Research exercise: art and the Golden Section

Definition

The golden section (also known as ‘golden mean’ and ‘golden ratio’) is a ratio of 1:1.618 (although the decimal stretches to infinity). It has a special mathematical quality as the smaller quantity is to the larger quantity what the larger quantity is to the whole (and the two quantities of the golden section always equal the whole). It can be shown graphically as a line divided into two segments (below). Here we see that the line $CB$ is the same proportion of the line $AC$, as the line $AC$ is as a proportion to the line $AB$.

The ratio has been measured and found in nature (spiral patterns in shells, reproductive sequences in rabbits, even human female reproductive organs, based on the number sequence of the ratio) and in artificial ('man-made') forms, particularly architecture - although there is often contention regarding whether the rules of the golden section are real or have been imposed by the over-zealous researcher wanting to find its form where it doesn’t really exist.

In art, the golden section is used to achieve aesthetically (the arguably most) pleasing proportioning within a piece, usually defined in terms of the proportions of a rectangle (although golden triangles, golden spirals, golden star [pentagram] and others are also used as measures). In the rectangle presented below we see the same ratio as the line above. The height of the rectangle is determined by the length of the horizontal line $b$: the vertical line $b$ is the same length (thus achieving the square, $B$).

If we assigned a numerical number to vertical line $b$ of 1, then the horizontal line of $a$ is 1.618, thus:
The construction of a picture, it is argued should follow these principles because, in the words of Rudolf Arnheim,

Traditionally and psychologically, this proportion of 1:1.618... has been considered particularly satisfying because of its combination of unity and dynamic variety. Whole and parts are nicely adjusted in strength so that the whole prevails without being threatened by a split, but at the same time the parts retain some self-sufficiency. (p.71)

The Golden Section in Art

In researching the application of the golden section in art, I came to two conclusions, which I discuss in turn:

1. the ratio golden section ration is objective, but its application is subjective, and
2. we cannot be sure that an artist has applied the principles of the golden ration unless he or she tells us so.

1. “the ratio golden section ration is objective, but its application is subjective”

Internet trawls of the terms golden section, golden ratio, and the like threw up countless arguments and counter-arguments about whether or not a piece of art – or architecture – was the product of the golden ratio. I will not attempt to prove or disprove any of the arguments, but suffice to say that there are plenty of discussions about whether the Parthenon, the pyramids of Egypt, da Vinci's Mona Lisa, the works of Mondrian, Rembrandt's self-portrait, Raphael's Crucifixion, Micahelangelo's Holy Family, and countless others do or do not use the principles of the golden section/triangle/star.

The arguments run along two themes:

• whether or not the measurements of the golden section/triangle/star have been correctly applied (do they include the steps of the Parthenon or not, for instance, or have the measures been taken directly from the canvas or a reproduction of the canvas that is some way distorted (masked by the picture frame, of from a photo taken at an odd angle)

• whether there really is a golden section/triangle/star to be seen in a picture, or whether it is based upon a subjective view of an image that others do not see.
At the bottom of this piece, I have applied golden section principles to a number of pictures. Undoubtedly my efforts suffer from the same arguments laid out above, but to some extent I’m not sure that it really matters. What it does suggest, though, is that there exists a consensus view that a general rectangular subject can be pleasing to look at – so we see pictures tend to be triangular, as do TV and cinema screens, letters, paintings, posters, and so forth – and compositions that are based on less-than-equal elements (i.e. not half-and-half) are more preferable to view than other forms.

**Artists/art that applies the golden section**

Outlined below are some examples of art that the artists have said themselves are based upon the rules of the golden section. This should remove beyond doubt that these pieces are based upon the golden section principles, although it is still for the viewer to see how these principles are applied.

The first of these, George Bellows’ Elinor, Jean and Anna (1920), below, Camfield suggests may have gone completely unnoticed as employing the Golden Section without Bellows supplying relevant documentation to Jay Hambridge for his book *Dynamic Symmetry in Composition*. Below is a copy of the painting, with a copy of the notes supplied in the book (p.24) further below:
Next are three abstract pieces from the 1950s and heavily influenced by the St Ives artist scene.

Red Form (1954) by Wilhelmina Barns-Graham, below, was painted at a time when she was producing abstract art and pictures of rock formations, using the rules of the golden section and fitting shapes into these parameters. Judging from the angular lines of pencil visible under the paint, the composition has been carefully considered. Whilst not trying to second-guess how Wilhelmina Barns-Graham used the golden section to develop her work, you can see by my liberal placing of golden section rectangles how the forms fit within the boundaries of the dashed parameters.
Sea-Bird Forms (1951) by John Wellsborn (below) is a composition based upon a Golden Section grid, as the catalogue entry for the work on the Tate website discusses;

the most prominent vertical division and the horizon-like line make a Golden Section in each dimension. A series of diagonals are generated from the points at which those divisions cross the bottom and left-hand edges of the board, becoming further elements in the composition.
Sir Terry Frost frequently based works like Black and White Movement (1952), below, on geometrical proportions of the Golden Section. This piece is one of a series of works inspired by the boats in St Ives harbour, in which diagonal and curving lines intersect.
Prominent in the development of cubism, Juan Gris displayed serious commitment to the use of geometrical proportions – more so, Camfield notes, than other artists of the movement. Le Lavabo (1912), below, is carefully constructed with golden section rectangles within it, some of which I’ve marked, as well as golden section triangle within the tied-back curtain.
Salvador Dalí explicitly used the golden ratio in his work, The Sacrament of the Last Supper. The dimensions of the canvas are a golden rectangle. A huge dodecahedron is suspended above and behind Jesus and dominates the composition. Regular dodecahedrons, of which this is an example, have twelve pentagon faces with edges in golden ratio to one another.
References

Arnheim, R. Art and Visual Perception, University of California Press, 1974


Hambidge, J. Dynamic Symmetry in Composition New Haven, 1923


Thompson, J How to Read a Modern Painting Thames & Hudson, 2006


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http://www.guardian.co.uk/science/alexs-adventures-in-numberland/2012/aug/14/golden-ratio-uterus
Looking for ‘Golden Sections’ in art

When looking at the composition of works of art, it quickly became clear that assessment according to ‘Golden Section’ principles is often compromised as the dimensions of the works do not follow the golden section ratio. Even works that artists explicitly refer to as having been composed using the golden section – such as Red Forms, Black and White Movement, and Sea Bird Forms - are on canvasses that do not conform to the rectangular 1:1.618 ratio.

As a result, the analysis in these examples is undertaken by loose application of the Golden section ratio to the overall composition. The white lines marked on each picture indicate an approximate measure of point C, that is 1.000/1.618 along the edge of the composition. There are four lines to indicate the measure of point C starting from point A on the bottom left and top right hand sides of the picture, and again from the bottom point A and the top point A of the picture (demonstrated in the diagram below). The point C measure is applied consistently in each picture, although the shape of the 9-box grid that the lines produce differs according to the dimensions of the overall picture. If the dimensions of the picture met the golden section ratio, then the rectangle $A'B'C'D$ would form a square.

Another way of applying the golden section measure is to look for subjects within the composition that appear to fit within a golden section rectangle. Where I have identified such subjects, I have marked the golden rectangle within pictures using a dashed line.

I have considered the composition of following pictures using these two golden section measures.
In doing so, I don’t suggest that the artists for any of these pictures explicitly used the golden section in composing their work, but merely that golden sections can be found.

Mario Sironi, Urban Landscape with Chimneys, 1921

Sironi’s work, depicting a dark industrial landscape, is full of geometric shapes and rectangles. I’ve marked out the main elements of the composition using dashed rectangles in golden rectangle proportions (1:1.618). Most of these elements have an approximate fit to the rectangle ratio. Adjacent, if not overlapping, each other, these elements move from left to right across the whole picture and are predominantly placed within the space between the horizontal lines.

Most of the interest is in the upper right-hand section of the picture (where the light falls on the factory walls and on the chimneys above). However, the diagonal rail lines and the (darker and less obvious) tower on the left, provide counter-balance.

Thomas Eakins, Swimming (The Swimming Hole), 1885
Eakin's Swimming holds very well the rules of the golden section, making a very balanced composition. The vertical line demonstrating the golden section from the left hand side of the picture holds the edge of the rock from which the boys are jumping. The line is supported by the statuesque pose of the boy waiting his turn, the main figure in the picture, and the edge of the tree foliage at the top.

The majority of the subjects - the young men and the rock - are in the larger left-hand space of the golden section, though the diving boy and the swimmer on the very far right provide balance.

Of the horizontal planes marking the vertical golden section, the subjects are strongly held within the two lines at the middle of the composition, in a much the same way as Hopper's Nighthawks, below. The presence of two boys and a dog in the lower third of the picture are counter-balanced by the torso and head of the standing boy which is the primary item of interest on the upper section of the picture. Combined with the figures below the torso, the figures assembled figures make up a triangle of foreground actors. Only the figure lying on the rock on his side is excluded.

Giorgio Morandi, The Courtyard of the Via Fondazza, 1954
The detail in Morandi’s work is on the right side of the picture behind the wall of a white building that dominates the left. Though less than half of the picture, the space occupied by the wall exceeds the left hand line, marking the golden section from the right. A dent in the wall is shown below the lower vertical line, offsetting the weight of the trees/shrubs in the bottom right and providing symmetry. Again, like other pictures offered here, the interest lies in the space between the two vertical lines, marking the golden section from the bottom and the top. This time it is the dense cluster of buildings that is the main area of attention and in particular the taller, narrower building, and the shadow it casts.

Georges Seurat, Bathers at Asnières 1883-4
In Seurat’s picture, the horizon is placed exactly on the vertical golden section line of the painting (61.8% of the way up the page). The main figure, the boy sat on the grassy bank, is also positioned around the intersection of the horizontal and vertical golden section lines. The main subjects in the pictured are balanced around the golden section (highlighted by dotted golden rectangles – where the ratio is 1:1.618). We have two on the upper horizontal golden section line (lady on the bank, boat with tricolour) and two almost directly underneath, below the line (man and dog, boy in river). The four subjects appear to be opposite, and providing balance, dissected by the vertical golden section line, also.

Joan Miró, Landscape 1927
Miró’s Landscape doesn’t appear so obviously associated with the golden section rule: neither of the two subjects straddle a golden section line, nor are they painted with the dimensions of the golden rectangle in mind, and neither does the horizon sit on the vertical line (it’s very nearly – but not quite – half way up the page: something the OCA course advises students to avoid as it ‘lacks interest’).

However, there is balance in the painting. Indeed the balance of the composition could be considered its main feature. The two elements sit firmly within opposites of the golden section – the lower ‘rabbit’s head is within the bottom left hand rectangle – the bigger area of the horizontal and vertical golden sections, and the ‘illuminated egg’ in the smaller surface areas of the horizontal/vertical divide (upper right rectangle)

Edward Hopper, Nighthawks, 1942
All the main elements in this picture appear on the right hand side, the vertical frontage of the bar is close to the vertical line that delineates the golden section on the right hand side. There is a strong horizontal plane in the picture, created by the far side pavement, the window sill of the bar window and the surface of the bar itself, that is closely aligned to the lower horizontal line of the golden section.

The main subjects within the bar, the man sitting alone and the bartender engaging in conversation with a couple sit well in their own golden rectangles (the lone man, vertically; the couple and bar tender, horizontally) which along the right hand side of the lower horizontal plane. They are positioned either side of the vertical line that represents the golden section from the left hand side of the picture. The lone man, positioned within the intersection of all lines of the golden section, is important in balancing the picture. He holds the attention of the viewer, encouraging us to speculate as to why he is there on his own, whilst the rest of the night goes on around him. Without the strength of this figure within the picture, it would look very unbalanced.