo 2010). From another angle, Leibniz contributed greatly to Political Arithmetic as a new tool for making decisions in complicated juridical or political cases. Defining key concepts and legitimizing mathematical methods kindled debates, and this new tool played an important role in the constitution of the social category of old age. Leibniz explicitly wanted to include the age criterion as a category in the census.

It remains to integrate the sum of the debates concerning the apprehension of age – a task that Leibniz did not take on. A long-term history is required for carrying out this integration. By adopting Leibniz' point of view during his time and the time of modern science, we can recognize several places where old age is questioned during the late seventeenth and early eighteenth century. From this viewpoint we can observe the development of medical knowledge about ageing and we can also observe other sciences or cultural categories where ageing was articulated. Furthermore, we can tease out the practical implications of this scientific elaboration. Rather than seeking unlikely precursors of gerontology or geriatrics, we have to understand how the modern period enabled novel encounters between distinct medical, mathematical, social, and political approaches. Some authors during this period argued for more interactions among those fields that had traditionally been separated. Thus, starting from the controversies Leibniz engaged in with his contemporaries we propose to study four modalities of thinking about ageing – *iatromechanical* with Descartes, empirical with Sydenham, animist with

[1] The sole outstanding exception concerns Troyansky 1989a, 109–124, especially chap. 5 which deals with scientific and medical thought concerning old age, and more precisely with Stahl's inheritance.

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Stahl, and finally arithmetical amongst several mathematicians. We have inherited their distinctions and convergences as they developed the medical category of "old age."

1. Inventory of the Medical Question in the Seventeenth Century

Ageing constitutes a category at the junction of the medical, social, and philosophical fields. Indeed, since Antiquity, this issue has been addressed by each of those fields. Aristotle addressed it in his short treatise of natural history (Aristotle 1965), in his rhetoric (Aristotle 1932, II, 14), and in his ethics (Aristotle 1994, 1121b, 1156a, 1157b) (Parkin 1998). Nevertheless, the empirical observation of ageing remained an individual approach, case by case, and especially concerned physicians (Hippocrates, *Aphorisms* I, §13–17, 1979a, 105–107; idem, *Aphorisms* III, §18–31, 1979a, 131–135; idem, *Regimen*, I §32–33, 1979b, 273–281). Similarly, in the modern age, this issue is at stake in several areas that we must understand if we are to properly distinguish between questions that are specifically medical and those that belong to the social and philosophical fields. But here again, the medical approach remains an internal one, i.e. at the level of the individual person. The challenge consists in locating the point at which an adult passes into old age in order to explain ageing and delay its pathological secondary effects.

In this quest for an objective criterion, there are two difficulties. One of these difficulties relates to the fact that several factors seem to provoke ageing, such as one's composition, hardening, heat, and humidity. How can we locate them all and constitute the matrix that explains ageing? And within this matrix, how can we identify the explanatory factors, that is to say, the factors that determine when an individual passes from one age to another? For this criterion must be found in every old person, must never be found in a young person, and must cause ageing by its mere appearance. The second difficulty is linked to the fact that within modern medicine, there are several schools that are involved in the controversy around ageing: the *iatromechanical* school, the empiric school, and the animist school. Each school offers a different approach to explaining ageing. From those two difficulties, modern physicians conclude that ageing constitutes a touchstone for establishing a rational medicine.

1.1. Old Patients in the Seventeenth Century

Generally, because of a mistaken representation of the phenomenon of ageing, we tend to think that people began to get old much earlier in the seventeenth century than nowadays. We refer to the Cartesian revival of the Stoic aphorism according to which one must check one's health as early as 30 years old. Moreover, the relatively premature death of Descartes has strengthened the feeling that life then was short. Since life expectancy was limited to thirty or forty years, we induce that old age started as

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early as thirty-five years old. But such representations do not fit the historical situation. Indeed, although the retrospective calculation of life expectancy at that time was very low because of the strong child mortality rate, once the critical age of sixteen was passed – or the labor of bearing the first child for women – the ratio quickly rose. Once they reached the age of thirty, both men and women could expect to live for thirty more years (Laslett 1977; Bourdelais 1998),[2] and if, in 1750, they had reached 64, they still had ten more years to live. In other words, it was quite common to live to sixty or longer. In the medieval age, legal texts set the threshold for old age as between 60 and 70, when one could be exempted from certain charges (Shahar 1998; idem [1995] 2004, 14–35). Recent studies have shown that at the end of the seventeenth century persons older than sixty represented ten per cent of the English population (Ottaway 2004, 22). Even the medical literature and the popular gazettes referred to cases of exceptional longevity (Laslett 1999). Dietary treatises provided advice on how to live long and a *materia medica* to lengthen the years was passed around (Gruman 1966, 68–73).

However, ageing is not limited to merely an accounting of years, but rather a qualitative transformation of the individual. Nowadays, we are used to defining age in calendar years, referring to a category in the population that we determine from specific social conditions (retirement, management, etc.). This has required us to invent a "fourth age" (Laslett 1989). In contrast, the historical data show that we must separate the population approach from the individual approach in order to understand how moderns think of ageing. For example, Descartes connected old age only to someone who lived 80 years. In his argument, he cared not about the fact that there were only very few of those cases, but rather about the physiological aspects of the phenomenon. And most physicians express the same point of view.

According to another false idea, modern medicine did not really begin to take care of old people until they constituted a large social class, i.e. in the twentieth century (Conrad 1998, 134).[3] But in fact, physicians – and in that field, Descartes is in no way an exception – try to understand to what extent ageing is a normal phenomenon in life, while they try to relate ageing to the pathologies that are more numerous and sometimes specific to old age.

Beyond those erroneous notions that recent historiography has deconstructed, the modern definition of ageing does not follow calendar years but rather physiological criteria. For example, it seems that the age that marked menopause has been quite unchanging as the beginning of ageing for women, who are said to start getting old

[2] Hippocrates pointed out that old men were less sick than young men, but that they complained more, *Aphorisms* II, §39 (Hippocrates 1979a, 119).

[3] In drafting a dynamic history of the medical management of old persons, Christoph Conrad wrote: "yet during the nineteenth century old age remained a category of medical study that drew little medical interest overall" (Conrad 1998, 134). This statement seems wrong. Even though the professionalization of medical care for the elderly occurred only when the elderly were conceived as members of a social class (Nascher 1914), the challenge of understanding the phenomenon of ageing was already a crucial one.

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earlier than men (Botelho and Thane 2001; Ottaway 2004; Shahar [1995] 2004, 18, 35). In addition, loss of vision, limping, infirmity, and memory loss are indications of aging common to both sexes. The years, considered in and by themselves, are not a sufficient element to determine who is old, because each individual evolves at a different rhythm. So physicians were the first to define the organic criteria of the threshold of old age, and to explain both its modalities and its reasons, in order to decide whether it is a pathological or a normal phenomenon. A former *topos* inherited from Galen (*De sanitate tuenda*) considered ageing an incurable disease – *insanibilis morbus* – which could only result in death. Ambroise Paré said that "ageing, even robustly, is by its nature like a kind of disease" (Paré 1633, 25). According to Descartes, who tried to distinguish old age from pathology, there is "pure" old age and there is pathological old age, which is mainly marked by weakening. He noted that one cannot avoid the former, but one must delay the latter, as the self-physician requires (Descartes to Huygens, 5 October 1637, I 645; XI 224, Descartes 1964–1974).

1.2. The Periodization of Age

Since Antiquity, philosophers have delineated the ages of life (*aetates hominum*) within 3, 4, 6, 7, 10 or 12 periods that separate the different stages of an individual's development. Those individual stages correspond to a natural order that is both immanent and transcendent (Standen 1954, idem 1969; Archambault 1966; Gruman 1966; Sears 1986). Indeed, on the one hand, they characterize a rationale that is internal to the individual, and, on the other hand, they relate to the stages of the cosmic nature (Sears 1986; Cole 1992). Thus, for example, Harvey held that the circulation of moods is linked to the meteorological circular trajectories (Harvey [1628] 1990, 39, 108), and Perrault that it can be met in the plants, and even in all beings, alive or not (Perrault 1721, 72–73, and idem [1709] 1733). To the same extent, ages resonate with seasons. Depending on the system of reference, there are different models of the ages of life. Aristotle divides the cycles of life into three periods; Galen and Hippocrates divide them into four; Ptolemy into seven; and others into ten. In the sixteenth century, Ambroise Paré, under the authority of Pythagoras, counted four ages of life, i.e. childhood, adolescence, youth, and old age, which correspond to the four seasons. Even though those stages are, by convenience, selected according to chronology, they do not correspond to a chronological age so much as to a characteristic temperament: "however ages should not be defined by the number of years, because some individuals are older at 40 than others at 50" (Paré 1633, 11).

Like most of the authors preceding or following him, Paré divides these four stages of life into sub-periods (Paré 1633, 11; Sears 1986; Botelho 2005, 118–121; Jaucourt "Vieillesse" Encyclopédie). For Paré, old age is divided into two: the first period begins at 35 years and lasts until 49; the second period begins at age 50 and goes to 80. For others (Shahar 2004), adulthood can be divided into three stages, i.e. the first

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stage when one still retains one's virile virtues and thus can go on exercising civic responsibilities, the second stage when one loses them, and the third stage when one returns to childhood, i.e. *bis pueri senes*. Even though the criteria are set by social life, this periodic representation is mainly based upon a theory of the temperament, which characterizes a specific blend of moods inside the human body. This blend balances in two ways, either by weight, i.e. according to the quantitative equality of the proportions among its elements, or by justice, i.e. according to the final adaptation of the body to its functions. Each individual embodies a specific temperament. Within this individual, each age corresponds to a specific temperament. At an even more delicate level, the hours within a day correspond to the predominance of certain moods within the temperament. Besides, the way of life directly impacts on the temperament and can even disturb one's specific balance. In the event of disease, the physician must try to restore the patient's own temperament, with particular use of purges, baths, and diets. In old age, melancholia turns out to be the dominant temperament. As such, it is a pathological state in the individual, because it vitiates the natural balance of the elements, but it cannot be corrected. Thus, old age is by itself vitiated by an excess and there is no pure old age, as Descartes theorized. On the contrary, old age becomes entirely pathological, since it is characterized by a lack of balance in the body. In this context, temperament is both an ontological and an explanatory cause of ageing.

2. Descartes' *iatromechanical* explanation (1596–1650)

Descartes did not practice except on himself, but he elaborated a physiological theory integrated into the knowledge tree as a particular branch of his mechanics. This theory plays an important part in the development of *iatromechanism* in France and in the Netherlands where he resided. Not only did he attach importance to explaining ageing, but he also introduced two breaks in galenic inheritance when he claimed that old age is not a disease, and that life is not a cyclic process, but rather a linear one.

Accordingly, Descartes drew a distinction between the pathologies that are accidentally associated with old age and normal old age, which would be integrated in the unique material process of life. To think of old age first requires thinking of the normal and sane phenomenon of the living. In that regard, growth, nutrition, and ageing constitute three aspects of the same reality. Of course, Descartes was not so naive as to believe that the human body could avoid disease, *a fortiori* when it gets older. However, he made a radical distinction between a sane old age – which he does not define positively – and the associated pathologies, just as one must distinguish a sane body from a sick body.[4] Thus, those discussions contravene the Hippocratic aphorism

[4] This question is still open: two recent studies prove the possibility of a sane brain at 115 years and that it is necessary to distinguish the phenomenon of ageing from the usual pathologies associated with it (den Dunnen, et al. 2008, 1127–1132; Tredici and Braak 2008, 1133–1136; see also Laslett 1989, 19).

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that states that "from his birth on, man is only sickness" (*totus homo sit morbus*). Disease is not consubstantial to life or to old age. Therefore, thinking of life and thinking of old age must not be limited to thinking of pathologies. This demand is even stronger for the therapist, whose aim is to preserve the body in good health, even when it is ageing. In order to explain ageing, Descartes referred to the sole material causes that govern life (Descartes to Morin, 12 Sept. 1638, II, 367, Descartes 1964–1974). That is to say that the child grows and the adult barely nourishes his body. The cause of ageing is the stopping of growth, since the limbs progressively harden: "the substance of its organs will slowly harden, so that after a few years its pores won't be able to enlarge anymore; and so, by stopping growing, this substance will present the body of an older man" (Descartes 1964–1974, XI, 126; my translation).

On that point, Descartes concurs with the classical position that can be found in the writings of Aristotle, but he applies them solely to the area of substance. Hardening constitutes the unique cause of death (Stahl opposed this point, arguing that it is a confusion between cause and effect) that consists in losing the figure that is necessary for the balance of the moods. "As we get older, the little fibers that make up the solid parts of the body contract and stick together more and more, and in the end they attain such a degree of hardness that the body stops growing entirely, and even loses the ability to be nourished. This leads to such a disproportion between the solid parts and fluid parts that life is extinguished by old age alone" (ibid., 250; idem [1985] 2006, 321). Faced with the phenomenon of old age, the physician should not pretend to avoid causal determinism that causes hardening of the limbs. Rather, the physician should seek to dissociate the inferred weakening from ageing itself (ibid., VI, 62). Thus, Descartes offers a linear view of the ageing process. Although this view might seem obvious to us, it marks a departure from the periodization of age that dominated antique and medieval medicine and still remains prevalent in modern times. This periodic conception goes hand in hand with the dismissal of the temperament as the main explanatory element of life, and offers a more mechanical point of view.

Nevertheless, restricting the primacy of temperament in no way eliminates it, and it still interferes greatly in the ageing process. On that aspect, Descartes concurs with classical data from Galen, Avicenna, and Fernel. Accordingly, his therapeutic approach requires adapting to one's temperament. In another place, Descartes emphasized the fact that, in general, men are endowed with a hot and humid character. Furthermore, as V. Aucante points out, the temperament itself evolves, but it is solely limited to the human body, in particular to the passions, by modifying the ways the body feels (Aucante 2006, 384). Therefore it is limited to a physiological role, since it conditions one's behavior without playing an immanent causal role. Thus, the intensity of a particular affect in one individual changes depending on one's temperament. But in itself, an affect depends on the movement of the particles, especially of the animal spirits.

Therefore, Descartes calls for a medical theory to understand the human body. Practical medicine alone is not enough, even though it is efficient, because it remains

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uncertain. Inside this theory, the issue of ageing appeared to be a necessary element, since it constitutes a normal phenomenon of the living. However, one must distinguish the normal determinism of physiological causes from the pathologies that are associated with a particular chronological age. Indeed, the human body is characterized by its ambiguity. On the one hand its health is fragile because the configuration that results from the movements of the parts is always changing, and on the other hand, it resists change thanks to the mechanisms of conservation that also explain its ageing (Descartes 1964–1974, IV, 346). This tension explains why diseases appear, but it does not follow that ageing is pathological.

3. The Periods of Life According to the Empirical Approach of Sydenham (1624–1689)

Friend of both Boyle and Locke, Sydenham refuted the *iatromechanical* claim in medicine. After his studies in Oxford, Cambridge, and Montpellier, he developed an empirical medicine based on his personal practice and on an empirical and experimental conception of the philosophy of nature. Whereas Descartes approached the issue of age according to a linear vision of human development, most of the modern physicians – such as Sydenham – approached ageing according to a periodic representation of life. As such, they concurred with the ancient tradition, thus highlighting their difference with Cartesianism. Sydenham consequently followed the tradition of the ages, but without linking it causally to a theory of temperament. By renouncing the link between symptoms and causes, he specifically refused to directly link age to temperament. Nevertheless, he kept, and even expanded, the concept of "constitution" which describes the main qualities of a season or an entity that grows within a specific period of time and is a corollary of the inhabitants' temperament – without pretending to find its causes or explain them. Sydenham, remaining faithful to Hippocrates, noticed first that all organic phenomena – disease, fevers, men, plants, animals, seasons, etc. – follow periods. The individuality of a phenomenon is even defined in relation to the period of time in which it evolves. For example, to identify a disease, one had to check both the clinical symptoms that are visible during an examination, and its own evolution, which constitutes the main clinical criterion, in order to implement a differential diagnosis.[5]

Nevertheless, according to the empirical hypothesis, we are not able to explain why this temporal term relates to such and such a phenomenon. In other words, we do not have direct access to the temperament itself, but rather to the symptoms

[5] A differential diagnosis characterizes a medical notion whereby a symptom or syndrome (system of symptoms), may have several explanations or causes (i.e., several diseases). The temporal evolution of the clinic – or nowadays complementary exams – allows for differentiating the most efficient of those distinct explanations, causes, or pathologies, to induce the corresponding etiology and the correct treatment.

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that indicate either a crisis, an acme, a development, or an envelopment. This is the reason why it is impossible to diagnose a disease before it reaches a certain stage in its development, and why, by inference, one's constitution needs to have stabilized its characteristics. The whole challenge is to locate the beginning and the ending of a constitution, its transitions and its stable phases: "that which seems especially difficult is to know the beginning of a *constitution*" (Sydenham 1774, 238). Indeed, the constitution only provides a general cause, since by itself it does not provoke the disease. Rather, it characterizes a disposition of the air that is concomitant with certain specific epidemic diseases that depend upon some more particular causes which justify its passing from endemic to epidemic. Thus, any disease is linked to a constitution, and correctly spotting it, even though backwards, enables us to identify the disease. The collateral evolution of one's constitution and of its diseases follow critical thresholds, since constitutions change according to place, year, and season, and they come with specific diseases (e.g. types of fevers, pox, measles, cough, plague, etc.).[6] The criterion of age must also be added to those external circumstances. The English Hippocrates provides us with a scale for recognizing a disease, which can be found in two ways, one following the constitution, and the other following the age. Therefore, Sydenham also followed the two Hippocratic approaches that had been explained in the compendiums *Airs, Waters, Places* and *Aphorisms* (Hippocrates 1984, IV, 99; 133; Jouanna 1992, 212).

However, a diagnosis does not enable us to go from those criteria to their causes, or to explain why certain fevers develop following repetitive crises every two, three, or four days. Moreover, nobody can explain why a certain type of fever develops in such or such location, why the horse reaches its higher growth at seven years of age, man at twenty-one, or why plants bloom in a specific season (Sydenham 1774, 50–51). As a consequence, ageing follows the normal development of the patient without our being able to provide a satisfactory explanation. It's the same for diseases:

> Nature produces all things by laws that are invariable, but with an art that only it knows; and it covers the essence of its productions & the forms that constitute their differences with a deep darkness. Thus, each type of illness as well as each type of animal or plant is constituted of constant properties that are proper to itself only, i.e. that run from its essence & that are inseparable from it. And don't ask me how we can cure illnesses, while we don't know its causes: indeed, illnesses cannot be cured by knowing their causes but rather by knowing a correct method confirmed by experience. (Ibid., 82–83)[7]

Therefore, Sydenham designed a clinical description of ageing, i.e. he described old age as a period of time that follows the normal development of the individual. Even though he followed an epidemiological approach by comparing the thresholds

[6] Through his theory of constitutions, Sydenham has defined the set of pathological states within a specific group of people, at a determined moment – which M. Grmek calls "pathocenose" (Grmek [1969] 1995, 1437–1483).
[7] Hippocrates also had a similar suspicion (Hippocrates 1979a, 99). A state of good health can be excessive, i.e. dangerous. This is the case of athletes in particular.

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of old age within one species and among species, his populational approach remains, in essence, a clinical one. He intended to characterize the common attributes of old age without explaining them, by following the classificatory rationale of botany. In addition, he did not intend to quantify the sample that he was studying, or to draw unchanging relationships among the groups that he studied.

4. The Animist Explanation of the Periods of Life by Stahl (1660–1734)

University lecturer in Halle, and pietist, Stahl criticized both Descartes and Sydenham. He chastised Descartes for reducing the living body to matter; he went after Sydenham for renouncing etiology. In his long controversy with Leibniz, Stahl demanded that medicine should keep its autonomy from physics and mathematics. His argument precisely targeted ageing: modern mechanics failed to consider organic temporality, because it reduced time to space.

Stahl – in contrast with Sydenham, who, in spite of his consideration of the periods of disease of human life, did not understand the similarity among the different organic phenomena such as illness, ageing, bloodstream, moods, excretion, or glandular secretion – showed that they all result from the same cause. Thus, comprehending disease, ageing, and age in general, cannot be reduced to describing them, to classifying signs, to identifying and differentiating entities. On the contrary, comprehension implies linking these phenomena to their origin. Broadly speaking, any organic phenomenon evolves within a period of time so that a disease can be acute, chronic, or periodic; bloodstream determines periods analogous to the ocean tide (Stahl [1692] 1864, 532);[8] age corresponds to the disposition of the vital acts following a fixed period of time, as certain characteristic signs or behaviors have proved, such as teething, puberty, menstruation, matrimony, widowhood, fecundity, infertility, or menopause. And all those different periods match with the intensity in the vital energy, which translates into the physiological mechanism, first in the way of the tonic movement and then in the way of the three fundamental movements, i.e. circular, excreting, and secreting, which themselves regulate the pulse and temperament of an individual (Stahl 1737, 218).[9] Since each of these movements is characterized by its periodicity, the development of diseases or of ageing still corresponds to the expression of this same vital energy that operates in the organism. The discovery of the periodicity of the movements that are internal to the organism – in particular thanks to bloodstream –

[8] Stahl focused on this analogy in his thesis *De aestu maris microcosmici*, 1692. He links the phenomena of tension, heartbeat, contraction, secretion, excretion, and bloodstream in the tonic movement, depending on whether it is applied to blood, to solid, fibrous or glandular limbs, at the level of each part or globally. Therefore, he applies the circular phenomenon more to phenomena such as gland secretion, than to the bare bloodstream.

[9] The rhythm and the number of the pulse constitute an important indicator for the diagnosis. Stahl mentions the Chinese tradition reported by André Cleyer (1645- ?), *Clavis medica ad Chinae pulsi doctrinam*, 1680.

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finally made it possible to give an account of the Ancient's empirical observations of ageing or of diseases, by relating them to their true cause.

In order to understand ageing, Stahl started with an analysis of temperament, which, since the time of the Ancient Greeks and Arab physicians, was thought to indicate a certain mixture of moods. Even though Stahl acknowledged his debt to them, he believed that their theories had been distorted by his modern contemporaries who refused to see in this mixture a proof of the effectiveness of the soul-like principle of life (ibid., 232). According to the Moderns, and as we saw for Descartes or Sydenham, the temperament rather indicated elementary qualities of moods and of solids. At best, they were related to habits of the soul (*animi habitum*). However, according to Stahl, this theory still had no foundation and would remain purely intellectual and fictitious as long as it would not recognize that the soul behaves differently depending on various textures in the body and that indeed, the temperament corresponds to a particular compounding of the moods along with the presence of the principle of life.

According to Stahl, moods can determine four different mixtures (*temperies*): the first one, sulfurous, ready to warm up and to be corrupted by fermentations constitutes the choleric or bilious temperament; the second one, more aqueous, more inclined with salinity determines the phlegmatic temperament; the third one, characterized as an intermediate fluid and hot mixture that flourishes in a mitigated way, corresponds to the sanguine constitution; the last one, thicker, less diluted, earthy is carried out by melancholic persons (ibid., 233). Under these four conditions, the vital activity maintains stable relationships to the temperament, insofar as it refers to the particular organization of the bodies and materials which constitute the mixture – *temperies*. Thus, a constant interaction exists between the vessels by which the mixture of moods conveys (§5) and the temperament which characterizes the individual and even determines one's standard, i.e. its own state of health,

> so that one can see in these bodies, characterized by the most adequate mutual proportion between the moods and the parts, that not only circulation, i.e. the progressive movement of moods, but also concurrently the secretions and the excretions, and consequently the universal vital trade, takes place simply and in a very adequate and free way. (Ibid., 234)

Indeed, the study of the various temperaments consists in locating the normal – though singular – modality of the circulation that is specific to each temperament. Thus in the choleric temperament, everything happens in a rather convenient way, by a vegetable act common – and even very suitable – to this temperament, so that this movement causes an all the more intense vegetative pulse. But most of the time, these temperaments are not pure but rather mixed; moreover, they evolve depending on the age and on the ways of life.

In any case, to diagnose the health or the age of an individual implies locating the conspiracy between, on the one hand, the proportions that articulate the vessel on a physical level and the moods which constitute the temperament on a chemical

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level, and, on the other hand, the behaviors of the soul, since they always respond to the various states of the body and to the proportions of moods (ibid., 236–240). Stahl criticized the Moderns, such as Descartes, because they disregarded the study of temperament or they reduced it to material movements.

Therefore, the temperament determines the identity of a body, its standard, which furthermore expresses the exact balance between soul and body, defined by the proportion between the moods, the vessels, and the movements. Consequently, all organic actions have developed a specific nexus to time, insofar as the Latin language underlines the relationship between the mixture (*temperies*), temperament, and time (*tempus*), considered as a state of temperament, therefore of mixture, at a given moment. Whereas the *iatromechanical* school only considered space and its various structures or parts, Stahl conferred a paramount organic dignity to time: "With regard to the business of secretion, the most important circumstance of all is time" (ibid., 252); or "You must know that, in the body, as well as in any animal species, actions are linked by a particular way with a particular time" (ibid., 241).

Slowness or speed, scarcity or frequency, succession or simultaneity, the instant, the moment or the duration have become the primary objects of the physician and have replaced the primary qualities of the physicist, such as movement, figure, and size. Certain movements – first the one of life, expressed like a tonic movement, then circulation, excretion, and secretion – follow universal periods, meaning that they remain as long as the temperament remains. Other movements develop within particular definite periods, which are included within limits that are internal to the state of the mixture – it is particularly the case of the diseases. However:

> It is very difficult to define this universal period, which is supposed to correspond to the natural life of humans, because it is not so much defined by a temporal and general dimension, than by its vital energy proper to each human being, either by increasing, by remaining stable or by decreasing following a certain temporal measure. In effect, 50 years (7×7) clearly corresponds to a limit of vital energy. This phenomenon is particularly visible in women who no longer have energy to reproduce, and, even if it is less notable in men, one notes that his energy decreases. (Ibid., 242)

Thus Man's existence is determined by measurements. Very few people reach 100 years of age, even fewer exceed it, and the majority dies earlier.[10] Within this universal limit, Man's vital energy experiences obvious changes, which correspond to the specific

[10] As part observation, the Bible offers a reference to determine Man's life expectancy. But the Holy Scripture proposes two antagonistic representations of age. The first one describes the prophets and some kings who lived to be very old, up to 930 years old (Adam, Seth, Methuselah...); the second one describes Man with a 70 or 80 year-old life expectancy (*Psalms* 90, 10). *Genesis* 47:8 considers that the age of Man kept on decreasing from the time of Creation. Stahl noted the hermeneutics issue in the Holy Scriptures, which say, according to a conventional expression, that men lived 120 years in those days. Thus, he agrees with Luther, who interpreted *dilatione* (time measurement) in a particular way, so as to designate the period of time awarded to men by God in

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dimensions of time, that is to say, to the degrees of age, i.e. the state of infant and young child (0–7 years old), youth (7–12 or 14 years), adolescence (12–25 years), the virile age (25–50 years), the old age (50–60 years) and senility (after 60) (*senescentem atque senilem*) (ibid., 242). Thus, from 7 months old, the child in the womb is viable, even if he is not yet inevitably lasting; he is visible and recognizable as a foetus. At seven years old, the teeth fall out; at fourteen years old puberty is completed; at 24 years old – medium of the fourth septenary – the growth is completed; at 49 years old, vital energy starts to decrease. In the same way, there are periods for the crises of the fevers (the fourth, third, or seventh days, and more precisely in the middle of the day). Therefore the rationale is not sought in astrology (Sears 1986, 47–53), but in vital energy. Indeed, "the thread" of pathology lies in its periods of time, and in particular in its relationships to age (Stahl [1692] 1864, 548). However Stahl also notices that luxury and idleness, which prevent one's temperament from expressing itself, can accelerate ageing. Luxury makes one age prematurely (Stahl 1737, 246), and it is consequently necessary to live with temperance – another word of the same family – in order to preserve the specific mixture of one's temperament.

Thus, ageing is not so much about physical measurement than about vital energy, and consequently, about temperament. In a traditional way, Stahl identified melancholy as the characteristic temperament of the old age, which tends not to fight anymore against the thickening of blood, then to produce corruption, and finally to lead to death. In contrast with the Cartesian thesis, Stahl characterizes a properly organic phenomenon that no physical description can explain. To the ages of life correspond variations in vital energy (childhood, youth, puberty, adolescence, virile age, old age, decrepitude), but it still remained to explain why Man dies naturally, and why he ages (ibid., 241).

Hence comes the question of knowing why Man did not live for more than one hundred years, why he dies of old age, why disease, at the end of a certain period of time, leads either to death, or to convalescence. As Sydenham understood well, death belongs to disease and to life in general, but the English physician gave up explaining why. While he differed from the common mechanistic tradition that conferred all prerogatives to the material substance, which hardens and causes the corruption of the body, it was nevertheless Stahl who opened a third way into the medical knowledge of ageing. First of all, he argues that ageing cannot be reduced to the number of one's years or to material means. Rather, it depends primarily upon one's body's lifelessness, which causes the deterioration of the body texture that shows through one's appearance. While wrinkles are a sign of ageing, lifelessness explains it (ibid., 241). The same rationale that is used for death and disease shall be used for ageing.

Indeed, the issue of ageing raised a beautiful problem for the medical field. The mechanistic explanations could not provide answers to the changes of the regimes,

order for them to repent before the Flood. Indeed, Stahl considered that, among thousands of men who lived, barely one had lived up to 100 years old (about the various interpretations, see Gruman 1966, 17–22).

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which characterized the organic mechanism of childhood, puberty, adulthood, and old age. On the contrary, it was necessary to resort to another type of explanation, which aimed more at explaining the causes than the means, in contrast with the mechanistic model. From this point of view, ageing was not considered a phenomenon that would be antagonistic to life, but rather a tendency engraved in life itself, that takes the appearance of corruption, which is always carried out in the organism's chemical texture that fights against disorganization (ibid., 244). Thus the speed and the brutality of death grow in opposite proportion to the individual's health. Sydenham made the same remark when he compared this effect to the needle. Indeed, if its pike is sharp-edged, it bores the cushion; in contrast, if its pike is blunted, it only marks a bump (Sydenham 1774, 85). Contrasting with the plague that kills a healthy individual in only a few days, ageing is linked to the second modality. Thus, in order to explain death, one must first answer at least two questions. First, why does Man die after a certain lapse of time? Second, since it is possible for Man not to die before a long time and thus to enjoy a long life, why can he not live forever (Stahl 1859–64, t.4, 29)?

In light of these two questions, life seems to be about the conservation of the natural disposition of the body against corruption. In other words, it is natural for compounds to be corrupted, and life only consists in maintaining the compounding in a purely virtual state of corruption. However, this virtual corruption is progressively updated, and constitutes the phenomenon of ageing itself. Thus Stahl perceived the properly organic nature of ageing and searched to explain its vital status. He criticized Cartesian reductionism, which obliterates the organic specificity in its causal research. Also, he deplored that Sydenham gave up a causal explanation at the exact same moment that he perceived the identity of the living that Descartes ignored. Among those two options, both of which in his eyes constituted dead ends for the development of medicine, Stahl proposed a theory that largely dominated the medical field of the eighteenth century (Roger 1963; Rey 1997, 2000). However his systematization required a refitting of animism into vitalism. On the issue of ageing, this metamorphosis first appeared in the *Encyclopaedia*, at least in certain articles such as "Crise" written by Bordeu, "Régime" whose author is unknown and who refers to Sydenham,[11] or "Tempérament." In contrast, the article "Vieillesse," written by Jaucourt, favored an *iatromecanical* approach. In short, in the second half of the eighteenth century, the tensions between the various interpretations of ageing remained sharp.

[11] The Schwab-Rex index does not give the name of the author of "Régime." The articles written by Binet, Astruc, and Dulieu in 1952 on the second-hundredth birthday do not mention this article. Moreover, "Régime" was published after the prohibition; therefore, the usual collaborators of medicine (Aumont, Tarin, Vandenesse) cannot have contributed to it, it could have been an occasional contributor. In addition, Louis deals with surgery and Venel with chemistry and pharmacy, which were more separate from medicine at that time than nowadays (I am grateful to Pierre Crépel for this information).

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5. The "Demographic" Approach

However, this retrospective look at ageing shows that there was still some confusion surrounding the modern definition of this phenomenon and its criteria. In fact, the concepts of age, old age, and ageing often proved to be intermingled, because a purely individual approach could not solve the problem of definition. Indeed, obviously, the representation of age, and in particular old age, depends upon seeing the elderly in flesh and blood. In other words, it became necessary to look at a population[12] in order to understand ageing, because ageing was more than objective data that medicine might deal with directly. However, looking at a population as an undisputed criterion or threshold for old age proved to be ambiguous, since understanding ageing also entails a set of cultural, social, political, and economic choices that predispose the category of old people. The concept of ageing is at the crossroad between scientific knowledge – in this case, medical – and a social construct, which also must be considered objective knowledge. Politicians and philosophers became aware of this new requirement: Petty, Graunt, Lodewijk, and Christiaan Huygens, Jan de Witt, and Leibniz – amongst others – proposed research in Political Arithmetic.

Until the middle of the seventeenth century, the study of ageing was limited to case-by-case observations by parishes and physicians such as Sydenham. However, first for reasons extrinsic to medicine, a new method was established to gather data concerning the elderly. Even though the transition from individual observation to observation of a population still raised insurmountable difficulties, the State perceived a need for apprehending objects globally (Dupâquier 1985; Desrosières 1993). Historiography in the English language provides a great deal of data with the British case of the Old Poor Law institutionalization (1598–1601). Botelho shows how, in England, after the religious crisis experienced during the Reformation, the State took on new responsibilities that had earlier been the domain of the Church (Botelho 1996, 92; idem 2004, 9).

Indeed, following the plague and epidemics that decimated London, the British government decided to introduce an accounting of the population in order to locate the critical periods of contagious diseases – in particular, the transition from endemic to epidemic – and to set the most effective time to take health measures (Petty 1905). Paris was faced with similar difficulties (Perrot 1992; Brian 1994); from 1644, the Parisian Faculty offered charitable consultations for poor people, and particularly for old people. Sixty years earlier, Theophraste Renaudot had already opened a *Bureau d'Adresse* for free medical care, but he had to close it under pressure from the Parisian Faculty, because he was scholar of the Montpellier Faculty (Jestaz 2006). Leibniz suggested that the German government establish a professional Council of Physicians for compelling

[12] I prefer to use the term "population" rather than "demographic" because the word did not exist before Achille Guillard (1799–1876) (cf. Bourdelais 1993, 118).

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some of them to take care of the poor people (Hartmann and Hense 1988): "any means to contribute to future progress [of therapeutics] is likely to be of interest for the State" (Leibniz 2004, 91). And hence in its new form, the State needed to know the components of its population and instituted a policy for public health in order to assess its power, to maintain social order, and to avoid the disastrous consequences of plagues. To be recognized as an absolute power and to manage the financial investments associated with this project, the State endeavored to take on the functions that had previously been carried out by the Church or the family (Faure 1997). In fact, this new quantitative approach to information proved to be particularly relevant for determining people's contribution to the power of the State (initially in military terms, then in terms of production) and for making forecasts concerning insurance and life annuities. Thus, there gradually emerged methods of quantitative analysis that would detect and classify social groups, in order to work out a *mesnagerie politique* (political grouping) which would link domestic affairs (health, age, fertility, capacity to work or bear weapons) with State affairs (State power and wealth) (Leibniz 1680, A IV III, 457).

The modalities of ageing soon came to be described and classified no longer at the individual level, but rather at the level of a specific population. Initially, this new approach arose in a field that was annexed to medicine, i.e. for the purpose of calculating annuities and tontines, in order to quantify risks and benefits and consequently, to constitute groups of people with risks within the population. Gradually, the category of old people emerged as a result of the determination of new notions such as life expectancy or longevity (Witt 1937; Leibniz 1995, idem [1680] 2000). No longer was it necessary to establish a causal nexus between the effect of ageing and its organic cause; on the contrary, the new approach consisted of selecting the criteria that were necessary and sufficient to enable a person to be integrated into the group of "old people," criteria such as age, type of pathology, reason of death, remaining life expectancy, etc. As a consequence, we started to think of old age in relation to the question of longevity, which became a new epistemic category for counting the population – a category to which physicians referred to more and more.

Thus, the establishment of political arithmetic created a formal method and enabled the development of new mathematical tools as well as, soon afterwards, specific concepts to represent and classify various age groups. This quantified description of the population made two important contributions to medical studies which had formerly focused heavily on the individual.

First, ageing did not indicate the same reality on the level of the population and the level of the individual. Societies could get older or younger, according to their mortality or fertility rates, but individuals could only get older (Bourdelais 1993). In addition, the age of an individual was relative to the average age of the population. Thus, we could differentiate chronological age from biological age, while connecting one to the other. Indeed, the former corresponded to a populational approach while the latter corresponded to a medical approach. In general, they are the same, but not always.

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Second, age covered three dimensions, i.e. the functional dimension, the cultural dimension, and the chronological dimension. The first one corresponds to the physiological functions that are specific to each stage of life, i.e. early childhood with no language, childhood devoted to growing, adolescence characterized by puberty and sexual activity, maturity without growing, and old age, indicated in particular by menopause in women and a decline in sexual activity in men. Traditional physicians studied this dimension. The second dimension corresponds to the social roles allotted to each age. And the third dimension refers to chronological years. Modern treatises of medicine did not refer to the two last dimensions, even though modern States were already confronting the issues of poverty and the increased dependence of the elderly, and were seeking to have parishes take care of them (Ottaway 2004; Botelho 2004). But the common criterion of those three dimensions consisted in trying to locate old age using objective criteria set either by a third party, a physician, or a politician. The point was to determine with precision the threshold of old age, according to well-defined criteria, such as age, health, appearance, and role held in the community, all of which must help build the social category of old people (Laslett 1989; Bourdelais 1993).

Initially, these tools of analysis were used to make legal decisions on matters such as inheritance, marriage, etc. by calculating the probability of whether the absent person was still alive or not. Secondly, these tools enabled the calculation of income and justified the interest, by taking into account the specific economic temporality of the money that is lent. Thus, what was then at stake was for the State to determine the optimal value that could be withdrawn from its loans, by contemplating the worst case, while the private individuals who had agreed to lend their money were certain to get a certain profit-sharing and thus would receive life annuities. Of course, the mathematicians of the time (Huygens, Leibniz, Witt, Daniel Bernoulli) still confused individual and collective life expectancies. Nevertheless, the studies gradually and clearly showed that the individual death rate was increasing, and so the State could exploit its creditors' age and thus favor the profitability of its loans. Studies also show that both parties benefited from life annuities. Indeed, the State had immediate money to seize any opportunity and, if it calculated well the age of its creditors, it could quickly exhaust its debt. As for the private individual, if he chose a life annuity with reduction, he could then enjoy his goods by anticipation (Leibniz 1995, 386–394).

Soon, those legal and mathematical calculations led to medical applications. Among other things, they revealed the irregular distribution of mortality depending on age. Contrary to appearances, the risk of dying did not grow continuously. Indeed, childhood, youth, and old age were each subject to major risks, but for different reasons (Witt 1937, 27). Furthermore, they gave an estimate of the expected life of a person at each age, of his or her life expectancy, and of the average length of human life (Leibniz 2000, 520). They also compared the results between town and country. They anticipate the fertility rate among women, which they could also relate to the death rate. They enabled considering old age as an economic phenomenon, whether the old people were creditors or borrowers (Botelho 1996; idem 2004). Finally, they

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led to legal questions, for example, the question of whether old people may be subject to torture (Alberti 1736, 241). In short, thanks to this demographic analysis, the factors used to understand the phenomena related to old age could be selected, i.e. initially death or the pathologies, but then also wealth and poverty. It led to the creation of a new social conception of old age, which would develop only in the following centuries (Troyansky 1989b), to such an extent that the challenge of taking care of the elderly soon became stronger than the medical will to explain and understand this phenomenon (Conrad 1998).

* * *

In the seventeenth century, old age was not understood to be an achievement of longevity, but was rather associated with disease and decrepitude, accompanied by dependence and impotence. It constituted a problem of medical theory, but was not yet considered a social issue. Three explanations – *iatromechanical*, empirical, and animist – offered elements of comprehension. In particular, Sydenham and Stahl focused on the importance of the temporal factor to understand the living. But the incapacity to end the debate revealed that it would always be impossible to provide a complete and sufficient explanation of ageing. This endless debate is not a question of ignorance or lack of knowledge, but indicates the complex nature of medical concepts, and today there are still multiple definitions of ageing. Not only must modern contemporaries give up the idea of an intellectual orthodoxy (Morange 2005; Keller 2004), according to which one among the three theories would be true, but they must change their approach drastically. In fact, the progressive constitution of the analytical tools in statistics demands a change of position, which also necessitates the responsibility of assuming the difficulties related to old age. This historic moment shows that, even though the three theories of medicine are involved in controversy, neither of them alone would provide a complete view of ageing. Furthermore, these three theories complement one another. Actually, even now in the twenty-first century there are still similar disputes concerning the suitable medical methods to apply for explaining ageing. More precisely, the subsequent history of ageing has proved that these three approaches are not antithetical, but complementary.

Referring to recent studies, Michel Morange has shown that the explanation of ageing requires at least three approaches (Morange 2005, 147–162). First, an *iatromechanical* analysis reveals a correlation between the macroscopic phenomena of ageing and the shrinking of the telomeres at the time of the cellular division. Second, on the level of the germinal cells, there is *autopoiesis*, which can explain ageing within the framework of natural selection which enables the living to reproduce young organisms. In contrast, ageing seems necessary at the level of the species; consequently, we can explain menopause as a selective advantage, which, at a certain age, releases the woman from the maternal occupation. Third, the phenomenon of ageing refers to

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two activities: on the one hand, to metabolic activity (in fact, the intensity of chemical reactions) – which itself depends on the mass of the organism in a precise ratio, and, on the other hand, to the time blood takes to travel in the organism, which is linked to the time that is necessary to train an adult, and, more generally, to lifespan. Thanks to Morange's explanation, a partial answer can be given to the interrogation undertaken by Sydenham or Stahl, although the cause of ageing still cannot be explained. Indeed, the cat, the man, and the elephant live for time-durations proportional to their size, and broadly, this relation seems to be stable throughout the species. Thus, we must combine the three explanations in order to think of ageing and we must retrospectively acknowledge that the three modern approaches by Descartes, Sydenham, or Stahl complement one another. The invention of a fourth theoretical approach focuses on the population, and not on the individual, induces immediate practical effects, and *vice versa*, for the indicators enable the medical community to see what before remained invisible – even though the next events also show that they conceal as much as they reveal.[13] Particularly, this new approach contributes to another comprehension of ageing: it tends to substitute a linear conception of life to the old periodic one, and to organize a new field for modern medicine associated with public health.

Thus, this critical period highlights the triple status of the medical concepts, i.e. semantic, semiotic, and pragmatic. Indeed, they refer to a reality that is lived at the individual and collective level, they are sealed in the heart of the mental representations – both scientific and social – and they have effects upon medical practices, and more broadly speaking on social issues. In short, they simultaneously say and do, without enabling us to separate the meaning and the effect of "what is said" from "how it is said." In fact, old age does not constitute a pure scientific problem, but also a human problem on the individual as well as the collective level. To medically treat old age can neither be reduced to a single description, nor to a social analysis. Rather, it implies going back and forth between these two sides of the same problem.

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[13] Concerning the debate on the right indicators and classifications of ages, see Bourdelais 1993, 159–237; and Laslett 1989, 154–158.

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