THE USE OF GOLDEN PROPORTIONS

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"TIME ALTERS FASHION . . .
BUT THAT WHICH IS FOUNDED
ON GEOMETRY AND REAL SCIENCE
WILL REMAIN UNALTERABLE"

Amongst the most beautiful houses of vernacular Cape architecture is the Koopmans de Wet House in Strand Street, Cape Town. Its facade has always been described as one of the best proportioned arrangements preserved.

The history of the house dates back to the turn of the 17th to the 18th century when Reynier Smedinga, silversmith and jeweller, built a simple little structure with a thatched roof, which is probably incorporated in the present building. A frequent change of hands and subsequent alterations followed until 1771, when Pieter Malet acquired the property and a small piece of land adjacent. By further improving and upgrading the building he was also likely to have "added" a new front.

In 1806 the house came into the possession of the widow De Wet until 1913, when the Government turned it into a museum. The nucleus of the furniture today still consists of her belongings[2].

Being one of the famous buildings of the Cape there has always been a tremendous discussion about the masterbuilder, who might have been responsible for the facade-alteration. It is clear that one must differentiate between plan and facade, as, like in many other buildings of the 17th century, the plan underwent frequent changes and the front was added at a later stage. Thus there is no unity between both of them.

Who ever might have built it, was influenced by the classical style of the outgoing 18th century and the type of houses common in the city. The "dakkamer" had probably developed into a pediment, and pilasters and a projecting central section were fashionable when the architect was thinking about the introduction of new features for a grand building.

This was not only a question of proportion. Many facades had already been designed with the "Golden Section" in mind as Figures 2—5 show. Nevertheless they lacked a certain consequence in detail. The overall dimensions of the front had been observed but not the positioning and spacing of elements within the facade[3].

The Koopmans de Wet House is the only example known where one can find the proportions of the Golden Section carried right through into every detail and applied in a manner which only the great masterbuilders of the Renaissance achieved.

Before analysing these proportions, it will be useful to become acquainted with some basic relations of the Golden Section. Figure 6 gives the six most important methods of construction[4]. The harmonic division of a given length "x" in major and minor is shown in Figure 6a. The equation is: $m/M = M/(m+M)$. M is the major and m the minor of the Golden Rectangle.

The proportions of the Golden Section are closely related to the geometry of a pentagram. The pentagram consists of five interwoven isoscele triangles with a top angle of 36° and two bottom ones of 72° (Figure 6b). The vertices lie on a circle's circumference. The base of each of the triangles forms one side of the pentagram.

The diagonals in a pentagram are subdivided by each other in golden proportions. If a perpendicular line is dropped from point C onto the base of the pentagram, the upper diagonal divides this line "golden" into M1 and m1 (Figure 6c).

The construction of a pentagram and a decagon is shown in Figures 6d and 6e. Within the given circle MB E_1 subdivides the radius into two equal parts. F_1 is the result of the circular arch around E_1 with radius E_1B. Connect D with F_1 and you get one side of the pentagram. In addition F_1 subdivides MC "golden".

The decagon is easily constructed using MF_1 for the length of one side (Figure 6e).

The angle of 36° is one of the major proportional devices in geometry. Brunelleschi is supposed to have discovered the relations between the "vertical" and "horizontal" lines of 36° in a pentagram and how they are applied to a design. Figure 6f gives the details.

Points M and N mark the dividing line for the Golden Proportions of the diagonals. This line and the line marked by points K and L subdivide the perpendicular in the pentagram into major and minor (see also Figure 6c). The two small pentagrams within the big one are easily visible, as is the small rhombus formed by the diagonals of the pentagrams. This rhombus appears when two pentagrams meet with their bases.

Palladio applied this principle for instance in his design of the basilica in Vicenza. The combination of

Figure 1: The Koopmans de Wet House, Strand Street, Cape Town (photo: author)

"vertical" and "horizontal" 36°-lines always achieves pleasing proportions.

FACADE ANALYSIS

The simplest method of analysing a facade with respect to its golden proportions is the implementation of "golden rectangles". Figure 7 shows that the whole facade of the Koopmans de Wet House can be inscribed into such a golden rectangle[5].

The subsequent application of the Golden Section to the height of the facade clearly defines the bottom line of the first floor windows (which indeed is the most important line and occurs in many of the Cape Town town houses (see Figures 2—5) and leaves exactly another golden rectangle on either side of the facade with a square above the doorway.

The door itself and the upper floor windows are also proportioned according to the Golden Section. It is no accident that the extension of that rectangle's diagonal meets the top of the pediment.

As the preceding geometrical relations have shown, the pentagram is a figure to follow the golden proportions in all details. How this can be applied to the facade of the Koopmans de Wet House shows Figure 8.
The focus of the enclosing circle lies in line with the ground floor window heads[6]. A number of important points become visible: The height of the pentagram is exactly the height of the facade from stoep to cornice, whereas the width is determined by the outer line of the pilasters. As all diagonals in a pentagram divide the pentagram's height "golden", the bottom line of the first floor windows is the most important line within the facade (see also Figures 6c and 7).

In addition the decagon gives the landing of the steps of the stoep and the first floor window heads.

To determine the vertical rhythm of the facade the system of 36°-lines is used. The "upright" isoscele 36°-triangles define the main axes (which can again be equally subdivided) in line with the centre of the windows. In addition we get the base line of the facade at the bottom by using the "lying" 36°-lines. Note the two smaller pentagrams and the hatched rhombus, which refers to Figure 6f, and it becomes obvious, how strictly the Golden Proportions were adhered to in this building.

There is no other Cape Town facade to my knowl-

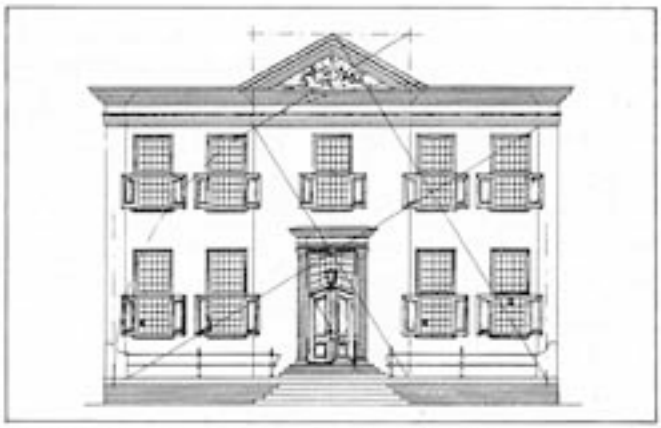

Figure 2: English Church House, Cape Town (Pearse)

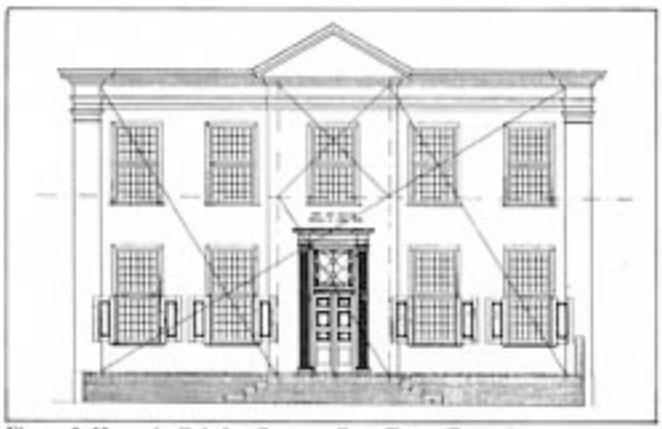

Figure 3: House in Caledon Square, Cape Town (Pearse)

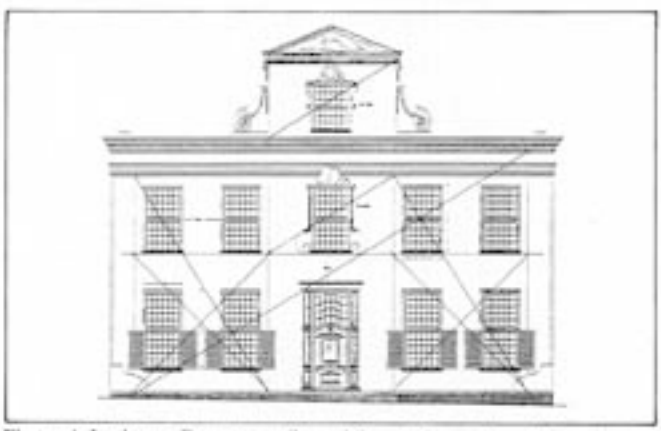

Figure 4: Lutheran Parsonage, Strand Street, Cape Town (Pearse)

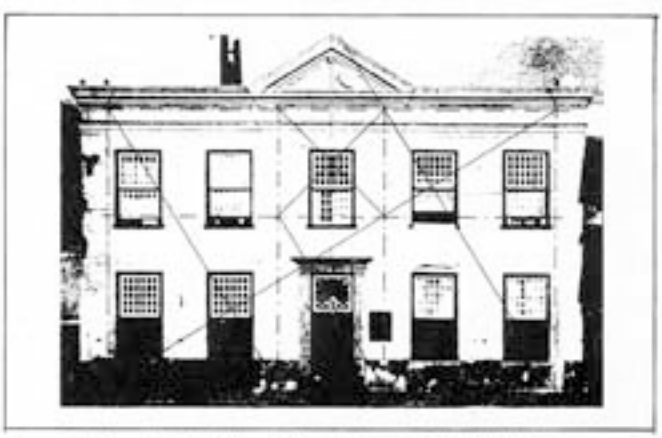

Figure 5: House in Bree Street, Cape Town (photo: Elliott)

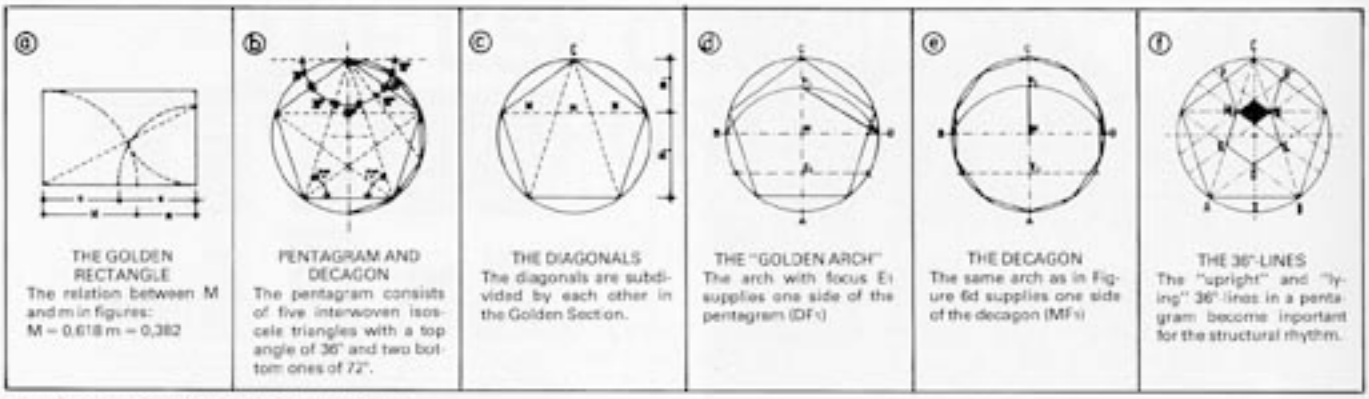

Figure 6: The Relations of the Golden Section

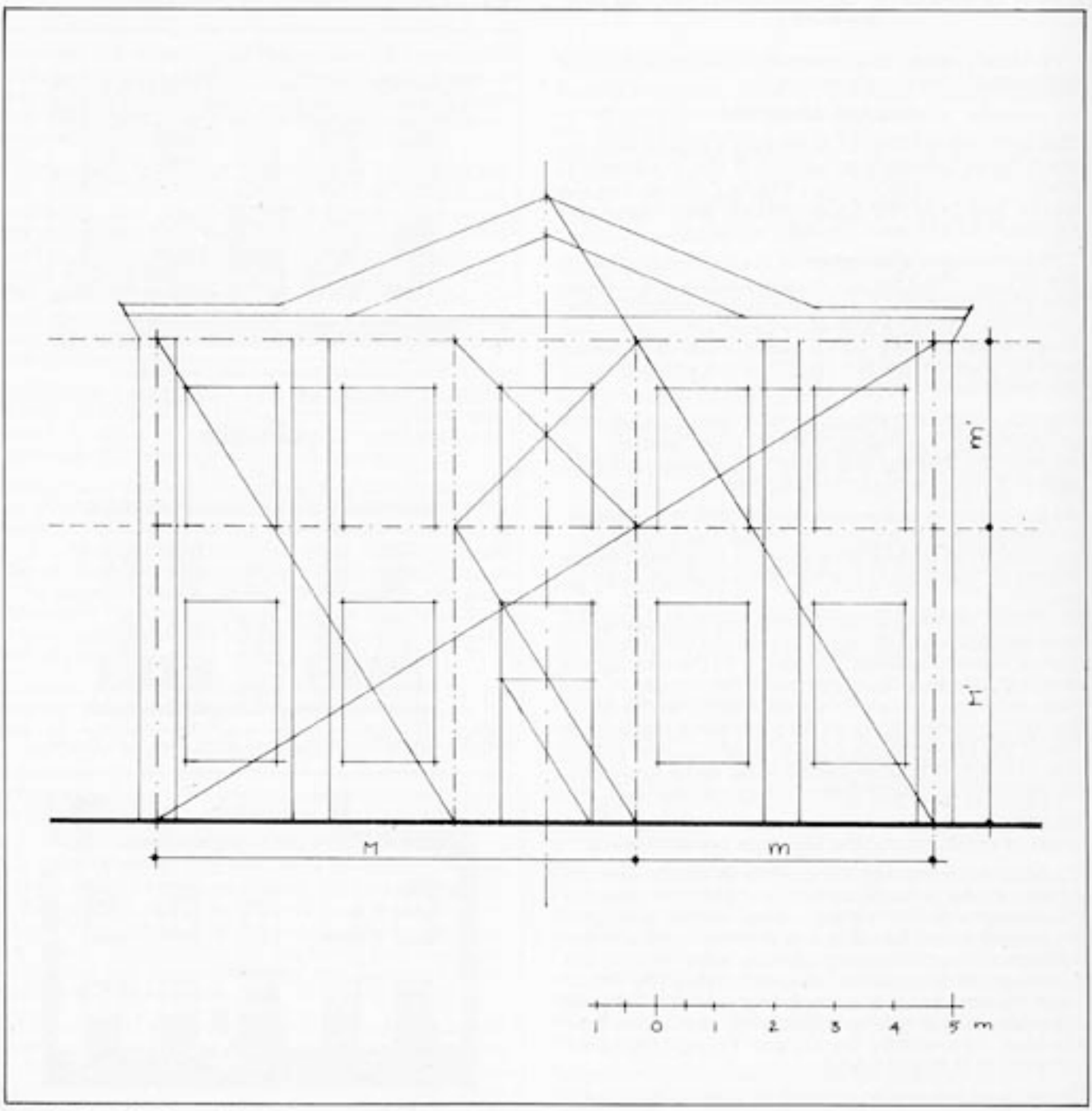

Figure 7: The Golden Rectangle in the Koopmans de Wet House Facade

edge, where this structural pattern was applied in the consequence described. Where other town houses come to a stand-still in observing facade proportions roughly designed in imitation of the Golden Section, the Koopmans de Wet House shows the capability of a masterbuilder to carry the age-old system of pleasing proportions right through every detail. But still this investigation will not suffice to make any further suggestions as to who might have been the architect. Keeping in mind Thibault's "leading position" in that matter, one can't be contented with the fact that exactly these 36°-lines do appear at the facade of the "Petit Trianon" in Versailles, which was designed by Thibault's teacher Jacques-Ange Gabriel. It must be regarded as common knowledge in Europe in the outgoing 18th century and any speculations in that direction should be ruled out unless further well-based research is undertaken.

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1 Sheraton, English carpenter
2 Fransen, H. and Cook, M.A. The Old Buildings of the Cape, Cape Town, 1980, p. 59
3 The facades of these four houses are terminated by pilasters. It is the section between these outer pilasters which follows the proportion of the Golden Section other than in the Koopmans de Wet House, which is designed to pick up the pilaster's centre line. The House in Bree Street, where only this Elliott photograph is left, comes closest to the geometrical structure of the Koopmans de Wet House.
4 after Freckmann, K. Proportionen in der Architektur, München, 1965, p. 8
5 Please note that due to the fact that the left pilaster was constructed slightly asymmetrically, it was shifted in the drawings to its supposed position.
6 LEWCOCK assumes the centre of the frieze of circles above the door as the focus of a number of circles, which he applied to the facade. He did not mention the Golden Section. (LEWCOCK, R. Early Nineteenth Century Architecture in South Africa, Cape Town, 1963, p. 361)

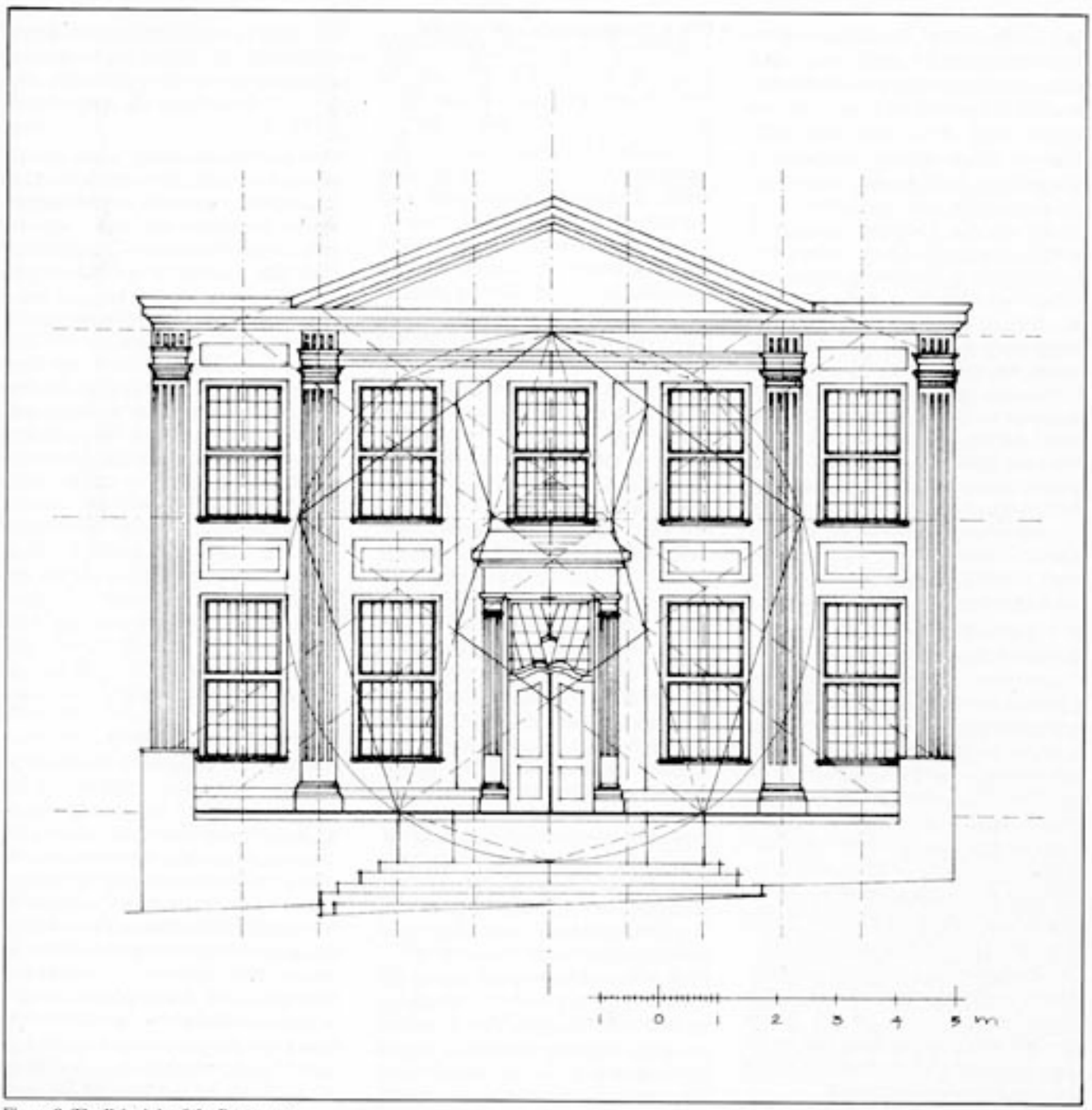

Figure 8: The Principle of the Pentagram