Anatomische sekse als uitvinding in de botanie : hoe stampers tot vrouwelijke en meeldraden tot mannelijke geslachtsorganen werden (1675-1735)
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Summary

ANATOMICAL SEX AS AN INVENTION IN BOTANY: HOW PISTILS AND STAMENS BECAME FEMALE AND MALE GENITALS (1675-1735).

The pivotal question in this dissertation is how in 1735 the representation has become widely accepted amongst early researchers that certain plants possess two types of reproductive organs to enable them to produce seed. These savants were interested in two flower parts: pistil and stamen. The pistil is centered in the middle of a flower and is often bottle shaped. The parts surrounding this pistil are called stamens. The pistil consists of an ovary – the part where seeds are formed from ovules – and a style. A stamen falls into an anther and a filament. The powder emerging from the anther is called pollen.

The theory of these flower parts which has become common knowledge, focuses on the role of pistil and stamen in producing fertile seed. Under those terms, according to the allegation, the pistils work together as the 'female genitals' with the stamen as 'male genitals'. This is achieved by the exchange of pollen. This view, which from now on I will call the 'bisexual' view, implies that plants have a sex attributed to them, which is subsequently presented as a natural fact.

Researchers of women’s studies who concentrate on the development of theories about sex in the biological sciences, assume that the theories about sex are constructions. Their basic assumption is that sex is not an ever-established, transhistorical or transcultural category, but a historical and cultural category which is produced from certain contexts. According to these researchers not only societal views about men and women or the social pressure to think in terms of two sexes determine the construction of sex. They demonstrate the role of material, technical and social factors in addition to these cultural factors. However, up till now, these researchers have not occupied themselves with the question of how all these various types of factors interact with each other in order to bring about sex. They obviously have not asked themselves if one
particular type of factor is the deciding one in that construction.

The influential American philosopher Judith Butler, on the other hand, is very clear about the type of factor which determines the construction of what she typifies as 'sex'. According to her, only cultural factors (in this case the societal concepts about men and women or the social pressure to think in two sexes, referred to by Butler as 'gender') determine the construction of 'sex'.

Since I am intrigued by these two diverging perceptions, I have examined in this dissertation if and how various types of factors interact in order to bring about sex. For that purpose I would query if cultural factors have been more important in determining the construction of the anatomical sex of plants than other types of factors, such as technical ones. In doing this, I define technical factors as techniques used by the researchers to convince others of a certain assertion. With reference to all this I pose the following theoretical questions: How did the construction of the anatomical sex of plants pass off and to what extent did cultural and technical factors interact during the development of knowledge about sex? Were cultural factors decisive over technical factors? Since the anatomical sex of plants was turned into a natural fact after, and as a result of the fact that, the bisexual vision on pistil and stamen became standard knowledge, I have primarily concentrated on the question of how this vision became standard knowledge.

In the first part of this dissertation I have described the development of several visions on the role of pistil and stamen in the forming of seed, among which the bisexual vision. In Chapter 2 I have, firstly, established by whom and under which terms pistil and stamen were collectively put on the agenda of naturalists who studied plants and when this was done. My conclusion is that the Italian philosopher and doctor Marcello Malpighi (1628-1694) was the first savant who in 1675, in his anatomical research of plants, examined both pistil and stamen. The fact that he occupied himself with these flower parts had to do with a tendency to acquire knowledge about plants not only from books, but also from experimental research.
This tendency had been started in the sixteenth century by the Italian savant Andrea Cesalpino (1519-1603), and was further developed in the seventeenth century by members of the scientific societies which had been founded in that period, such as the French Académie Royale des Sciences, the German Academia Naturae Curiosorum and the English Royal Society. This interest in the anatomy of plants, which resulted from the experimental tendency, and which came down to making preparations, handling the microscope and the assumption of the uniformity principle also created a forefront position for the flower parts pistil and stamen.

Subsequently, I have mapped out the problem which the early naturalists researching pistil and stamen sought to solve. It was found that the main question they asked themselves was which part pistil and stamen played in the forming of seed. My analysis of these researchers' answers has revealed something unusual. Although all four natural philosophers occupied with pistil and stamen concluded that plants reproduce themselves by means of seed; that pistil and stamen contribute to the seed production and that pollen plays a key role in this seed production, four fundamentally diverging perceptions on pistil and stamen were deduced from this.

In 1675, Malpighi published the concept that pistil and stamen collaborated as 'female genitals' in order to accomplish seed. In 1682 the English naturalist Nehemiah Grew (1671-1712) claimed that pistils and young stamens worked together as "wombs" with older stamens in the role of "penises" or "testicles". In 1694 the French natural philosopher Joseph Pitton de Tournefort (1656-1708) submitted the idea of a partnership for the sake of seed production between pistils -functioning as organs in which germs were developed- and stamens in the quality of "excretion organs". In the same year the German savant Rudolph Jakob Camerarius (1665-1721) decided that the forming of seed was accomplished by the cooperation between pistils -functioning as "wombs with ovaries"- and stamens, performing as "male genitals".

Chapter 2 ends with the question "which year did the consensus about the bisexual perception on pistil and stamen become a fact?" This turned out to be 1735. In that same year the Swedish naturalist Carl Linnaeus (1707-1778) turned this view of pistil and stamen into a constitutive part
of his method to place plants in a taxonomic system. According to the number of 'male stamens' he grouped plants into classes, and he classed them in orders depending on the number of 'female pistils'. Despite a few objections this method of Linnaeus' quickly found international support. The book in which Linnaeus published this bisexual perception gained the status of a reference work.

In Chapter 3 I have explained what I mean by the concepts of 'technical and cultural factors', which have played a key role in my theoretical question. I have done this by analysing the examination, in general, of reproduction of the living world for the periods of 1670-1695 and 1695-1760. I have considered which technical factors and which cultural factors were the determining ones in this study. As I mentioned before, my interpretation of technical factors is to be understood as techniques of persuasion, and of cultural factors as the perception of the relationship between masculinity and femininity.

The techniques of persuasion that the naturalists referred to launched four sorts of similar techniques, namely a material, a social, a literary and a cognitive one. All of these appear to unravel into two variants. The application of the material technique of persuasion implied that the researcher carried out tests using instruments. In one variant the microscope was used to carry out observations; in the other variant experiments were carried out as well as observations. Following the line of this material technique of persuasion, the naturalists occasionally hinted at their vision on the relation between savant and nature. Those researchers who only carried out observations, handled a model in which researcher and nature were equal partners. Those who also carried out experiments, portrayed this relation as one in which a powerful natural philosopher forced a submissive nature down on its knees in order to reveal its mysteries. Launching the social technique of persuasion implied that the naturalist sometimes repeated his tests in front of other people. The use of the literary technique meant persuading the people to accept the naturalist's findings by reading the evocative description of the tests he had used. To
do this, he disposed of seven different resources. This literary technique of persuasion fell into two variants, depending on the extent to which these resources were launched. In one variant the researcher made use of three, or fewer, resources conjuring up a vague impression for the reader of the research method used. In the other, the naturalist would apply four or more literary resources. This would produce the effect that the reader would get a clear picture of the research method followed.

Finally, within the framework of the cognitive technique of persuasion, the natural philosopher made a comparison of what he saw with animal organs. This technique had a sexual and a non-sexual variant. Naturalists applying the sexual variant would employ an analogy using both male and female animal sex organs. Naturalists applying the non-sexual variant used comparisons with different animal organs.

My conclusion regarding the understanding of the relation between masculinity and femininity is that in the study of reproduction, from around 1670, two different opinions of the living world emerged: 1) the way of thinking in which femininity was deduced from masculinity, and 2) the way of thinking in which femininity was put diametrically opposite to masculinity. The latter way of thinking came to light around 1695 and dominated in 1730.

In chapter 4 I have answered the question "how did the naturalists arrive at differing opinions on pistil and stamen? Could this divergence of knowledge perhaps be explained from the biographic backgrounds of Malpighi, Grew, Tournefort and Camerarius?" In this light I have analysed differences in their social, national, religious, institutional or disciplinary backgrounds, and also in their opinions of the association between men and activity on one hand, and women and passivity on the other.

When it became clear that the four researchers hardly differed in these respects but, on the contrary, agreed to a great extent, I looked to see if this divergence of knowledge about pistil and stamen corresponds with the techniques used by the four naturalists to enable them to persuade
others of their visions of pistil and stamen. I concluded that each one of the four naturalists used a unique mixture of techniques of persuasion.

In the second part of my study I have worked out how the bisexual vision became standard knowledge. In chapter 5 I have given a survey of all the researchers who were actively involved in the study of pistil and stamen in the period of 1695-1735. Those researchers were the Englishman Samuel Morland (1625-1695), the Frenchman Claude Joseph Geoffroy (1685-1752), the Englishman Richard Bradley (deceased in 1732), the Frenchman Sébastien Vaillant (1669-1722), the Englishman Patrick Blair (deceased in 1728), the Italian Giulio Pontedera (1688-1757), the Frenchman Antoine de Jussieu (1686-1758) and the Swede Carl Linnaeus (1707-1778). I have shown which motives inspired them to study plants in detail; which view of pistil and stamen was presented by them, and which (variants of the) techniques of persuasion appearing in the study of the reproduction of the living world and were applied by them in their studies of pistil and stamen.

In Chapter 6 I have elaborated on this, and I have raised two issues to demonstrate how the bisexual vision became standard knowledge. To begin with, I have made explicit the patterns found in the techniques of persuasion which were used by the naturalists. Between 1695 and 1735 a total of four variants of techniques of persuasion became popular. Firstly, the particular material technique of persuasion found general support where the researcher not only performed observations, but also ventured into experiments. Combined with this, the view on the relation between savant and nature as being unequal became popular.

Secondly, the social working method of repeating observations and experiments in front of expert others faded into the background, and gave way to a strategy which did not involve any of these. Thirdly, the majority of the naturalists who studied pistil and stamen during that period...
used the literary technique of persuasion which gave the readers of the research reports a clear picture of the research procedures followed.

Finally, the majority of the naturalists availed themselves of the sexual cognitive technique of persuasion. They drew parallels between pistil and stamen and male and female animal sex organs.

In short, between 1695 and 1735 a common standard came into being among the researchers about the way in which others could best be persuaded of a pistil-and-stamen-vision.

In chapter 6 I have also shown the connection that exists between the followed techniques of persuasion and the perception of the relation between masculinity and femininity. Two of the four variants of the techniques of persuasion which became popular after 1695, appeared to be connected to the polarised way of thinking about the relation between masculinity and femininity that was supported in that period. To begin with, the perception of the relationship between masculinity and femininity showed a connection with the model of the relation between savant and nature that was the basis of the material technique of persuasion, which implied observing as well as experimenting. This model assumed a clear contrast between the researching savant on the one hand and nature, which was to be researched, on the other. The terms masculinity and femininity which were connected with the researcher and his object respectively, emphasized this opposition. These very definitions fitted in perfectly with the tendency in the perception of the relation between masculinity and femininity to regard femininity as clearly defined from and opposed to masculinity.

Apart from that, the prevailing vision on the relation between masculinity and femininity fitted in perfectly with the cognitive technique which drew parallels with male and female animal genitals. In line with this cognitive technique the natural philosophers defined femininity in relation to flower parts distinctly from masculinity, both in space and in time. This clear definition in space was made by matching femininity with specific flower parts, namely pistils. These pistils were situated in a different part of the flower than the stamens, which were
connected with masculinity. The clear definition in time occurred as a result of the fact that the researchers let the pistils and stamens keep the same (different) sex throughout their entire plant life.

This definition of sex in space and time led to the idea that 'female' pistils which formed seed were entirely different from their 'male' counterpart. The specific way in which sex was connected with pistil and stamen showed a close relation to the thinking in which femininity was differentiated distinctly from masculinity.

What, then, is my conclusion in regard to the pivotal theoretical questions in this study? As I mentioned before, the process in which the anatomical sex of plants was brought about shows an interaction between certain techniques of persuasion and the perception of the relation between masculinity and femininity. Firstly, this means that technical factors interacted with cultural factors. Secondly, within this interaction the cultural factors were not decisive. Indeed, only two of the four variants of the techniques of persuasion which caused the origin of the bisexual standard vision interacted with the perception of the relation between masculinity and femininity.

On this basis my conclusion is that these cultural factors -the perception of the relation between masculinity and femininity- were granted a modest rather than a dominating role in the realisation of the sex of plants. This m-f-perception was not so much the cause or the stepping stone, but rather the background against which the bisexual vision on pistil and stamen became standard knowledge in 1735 and the anatomical sex of plants could be presented as a natural fact.