

# Some Reflections on the Non-constructible Polygon in Santa Maria Novella, Florence

Albert Samper<sup>1</sup>(✉), Pau Carazo<sup>2</sup>, and Blas Herrera<sup>3</sup>

<sup>1</sup> Unitat Predepartamental d'Arquitectura, Universitat Rovira i Virgili,  
Avinguda de la Universitat n°1, 43204 Reus, Spain  
albert.samper@urv.net

<sup>2</sup> Departament d'Enginyeria Mecànica, Universitat Rovira i Virgili,  
Avinguda Països Catalans n°26, 43007 Tarragona, Spain  
pau.carazo@urv.cat

<sup>3</sup> Departament d'Enginyeria Informàtica i Matemàtiques,  
Universitat Rovira i Virgili,  
Avinguda Països Catalans n°26, 43007 Tarragona, Spain  
blas.herrera@urv.cat

**Abstract.** The geometric process followed by Leon Battista Alberti when designing the façade of the Santa Maria Novella church in Florence is well-known. This façade contains 48 ornamental elements which were created through the construction of regular polygons. Specifically: 7 elements have a pentagonal base, 3 elements have an hexagonal base, 36 elements have an octagonal base, and 2 elements have an icosikaihexagonal base (26 sides). In our view, it is interesting that Alberti, having designed all ornaments on the façade on the basis of regular polygons which can be constructed using a straightedge and a compass only, decided to top the lateral scrolls with a circular design arising from a 26-sided regular polygon, since this regular polygon cannot be constructed using only a compass and a straightedge. Therefore, in this paper we use a mathematical approach to theoretically compare several approximate methods for constructing an icosikaihexagon using a compass and a straightedge, in order to ascertain which of these methods best suits the point pattern of this special Renaissance ornament.

**Keywords:** Icosikaihexagon · Polygons · Santa Maria Novella · Alberti · Classic geometry

## 1 Introduction

Renaissance architecture flourished in Italy from the fourteenth century onwards. More specifically, it was in Florence where architects such as Filippo Brunelleschi led the way to Renaissance by rediscovering the geometric shapes which had been found and used in the Greek and Roman classicism. Many architects followed in the footsteps of Brunelleschi, i.e.: Donato Bramante, Michelozzo, Bernardo Rossellino or Leon Battista Alberti. In order to design buildings which are proportional and beautiful, all of them used the classic geometry shapes which can be constructed using a compass and a straightedge. These constructible shapes were not only used for the general design of