The origins of entasis: illusion, aesthetics or engineering?

PETER THOMPSON *, GEORGIA PAPADOPOULOU and ELENI VASSILIOU

Department of Psychology, University of York, York, YO10 5DD, UK

Received 21 July 2006; accepted 5 February 2007

Abstract—A typical characteristic of columns in Doric temples is entasis; a slight convexity in the body of a column. Often, and particularly in guide-books, it is suggested that entasis is intended to compensate for an illusion of concavity in columns with truly straight sides. We have investigated whether any such visual illusion exists, both in parallel sided and in tapering columns in a series of experiments, finding little evidence to support any illusion-compensation theory. Further, we explored the possibility that entasis was employed for purely aesthetic reasons, but the results do not support this conclusion. Finally, evidence supporting an engineering role for entasis is presented.

Keywords: Entasis; illusion; aesthetics.

INTRODUCTION

‘Entasis’, from the Greek word εντέινειν, to stretch, means tension or bowing. According to Penrose (1888, p. 39), it is the ‘swelling given to a column in the middle parts of the shaft for the purpose of correcting a disagreeable optical illusion, which is found to give an attenuated appearance to columns formed with straight sides, and to cause their outlines to seem concave instead of straight’. Nuttgens, in his ‘The Story of Architecture’ (Nuttgens, 1999) writes ‘Most Greek buildings of this golden period use entasis, the device whereby tapering columns are given a slight swelling about a third of the way up to counteract a tendency of the eye to see them as curving inwards from either side…’ There are many other sources that concur with this view, e.g. Encyclopedia.com, 2006; Long, 2004; The Columbia Encyclopedia, 2005; Wikipedia contributors, 2006 and this view clearly has a long history, see Vitruvius’ treatise, 3.4.5., (1486); Heron’s Definitiones, first century A.D.; Philon of Byzantion’s Belopoïika, third century B.C. It is important here to distinguish between the tapering of columns, which is a common perspective device in the Doric order, and entasis, which refers specifically to the convex bulging of the columns to counteract an alleged ‘waisting’ of columns.

*To whom correspondence should be addressed. E-mail: p.thompson@psych.york.ac.uk
The first use of entasis is probably in the Later Temple of Aphaia at Aigina, in the 490s B.C., and it is most often seen in Doric temples built by the Ancient Greeks and in Renaissance buildings. The Doric order is the oldest, simplest, and most preferred style in mainland Greece and southern Italy, including Sicily. It is often argued that the Doric order obtained its proportion, its strength, and its beauty, from the human figure (Gill, 2000; Mavrikios, 1965). According to Vitruvius, the Roman engineer and architect of the first century B.C., a Doric column’s diameter-to-height ratio is based on the relationship between foot length and height in a man (see Note 1). According to Mavrikios (1965), the relation of the construction to the human figure can be seen in certain formal elements evident in the Doric order (such as entasis) which create an ‘aesthetic’ weight that makes the appearance of the construction look plastic, or alive (see Korres, 1993). Moreover, according to Haselberger (1999, p. 24), the functional role of entasis is that of supporting the load: ‘not as a lifeless, isolated element but . . . comparable to a muscle in action’.

While the most famous Doric temple is the Parthenon in Athens, built in dedication to Athena Parthenos, between 447 and 438 B.C., the best preserved are perhaps the three temples at Paestum (Poseidonia) on the Amalfi coast south of Naples (Fig. 1). The oldest of these temples is the Temple of Hera I, built in 550 B.C., the Temple of Athena followed in 500 B.C. and the last temple is the Temple of Hera II, built in 470–460 B.C. The columns in all of the three temples have pronounced entasis, most prominently in the Temple of Hera I. The first to document the entasis in the Temple of Hera I, the strongest Greek entasis known, was Piranesi (1778).

There are several refinements in Doric temples in general, which have been consistently reported, apart from entasis. Goodyear (1912), in his Greek Refinements, defined these as: ‘purposed departures from the supposedly geometrical regularity of the horizontal and perpendicular lines . . . and from the presumed mathematical equality of their apparently corresponding dimensions and spaces’. These usually include smaller gaps between the corner columns and the remaining columns (this

**Figure 1.** (See color plate IX) The temples at Paestum. Top: Temple of Hera I (550 B.C.). The first temple to be built at the greek colony of Poseidonia, modern day Paestum, south of Naples. This archaic Doric temple, one of the best preserved in the world, is built of local sandstone and has 9 × 18 columns on a three step stylobate. All 50 columns of the peristyle have survived and they exhibit pronounced entasis and tapering of the columns. Middle: Temple of Athena (500 B.C.). The smallest of the temples at Paestum, this temple has 6 × 13 columns. All 34 outer columns survive and while they exhibit entasis it is less marked here than in the temple of Hera I. Bottom: Temple of Hera II (470–460 B.C.). The last of the great temples of Poseidonia, and the largest with 6 × 14 columns. All 36 outer columns, made of local travertine, survive. The entasis here is less marked than in the two earlier temples, representing a shift from the archaic to the classic Doric style. (Photographs by the first author.)

**Figure 2.** (See color plate X) Borromini’s Trompe-l’oeil gallery at the Palazzo Spada, Rome. The gallery, which appears to be 37 metres long actually only extends for 8 metres. The apparently life-size statue at the far end is 60 cm high. (Photograph by the first author.)