Streets and streams : health conditions and city planning in the Graeco-Roman world

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III. CITY AND ENVIRONMENT

A 'Healthy Mistake': The Excrement Problem from Ancient Greece to Nineteenth Century Holland

Context

This chapter is actually a sequel to the previous one, from a diachronic perspective.

In the course of history, Roman sewers were considered as masterpieces of hydraulic and hygienic engineering. They showed that the Romans were centuries ahead of their time. The *communis opinio* was that Roman streets were clean, with a strict separation of drinking and sewer water. In the Middle Ages, however, hygienic circumstances are supposed to have deteriorated. However this may be, even until the 19th century, people still drank water from canals and rivers. Only after the discovery of germs in polluted water, sewers were constructed again.

The *communis opinio* was, therefore, a misunderstanding. In fact, in Antiquity sewers were built for other purposes: reclaiming marshy lands and discharging rain and bath water after use, at street level or underground. So the decision to construct sewers in the 19th century – by filling up or covering canals, or by constructing underground pipes – was actually based on a mistake.

Many books and articles discuss the hygienic situation in the Netherlands in the 19th century, including their solutions from medical, civil engineering and historic points of view.[1] These publications are, however, restricted to the 19th century, little or no attention having been paid to the preceding centuries since Antiquity; see Van Hee and Weynants, who published articles in 2007 about the Italian utopians in the Renaissance.[2] Shortly before the publication of my article, G. Bartelink wrote in 2014 an article about the Italian city planner, architect and utopian Leon Battista Alberti;[3] he is currently preparing a Dutch translation of Alberti's *De re aedificatoria*.

In the article published in Germany, the editors preferred to leave out the illustrations; in this version, they are included again as in the original Dutch article, published in *Studium*.

1 Medical perspective: Meijer, H.A.M.M. 2005 (see Bibliography); civil engineering perspective: Berens, H.E.M. 2001. *W.N. Rose 1801-1877: Stedenbouw, civiele techniek en architectuur*, Rotterdam; historic perspective: Woud, A. van der. 2010 and Swaan, A. de. 1989 (see Bibliography).

2 Van Hee, R. 2007 and Weynants, S. & Van Hee, R. 2007 (see Bibliography).

3 Bartelink, G. 2014. 'Leon Battista Alberti en zijn voorbeeld Vitruvius', *Hermeneus* 86, 3, 139-144.

A 'Healthy Mistake': The Excrement Problem from Ancient Greece to Nineteenth Century Holland

Abstract

Nowadays, faeces and urine are considered as noxious and unhealthy. In ancient times, however, urine and excrements were seen as harmless and even useful; urine for textile production and excrements for agriculture. The Romans constructed sewers like the Cloaca Maxima, in the first place to remove (rain-)water and drainage. Only later, toilets were connected to these sewers to remove the smell of urine and excrements. The idea that sewers were constructed with the specific aim of removing urine and excrements is therefore no longer valid, but the memory of this function of the (Roman) sewers lasted throughout the Middle Ages.

From the Renaissance onwards, city planners developed their 'ideal cities'. In these cities, there was no place for the dirty smell of urine and excrements, so subterranean sewers had to be constructed. Yet such ideals proved difficult to implement in the Dutch context. The Dutch engineer Simon Stevin realised that the situation described by the ancient and Renaissance sources did not offer a solution for the problems in Dutch cities, with standing water in canals and without natural drainage. Moreover, in this period there was not yet an awareness of the relation between the presence and smell of urine and excrements on the one hand, and hygiene and public health on the other.

Awareness of this relation came not earlier than the 18th century. The German physician Johann Peter Frank argued in favour of diminishing the bad smell by means of filling up canals; the city physician Willem Frederik Büchner was confronted with the extremely unhealthy situation in the typical Dutch city of Gouda. But their political influence was small. Only at the end of the 19th century, the construction of sewers began in Dutch cities, thus improving health conditions.

Introduction

At first sight, there is little coincidence between the cities in the Graeco-Roman world and the Dutch city of Gouda,[1] in the south-western part of the Netherlands in the 19th century, far away in time and distance. On the other hand, comparing the city hygiene of these different cities, we see an astonishing similarity until far in the 19th century. Which policy concerning urine and faeces was in use in these different con-
[104] texts and were these substances considered as dangerous for public health? When, and for what reasons, did a change of policy occur?

The Graeco-Roman civilisation was mainly situated in the Mediterranean area. The Romans had occupied a part of the area nowadays called The Netherlands, but their influence was relatively small. In the province of Zuid-Holland (in the western part of the Netherlands) there was, indeed, some habitation along riverbanks in a vast marsh, nowadays no longer visible – except for some reconstructions of road parts and milestones. After the Roman period, the Middle Ages came up.

Thousand years later, the situation had changed dramatically. The Netherlands were no longer a vast marsh without habitation, but an emerging superpower. In the Middle Ages new cities arose. Renaissance and Classicism came up, but their features had to be incorporated into the Dutch Christian culture. No Roman temples, but Christian churches with classicistic elements.

Medicine was still mainly based on ancient medicine.[2] The works of Hippocrates and Galen influenced medical sciences until the middle of the 19th century; the physicians' knowledge was examined by explaining passages from the Hippocratic Corpus,[3] especially the *Aphorismi* (*Aphorisms*), although many ideas were no longer deemed valid.[4]

During Renaissance and Classicism, people were aware of the fact that the Romans constructed sewers, and it was generally assumed that they were constructed for evacuation of urine and faeces. In fact, they were constructed for other purposes. At the same time, physicians stated that stench was unhygienic. Solutions for the export of urine and faeces, however, were not developed by physicians, but by planners and engineers. They knew the existence of Roman sewers and the works of the Roman engineer Vitruvius. City governments started to enact rules concerning sanitation,[5] but only from the 19th century onwards, city governments were convinced of the necessity to tackle the stench problem by constructing sewers, like ancient Roman cities. Nowadays, this seems to be a 'mistake', but a 'wholesome' one. The Roman sewer, although realised not in the first instance for the discharge of excrements, was the model for the solution of the stench problem in the 19th century.

The Roman model to plan cities was used also by the Dutch. They stated, however,

1 I have chosen Gouda, because this city was a representative, medium-sized one, and the city physician Büchner (1780-1855) discussed the city hygiene in Gouda, providing a lot of information.
2 Van Hee 2007, 260-261.
3 Houwaart 1991, 35.
4 Huisman & Warner 2004, 40.
5 Van Hee 2007, 269.

already in the 17th century, that the Roman model was not always suitable because the marshy soil and large quantity of canals, used for dropping excrements, caused different situations.[6] Dutch (and Flemish) canals were used for dropping urine and excrements, inevitably causing stench. Physicians considered them as dangerous for public health, but they did not tackle the problem. The situation in the city of Gouda offers an interesting example, since the municipal physician W.F. Büchner described the unhealthy situation of the city in the 19th century, although without giving any solution.

1. Ancient medicine and sewerage [105]

In ancient Greece, urine and faeces were collected in cesspits,[7] fixed and mobile toilets[8] and urinals.[9] Chamberpots containing faeces were emptied in gardens or exported to the countryside for fertilising; urine was used in fulleries.[10]

The Greeks were also the first people in Europe who constructed underground sewers for waste water. At the beginning of the 5th century BC, in Athens the Great Drain was built for draining the Agora; at the beginning of the 4th century, a southern branch was added.[11] This drainage sewer must have had the same goal as the underground Cloaca Maxima in Rome: to drain a valley amongst hills (**fig. 1**).

In a later period, we see a decrease of the use of cesspits and an increase of the use of fixed toilets. If possible, fixed toilets were connected to sewers. Of course, there was not always the possibility to do this; in Rome, for example, chamber pots might be emptied by throwing their content out of the window.[12] Public baths and toilets were usually connected to sewers. In Late Antiquity, there were 144 public toilets in Rome itself.[13]

In ancient medicine, no attention was paid to discharge of human waste. In the Hippocratic treatise *De aëre aquis et locis* (*Airs Waters Places*), the position of a city is mentioned, but not its planning.[14] According to the Hippocratic-Galenic tradition, stench was causing diseases, so stench had to be tackled and not the cause of stench.[15] In short: in the Graeco-Roman world, urine and faeces were exported to fulleries and the countryside, and sewers were built for drainage. In later times, these sewers were also in use for the evacuation of human waste.

6 Weynants & Van Hee 2007, 11-20.

7 Thompson 1959, 91-108; Owens 1983, 47 n. 32.

8 Fixed toilet: Artem. *Onirocriticus* 2.26; mobile toilet: Poll. 10.44; Pherecr. *Fr.* 88 Kock. For more references see Thédenat 1910, 987.

9 Henderson 1975, 191.

10 Wilson & Flohr 2011, 147-153; Morley 2015, 114-115.

11 Owens 1983, 49; Young 1951, 135-288, esp. 151.

12 Jansen 1998, 119; Wilson 2011, 96.

13 Thüry 2001, 12 and 63; Jordan & Hülsen 1871, 573.

14 The only ancient physician paying attention to city planning is Sabinus (1st-2nd century), advising parallel streets for sunlight and fresh air; Sabinus apud Orib. *Med. Coll.* 9.20. He does not mention the evacuation of waste water.

15 Gal. *In Hipp. Nat. Hom. comment.* 2.3 (15.118-119 K.); Nutton 2000, 71. Here the stench of sick people is meant.

Fig. 1. *Cloaca Maxima, Rome (internet, http://www.romanaqueducts.info/aquasite/foto/cloacamax_gt_I.jpg).*

2. Vitruvius and his reception

The Roman architect Marcus Vitruvius Pollio (85-20 BC) is the author of *De Architectura* (*On Architecture*). In this work, he pays attention to buildings and constructions, amongst others aqueducts. Vitruvius had a basic knowledge of medicine (which he prescribes for architects in book I.1.10) and he refers to the conditions for building an ideal city; however, he does not mention the evacuation of human waste.

[106] After the fall of the Roman Empire, these ways of discharging human waste were not yet completely forgotten. In some monasteries (e.g. St. Gallen), sewers were in use.[16]

In the Renaissance, there was a growing interest in ancient problems and their solutions. During the Middle Ages, European cities were unhygienic according to our modern point of view. Unpaved and muddy streets with pigs, cows and other animals and full of dung and urine, causing epidemics like the Black Death in the 14th century. At the end of the Middle Ages, new interest in ancient problems and solutions arose. People started to study Vitruvius' works; moreover, ancient Roman sewers, like Cloaca Maxima, were still visible and sometimes even in use.

16 Horn & Born 1979, II, 300-311.

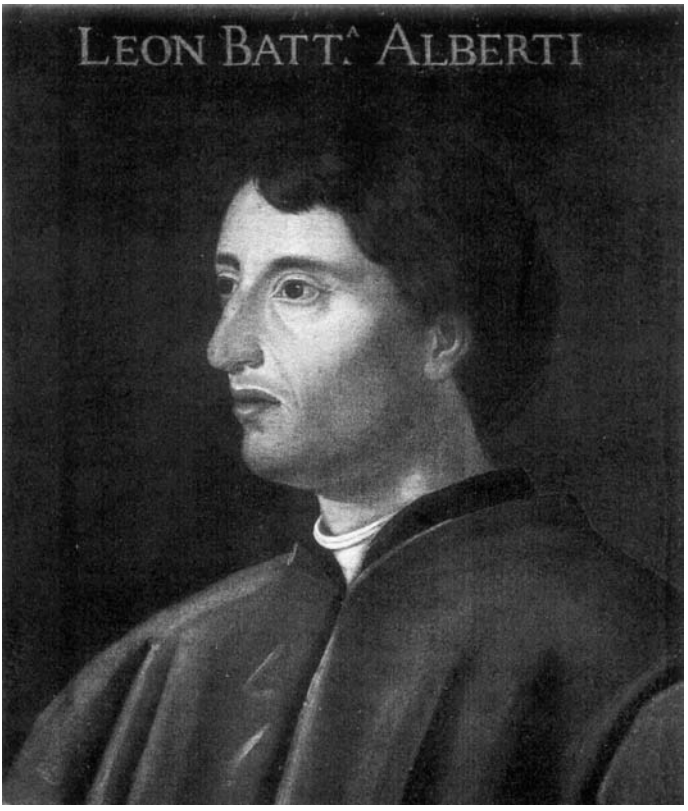

Fig. 2. *Leon Battista Alberti (internet, http://files.umwblogs.org/blogs.dir/6253/files/2011/12/Alberti.jpg).*

3. Leon Battista Alberti (fig. 2)

In 1450, the Italian artist, philosopher and architect Leon Battista Alberti (1404-1472) wrote a monograph, subdivided into ten books on architecture, entitled *De re aedificatoria* (*On the Art of Building*), following Vitruvius (printed in 1486).[17] But there are differences; Vitruvius describes buildings, but Alberti describes cities and buildings to be built.[18] So, Alberti can be considered as a utopian. Beside Vitruvius and other architects, Alberti's ideas are also based on the Hippocratic Corpus.[19] Following *Airs Waters Places*, Alberti starts his work with a description of climatological circumstances.[20] Another difference from Vitruvius is that Alberti does mention sewers:

17 Alberti 1988, XVI-XVIII.

18 Alberti 1988, X: 'The essential difference between Alberti and Vitruvius is therefore that the ancient writer tells you how the buildings that you may admire as you read him *were* built, while Alberti is prescribing how the buildings of the future *are to be* built' (emphasis in original).

19 For information of Vitruvius' influence on Alberti see Taverne 1978, 30; Alberti 1988, IXf.; Daru 1985, 10 and further the voluminous work of Wulfram 2001, *passim*.

20 Alberti 1988, chapters 1.3-4; 9-15.

> 'I have observed that the best architects ensured that rainwater was [...] forced to flow somewhere to wash away human filth, making it less offensive to the noses and eyes of mankind.'[21]

By his mentioning the nose (the smell), I suppose that faeces and urine are referred to. Further on in his work, Alberti discusses cesspits and sewers and their constructions. They are part of the urban infrastructure (roads) and they have to be compared with bridges: this implies that they have to be covered.[22] He admires the sewerage of Rome, after having stated that a good sewerage is crucial for fresh air in the city; he refers to Smyrna and its absence of a good urban sewer.[23] It is hard to live in a city without a sewer, like Siena in his time.[24] Especially the stench is noxious. Sewers have
[107] to be slanting to realise a fluent evacuation of waste water to the river.[25] The material must be solid enough; and, finally, there must be a sufficient height between sewer and river to prevent barriers arising as a result of floods or sludge.[26] Neither Alberti, nor Vitruvius mention any trade in faeces and urine, although this took place in Antiquity.

4. Simon Stevin (fig. 3)

After Alberti, other utopian city planners developed ideas concerning city hygiene and the export of human waste, like Helmut Siefert, Johann Valentin Andreae, Thomas More and Ulysses Aldrovandi, all based on a continuing disposal of water.[27] Amongst them, there was also Aldrovandi's contemporary, the Dutch-Flemish engineer Simon Stevin (1548-1620), who knew the theories of Vitruvius and Alberti.[28] In his treatise *Onderscheyt vande oirdeningh der steden* (*City Planning*, published posthumously by his son Hendrick), he recommends 'overwelfde waterloopen' (covered sewers):

> 'A vaulted sewer in the middle of the street, 3-4 feet deep and just as wide, with branches, connected to the houses. The branches are equipped with bars or perforated sheets of iron, keeping off stones or other raw material, causing congestion.'[29]

Unfortunately, it is unclear if human waste can be dropped in these sewers; maybe, these sewers are constructed only for rainwater drainage:

21 Alberti 1988, 32.
22 Alberti 1988, 113; Taverne 1978, 41, 412 and 417; Daru 1985, 10. An example of a vaulted sewer called 'bridge' is the Langebrug ('Long Bridge') in Leiden.
23 Alberti (1988) 113; cf. Str. 14.1.37.
24 Alberti (1988) 113.
25 So, the city must be built on a higher level than the final destination of waste water; Str. 5.1.7.
26 Alberti 1988, 114.
27 Daru 1985, 10-11. For a description of Aldrovandi's ideas see Van Hee 2007, 268.
28 Stevin 1649, 110; Stevin mentions here, amongst others, Vitruvius and 'Leo Baptista Albertus'. Taverne often refers to the relation between Stevin's and Alberti's opinions. Cf. Taverne 1978, 40-48.
29 Stevin 1649, 21-22, translated by the author; Daru 1985, 11; Taverne 1978, 35-36; 41-43.

Fig. 3. *Simon Stevin (internet, http://www.physics.ua.ac.be/~devreese/stevin/stevin19aug2001.html).*

> 'The evacuation of rain water and street drainage must be planned from the outset and developed. At some places, a sewer must be realised (...); at other places two sewers along the houses; here, the central part of the street must be a little bit curved. A third solution is the best: an underground vaulted sewer [see the previous citation]. This solution does not cause congestion, collection of mud in the street and stench as a consequence.'[30]

Open sewers on street level have the disadvantage that they are open to waste like fish and slaughter waste, and for animal dung. Stevin does not mention human faeces here, but he does so in another chapter entitled 'Heymelicken' ('secrets', toilets), where he discusses the advantages and disadvantages of cesspits and drain pipes. Stevin is a fan of cesspits; faeces do not produce stench in ground water and they are removed easily. Pipes are worse, causing stench, and they are blocked quickly. For

30 Stevin 1649, 21-22, translated by the author; Daru 1985, 11; Taverne 1978, 40-43.

sick people, a stench-producing indoor toilet is dangerous. In order to prevent stench, toilet covers were used. A more radical way to prevent stench was an outdoor toilet, but a disadvantage was that one always had to leave his house, also when it was rain-
[108] ing.[31] In this context, he does not mention the evacuation of faeces, which may be seen as a confirmation that sewerage is developed for drainage and evacuation of rain water. Like Vitruvius and Alberti, he does not mention the export of faeces to the countryside. He knew the sewers of Rome; probably, he considered them as drainage sewers. He also remarked that the situation described by Vitruvius was not the same as the Dutch situation in his time:

> 'Vitruvius states in book VIII, chapter 4, that he has read Theophrastus, Timaeus, Posidonius, Hegesias, Herodotus, Aristides, Metrodorus about water. After Vitruvius, Pliny the Elder, Palladius and some others have described this topic. But I will explain that the Dutch situation is totally different, so the solutions of the Ancients are not valid here and now.'[32]

The similarity of Stevin's ideas, the separation of discharge of rain water by sewers and faeces by cesspits, and the present views on the situation in the Graeco-Roman world as researched in the last decades, is striking.

5. Johann Peter Frank (fig. 4)

Two centuries later, the German physician Johann Peter Frank (1745-1821) was the first who compiled a coherent work, describing everything concerning public health: *System einer vollständigen medizinischen Polizey* (*A System of Complete Medical Police*), in the years 1786-1790, in which he advises local and national governments.[33] It is translated into Dutch, entitled *Geneeskundige Staatsregeling*. The compilation covers entire Europe. In the introduction of the third book (where city hygiene is discussed), he mentions that there are more excrements in the street scenery in Vienna than in Constantinople and that the amount of waste (including faeces) in Paris is larger than that in Amsterdam or London.[34]

Like his predecessors, Frank states that, at first instance, the stench problem must be tackled and marshy areas have to be drained, for example by paving streets, as in the Roman Empire, preventing that

> 'Animal dung and water, standing in ruts and holes, transform a city into an unhealthy and not fordable marsh (...). The Romans paved all their public roads and streets with bricks.'[35]

31 Stevin 1649, 91-95.
32 Stevin 1649, 83, translated by the author. Here wells are discussed.
33 Lindeboom 1993, 251; Porter 1995, 466.
34 Frank 1787-1795. For this chapter, I used the Dutch translation by H.A. Bake. See 'voorbericht' (introduction) VII-VIII.
35 Frank 1787-1795, 725, translated by the author; Daru 1985, 14. Cf. concerning marsh the Hippocratic

Fig. 4. *Johann Peter Frank (internet, http://upload.wikimedia.org/wikipedia/commons/4/41/Johann_Peter_Frank.jpg).*

According to Frank, animal dung had to be collected at fixed places, exported from the city boundaries and brought to the countryside.[36] He refers to Galen, who states that excrements have to be brought to gardens via *cloacae*.[37] I suppose that human excrements are referred to, because animal excrements are usually not removed via sewers. Human excrements had to be evacuated through underground sewers in Roman style:[38] [109]

> 'Planning and maintaining a good system of street sewers is one of the most important measures to improve public health. It is a benefit of the Roman king Tarquinius

Corpus: *Aer* 7.

36 Frank 1787-1795, 724-725; 731-732; Daru 1985, 14.

37 Frank 1787-1795, 723; In Frank's text, the reference is mentioned as follows: Gal. *Epid*. 1 conc. 14. This is Gal. *Hipp. Epid. III* 3.1.14 (17a.563 K.).

38 In the 19th century, sewers were usually ruts in streets: De Swaan 1989, 129. I suppose that Frank is describing the situation in Europe in general, because in the Netherlands faeces were usually dumped into the canals.

> Superbus to construct underground sewers (...), so that all waste from the streets were removed and flushed through seven small streams, pouring out into the Tiber.
>
> So it is an advantage when a city is situated on a slope along a river; the evacuation of waste can take place easily. If not, it is an intensive and expensive matter.
>
> One has to clean sewers with a small fall regularly, preventing stench. Besides that, cleaning these sewers must not take place in the hot summertime. The Romans knew that.'[39]

In a later passage, Frank recommends to erect public toilets, following Emperor Vespasianus:

> 'In order to prevent pollution in cities, caused by inhabitants and visitors, who have the need to defecate during their occupations in the street, the government must install public toilets, like Vespasianus did in Rome.'[40]

So, Frank stated that improvements of public hygiene in respect to the removal of faeces had to be derived from Antiquity. Still completely embedded in the Hippocratic-Galenic tradition, he suggested that for a healthy city stench had to be removed. His work is describing entire Europe, but the fact that it was translated into Dutch is an indication that his ideas were appreciated in the Netherlands. Stevin, however, had already acknowledged that the ancient ideas were not always suitable, due to the marshy soil.[41] Moreover, the city canals, containing mostly standing and stench producing waters, were exactly in contrast to the theories of the Hippocratic Corpus and its successors, condemning that situation. Frank recommends to fill up canals:

> 'Our canals are usually the final destination of all urban waste. The sewers discharge all their contents, all waste; dead bodies are dropped into them, but nobody has the intention to clean them. On the other hand, cleaning them should be even dangerous for the inhabitants in hot summertime. The government has to fill up all redundant canals of each smaller city, if they can not be cleaned by flowing water.'[42]

[110]

6. Willem Frederik Büchner (fig. 5) and the city of Gouda

This was the situation found by the Gouda physician Willem Frederik Büchner (1780-1855). He had studied at Leiden University and the influence of the Hippocratic Corpus and Frank is visible when he discusses the unhygienic stench of the canals.

Büchner started his medical education in 1798 at Leiden University; he finished his PhD thesis in 1801 in Würzburg and in 1802 he became municipal physician in Gouda. He wrote several books, amongst them *Wenken en raadgevingen, betreffende*

39 Frank 1787-1795, 736-737 and 754, translated by the author.
40 Frank 1787-1795, 755, translated by the author.
41 Stevin 1649, 83.
42 Frank 1787-1795, 720, translated by the author.

den Aziatischen braakloop aan zijne stadgenooten (*Recommendations to the People of Gouda concerning Cholera*) in 1832 and *Verslag van de epidemie der kinderpokken, gedurende de jaren 1831 en 1832 te Gouda waargenomen* (*Report of the Epidemic of the Child Variola, observed during the Years 1831 and 1832 at Gouda*). His most important work in this context is *Bijdragen tot de geneeskundige topographie en statistiek van Gouda* (*Contributions to the Medical Topography and Statistics of Gouda*), which was published in 1842 describing meticulously the local hygiene.[43] This was, inevitably, a consequence of the development of the city.

After the year 1000, Gouda arose as a settlement on the banks of the Gouwe river, where it flows into the IJssel river. The environment was a bog forest, intersected by some small rivers. The bog forest yielded fuel and building material for the city. To drain the soil, canals were dug out and the entire city was surrounded by a concentric canal for defence. After deforestation of the surrounding area, peat was dug out for fuel, and wooden houses were replaced by brick ones. So the typical Dutch city, with stone houses and canals, arose.

In the 19th century, Büchner's time, Gouda was converted into a stone city and due to the need of peat, underwater peat was dug out, causing vast lakes; they were reclaimed again in the course of the 19th century. By compact soil, however, the soil became lower and the river Gouwe could no longer export its water to the IJssel. On the contrary, the level of the IJssel was high enough to incite watermills, moving water *into* the Gouwe (**fig. 6**).[44] The polluted water of the Gouwe could hardly be refreshed by IJssel water.[45] Nevertheless, this way of refreshing water was usual until 1866, but the result was meager.[46]

What about the removal of excrements in Gouda? In the Middle Ages, the local government enacted laws and edicts concerning the deposit of waste, cleaning streets and reducing stench. In Gouda, in the 15th century, there were restrictions in respect to times and places for the deposit of waste and dung, including places where it was forbidden. In the 16th century, however, dung heaps are no longer mentioned and it became allowed to connect toilets immediately to the open canals.[47] There were fixed points where waste and ash could be offered; this was forbidden at other places.[48] [111]
Streets and lanes were too small to give access to the horses and rubbish carts of the refuse collector's service.

> 'There are only a few locations providing refuse-bins where rubbish can be collected, being now and then emptied. Nearly all waste, including slaughter and tinner waste

43 The first one was *Proeve eener geneeskundige plaatsbeschrijving (topographie) der stad Amsterdam* by C.J. Nieuwenhuys, 1816-1820; Houwaart 1991, 44-45.

44 The water-wheels of the fulling-mills in Gouda were moved by giving access water from the IJssel river. So, inevitably, the water level of the IJssel was higher than the water level of the city canals. Cf. Büchner 2007, 51-53.

45 Büchner 2007, 52-53.

46 Vogelzang 1956, 59. Even until the 1950s, this way of refreshing canals was scarcily used.

47 Van Zon 1986, 21. Cf. the enactments from the 16th century onwards: Van Hee 2007, 269.

48 Büchner 2007, 52.

Fig. 5. *Willem Frederik Büchner (photo SAMH; Habermehl 2007, 13).*

> is thrown into the canals and water pipes, because there are nearly no refuse-bins, the times of picking up refuse of the house of the residents are unregular and the carts and horses cannot pass a lot of streets and lanes.'[49]

In Gouda, the situation was not worse than in other parts of the Netherlands.[50] Everywhere were dung heaps (sometimes even indoor heaps; poor people kept animals for selling their dung); everywhere waste was dumped into the canals and everywhere enactments concerning this were neglected.[51] Büchner states that a citizen of Gouda (and I suppose that this rating is valid for an average man) produces 1 pound of urine, and a quarter of a kilogram faeces each day.[52] The amount of animal urine and dung is not even mentioned, but certainly must be added. Büchner does not mention cesspits; they were probably scarce or lacking.

49 Büchner 2007, 52, translated by the author; Bik 1989, 18-19.
50 Van Zon 1986, *passim*.
51 Houwaart 1991, 258; Van Zon 1986, 32-32; 130-131.
52 Büchner 2007, 52. In 1842, Gouda had 14.451 inhabitants. For other calculations see Van Zon 1986, 73 and 289 n. 2; Van der Woud 2010, 269-270.

Fig. 6. *View of Gouda from the IJssel river. Left of the gate the watermill building (photo H. Zuidervaart).*

Is it possible to see Büchner as a physician still belonging to the Hippocratic-Galenic tradition? Did he consider the polluted urban situation as a danger for public health, or did he consider diseases as a result of a wrong balance of the four humours and constitutions as described by Galen? There is clear evidence that Büchner knew the Hippocratic treatise *Airs Waters Places* very well; he cites it at the beginning of chapter seven, which discusses drinking-water.[53] Stench is an important cause of several diseases, especially marsh stench. The amount of waste and faeces is enormous:

> 'The quantity of faeces and waste, carried away by flowing water, is so large that the water, leaving the city and discharged through the Gouwe river, looks more like mud than water.'[54]

He continues, speaking about faeces:

> 'In the winter of 1840, the frozen canals were covered with a layer of the most disgusting waste and excrements, one foot thick. The bridges were surrounded by waste and dung heaps, their levels were higher than the quays. I have observed a lot of times – who did not? – two people, next to each other, in conversation, not aware of their actions, the one ladling out the water from a hole in the ice in a bucket for

53 According to Büchner, the people of Gouda belong to the choleric and phlegmatic type; Büchner 2007, 57. See also 63.

54 Büchner 2007, 51-53, translated by the author.

> drinking, the other emptying his bucket full of faeces and cleaning it. The water in the small canals, lacking the most basic qualities, spread a horrible stench.'[55]

[112] According to this story, Büchner disapproves the drinking of canal water with excrements, but he does neither give a solution for this problem nor for other hygienic problems. These were common situations. In Moordrecht, a village close to Gouda, people drank water from the IJssel river and polder canals, usually polluted. Rain water was not a good alternative, because rain water tanks were also polluted and roofs were small.[56] Moreover, in Büchners time, Gouda was still enclosed within the medieval defence walls. In the course of time, the physiognomy of the city did not change and human and animal dung and urine were a usual part of the street scenery. On the other hand, the population density of Gouda was higher than in the preceding centuries.[57] Solid waste like bones and building material was also part of everyday life and the situation seems to be strikingly similar to the street scenery in the Graeco-Roman world. In Rome, non-organic waste like sherds was dumped at Monte Testaccio, in Gouda in the surrounding lakes. Büchner's opinions do not differ from the Hippocratic authors and Galen, ascribing the causes of diseases and epidemics not to urine and faeces, but to their stenches. One has to tackle the stench, not the excrements themselves. According to Büchner, stench of canals causes diseases, especially due to dredging the canals and rivers in summertime:

> 'Moist and noxious exhalations fill the houses and deteriorate the health of the inhabitants, aggravated by the exhalations caused by sledging the canals in the hottest period in summertime.'[58]

Dredging in summer is exactly against the advice of Frank. The common opinion in the Netherlands was that not excrements themselves, but their stench caused unhygienic situations, the so-called miasmatic theory.[59] After the cholera-epidemic of 1832, Büchner discusses in 1833 the miasmatic and contagion aspects in his work *Aanteekeningen en opmerkingen betrekkelijk den Aziatischen braakloop te Gouda*; he started to be an adherent of the contagion theory, but the stench of water is the main cause:

> 'Although I do not agree with the physicians' opinion that the cause of cholera is miasmatic, I argue that the bad quality of drinking water must be noxious (...); but improving its quality will be wholesome to fight against the extension of the epidemic, and it does not matter whether the cause is contagious or miasmatic.'[60]

55 Büchner 2007, 65, translated by the author; Vogelzang 1956, 58.
56 De Graaf 1970, 151-152.
57 De Swaan 1989, 138, n. 47 concerning deteriorated hygiene, caused by population growth.
58 Büchner 2007, 62, translated by the author; Van Zon 1986, 15. See also Frank's references *supra*.
59 Van Zon 1986, 5-7; he mentions the German physician Max von Pettenkofer (1818-1901), a supporter of the miasmatic theory. Cf. Van der Woud 2010, 281-285.
60 Büchner 1833, 7-8 and 74, translated by the author.

Although Büchner was, more than Frank, a practical man, discussing the situation in Gouda meticulously, one has to observe that he – still in the Hippocratic-Galenic tradition – does not give solutions and advice, such in contrast to Frank. He does not advocate a verdict on dredging in summer; he does not advise to vault or fill up canals; he does not call on people to stop drinking faeces water from the canals and, for example, drink rain water; he does not mention the removal of dung heaps. It should have been possible to construct a windmill to remove filthy water, as in Leiden. This might be due to the bad financial situation of Gouda. The construction of a well-functioning sewer system costs a lot of money, also in Antiquity: [113]

> 'These [sewers] were the accommodations, marvelled at and praised by Dionysius of Halicarnassus (...). One gets an impression of the large amounts of money involved, taking into account that C. Aquilius spent 1000 talents – according to his own words – were spent on maintaining and improving the sewer system only.[61] Nowadays, we spend our money and work for useless and extremely expensive foundations, neglecting the most important needs for a densely populated city, without any responsibility.'[62]

According to the books of the Roman agronomists Varro and Columella, the possibility to export human faeces to the countryside for fertilising soil, instead of dumping it into the canals is not explicitly discussed by Büchner. Probably, in the environment there were many lakes, but only a small amount of land suitable for agriculture was available. Moreover, farmers preferred bovine dung.[63]

Büchner was still mainly embedded in the Hippocratic-Galenic tradition, restricting his task as a physician to cure sick people in a polluted environment; this pollution was stench and filthy water.[64] It is not sure if a realistic solution was available. In the thirties and forties of the 19th century, Gouda was a poor city and in the Hippocratic-Galenic medicine there was no hint of a solution; one had to accept the situation. Only after the middle of the 19th century, after the cholera epidemics of 1832 and 1849, the city government was convinced that a sewer system was needed to remove the stench and to improve public health.[65]

In other Dutch cities, the situation was the same. In Leiden, for example, the canals were also in use for dumping garbage and providing drinking-water. In this city, smaller canals had already been covered, some of them in the Middle Ages, so that they actually functioned as sewers. But the large-scale process of filling-up canals for improving health (and traffic flow) took place in a later time.[66]

61 D.H. *Antiquitates Romanae* 3.67.5.
62 Frank 1787-1795, 754-755, translated by the author.
63 Vogelzang 1956, 67.
64 Next to his profession of city physician, Büchner was also engaged in education and fighting poverty; Habermehl 2007, 21-23.
65 Finally, everywhere sewers were constructed at private or public expenses, like the railway system; De Swaan 1989, 140-149.
66 Wieles & Van Noort 2002, 15-16 and 55-61.

Only after the cholera epidemics of 1832 and 1849, local authorities were convinced that they had to tackle the problem radically by constructing sewer systems; not only for removing the stench, but also to improve public health of both the poor and the rich. Hitherto, the upper class had the opinion that the poor people's lifestyle caused unhygienic situations.[67] In 1849, the English scientist John Snow had discovered that polluted drinking-water, rather than stench, caused epidemics like cholera. His German opponent Max von Pettenkofer, on the other hand, argued that these were
[114] caused by faeces pollution of the soil. The majority of the Dutch physicians and scientists were adherents of von Pettenkofer's theory. Only after 1866, Snow's influence became more important.[68]

After the 1870s, the so-called 'tonnenstelsel' (barrel system) was introduced: faeces were collected in barrels, for fertilising soil in the countryside, as in Roman times. In Gouda, however, the unlimited dumping of faeces and garbage continued for a long time, due to the system of refreshing water by water from the IJssel river.[69] In Leiden, where the possibility to refresh canal water was absent, the so-called 'Liernur system' was introduced in 1871. In this system, faeces were collected in iron tanks, emptied by compressed air and finally exported to the countryside. This system remained in use until 1915. For this reason, Leiden realised a modern sewer system relatively late. Still in the 1980s, polluted water was still drained immediately into the canals.[70] Of course, the time that they supplied drinking-water was already long ago. Also in Germany, from about 1900 onwards, sanitation in the cities got better, after the hygiene situation was improved.[71]

Summary and conclusion

In former times, urine and faeces were not considered as noxious and dangerous, to be removed as quickly as possible. Stench had to be removed, not the cause of stench. Authors of the Hippocratic Corpus, Galen and Celsus do not mention human waste in the street scenery and their removal. Some cities, like Athens and Rome, constructed sewers to drain lower areas and created the possibility to connect toilets to them, reducing stench. The idea that the Romans realised sewers especially for the evacuation of faeces and urine remained popular for a long time, but it was a wrong one. The Italian humanist Alberti referred to Cloaca Maxima in his argument of reducing stench and for improving the discharge of excrements and waste water. A city without a sewer was an unliveable city. On the other hand, he was not a physician and he does not mention the connection between excrements and public health. Stevin, referring to the Roman architect Vitruvius and Alberti, pays attention to the typical Dutch situation, including its canals and marshy soil. He recognises that a sewer like Cloaca Maxima cannot be realised in the Netherlands, because the soil level of the

67 Wieles & Van Noort 2002, 138-140; Meijer 2005, 20.
68 Eelkman Rooda 1989, *passim*.
69 Van Zon 1986, 85; Vogelzang 1956, 59 and 64.
70 Van der Woud 2010, 323-327; Wieles & Van Noort 2002, 59-78.
71 Huisman & Warner 2004, 213-214; Witzler 1995, *passim*, esp. 205-209.

Dutch cities is not high enough for a fluent evacuation. He still makes a distinction between sewers for water drainage and the removal of faeces. Medical authors are not mentioned.

The first to consider faeces stench in standing canal waters – like marshes – as dangerous for public health is Johann Peter Frank. He argues for filling up redundant canals and dredging them in cold weather. The Gouda physician Büchner shares his opinion; according to him, the stench of the polluted canals is responsible for the unhygienic conditions in Gouda. From the point of view of the Ancients, the situation of Gouda, with its large quantities of standing water and its marshy environment, represents the worst medical and geographical situation.

So there is the paradox that in the latter part of the 19th century sewers were constructed, inspired by their Roman forerunners, considered as a symbol of excellent hygiene, no stench and no annoyance being caused by excrements. On the basis of this misunderstanding, the faeces problem was tackled from the 19th century onwards; according to recent research, however, cities in the Graeco-Roman world were not as healthy as thought for a long time, and sewers were constructed for another purpose, drainage. [115]

So we can rightly speak of a wholesome mistake: wholesome because the construction of sewers caused less stench and an improved public health, but a mistake because it was based on the opinion that underground sewers were built for these purposes, and this opinion was incorrect.

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A Good Place to Be: Meteorological and Medical Conditions in Ancient Cities

Context

From the 5th century BC onwards, people are aware that a healthy environment is an important factor for a town. The first treatise discussing this theme is the Hippocratic *De aëre aquis et locis* (*Airs Waters Places*), indicating (albeit in a speculative way), in which direction a city has to face in order to have a healthy location, fresh air and sunshine, and some winds are supposed to be healthier than others. These points of view are discussed by other ancient authors.

In practice, however, many settlements were built fulfilling other conditions, e.g. connections to roads, means of support and the availability of drinking water. Sometimes (new) settlements and towns, however, could also fulfil conditions described by ancient medical authors, possibly after adjustments.

In this next chapter we meet the scientist and commander M. Terentius Varro. He put knowledge of theories concerning the ideal medical and meteorological circumstances into practice and radically changed the orientation of a patient's room full of sick people after the Battle of Pharsalus in 48 BC. Although his measures were mostly based on speculation (he posed a hypothesis of the existence of bacteria!), he was ahead of his time. Fresh air was first considered healthy in early modern times; polluted air, like stench of marshes, had to be avoided.

A Good Place to Be: Meteorological and Medical Conditions in Ancient Cities

Abstract [1]

The founding of a city requires certain hygienic and meteorological conditions. The climate must be moderate, neither too hot, nor too cold; neither too dry, nor too moist; fresh air and water are crucial.

Ancient medical writers such as the authors of the Hippocratic Corpus, Celsus and Galen prescribe ideal conditions for the city. Wind-directions, local climate (heat, cold, humidity), quantity and quality of air and water and a clean environment were crucial factors to establish a healthy city. Did their opinions correspond with the opinions of non-medical ancient sources like Vitruvius, Varro, and Columella? And, finally, were these conditions really realised in practice, as proved by excavations?

According to his book *On Agriculture*, the Roman author M. Terentius Varro improved the hygienic situation by cleaning polluted air, when he changed the position of doors and windows. If this story is true, there is evidence that there was some knowledge of improving health, bringing theory into practice.

Introduction

The Roman statesman and scientist M. Terentius Varro (116-27 BC) tells us in his *Res rusticae* (*On Agriculture*) that, after the Battle of Pharsalus in 48 BC, he improved the hygiene in the sick-rooms of his comrades and his servants by changing the position of the windows and a door in order to extract polluted air. If this story [2] is true, then it provides evidence that Varro accepted a correlation between public health and the direction of the wind, showing that he actually took active measures to correct the flow of air to the convalescents under his care. Whilst one might wonder about the veracity of this story, it does, at the least, spur one to consider whether there was any connection between a) the planning and construction of buildings (and cities) in Antiquity and b) concerns about public health that were connected to meteorology. If there were any such connections, a further important

question arises as to whether medical theory played any role in informing thought on this issue.

In discussing how and where cities should be built, authors in Graeco-Roman Antiquity display clear preferences for certain types of location and layout and they pay particular attention to questions concerning wind direction. In this chapter I will investigate the similarities and differences between the actual practice of city planning and building and the theories of medical and non-medical authors. My focus will be restricted to issues concerning location and climate.[1]

1. Health and wind directions: Varro

In Varro's *On Agriculture* a story is told about how Varro, confronted with houses full of the dead and ill in the city of Corcyra after the battle of Pharsalus, played an important role in the recovery of his comrades and his servants by changing the positions of windows and a door so as to admit the fresh north wind and drive out polluted air:

> 'Did not our friend Varro here, when the army and fleet were at Corcyra and all houses were crowded with the sick and the dead, by cutting new windows to admit the north wind and shutting out the pestilential winds, by changing the position of
> [3] the door [this will be discussed in paragraph 10], and other precautions of the same kind, bring back his comrades and his servants in good health?'
>
> *Non hic Varro noster, cum Corcyrae esset exercitus ac classis et omnes domus repletae essent aegrotis ac funeribus, immisso fenestris novis aquilone et obstructis pestilentibus ianuaque permutata ceteraque eius generis diligentia suos comites ac familiam incolumes reduxit?* (Var. *R.* 1.4.5).[2]

This conversation takes place during a meeting with, amongst others, Varro himself and his father-in-law Fundanius. Another guest, Gn. Tremelius Scrofa, 'a man distinguished with all virtues, who is esteemed as the Roman most skilled in agriculture' (*virum omnibus virtutibus politum, qui de agri cultura Romanus peritissimus existimatur*),[3] narrates the story here.

Varro, the author of *De lingua Latina* (*On the Latin Language*) and *On Agriculture*, was already considered to be a very important scholar in the ancient world[4] but most of his works have been lost, making it difficult to be sure about the breadth of his learning. Despite this, some surviving evidence suggests that he may have had a medical education. One of his lost works was entitled *Disciplinae*, a 'handbook' for

1 I will not consider here issues concerning military settlements, civic water supplies, soil types, or economic factors, although I hope to return to these topics in future articles.

2 All citations in this chapter come from the Loeb series (slightly revised), except citations from Hippocrates' *Letters*, which come from W.D. Smith's edition (see the Bibliography).

3 Var. *R.* 1.2.10.

4 August. *C.D.* 6.2; Van Rooijen-Dijkman 1999, 301.

liberal arts, including medicine,[5] whilst a passage of Pliny shows that Varro knew of Hippocrates' works.[6] This evidence is, of course, not conclusive by itself but it provides a valuable framework within which we can set the passage recounting Varro's actions at Corcyra.

Let us consider the context of the passage quoted above. The guests in this story are discussing agriculture and, in particular, the orientation and position of a villa. The gentleman-farmer must have a knowledge of meteorology and medicine in order to judge whether or not a region is healthy and, thus, must know which types of climate and winds are beneficial and which are not.[7] So, a connection is assumed here between meteorological phenomena and the salubriousness of a given region. What might be the basis for this connection? Why did Varro think that the northerly wind was beneficial and which winds did he aim to shut out? And what could possibly have been the intended effect of changing the position of the door?

2. Health and wind direction: the Hippocratic Corpus

The Hippocratic Corpus contains a number of views about wind directions and their influence on public health. An early treatise in which wind direction is considered is [4]
De morbo sacro (*The Sacred Disease*, second half 5th century), in which the author considers the polarisation of a northerly wind and a southerly wind and takes northerly winds to be the most beneficial.[8] However, the most important Hippocratic treatise that describes the relationship between wind directions and public health is *De aëre aquis et locis* (*Airs Waters Places*), which was probably written by the same author as *The Sacred Disease*.[9] *Airs Waters Places* has a specific place within the Hippocratic Corpus: it describes the influence of wind directions, seasons, and their changes on the human body and was meant for travelling physicians.[10] The author distinguishes four types of cities based on their situation: those cities that are exposed to hot south winds (*Airs* 3); those exposed to cold north winds (4); cities lying towards the rising of the sun (i.e. towards the east) (5); and cities lying towards the setting of the sun (i.e. towards the west) (6). It is noteworthy that there is talk here of the north and south winds, but not of east and west winds.

If we examine the relation of wind directions to the health of the inhabitants of cities in *Airs Waters Places*, we find that the cities facing east are the healthiest be-

5 Van Rooijen-Dijkman 1999, 308. For Varro's knowledge of medicine, see Boscherini 1993.

6 Plin. *Nat.* 29.2.4; Pinault 1992, 12; Boscherini 1993, 741. In ancient medicine, there was a strong sense of continuity.

7 Var. *R.* 1.4.4.

8 Hipp. *Morb. Sacr.* 13 (16, 170-172 Jones = 6.384 L.); cf. *Vict.* 2.37-38 (298-304 Jones = 6.528-534 L.); Kosak 2000, 37. In this chapter, I follow Jouanna's sequence (1992).

9 Jouanna 1992, 549; Jouanna 1996, 82; Lo Presti 2012, 169; Craik 2015, 11 and 195. These works are not, however, the first to mention the connection between meteorology and medicine. See already Alcmaeon, DK VS 24 B 4, 215-216; López Férez 1989, 52; Miller 1962, 129; Stamatu 2005b, col. 502.

10 *Airs Waters Places* is one of the first treatises that describes the connection between nature and human diseases from a sophisticated perspective; see Horstmanshoff & Stol 2004, 5; Cilliers & Retief 47. On travelling physicians: Hipp. *Aer.* 1-2 (70-72 Jones = 2.12-14 L.); Jouanna 1996, 10-11; Kosak 2000, 36.

cause the temperatures are moderate and the water is the best. Cities exposed to hot and cold winds are less healthy and cities facing west are the unhealthiest. However, these passages in *Airs Waters Places* cause a problem: what exactly is meant by 'lying towards the rising of the sun'?

One possibility is that we are not to understand 'lying towards the rising sun' in terms of a cardinal direction but, rather, as referring to exposure to the east wind. But such an interpretation runs into difficulties when we consider the situation of cities mentioned in chapter 5: 'those that lie towards the setting of the sun, […] while the hot south winds and the cold north winds blow past them'. A second possibility is that 'lying towards the rising of the sun' is a reference to the direction of the façades and front doors of a city. Consistency in the directions of the buildings is only possible in cities in which there are parallel streets. Some cities in the ancient world, for example Olynthus and Priene, were, indeed, constructed on a chess-board-like grid but many other cities were constructed without adhering to such a
[5] plan and it seems unlikely that the author would have restricted his reflections to this limited group of cities. A third possibility is that wind direction is determined by the coastline. On this analysis, a city 'lying towards the rising of the sun' would be a city situated on a coastline that runs on a north-south axis, like Corcyra.[11] There were, however, cities with no connection to a coastline, so, again, unless the author of *Airs Waters Places* left implicit restrictions there may have been as regards the application of his views, this possibility is not particularly attractive. A fourth option is that 'lying towards the rising of the sun' is a reference to the slopes of a hill or mountain against which the city was built. In a mountainous region like Greece it was common practice to build a city on a slope with the top of the mountain functioning as a fortress (Corinth provides a good example). The presence of a mountain can also answer the question as to what is meant by 'sheltered from cold winds' and 'exposed to hot winds'. But this hypothesis is also problematic. For instance, a person moving from one side of a city to the other should, if the city is built across a number of slopes, thereby suffer changes to his physical constitution, which hardly seems plausible.

The final possibility I will consider is that the expression 'lying towards the rising of the sun' should be understood as meaning 'situated in the east'. If one takes the central area of Greece as a starting-point, 'situated in the north' would indicate northern Greece, 'situated in the east' would be Asia,[12] 'situated in the south' would mean in Crete or Africa, and 'situated in the west' would mean Italy. *Airs Waters Places* is after all written in Greek for a Greek audience. In my opinion, this explanation is the most plausible in this context. The arguments are the following:

- The references in the text are vague but climate is *not* confined to man-made boundaries.

11 Crouch 1993, 50-51.
12 Hipp. *Aer.* 12 (104-108 Jones = 52-56 L.).

- Wind directions are described as 'between the rising and setting of the sun'. A city 'lying towards the rising of the sun' is situated between summer sunrise and winter sunrise, so in the direction of the horizon between summer sunrise and winter sunrise.[13] In *Airs Waters Places*, the cardinal directions are not indicated by straight directions but in quadrants (**fig. 1**).
- *Airs Waters Places* is written for travelling physicians. [6]

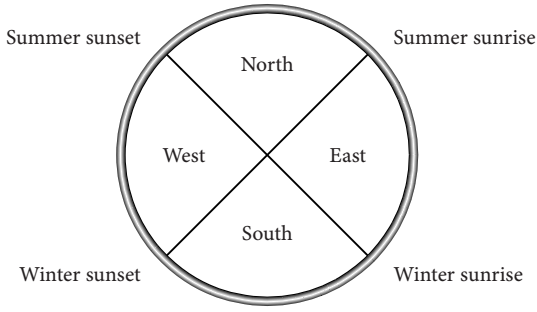

Fig. 1. *Wind directions, sunrises and sunsets.*

3. Health and wind directions: other authors

Celsus claims that northerly winds are more beneficial than easterly and southerly winds, although he also states that this depends on the region.[14] In another passage, he makes a rough division of winds into those that are northerly and those that are southerly but without indicating a clear preference; both, he thinks, are unhealthy.[15] In *On Agriculture*, Varro advises that insalubrious winds and exhalations should be avoided in general but without identifying a specific wind direction.[16] P. Agrasius has a preference for the north (see *infra*).

Vitruvius' theory gives preference to the east and the north winds, despite mentioning only the beneficial characteristics of the directions and not the specific winds themselves. The disadvantages of heat are discussed extensively here and it follows that the warm southerly winds are detrimental to the health.[17] But there is another problem, for, as Vitruvius writes, the wind's 'aspects should neither be extremely hot nor intensely cold', and this implies that the north – which is coldest – is not a good direction either. Yet he continues to describe the north and its coolness in positive terms: in summer, healthy regions change into unhealthy regions and unhealthy regions become healthy in winter.[18] The situation of Altinum, Ravenna and Aquileia to the north and north east (of Italy) is one of the reasons that these cities have an *in-* [7]

13 Jouanna 1996, 34-35.
14 Cels. 2.1.3-4.
15 Cels. 2.1.10-11.
16 Var. *R.* 1.4.4.
17 Vitr. 1.4.1; Fleury 1990, 126. Cf. Gal. *Temp.* 4 (1.533 K.).
18 Vitr. 1.4.2-4; Fleury 1990, 127. People in the north are also, according to Vitruvius, stronger and

credibilem salubritatem, an 'unbelievable health'.[19] Concerning the ventilation of a city, Vitruvius states that streets should be planned in such a way that the prevailing wind, if bringing disease, is prevented from blowing in the streets. Wind must be moderate and draught must be avoided. North and south winds are unhealthy but northerly winds slightly less harmful than southerly winds. Gentle winds, however, are harmless and can even be therapeutic.[20] Like Vitruvius, Columella also keeps a more open mind concerning his preference for a wind direction. The direction of the villa – the façade? – should be exposed to the east or the south; if this is impossible, then to the north, but always away from pestilential winds.[21]

In general, our texts consider northerly winds to be more beneficial than southerly winds. The physician Sabinus is an exception. He prefers the heat and advises a southern situation with hot southerly winds.[22] He is, together with Rufus of Ephesus,[23] the only medical author who gives information on wide streets and hygiene.

4. Health and the seasons

In Graeco-Roman medicine, the practitioner needed to be aware of not only the importance of wind directions but also the influence of the seasons on public health. In the Hippocratic Corpus and Celsus, 'constitutions' (καταστάσεις, *constitutiones*)[24]
[8] are exploited as a category that brings together a range of variables, such as descriptions of oncoming diseases in combination with season changes, wind directions and sometimes regions.

Five constitutions are mentioned in *Airs Waters Places* (10) and *Aphorismi* (*Aphorisms*). Chapter 11 of *Airs Waters Places* claims that marked seasonal changes are harmful.[25] Changes in the season cause changes in the qualities of human bodies (the dry, wet, hot and cold) and these changes are generally mistrusted in Hippocratic medicine. In spring these qualities are balanced in the best way, with temperatures being neither too hot nor too cold; so in cities 'facing spring' (= east), the temperatures are also well-balanced while the other wind directions are less healthy.[26] According to *De natura hominis* (*Nature of Man*), seasons alter the four humours.[27] In

braver than people in the south: Vitr. 6.1.4; Callebat 2004, 73. Cf. the remarks concerning people and climate, paragraph 5.

19 Vitr. 1.4.11; Str. 5.1.7; Fleury 1990, 132; Potter 2005, col. 616.

20 Vitr. 1.6.1; 1.6.3; Fleury 1990, 156-157; Gros 1997, I.94 n.232.

21 Col. 1.5.

22 Sabinus apud Orib. *Med. Coll.* 9.19.

23 Rufus is cited in the Arabic treatise *K. Daf' maḍārr al-abdān bi-arḍ Miṣr* (*On the Prevention of Bodily Ills in Egypt*, ch. 6) of the Egyptian scholar Alī ibn Riḍwān († 1068); Ullmann 1974, 39-40; Haak 2013, 170.

24 Stamatu 2005a, col. 487; Stamatu 2005c, col. 613; Langholf (1990, 169) gives, in discussing the constitutions of the *Epidemics*, the translations 'condition', 'situation', and 'state'. See also Nutton 1995, 28; Hulskamp 2012, *passim*.

25 Hipp. *Aer.* 11 (104 Jones = 2.50-52 L.); Wenskus 2005, 465-466; Hulskamp 2012, 158 and 162.

26 Miller 1962, 130-132; Lo Presti 2012, 180. Other winds: south: Hipp. *Aer.* 3 (74 Jones = 2.14-16 L.); north: Hipp. *Aer.* 4 (76 Jones = 2.18 L.).

27 Hipp. *Nat. Hom.* 7 (18-22 Jones = 6.46-50 L.); Hulskamp 2012, 159.

Airs Waters Places (12) the moderate changes in season in Asia are praised and in (13) the more marked changes in season are described as unhealthy for the inhabitants of Lake Maeotis. Other Hippocratic treatises also provide evidence for the relation between seasons, wind directions and diseases.[28] In *Epidemiae* (*Epidemics*) 1 and 3, four constitutions are described[29] and here we see again the strong connection between seasons and wind direction.[30] Celsus does not attribute the various diseases to the winds, as does the author of *Airs Waters Places*, but, rather, to the seasons, in agreement with the author of *Aphorisms*. His four constitutions correspond to four Hippocratic *Aphorisms*; he declares that he is a follower of Hippocrates, sometimes also adopting the theories of later authors.[31] So, in short, all authors mentioning seasonal changes agree that there could be some relationship between wind direction, season and disease.[32] It is impossible to avoid disease entirely at any time but periods of seasonal change are described as particularly detrimental to one's health.[33] [9]

5. Philosophical aspects

Is there any theoretical underpinning given for these descriptions of climate and diseases? In ancient medicine, theories were not exclusively based on perceptions, but perceptions had to correspond with theories. For example, in *Airs Waters Places*, in his polarisation between Europe and Asia,[34] the author states that in Europe, where there are noticeable seasonal changes, the landscape is mountainous and the people are 'wilder'. Therefore in Asia, with its moderate changes, the people are 'gentler' and the landscape must inevitably be flatter, because Asia is the opposite of Europe. Here, characters are determined by seasonal changes and by landscapes. Galen

28 E.g. in the *Aphorisms;* spring: Hipp. *Aph.* 3.20 (128 Jones = 4.494 L.); summer: Hipp. *Aph.* 3.21 (128 Jones = 4.494-496 L.); autumn: Hipp. *Aph.* 3.22 (130 Jones = 4.496 L.); winter: Hipp. *Aph.* 3.23 (130 Jones = 4.496 L.); Hulskamp 2012, 160.

29 On which see Langholf (1990, 171-179), Brunn (1947, 14-18 and 74-76) and Hulskamp (2012, *passim*) for an extended description.

30 Unhealthy summer: Hipp. *Epid.* 1.2 (148-150 Jones = 2.604-610 L.); unhealthy autumn and winter: Hipp. *Epid.* 1.5 (154 Jones = 2.616-618 L.); Wenskus 2005, 465. See for the seasons' influences on the human body described in the *Epidemics* also López Férez 1989, 54-56. Connotations of spring and autumn: Spring: Hipp. *Epid.* 2.1.5 (20 Smith = 5.74 L.); autumn: Hipp. *Epid.* 2.1.4 (20 Smith = 5.72-74 L.); López Férez 1989, 56.

31 Spring: Cels. 2.1.6 (= Hipp. *Aph.* 3.20); summer: Cels. 2.1.7 (= Hipp. *Aph.* 3.21); autumn: Cels. 2.1.8 (= Hipp. *Aph.* 3.22); winter: Cels. 2.1.9 (= Hipp. *Aph.* 3.23). Later authors: Cels. 2.pr.1; Gros 1997, I.88 n. 188.

32 For other references to noxious season and wind changes see Hipp. *Morb. Sacr.* 10 (13, 166-168 Jones = 6.380 L.); *Epid.* 1.1-4 (152-154 Jones = 2.598-614 L.).

33 In reality, in some cases there *is* a connection between diseases and seasons. Mosquitos are seasonal and so are coughs (winter) and digestive upsets (summer). Galen states that the Mediterranean area has the best temperature: Gal. *San. Tu.* 2.7 (6.127 K.).

34 According to Jones (Loeb edition of *Airs waters places*), 'Asia' means, respectively, Anatolia and Asia Minor: nowadays Turkey. According to Lo Presti (2012, 169), 'Europe' includes Europe from South Spain to the Maeotis Marsh; 'Asia' includes the Persian Empire, Egypt and Libya. For the polarisation between Europe and Asia, see Lo Presti 2012, 180-181 and 190-192.

agrees: not only the body but also the soul depends on these features.[35] In reality, however, Asia Minor is *not* flatter than Europe and seasonal changes are even more extreme.

Is there a reason why the east was deemed healthy and the west unhealthy? Perhaps the answer simply lies in the benevolent connotations of all things 'right' and the malevolent connotations of all things 'left'. This association is mentioned in an-
[10] cient texts from Homer onwards.[36] The Greek word σκαιός means 'infamous', 'stupid' and 'west', as well as 'left', and the west, the direction of the sunset, was ill-famed, being associated with Hades.[37]

If the west is to the left hand side, and the east is to the right, then inevitably the view straight ahead is to the north. This direction was associated with the home of the gods (Mount Olympus is in the north of Greece) or considered as the primary direction, because, from this point of view, the 'positive' right is to the east and left is to the west.[38] In addition, if we consider the wind rose, we see that the east is positioned to the right and the west to the left, and looking in the direction of the words, the north is uppermost.[39]

6. Healthy and unhealthy soil

In addition to the climate and the prevailing winds, the configuration of the ground is also important if a city is to be situated agreeably. I will now examine whether the authors who wrote on this topic had a preference for certain favourable positions. Aristotle states that the best situation for a city is on a slope, facing east or receiving the east wind. If that optimal arrangement is impossible, the city should face south instead.[40] Vitruvius agrees: the best situation is in a high place, facing neither towards the hot or cold directions, nor to the west – so facing east.[41] The situation of a city on a slope is also mentioned by Athenaeus Medicus and Antyllus, who consider the slope of a hill to be a healthy place to situate a city.[42] Columella, too, thinks that slopes provide a good situation and they are his preferred locations for farms.[43] Ac-

35 Hipp. *Aer.* 12-13 (104-110 Jones = 2.52-58 L.), 16 (114-116 Jones = 62-66 L.), 23-24 (130-136 Jones = 2.82-92 L.). Cf. Stamatu 2005b, col. 502; Boudon-Millot 2014, 8. Galen: Gal. QAM 8 (4.798-803 K.). Cf. Van der Eijk 2005, 225 and Lo Presti 2012 *passim*.

36 Lloyd (1966, 37) states: the adjective 'right' may mean (1) morally good ('do the right thing'), (2) true or correct (the 'right' use of words, the 'right' way of doing something) and (3) sound or sane (in your 'right' mind), while 'right' the substantive stands for a legal entitlement ('right' of way, 'right' to the throne). Cf. *ibid.* 42; on p. 47 he discusses the association right = east = good, left = west = bad since Homer: *Il.* 12.238-240. Cf. Lloyd 1996, 114. At p. 135, he mentions that Aristotle describes 'right' as naturally superior; it is an ἀρχή, 'starting-point' (*Met.* 986a23-26).

37 LSJ s.v. σκαιός. Infamous west side: Wirth 2010, 15-16 (with commentary); 243. See for the negative connotation of 'left' Wirth 2010 *passim*; Masselink 1956, 25-26.

38 Wirth 2010, 79-80.

39 For the north as starting-point see also Obrist 1997, 40.

40 Arist. *Pol.* 1330a38-41; Wycherley 1962, 31.

41 Vitr. 1.4.1; Fleury 1990, 126; Gros 1997, I.88 n. 187.

42 Ath.Med. apud Orib. *Med. Coll.* 9.12.1; Antyll. apud Orib. *Med. Coll.* 9.11.1.

43 Col. 1.4.10.

cording to Sabinus, in cities not situated on a slope but in a flat area, the wind can remove polluted air and the sun can shine on all the streets, since none will be shaded by the landscape. Other cities, built in a flat area but with an irregular street pattern and winding streets, receive either less or no sunshine at all or are subjected to harmful winds, causing draughts.[44] Polluted air remains in the lower part of the city, so city quarters that are built higher up have fresher air (a striking example of this is Rome).[45] In short, all authors prefer a slope, both from a strategic and a hygienic point of view. [11]

In many cases, flat areas contain marshes, usually considered to be unhealthy.[46] Varro thinks that marshes near villas are extremely unhealthy. He speaks of small marsh creatures (*animalia minuta*), so minute that they are invisible to the eye, which float in the air and enter the body through the mouth and nose, causing serious diseases.[47] Like Varro, Vitruvius speaks of marsh creatures but calls them *bestiae palustriae*.[48] Columella and Pliny the Elder also advise against agriculture in the vicinity of marshes, as do Antyllus and Galen. Athenaeus Medicus describes marshes as pathogenic areas, especially in summer, a sentiment which Antyllus shares.[49]

7. Practice: general aspects of meteorology and city planning

So according to the sources considered thus far, a city should be on high ground, receiving fresh air. Its aspects should be neither extremely hot nor extremely cold, but temperate. Marshes must be avoided and the east is the best direction. Did cities exist which fulfilled all these conditions?

A settlement or city can be established either spontaneously or in a planned way. As far as its situation is concerned, this will, in the first instance, depend on the local terrain. For instance, a city situated on the east coast, along a north-south running coastline, will inevitably be orientated to the sea in the east and a city will be erected on a slope when there is one available.

What about the orientation of cities and buildings? In the preceding discussion it was mentioned that 'situated to the north' could refer to the direction of the façades and front doors of a town house and that the situation of the doors is mainly determined by the street pattern.[50] An important question is whether there is actually any [12]

44 Sabinus apud Orib. *Med. Coll.* 9.20.1-7; Nutton 2000, 69-70.

45 Sabinus apud Orib. *Med. Coll.* 9.20.8. Air pollution was one of the causes that rich people escaped from Rome to villas in the countryside: Mudry 2006, 234. Cf. Ath.Med. apud Orib. *Med. Coll.* 9.5.5-6 and 9.12.1-4.

46 Hipp. *Aer.* 7 (84-86 Jones = 2.26-28 L.); the author continues to enumerate many diseases, caused by drinking stagnant water.

47 Var. *R.* 1.12.2; Sallmann 1986, 216-217; Boscherini 1993, 749.

48 Vitr. 1.4.1; 1.4.11; Fleury 1990, 125-126; Sallmann 1986, 219-220. Cf. Lucr. 6.1096-1102.

49 Col. 1.5.6; Plin. *Nat.* 18.33; Sallmann 1986, 220-221; Nutton 2000, 69. Antyll. apud Orib. *Med. Coll.* 9.11.4; Gal. *Diff. Feb.* 1.6 (7.289-290 K.); Ath.Med. apud Orib. *Med. Coll.* 9.12.6; 9.12.8; 9.12.10; Nutton 2000, 67. Sallares' reference (2002, 61 n. 43) to this citation (Ath.Med. apud Orib. *Med. Coll.* 9.2.10) must be 9.12.10.

50 E.g. Hoepfner & Schwandner 1994, 83 and 87 (Olynthus) and 214 (Priene).

coincidence between street orientations and wind directions? On the one hand, city planners were subjected to local circumstances, as Fleury states. Street patterns of planned Roman cities, for example, usually follow the directions of rivers and reliefs. On the other hand, Strabo and Diodorus praise the orientation of the streets of Alexandria; following its grid plan, the northwesterly Etesian winds can blow through the northwest-southeasterly running streets. Vitruvius mentions Mytilene as a city that has been poorly planned with respect to the winds. In Goritsa, a forced north-south street pattern is found, although considering the shape of the city outline one would expect diagonally running streets. It seems likely that meteorological circumstances were crucial for street design.

Although Miletus and Priene are close to each other (so they enjoy the same meteorological conditions), their orientations differ. In Miletus, the streets follow the landscape and, thus, run slightly diagonally. However, in Priene, founded later, the orientation is exactly north-south and it is possible that, as in Goritsa, this is due to meteorological considerations.[51]

Perring states that in Britain 'Even in the later period many Romano-British houses were built without any particular concern for the distinction between east and west. Other issues, of location and aspect, were of greater importance'.[52] In short, there is no clear evidence that the orientation of real buildings took place according to the advice of the authors. Other factors, depending on the actual situation, such as the presence and direction of rivers and water sources, as well as infrastructure and local customs, were at least as important. Therefore, Varro's changing of the orientation of door and windows was exceptional.

8. Practice: marshes

In the ancient world marshes were considered to be dangerous areas where malaria was common but they could be reclaimed and made habitable, as they sometimes were by the Romans. According to literary tradition, King Tarquinius built the Cloa-
[13] ca Maxima in order to drain the marsh between the hills, the later Forum Romanum.[53] Settlements near marshes could also be moved – Vitruvius mentions Salpia in Apulia, first situated in a marshy region but later removed to a healthier environment[54] – but they were more usually maintained in their original locations (Strabo mentions a vast marsh in the neighbourhood of Tarracina, for instance).[55] Cosa, a

51 Local circumstances: Fleury 1990, 150 with references. Roman cities: Le Gall 1975, 311-318. Alexandria: Str. 17.1.7; Jones 1932, 267. D.S. 17.52; Hoepfner & Schwandner 1994, 237. Mytilene: Vitr. 1.6.1. Miletus and Priene: Hoepfner & Schwandner 1994, ill. 11 and 179. Goritsa: Cahill 2002, 17, 'Although Goritsa could have been laid out on a very regular grid oriented northeast-southwest, it was in fact oriented almost due north-south'.

52 Perring 2002, 143-145. For more villas see Becker & Terrenato *passim*.

53 Liv. 1.38.6; see for more references Bauer 1993, 288.

54 Vitr. 1.4.12; Fleury 1990, 132-133.

55 Pliny the Elder mentions 24 former cities, arguing that it's a wonder: *Nat.* 3.5.59; Borca 2000, 79-80; Walsh, Attema & De Haas 2014, 37. Cf. Str. 5.3.6 (Tarracina); Nutton 2000, 84 n. 2; Sallares 2002, 168-191.

former *colonia* (273 BC) was situated strategically on a hilltop and was comparable with Olynthus and Priene. However, the city was not a success, due to it being plagued by malaria.[56]

Malaria was common, not only in the areas around Rome but also in Rome itself, due to floods and the presence of stagnant water. The pathogenic south winds transported malarial mosquitoes from the Pontine Marshes and other marshy regions to Rome. Whether they were dry or wet, these winds caused fever.[57] Empirical observations may have prompted Varro and Vitruvius to discuss marsh animals (respectively *animalia* and *bestiae*) as the cause of these diseases.[58]

9. Varro's measurements: true or false?

We can now return to our point of departure: Varro's text. Did Varro actually take measures to change the positions of the door and windows in Corcyra? To answer this question, we have to take account of the views of ancient authors, including those concerned with medicine, as well as the actual situation in Antiquity and Varro's (Scrofa's) text. The central question is whether the story concerning Varro's precautions is apocryphal or not. One way of approaching this question is to consider whether the text says that Varro changed just one door or several. Both Heurgon and [14]
Hooper & Ash translate *ianuaque* in the plural (respectively 'changé la place des portes" and 'changing the position of the doors") but, since it defies belief that many houses could have been rebuilt in a short period of time, if we accept this reading then there are good grounds for supposing the story to be apocryphal. If, however, we translate *ianuaque* in the singular (and it *is* a singular form, according to all MSS), then Varro will have changed only one room or a building with one door (plus some windows), a story that is much more credible. The fact that Varro is explicitly said to have saved his own people,[59] rather than all the sick, provides further important support for the claim that his modifications were limited to a single structure.

Scrofa refers to a legend about Hippocrates: Varro would have aided the recovery of the sick in one building, but Hippocrates would have saved entire regions. Maybe this is a reference to (hyperbolical and apocryphal) letters of Hippocrates:

> 'Did not the famous physician, Hippocrates, during a great pestilence save not one farm but many cities by his skill?' (Varro, *On Agriculture* 1.4.5).

56 Sidonius Apollinaris 1.5.8; Sallares 2002, 64-72. Cosa: Ward-Perkins 1974, 27 and fig. 45; Owens 1991, 107-108. Malaria in Cosa: Sallares 2002, 250-251.

57 Sallares 2002, 201-226. In his opinion, malaria could be the disease with which besiegers of Rome were confronted. Pathogenic south winds: Arist. *Pr.* 862a; Plu. *Moralia* (*De Curiositate*) 515c; Plin. *Nat.* 2.48.127, but see especially Celsus: Cels. 1.10.4; 2.1.15; cf. Palladius 1.7.4. Nevertheless, other winds could also cause fevers: Cels. 2.1.16; Sallares 2002, 73-74; Walsh, Attema & De Haas 2014, 29-30.

58 The fact that the malaria mosquito is responsible for malaria was first discovered in the 19th century. See Sallmann 1986, 222-228 for the right statements of Varro, Vitruvius and Palladius on the development of early modern microbiology.

59 Heurgon 1978, 121 'Les mesures d'hygiène qu'il a prises ne portaient que sur le bâtiment qu'il occupait avec son État-Major et ses esclaves'.

An non ille Hippocrates medicus in magna pestilentia non unum agrum, sed multa oppida scientia servavit?

'Whereas Hippocrates of Cos, being a physician and descended from Asclepius, has shown great concern for the safety of the Greek people. And whereas on the occasion of a plague coming from the land of the barbarians towards Hellas, he sent out his pupils to different places to proclaim what therapies they had to use to keep themselves safe from the imminent plague, and, in order that medical science bequeathed to the Greeks would preserve safe those that were ill from it, he generously published his writings on medical science because he wanted there to be many physicians who saved people.' (Hippocratic Corpus, *Epistulae* (*Letters*) 25 (106-107 Smith 1990 = 9.400 L.).

Ἐπειδὴ Ἱπποκράτης Κῷος […] σώζοντας ὑπάρχειν ἰατρούς.

[Thessalos is speaking] 'The benefaction of my father Hippocrates […]. In the time in which the plague was running through the barbarian land north of the Illyrians […]. And he (Hippocrates) made inquiry what kinds of disturbances there were, area by area, in heat and winds and mist and other things that produce unusual conditions […] he arranged to announce to the Thessalians by what means they [15] could contrive protection against the evil that was coming, and, writing down the therapy, he posted it around the cities.' (Hippocratic Corpus, *Letters* 27.7 (116-119 Smith 1990 = 9.418 L.).

Εὐεργεσίην Ἱπποκράτους […] περὶ τὰς πόλιας.

Pliny the Elder mentions a similar story about Hippocrates:

'In medicine, Hippocrates, who foretold a plague that was coming from Illyria and despatched his pupils round the cities to render assistance.' (Pliny the Elder, *Historia naturalis* [*Natural History*] 7.123).[60]

Hippocrates medicina, qui venientem ab Illyriis pestilentiam praedixit discipulosque ad auxiliandum circa urbes dimisit.

The legend is roughly as follows: Hippocrates saved northern Greece from a plague coming from Illyria by sending his collaborators, including his own sons, to the region; his precautions were successful and he published these results.[61]

But which precautions are meant? There is no reference at all to changing the positions of doors or windows. On the other hand, there are (exaggerated) stories concerning Hippocrates' recommendation that precautions be taken against plagues

60 But does Pliny refer to the same story of Hippocrates as Varro? Indeed, according to Flach (2006, 246), the Loeb edition of Varro (Hooper & Ash 1935, 186) and Heurgon (1978, 121), but according to Boscherini (1993, 742) this point of view is not proven: Varro does not speak of a specific epidemic from Illyria.

61 Varro: Pinault 1992, 43-45. Hippocrates: Hipp. *Epist.* 25 (106-107 Smith 1990 = 9.400 L.); Hipp. *Epist.* 27.7 (116-119 Smith 1990 = 9.418 L.). Pliny: Flach 2006, 246; Pinault 1992, 44; Smith 1990, 3-4.

by lighting fires. Both the apocryphal letters of Hippocrates and Pliny's citation mention precautions taken *around* the cities (περὶ τὰς πόλιας and *circa urbes*). According to Scrofa, Varro improved the situation in Corcyra not by lighting fires but by changing the positions of windows and doors. In Varro's book, the orientation of doors and windows is of crucial importance for constructing a villa, as is stated in the previous lines: 'The situation of the buildings, their size, the exposure of the galleries, the doors and the windows, are matters of the highest importance' (*quod permagni interest, ubi sint positae villae, quantae sint, quo spectent porticibus, ostiis ac fenestris*).[62] The comparison between Varro and Hippocrates seems intended to identify differences in scale (Varro's works are small-scale, *unum agrum*, affecting only one building; Hippocrates' are large-scale, *multa oppida*, affecting complete cities) rather than differences in the precautions taken. If Hippocrates had changed the positions of doors and windows, his collaborators would have been, inevitably, *inside* the cities. [16]

Which sources did Varro draw upon for his knowledge of wind directions? Being the author or compiler of the *Disciplinae*, including works describing astronomy, architecture and medicine,[63] he must have had knowledge of the different wind directions and their influences on public health. This topic is mentioned for the first time in Graeco-Roman literature in the Hippocratic Corpus and Varro did have knowledge of Hippocrates, as mentioned at the beginning of this chapter. In *On Agriculture* (1.2.4), P. Agrasius, a publican and guest at the meeting, states that the north is healthier than the south and this could explain why Varro allows the north wind in Corcyra; in his opinion, a north wind is more beneficial.[64]

Not only did Varro arrange for the north wind to have free access but he also ensured that 'pestilential winds' (*pestilentibus*) were excluded. From which direction did these polluted winds come? It is possible that they came from a marsh, situated south or west of Corcyra, or from the exhalations of seriously injured people and from corpses, emanating from adjacent rooms or buildings. We cannot know the origins of these pestilential winds with any certainty but what *is* clear is that Varro does consider the winds to be bringers of health or disease.[65]

According to ancient criteria, Corcyra must have come close to being the ideal city. It was situated to the east, on the eastern coastline of the island. It was built against a slope, underwent only minimal changes of temperature across the different seasons, and had a fresh north wind during the summer.[66] Perhaps these conditions led Varro or other leaders to choose Corcyra as a place for recovery and convalescence. However, the particular building in which Varro's patients were housed was not suitable for the convalescents. Corcyra was a healthy city but the health-bringing north wind was not admitted in to the sick-room and the door was constructed in the wrong place.

62 Var. *R.* 1.4.4.
63 Van Rooijen-Dijkman 1999, 308; Janssen 1979, 217.
64 For Varro's preference for fresh northern wind see Boscherini 1993, 749.
65 Boscherini 1993, 749.
66 Bürchner 1921, 1404; Strauch 2008, 753.

Which pestilential winds is Varro referring to when he discusses the situation in the sick-room in Corcyra? Perhaps marshes in the neighbourhood of Corcyra, areas with stagnant water caused by abundant rainfall, created a breeding-ground for insects or *animalia minuta*.[67] It is possible that due to a temporary wind direction, a
[17] pestilential wind gained access to the sick-room through the original windows and door, blocking the fresher and healthier north wind. Added to this, it is also possible that other sick-rooms close to Varro's room, possibly containing dead bodies, spread stinking, polluted air.

To summarise, in answering the question of whether Varro actually took measures to improve the situation in Corcyra we must consider the following points: 1) Varro was well-versed in medicine and meteorology; 2) Corcyra must have had a reputation as a healthy place; 3) according to the MSS there was only one *ianua*, so Varro's reported actions probably concerned only one room or building; 4) Varro was a commander, so he would be in a position to order the changing of the position of the door and windows; 5) pestilential winds were caused either by the presence of the sick and/or dead bodies in adjacent rooms or by the presence of pathogenic marshes in the south of the island. Putting these points together, it seems that there is little reason to doubt the truth of Scrofa's story of Varro's reconstruction of the building.

Conclusion

Some authors in the Graeco-Roman world concerned themselves with describing the various conditions that needed to be met in order to ensure that a city was situated in a healthy position. *Airs Waters Places* (from the Hippocratic Corpus) concentrates on the influence of climate and the configuration of the land on the people who lived in cities and some diseases here are related to corresponding wind directions. The Hippocratic *Aphorisms* describe the connection between seasons and diseases. Later authors give more empirically grounded advice concerning the salubriousness of the various positions of cities, including arguments concerning the influences of the seasons, the heights, and the proximity of marshes. Varro, Vitruvius, Columella and Sabinus also discuss aspects of city and estate planning, but their discussions were influenced and informed by older treatises. Sometimes, a city came close to conforming to the ideal, as was the case with Corcyra: the situation of this city, its climate and its environment were coincidentally very similar to those approved by the majority of our authors. But cities were more normally planned and built for other reasons: economic, social and military factors played a crucial role.

According to Vitruvius, an architect had to know about medicine, including meteorology, but city planning and architecture were apparently not embedded in medicine. While some ancient physicians do discuss city planning (see Sabinus and

67 In 1537, during the Turkish attack, a lot of inhabitants of Corfu fled into local marshes: Nicander Nucius 84.3. According to http://www.islandsinfo.com/corfu_greece.htm (seen 11 June 2012), nowadays there are still marshes in the neighbourhood of Lake Korission, south of the city.

Rufus) this is not common. Varro, Vitruvius and Columella, on the other hand, are [18] not just medical authors but well-rounded scientists with a broader array of interests. It appears, then, that ancient medicine was restricted to the human body itself and not to its urban and environmental context.

In his book *On Agriculture*, Varro describes how he cured many of his sick comrades and servants by changing the positions of the door and windows that determined the flow of air through the sick-room, admitting the fresh, beneficial north wind and keeping away other pestilential winds. If this story is true (and I believe that it is), Varro was exceptional in putting into practice his theoretical knowledge of both meteorology and medicine.

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