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Volutes and Violins: Visual Parallels between Music and Architecture

In early Greek architecture, above all in the Ionic order, the volute was developed with particular perfection and grace. From 1957 to 1965, I carried out an extensive investigation into how the violin acquired its singular shape. One aspect of violins that I studied was the strong spiral line of the f-holes and scroll. The present paper compares the constructions of Vitruvius, Alberti and Palladio for the volute to my own analyses performed on the scrolls of historic violins. It also seeks a parallel for constructions of volutes with arcs of different degrees in the volutes of the Medici Chapel by Michelangelo.

Introduction

From 1957 to 1965, I carried out an extensive investigation into how the violin acquired its singular shape. The results of my research were published as *The Art of Drawing a Violin* [1994]. One aspect of violins that I studied was the strong spiral line of the f-holes and scroll (Fig. 1).

Spiral patterns in art are found from early times in many different parts of the world. The idea of such a figure, it seems, derives from natural forms: shells, climbing plants, the tails of reptiles, an elephant's trunk, ram's horn, locks of hair, etc. Man, at play rolling up a flat strip of potter's clay or a piece of leather in gradually more ingenious forms, may well have seen the way to a more shapely version of this fascinating motif, in addition to forms directly copied from nature. Such rolled up figures of different kinds are collectively termed volutes. They are found in numerous guises

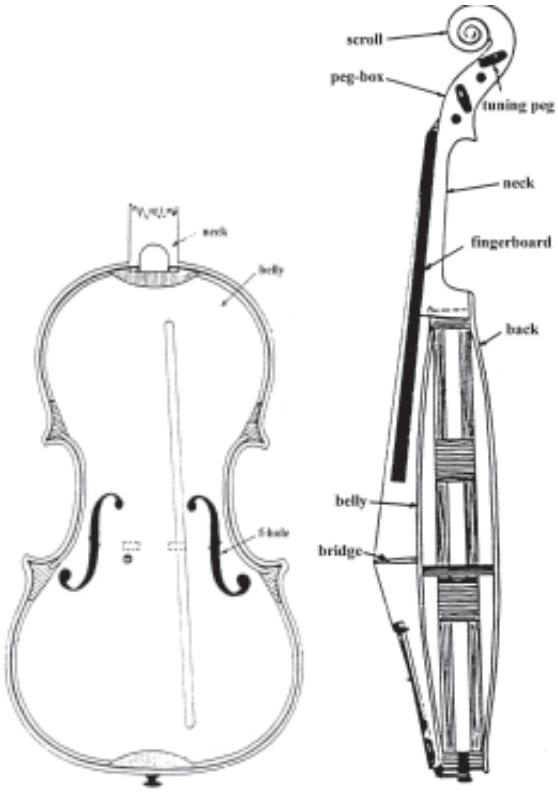

Figure 1: Parts of the violin and terminology

and materials. In early Greek architecture, above all in the Ionic order, the volute was developed with particular perfection and grace. During the Renaissance the volute once again became fashionable, and much use was made of it in late Renaissance and Baroque architecture.

So much, more or less, one can gather from various present-day works of reference. But what has earlier literature in violin-making to say of spirals and volutes? Absolutely nothing, or so it would seem after an extensive search in this kind of the international literature. How the actual marking-out of an f-hole was done when Stradivarius, for instance, made his violin plates has been described by Hill [1902]. The f-holes, it is said in this book, were drawn to some kind of pattern. But there are several further questions one can ask. How was the pattern made? Who made such patterns? Were draughtsmen's curves of this kind in general use in the sixteenth century?

I posed the last question, somewhat cautiously, to a modern manufacturer of draughtsmen's curves, the firm of A.W. Faber of Nürenberg, who have been making drawing materials since 1761. They regretted that they were unaware of the history of the drawing pattern.

Volutes in architectural theory

Although my studies in reference books and libraries were rather haphazard, I could hardly avoid learning of the three great writers on classical architecture: Vitruvius, Alberti and Palladio. To my surprise, I found in the treatises of all three authors illustrated descriptions of the precise methods of constructing volutes, by means of geometrical spirals. Vitruvius is thought to have written his work around 20 B.C., and it is [the only surviving] written work on classical architecture from antiquity. The Renaissance architects Alberti (1485) and Palladio (1576) are believed to have used Vitruvius as their source for many topics, but their information on volutes clearly has a different origin or origins. Even so, all three state that the volute construction they describe belong to the Ionic order of columns (Figure 2).

Vitruvius's principle of construction is shown in Figure 3a. Modern textbooks on draughtmanship often show a somewhat similar construction (Figure 3b) but in such examples, the inner circle, or eye, is lacking, thus eradicating the connection with the classical volute. In Figure 3a, as in later descriptions, in order to clarify how the drawing is produced, I have given the ordinal number and delimiting arrows of the arcs that are 90°, that is, from and including the third arc. Note also that the transition between Circle no. 1—the eye of the volute—and the Arc no. 2 is so constructed, or fitted in, that the tangents are geometrically correct. It should be added that Vitruvius, like Alberti, made things more difficult for himself by starting with the outermost whorl and working inwards to the eye.

If we call Vitruvius's volute a mainly 90° volute, then Alberti's construction (Figure 4), can be called a 180° volute. Both are geometrically "correct", in that the arcs are tangentially joined to each other. Palladio's work describes a more complicated spiral, with which he hints at something different and more complex (Figure 5). But, taken together, here the theoretical nature of the variations seems to be that

Figure 2. Volutes in the Ionic order of architecture.

Figure 3. left) Vitruvian volute. 90° from and including arc 3; right) Spiral figure from modern textbook in draughtsmanship; the involute of a square.

Figure 4. Albertian volute; 180° from and including arc 2.

Figure 5. Palladio's construction of the volute, after Inigo Jones. a) general construction; b, c) enlarged details of the eye.

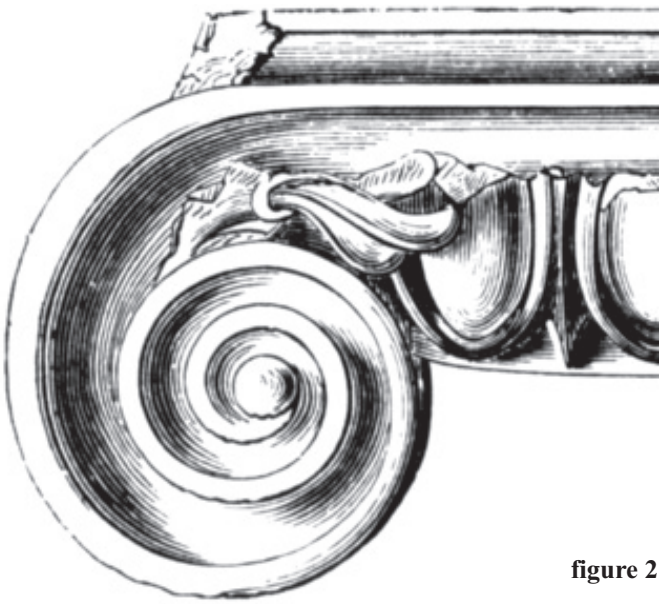

figure 2

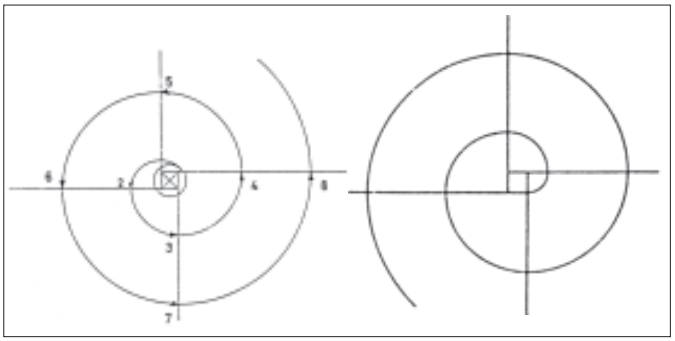

figure 3

figure 4

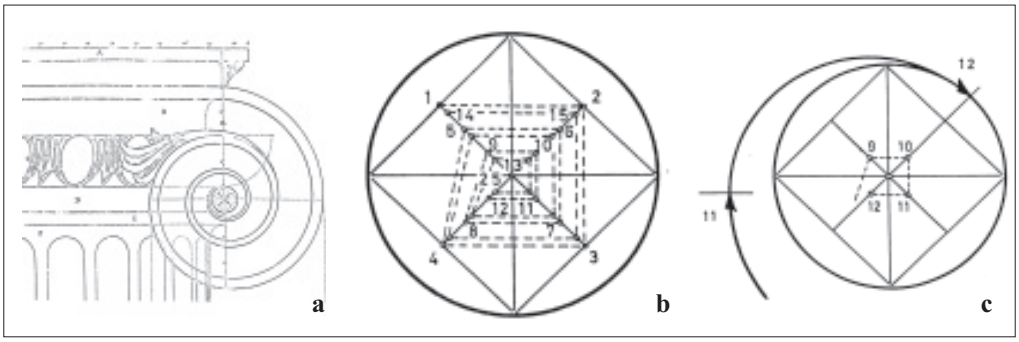

figure 5

which could have existed in the formal world to which a geometrically constructed volute belongs.

I think it is possible, indeed probably, that the construction of spirals with the help of compasses during the fifteenth and sixteenth centuries derives from centuries-old traditions, still very much alive within the membership of advanced craft guilds. The occurrence, dissemination and variation in the exact shape of the volute are likely to offer further clues, not only to those concerned with the genesis of the earlier bowed instruments. To judge from certain ornaments, precision techniques in general—as represented, for instance, by Galileo Galilei and his son—are likely to have been closely allied to the guilds.

Even the great gilded volutes that so often weigh down the church decorations we Swedes have imported from Southern Germany may offer certain links. Their lively, sweeping lines invite analysis. I would venture to suggest that even in such contexts volutes of different kinds took their basic form from the patterns that artists themselves had once learned to construct with ruler and compasses—guild secrets, which the uninitiated were reduced to copying. Or perhaps draughtsmen's patterns of this kind were on sale even at that early time?

Inexact volutes, composed free hand, seem often to have predominated during the Renaissance and Baroque. Perhaps this was the case even earlier. Vitruvius's works on

Figure 6a. Instrument with straight peg-box pointing sharply backwards

architecture, which are said to have had an enormous influence on Renaissance architecture, are considered in some ways to have misled archaeological research. I have not thought it my business to study this further.

Volutes in the design of stringed instruments

The historical development of the design of the peg-boxes for stringed instruments is difficult to trace. This is particularly true of the periods preceding the violin. The different stages interlock, as it where, and similar forms appear in different centuries and in different parts of the world in a perplexing way.

An excellent general picture can be obtained by leafing through *Die Gitarre und ihr Bau* [Jahnel 1963]. In the long succession of forms and ideas, we observe, for instance, the way in which the straight, backwards-pointing peg-box (Figure 6a) appears at a very early time (B.C.), obstinately persisting right through the centuries in which classical violins were made. At this point I should like to bring in my argument. Backwards-pointing constructions of this kind called for softer lines. As early as the fifteenth century, a volute came to be something of a standard solution in a variety of different contexts.

In Figure 6b, we see how the sixteenth-century artist Jost Amman portrayed a couple of musicians. In some respects, his lively picture seems somewhat unrealistic, but I would like to assume that the peg-box and the scroll on the instruments portrayed show how roughly the geometrically designed volute necks once looked — a traditional volute borrowed from other crafts, with the transverse direction from earlier instruments retained.

The design pointing directly backwards, however, was gradually to disappear. Different reversed connecting arcs were needed for such patterns. Here is a more concrete example

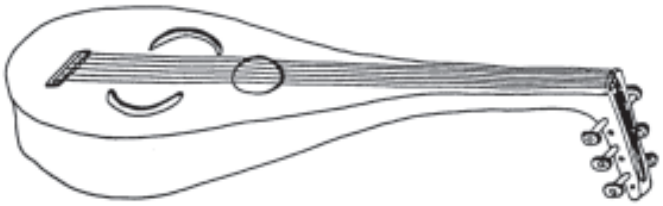

Figure 6b. Instruments with backwards-pointing peg-boxes with a volute construction; from an illustration by sixteenth century artist Jost Amman.

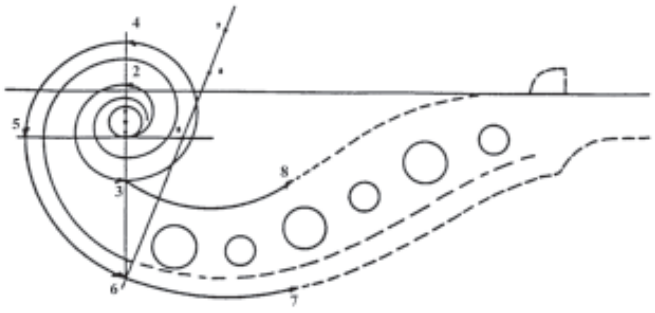

Figure 7. Line reconstruction of scroll from a bass viol attributed to Gasparo da Salò in the Ashmolean Museum, Oxford.

of this step in development. Figure 7 shows my outline reconstruction of the scroll on a bass viol I measure-photographed at the Ashmolean Museum, Oxford.

The instrument has been ascribed by Hill to Gasparo da Salo. Here the volute has been given a more attractive angle in relation to the neck, but a sizeable block of expensive wood is still needed if both are to be made in one piece. As we can see, my reconstruction of the scroll gives a simple and exact geometrical line-system, except for the transition to the neck, which is still abrupt. To make the volute was simpler than to adapt it to its new context. The figure should give the reader a clear picture of the system. The centres for the first five arcs of the volute lie grouped in the eye along a vertical centre line. This, and the fact that the first arcs of 180°, associate the design with Alberti's system. Arc 5, however, is 90°; subsequent arcs have much larger radii, ending precisely on the vertical line through the eye. The eye of the volute and the side of the peg-box lie in the same plane. A concave, rounded chamfer follows the lower edge of the peg-box, the outer whorls, then, as a countersink, penetrates to the eye, decorated in the form of a simple, stylised, rose.

Numerous experiments must have been carried out with the volutes constructed and connected in different ways, before the violin scroll was created. Figure 8 is my line construction of a scroll to a treble viol made by Giovanni Maria.

At first sight, it is hard to avoid the suspicion that this is the result of some kind of mass production: a rough-and-ready scroll, as it were. As with the preceding instrument by Gasparo da Salo, the peg-box and the eye lie in the same plane (there are thus no stepped whorls as on an ordinary violin scroll. The execution is mediocre. Yet an analysis and reconstruction reveal a surprising elegance of line, and a definite system of construction that is full of character.

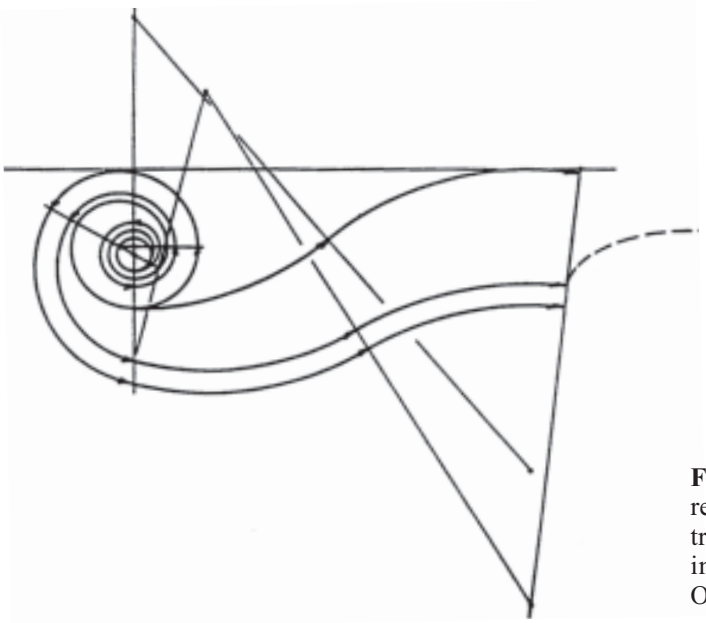

Figure 8. Author's line reconstruction of scroll from a treble viol by Giovanni Maria in the Ashmolean Museum, Oxford.

An ingenious double-line schema whirls out into the lower concave countersink of the peg-box and into its upper arcs. (The inconveniently acute angle where the twine for hanging up the instrument is usually attached has in fact been rounded off slightly, for it is impractical to work with such an acute angle. It is worth making a comparison with the way in which this part of the scroll subsequently developed on the violin, as a result of such practical considerations.)

The outer whorls of the scroll cover 120° — repeated twice. The upper and lower arcs of the peg-box, it seems, have been built up of four radii of equal length. But the neck's graceful transition to the peg-box is lacking; a straight line, and suddenly everything comes to an end. Later we shall see how this problem acquired a simple and elegant solution in the violin.

From the standpoint of manufacture, however, the rational principle employed is clear enough. When the upper surface of the neck came to be planed smooth, clearly the scroll itself must not get in the way of the plane. Compared with the earlier example, the scroll has been pressed down, so to speak, below the level of the tool. This was the position in which its development was to continue.

The details, and the possibility of freehand lines here and there, are obviously matters of debate in making such analyses and attempts at reconstruction. No maker could altogether avoid minute errors in the course of his work, and sheer wear and tear has in many cases left its mark. But there can be no doubt that characteristic features in the linear interplay of different scrolls can all be described by exact systems of the type I have exemplified here.

Given the small size of a violin scroll, the original drawing must have required something of a watchmaker's precision. If you study the scribed areas of the outer surfaces of scrolls found in the Cremona Museum, you will not be inclined to reject this idea, improbable though it may seem to some. If the mind reels at such an idea, then bear in mind that much of the development could have been made at the scale of the bass viol rather than the violin itself.

The line scheme and the system of arcs of the scroll

My studies of violin scrolls permit the conclusion that these too, in the great masters, are often built up in a simple scheme of four lines, the positions of which vary only slightly in relation to each other (Figure 9).

Uppermost is the horizontal line A-A on a level with the upper surface of the neck (that is, the lower surface of the fingerboard). By the fingerboard nut, at right angles to the main line, is drawn the line B-B to a length of 1 Venetian inch (29.98 mm) (if these two measurements are modified by some half-millimetre the appearance will be spoilt). With the centre on the line C-C, a circular arc is drawn tangent to line A-A. This I call the initial arc of the scroll, I. Its radius varies very slightly from case to case. It is often 90°, but other easily constructed degrees frequently occur. On the oblique line D-D is the centre of the reverse arc II, which comprises the lower side of the peg-box. This reaches to the lower point B. To the same point runs also the little terminal arc of the neck. The sharp corner, of course, is then rounded off. The large upper arc IV of the peg-box varies, but the execution shown in the figure seems very common.

The initial arc is connected at its upper end, via arcs 2-4, to the reverse arc in the lower side of the peg-box. In the lower end of the initial arc, a number of increasingly smaller arcs run into the eye.

The whole character of the scroll is dictated by the line scheme and the system of arcs-with different degrees and radii. To put it another way, tradition demands that its elements should be selected according to certain rules, combined with a view to the function and harmony of the whole.

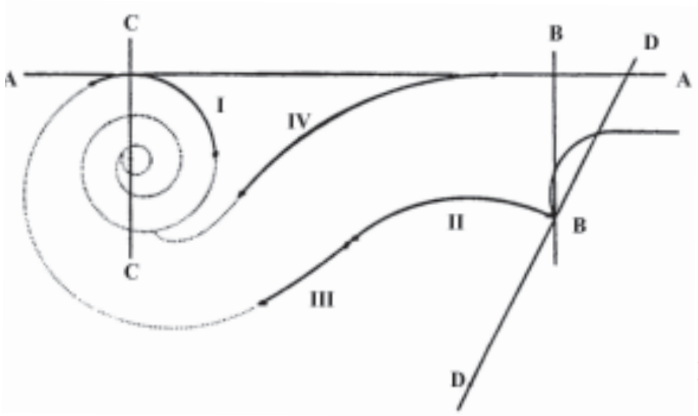

Figure 9. Arcs of the violin scroll.

Other volutes with circular arcs of different degrees

One question was natural: were violinmakers alone in designing these ingenious volutes, joined together by circular arcs of different degrees? It was clear that the works of Vitruvius, Alberti and Palladio made no mention of such constructions. And, according to Vincio Gai's survey [1988], there are no clues in Vignola either.

There were four volutes by Michelangelo in the Medici Chapel, or New Sacristy, in Florence that I was anxious to analyse (Figure 10).

The Italian Embassy referred me to the Casa Buonarroti in Florence for further information and possible assistance in obtaining the pictures I needed for my analyses. But possibly the very idea of the great Michelangelo using geometrically constructed volutes seemed too absurd to the Florentine art experts. I wrote letter after letter without receiving a reply. Eventually I was able to find a picture [Poulsen, Nygård-Nilssen and Gauffin1947] upon which I could perform an analysis (Figure 11).

As I had long suspected, it was actually a geometrically constructed volute. Obviously Michelangelo (or possibly one of his assistants) was well versed in the techniques of draughtsmanship I had found in the work of the violinmakers. What was required here was to join a volute into an unusual context. A long, slanting, curved line was to roll

Figure 10. The volutes in Michelangelo's Medici Chapel (the New Sacristy) in the church of San Lorenzo in Florence. Shown in the sculpture of the Aurora, or Dawn. Photo courtesy of Kim Williams.

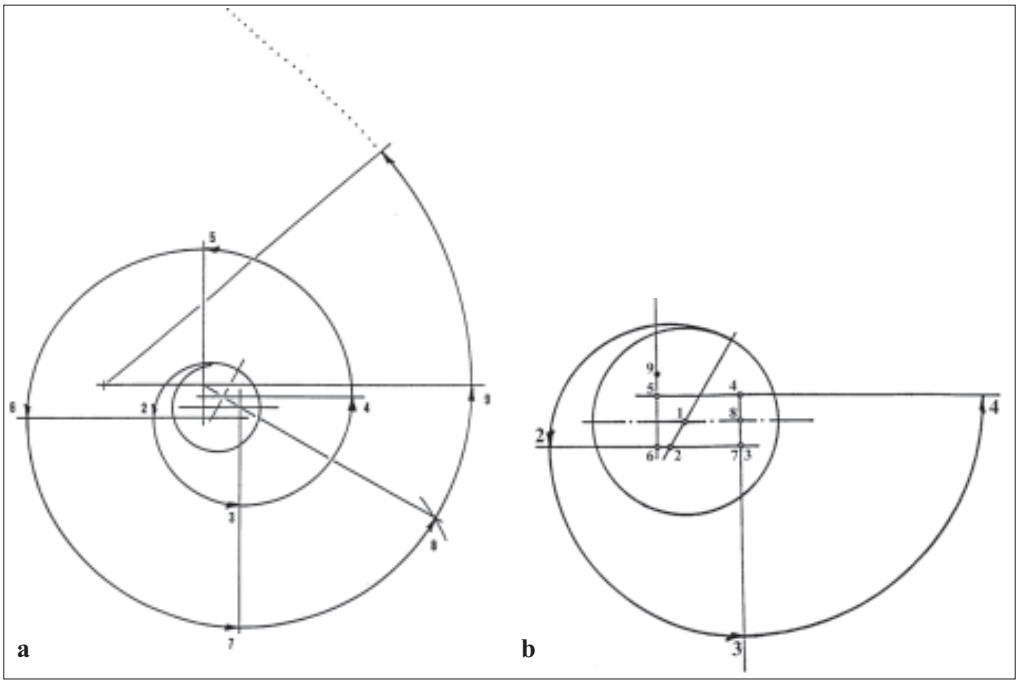

Figure 11. a) Reconstruction of a volute forming part of the tomb ornaments in the Medici Chapel in San Lorenzo. The work was carried out by Michelangelo Buonarroti from 1524-1532; **b)** Enlarged detail with the inner whorls of the volute and clarification of the position of the centre points.

itself up into a volute. The volutes we have seen earlier began with a little circle, the eye, unrolling and forming ever-wider revolutions. But this option was not open to Michelangelo. In order to capture the slanting, curved line, he actually allows the distance between the volute's two outermost whorls to diminish slightly at the end. Analysis of Michelangelo's volute thus shows that there were others in the sixteenth century who were designing ingenious volutes held together by circular arcs of different degrees.

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About the author

Åke Ekwall studied mechanical machine engineering at HTS in Hässleholm in the south of Sweden and then worked as a mechanical engineer in auto and aviation plants and steelworks in Sweden. Through his own, very small, publishing firm he has produced many new devices and methods for violin making in the form of small booklets (compendia). He has been a member for 30 years of the Catgut Acoustical Society and has contributed to their newsletters and journals. The CAS is an international non-profit organisation that aims the increase and diffusion of the knowledge of musical acoustics.