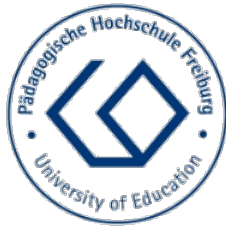


# Fashion Design in the Context of Sustainability (Part 2)



Hochschule Reutlingen  
Reutlingen University



Co-funded by  
the European Union

# Learning Objectives

After this lecture you should be able to:

- Understand the slow fashion, based on the long life fashion elements.
- Design clothes applying sustainable long life fashion elements: different types of drapes, other 3D elements and peplums.
- Design clothes in combined sustainable silhouettes.
- Design clothes using sustainable proportions, based on the golden ratio and Fibonacci sequence.
- Design clothes using geometrical figures and tiles, based on the golden ratio and Fibonacci sequence.
- Design textiles using geometrical figures, based on the golden ratio and Fibonacci sequence.

# Slow Fashion

The **slow fashion** is an aspect of sustainable fashion and is the opposite concept of the fast fashion. The slow fashion offers sustainable fashion solutions, which are based on new strategies for design, manufacturing, consumption, use and re-use that challenge the global fashion system. The slow fashion involves a fashion awareness of the production and resources required to create clothing. The slow fashion promotes the purchase of higher-quality clothes with trendless design that will last longer, and fair treatment of people, animals, and the environment.

The **trendless designs** are based on application of the **long life fashion elements**.

# Long Life Fashion Elements

A study of women's fashion of the last decade of 20<sup>th</sup> Century and 21<sup>st</sup> Century from the beginning till now shows that there are elements, which stay in fashion for a longer period of time or in other words they are always in trends. The application of long live fashion elements in design is a precondition for the long life of clothes (slow fashion). These elements are:

- **Drapes.** The draperies are always in fashion trends. The free and twist knot ones are the more popular types of drapes.
- **Other 3D elements.** The tucks, pleats, gathers, and ruffles are with long life in fashion.
- **Peplums.** Although they are not as popular as 10 years ago, they are in still in trends for a long time.
- **Non volume silhouettes.** They are always in trends.

# Back to fashion history



The long life fashion elements of **drapes**, **other 3D ones**, **peplum** and **non volume silhouette** in combination with **zero waste** construction can be seen in the women's **ancient Greek and Thracian chiton**.

# Drapes. History

Drapes take their place in the contemporary fashion in the first half of the 20<sup>th</sup> Century. Then Mariano Fortuny created his draped, inspired by ancient Greek costume, evening “Delphos” dresses.



“Delphos” evening dress by Mariano Fortuny, 1910-1920  
Source:  
Museum of Applied Arts & Sciences,  
<https://ma.as/169168>

# Drapes. History



Madeleine Vionnet, known for her elegant Greek inspired dresses, has been called the “Queen of the bias cut”. She introduced the bias cut to the fashion design.

Vionnet’s pink crêpe nightgowns, 1931

Photograph by Hoyningen-Huene  
Source:

Berznak A., Vanity Fair, 2012,  
<https://www.vanityfair.com>

# Drapes. History



Madame Grès has been called the “Queen of the drapery” and the “Master of the wrapped and draped dress”. She has been famous with her floor-length draped Grecian goddess gowns.

Draped Dress of Madame Grès, Paris, 1955  
© Atelier Robert Doisneau courtesy of GAMMA-RAPHO Agency



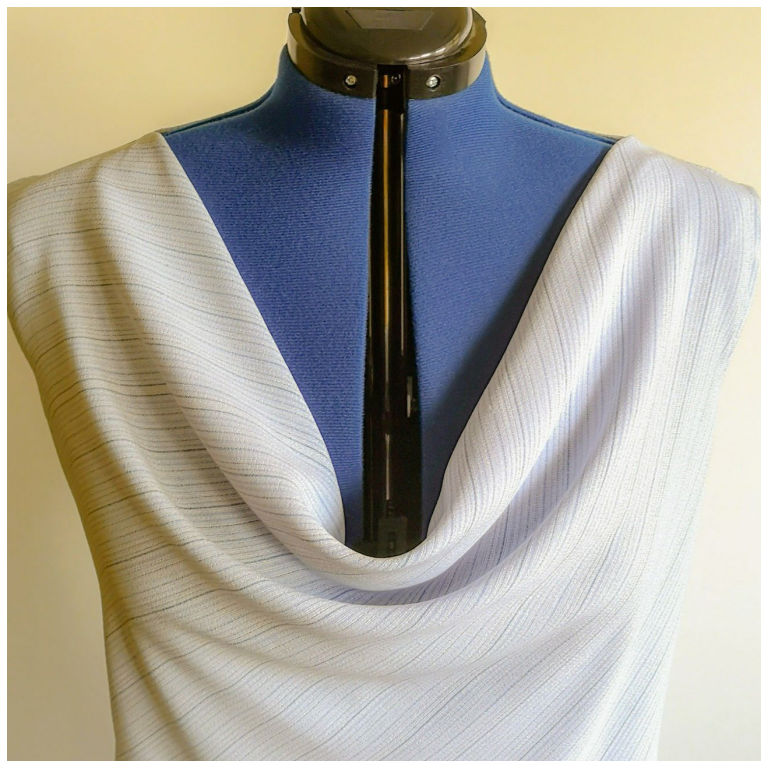
# Types of Drapes

The **drapes** in today's fashion on the base of their pattern design can be classified in **four types**:

- **Free drapery.** The draped neckline, named Greek neckline is the most popular free drape;
- **Drape, formed with a seam or darts;**
- **Twist knot drape,** or drapery, fixed in a knot;
- **Twisted drapery.**

The four types of drapes are presented in the next slides. According to the design principles, a drape has to be the main element of a composition.

# Free Drape



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# Drape Formed with Seam

Drape formed with seam or darts. This type of drape can be formed in symmetric and asymmetric design. Presented asymmetric drapes are shaped with a seam (in blue) and darts (in green).



# Twist Knot Drape

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# Twist Knot Drape

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This type of drape, as its name shows, is formed by a twist between two pieces of a part. The twist and forming seams shape a drapery, fixed in a knot. Usually, twist knot drape is designed in the front in different places of the part, but it can be formed in the back of a women's garment.

# Twisted Drape

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# Twisted Drape



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This type of drape is formed by twisting of a piece or two pieces of a part. Similarly, to the twist knot drapery, usually, the twisted drape is designed in the front in different places of the part. The twisted drapery also can be formed in the back of a women's garment.

# Peplum. History

The **peplum** comes in contemporary fashion from the ancient Greek overdress “peplos”. Mariano Fortuny has been inspired not only by drapes in ancient Greek costumes, but by peplos too.

A Mariano Fortuny apricot silk Peplos gown, circa 1920

Source:

Kerry Taylor Auctions,  
<https://www.kerrytaylorauctions.com>





# Peplum. History

**Peplums** have been seen in Christian Dior's "New Look" designs.

Bar suit, haute couture spring/summer 1947 collection by Christian Dior

Photo: Associations Willy Maywald / ADAGP, 2020 / Courtesy of Christian Dior

Source:

Cardini T., Vogue, 2020, <https://www.vogue.com>



# Peplums

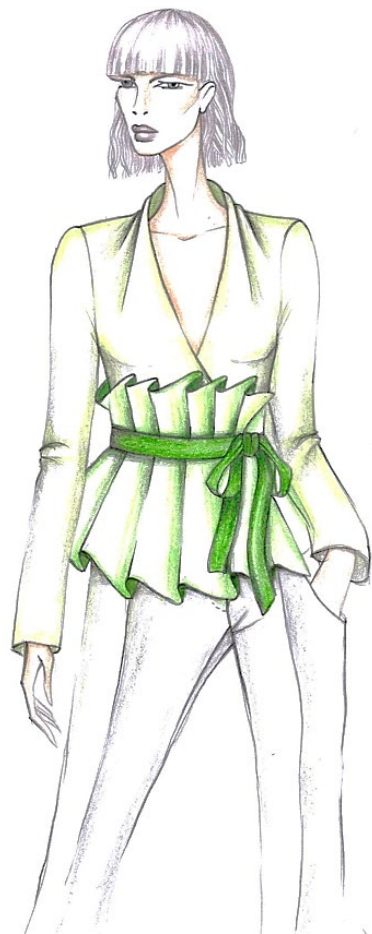
The sustainable long life fashion element **peplum** can be whole or partial one. It can be with uneven length, and it can be situated at the waist, as it is usually, or between the breast and waist, and under the waist area. The peplum can be combined with different types of 3D elements, which are sustainable long life fashion elements too.

The next slides presented dresses and jackets with peplums, which are whole and partial ones, with uneven length, situated in the waste or between the breast and the waist, and 3D elements: ruffles, unsmoothed and ironed one-sided and bi-sided pleats, symmetrical and asymmetrical situated ones, and gathers.

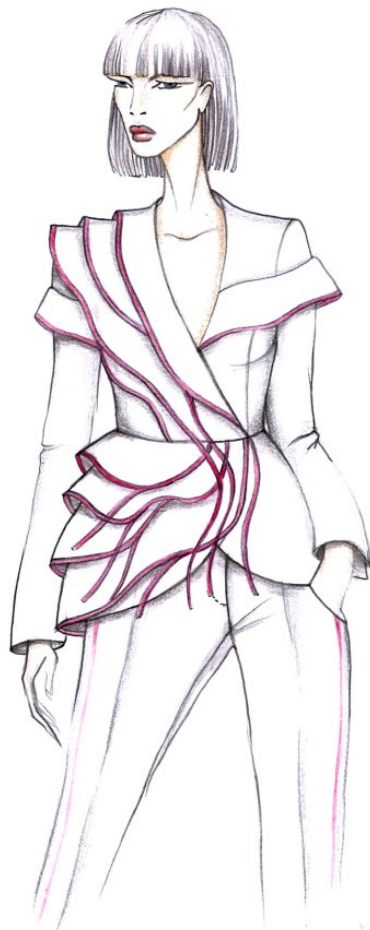
All presented peplum are in harmonic connections with other design elements, based on the main design principles.







CC BY Dineva



CC BY Dineva



# Combined Silhouettes

The analysis of fashion of 21<sup>st</sup> Century shows that **non volume silhouettes** are always on trends. An analysis of the silhouettes of women's clothing concludes that volume silhouettes will be for a long time in fashion if they are combined with non volume ones. The long life of garments can be result of combination of two volume silhouettes, formed with other long life elements.

The next slides present designs of women's dresses in **combined silhouettes**. The volume parts are formed with the help of other **long life fashion elements: drapes, 3D elements, peplums**.

All elements in presented designs are in harmonic connections with other elements of compositions, based on the main design principles.





An asymmetric dress, combined Y line and vase silhouette. Y line is a result of the forms of the sleeves and the neck opening. The vase silhouette is a result of the peplum in a form of a turned trapezium. The right part of the peplum is designed with a free drapery.



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An asymmetric dress, combined Y line and vase silhouette. Y line is a result of the forms of the sleeves and the neck opening. The vase silhouette is a result of a peplum in a form of a turned trapezium. The right part of the peplum is designed with tucks and the left part is formed with a frill.



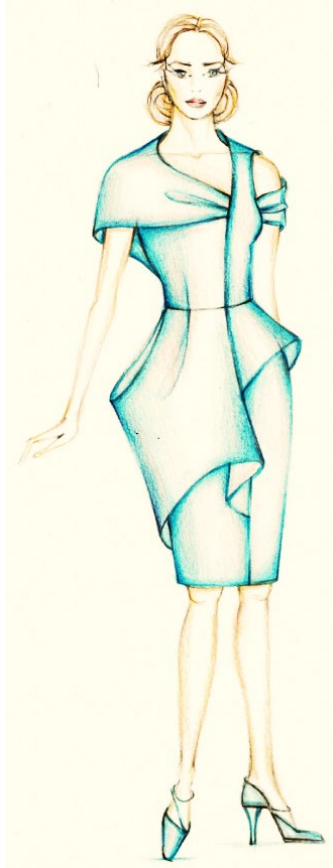
CC BY Ilieva



An asymmetric dress with right part in vase silhouette and left part, combined Y line and vase silhouette. The Y line is a result of the form of the sleeve and the asymmetric neckline. The vase silhouette is a result of a peplum. The right part of the peplum is designed with a drapery. The left part of the peplum is formed with tucks and frills.



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An asymmetric dress with an asymmetric peplum. The right part of the dress is in silhouette, which combine Y line and vase. The left part is in Y line. The peplum design combines a drape, a frill and tucks. Y line is a result of draped sleeves and an asymmetric neck opening.



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An asymmetric dress in combined silhouette. The right part is in vase silhouette and the left part is in X line. The sleeve is designed by volume frills. The asymmetric peplum is formed with frills to, volume ones in the left and not too volume in the right. X line is a result of the volume frills in the sleeve and the peplum in the left. If the peplum is designed in smaller volume, the silhouette of the dress will be modified in mixed one, which is fitted in the right and combined Y line and vase in the left.



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Combined asymmetric silhouette. The left part is in O under waist or vase silhouette. The right part combines Y line and vase. The lower part of the dress is asymmetric. It is formed by a peplum and a tuck in the left, and a drape and a tuck in the right. A bow in the collar balances the sleeve, which forms the Y line in the right.



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An asymmetric dress, combined Y line in the left upperpart and vase silhouette. Y line is formed by the forms of the asymmetric neckline and the sleeve. The vase form is a result of a combined peplum, a double peplum in the right and a single peplum in the left.



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An asymmetric dress in a silhouette that combines vase form under the waist and Y line over the waist. The volume forms of the sleeves, which made Y line, and the peplum, which made vase form, are shaped by one-sided and bi-sided tucks. The asymmetric peplum is balanced by a bow in the left shoulder.

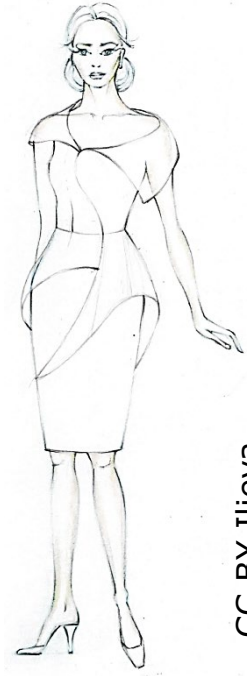


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A dress in a silhouette, which combines vase form under the waist and Y line over the waist. Y line is shaped by a big collar and neckline. The vase form is formed by a peplum. The asymmetric peplum is balanced by the asymmetric neck opening and collar.



CC BY Ilieva



A dress in a silhouette, which combines Y line and vase in the right and Y line in the left. Y line is shaped by an asymmetric neckline and sleeves. The vase form in the right is formed by a drape. The asymmetric situated drape in the right is balanced by the bigger sleeve in the left.



CC BY Ilieva

# Design Principles

In creation of sustainable fashion products, the designers must not compromise on the application of the design principles.

There are many examples of zero waste fashion designs, upcycled designs, circular designs, etc., which are with not so good aesthetic value. The balance have to be found between a sustainable fashion conception and the applying of the design principles, which are symmetrical and asymmetrical balance, proportions, rhythm, emphasis, unity.

There is a principle which is strongly connected with sustainability. It is the proportion. The proportions in combination with symmetrical or asymmetrical balance determine the next principles of rhythm, emphasis, and unity.

# Sustainable Proportions

The **Golden ratio** and **Fibonacci sequence** are applied as proportions in design as expressers and symbols of beauty and harmony.

Their symbolism is a result of strong connections in their mathematical nature.

The golden ratio has been applied as harmonic proportion in the art and architecture since the ancient times. In more recent times, the relations between Fibonacci numbers have been also beginning to be used as harmonic proportions. Therefore, the proportional relations of the golden ratio and Fibonacci sequence are the best examples of **sustainable proportions**.

# The Golden Ratio

The **Golden section** is a number, introduced with Greek letter  $\phi$ , which is found by dividing a line into two parts as the longer part divided by the smaller part is equal as the whole length of longer and smaller parts divided by the longer part, or

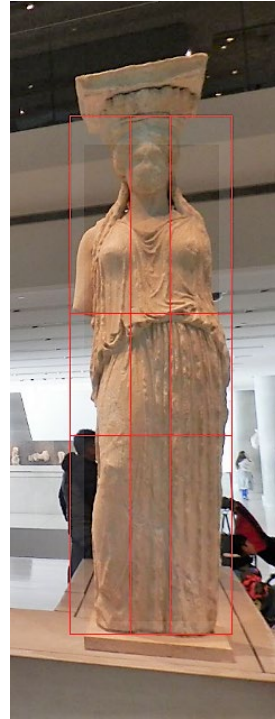
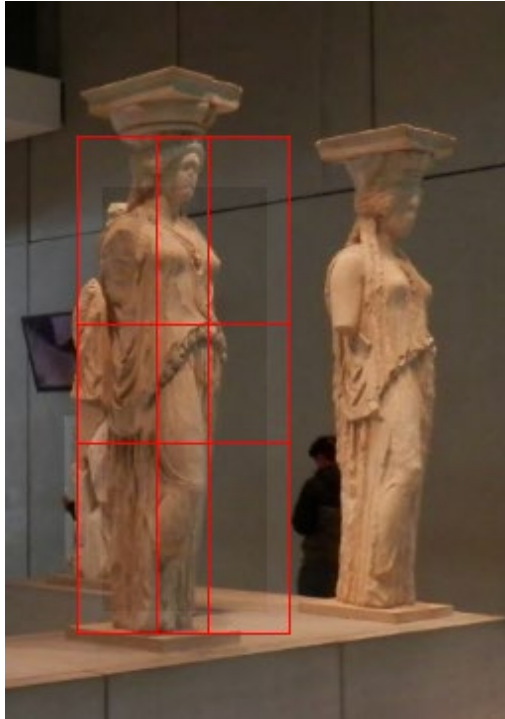
$$\phi = a/b = (a+b)/a = 1.61803398874989484\dots$$

Sometimes the Golden ratio is presented in a turned way in which the number is equal to the division of the smaller by the longer part equal to the division of the longer part by the whole length of the line, or

$$b/a = a/(a+b) = 0.61803398874989484\dots$$



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## The oldest example of the applying of the golden ratio in clothing

Caryatids of Athens' Acropolis. The peplos of the chiton divided the woman's body in golden proportions.

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# Fibonacci Sequence

Fibonacci numbers are the sequence of numbers defined by the linear recurrence equation

$$F_n = F_{n-1} + F_{n-2}$$

with  $F_1 = F_2 = 1$ . As a result of the definition, it is conventional to define  $F_0 = 0$ .

The Fibonacci numbers for  $n = 1, 2, \dots$  are 1, 1, 2, 3, 5, 8, 13, 21, ...

# The Golden and Fibonacci Proportions

In fashion design the golden ratio and Fibonacci sequence can be used in creation of beautiful and harmonic forms directly or with the help of geometrical figures and tiles. The geometrical figures are:

- **The golden triangle:** an isosceles acute-angled triangle with golden proportion  $\phi$  between the lengths of both same sides and the base, which is equal to 1,618...;
- **The golden rectangle:** a rectangle with golden proportion  $\phi$  between the lengths of the sides;
- **The golden ellipse:** an ellipse with golden proportion  $\phi$  between both axes;
- Figures in **Fibonacci** numbers proportions can be created similarly to the **golden** ones.



In directly use the golden section and Fibonacci numbers proportions can be in one and the same or different directions. In the application with the help of geometrical figures the golden ratio and Fibonacci sequence shapes combine proportioning and form creation. The golden section and Fibonacci series figures can be used directly as forms or as frames of forms creation of elements and pieces. Its application can be in different directions and location according the bodice. The golden ration and Fibonacci sequence can combine proportions with other principles of design as symmetrical and asymmetrical balance, rhythm, emphasis, and unity.

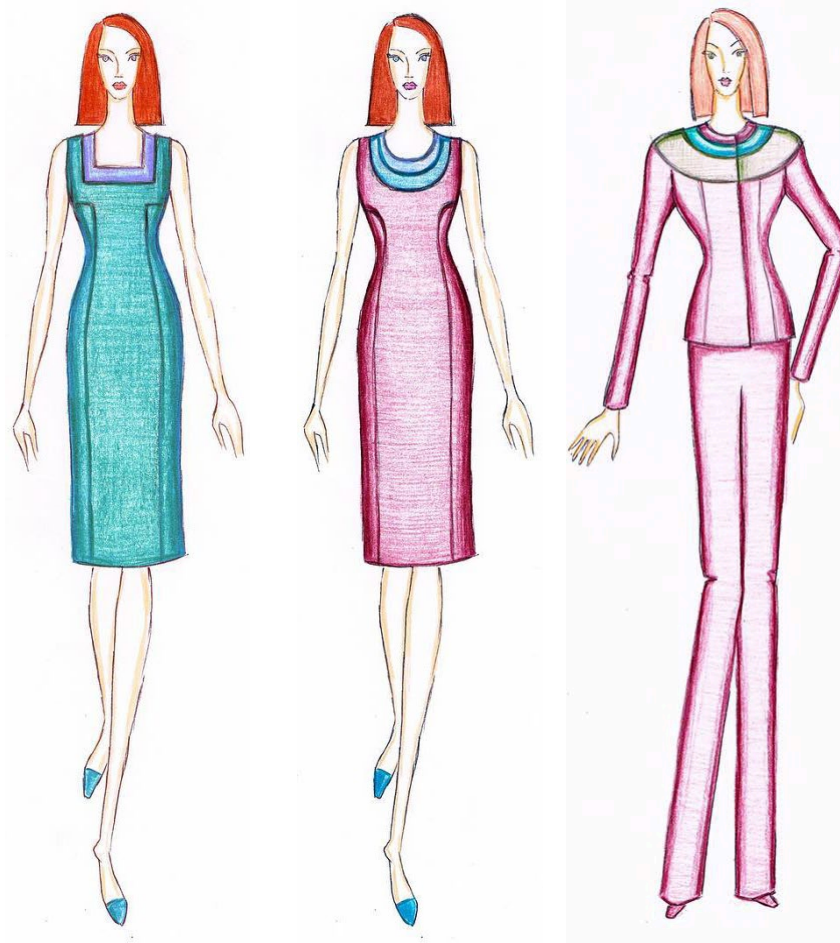
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## Application of the golden triangle in fashion design

The triangle is used directly or as a frame of forming of shapes of elements and pieces in presented designs.

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## Application of the golden rectangle and the golden ellipse in fashion design

The rectangle and ellipse are used directly or as a frame of forming of shapes.

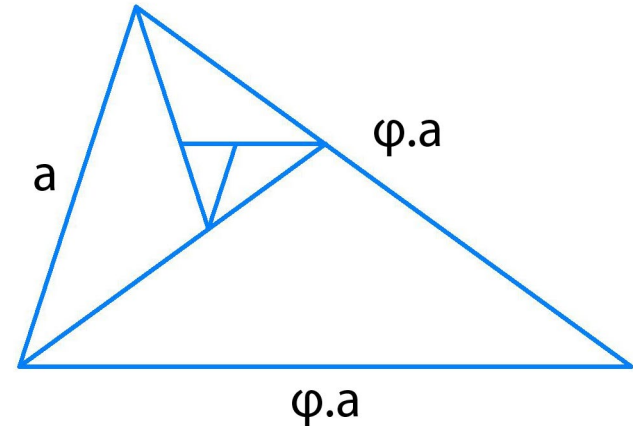
# The Golden and Fibonacci Tilings

The tiles are the other way of integration of the golden ratio and Fibonacci sequence in fashion design. The tilings are created with geometric figures: triangles, squares and rectangles with ratio between sizes of their sides, equal to the golden and Fibonacci proportions. These tiles can be applied in design of clothes and accessories not only for applying of sustainable aesthetic and harmonic proportions, but they give possibilities of utilization of small pieces of fabrics. The most appropriate golden and Fibonacci tilings are:

- **The golden triangle tiling;**
- **Fibonacci series tilings with squares** (both types);
- **Fibonacci sequence tiling with equilateral triangles** (Fibonacci rose).

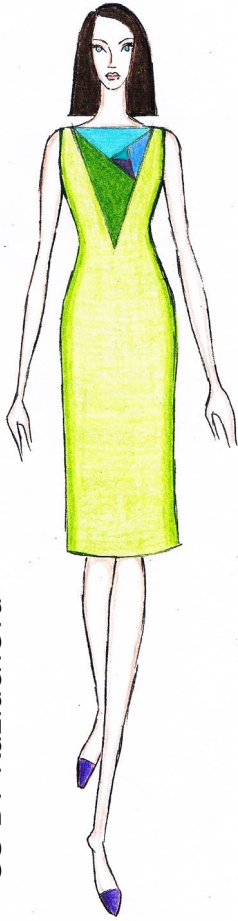
# The Golden Triangle Tiling

The golden triangle is an isosceles acute-angled triangle with golden proportion  $\phi$  between the lengths of both same sides and the base, which is equal to  $1,618\dots$ . The acute-angled golden triangle is a base of a tiling in which obtuse-angled golden triangles form a spiral. The obtuse-angled golden triangle is an isosceles triangle with golden ratio between the lengths of both same sides and the base, equal to  $0,618\dots$ .



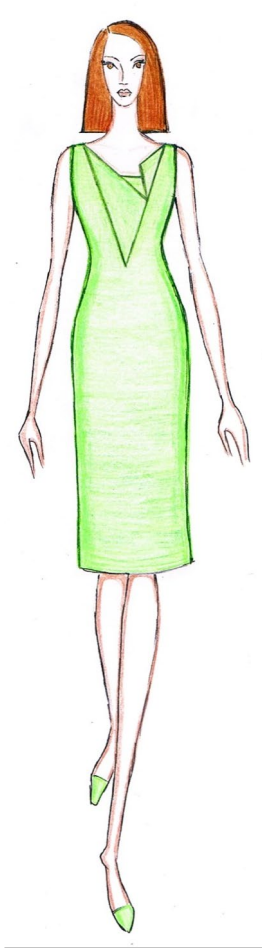
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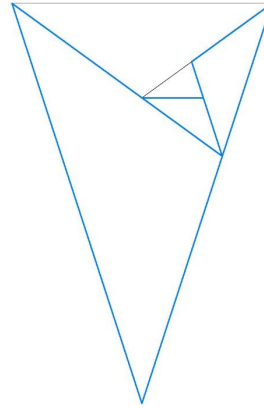
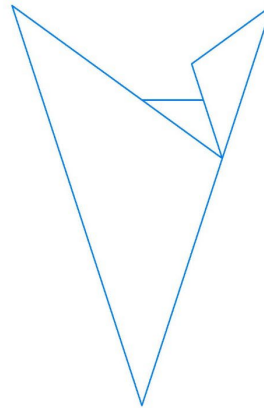


In presented designs of women's dresses, the **golden triangle tiling** is used directly in whole.

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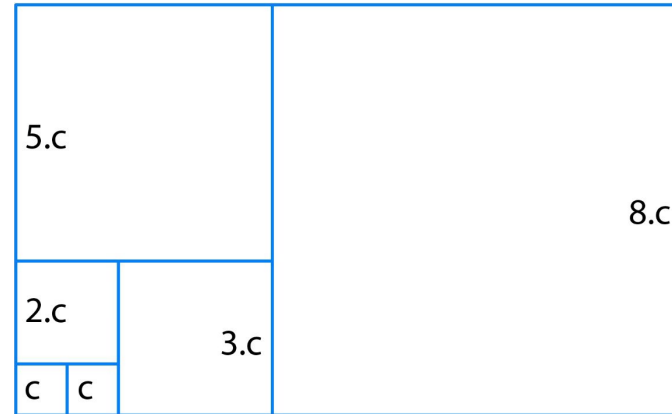
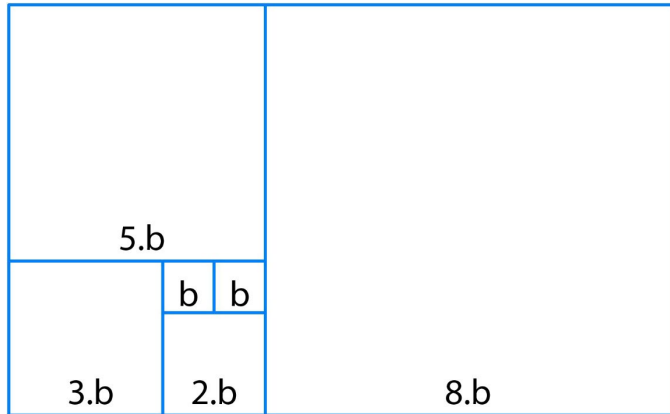
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The **golden triangle tiling** is non whole applied in presented design.

# Fibonacci Series Tilings with Squares

There are two types of Fibonacci sequence tiles with squares, one, in which squares form a spiral (in left) and one with squares, which are set in two perpendicular directions (in right). In both tiles, the ratio between consecutive set squares is equal to Fibonacci numbers.

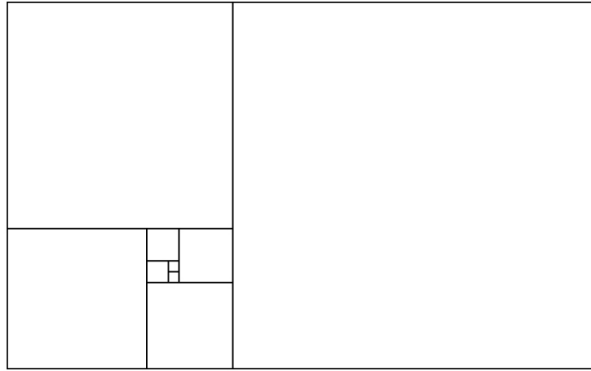


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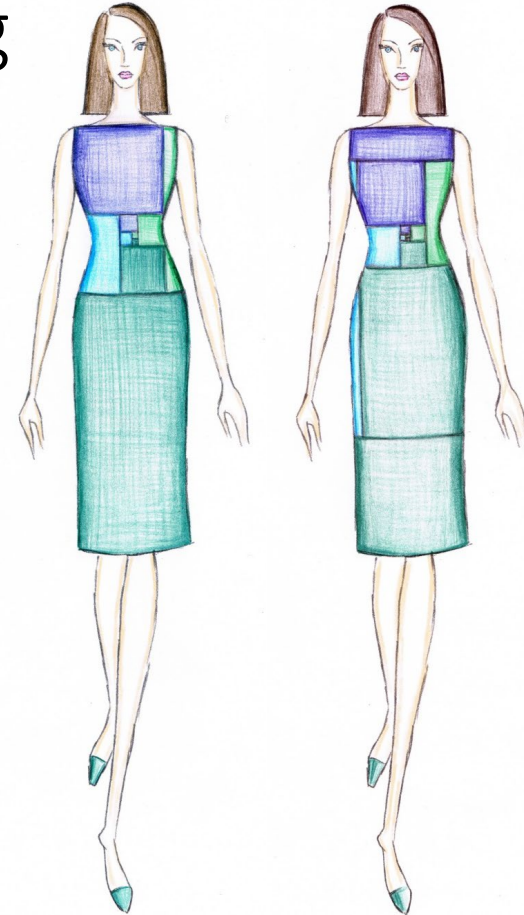


# Fibonacci Square Spiral Tiling

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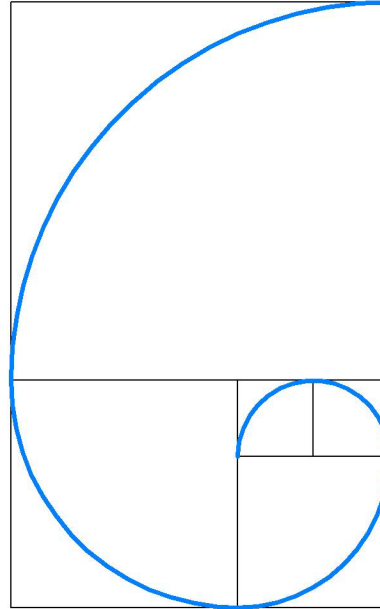
Presented designs of women's dresses are created with the use of **Fibonacci series tiling with squares, which forms a spiral pattern.**



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# Fibonacci Spiral

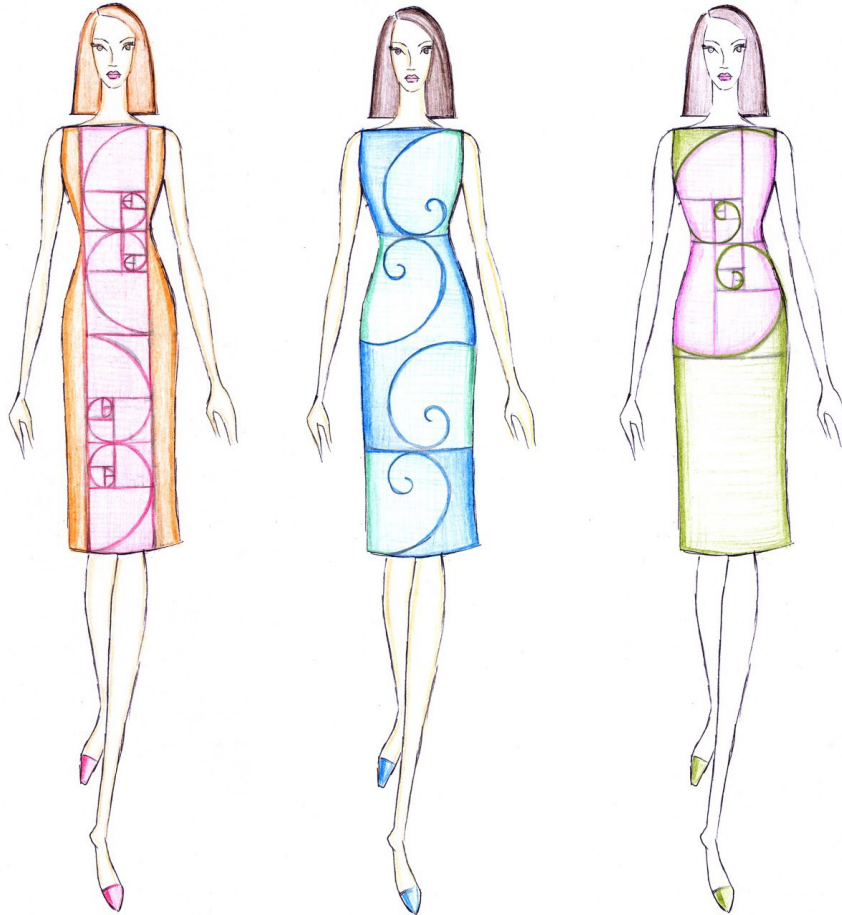
**Fibonacci series tiling with squares in a spiral pattern** is used as a base of creating of **Fibonacci spiral**. Similarly, to Fibonacci spiral, the **Golden spiral** is created based on a tiling in a spiral form made by golden rectangles.



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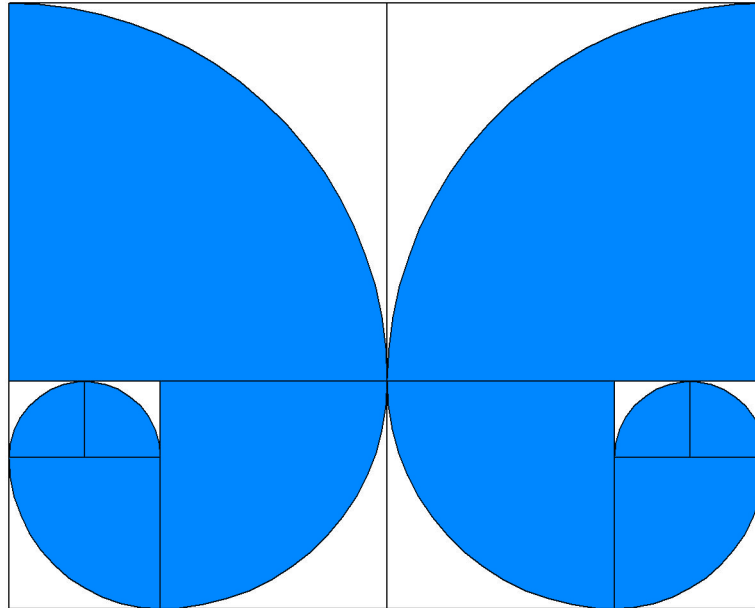
**Fibonacci series tiling with squares in a spiral pattern and Fibonacci spiral** can be used in creation in different forms. Similarly, to Fibonacci spiral, the **Golden spiral** can be used in fashion design.

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Presented designs of women's dresses are with application of **Fibonacci spiral** with or without the frame of **Fibonacci tiling with squares in a spiral form.**

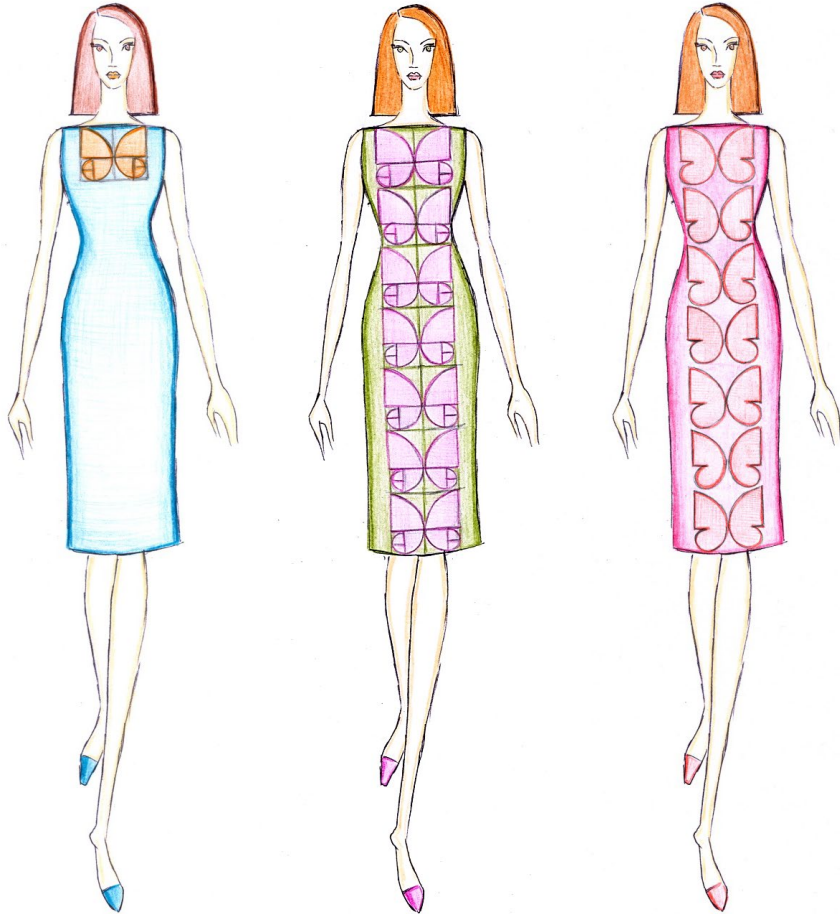
# Fibonacci Butterfly



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Two **Fibonacci spirals** in connection of a bilateral symmetry create a form of stylized butterfly, named **Fibonacci butterfly**.

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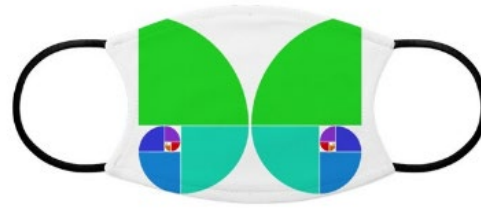


Presented designs of women's dresses are created applying **Fibonacci butterfly** with or without the frame of **Fibonacci tiling with squares in a spiral form**.



CC BY Kazlacheva, Ilieva

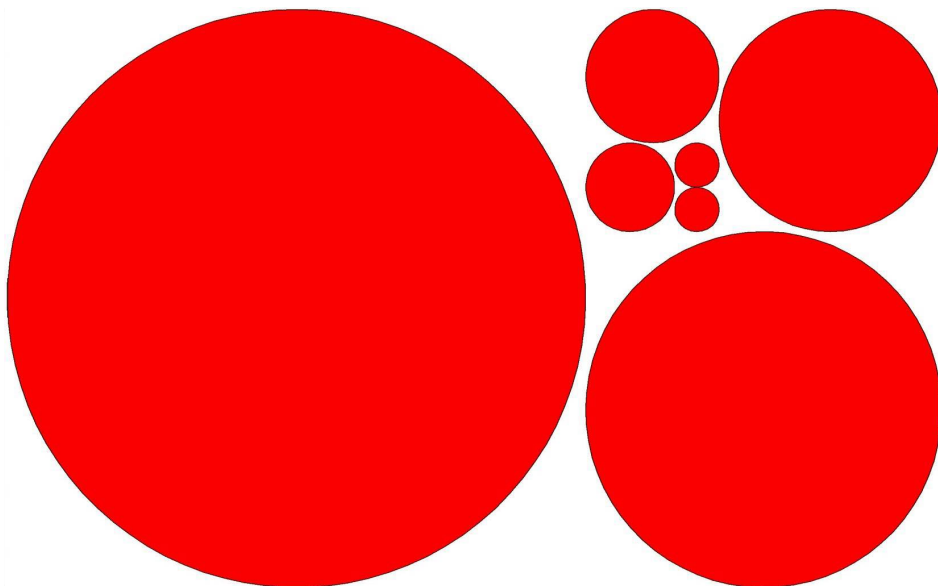
Jewels and accessories in form of **Fibonacci butterfly**, made by recycled materials.



The ornament of golden butterfly and its application as print in personalized designs of a bag, a watch, a laptop case, and a face mask. For personalization web-based services are used:  
<https://studio.shopvida.com>,  
<https://artofwhere.com>,  
<https://www.zazzle.com>, etc.

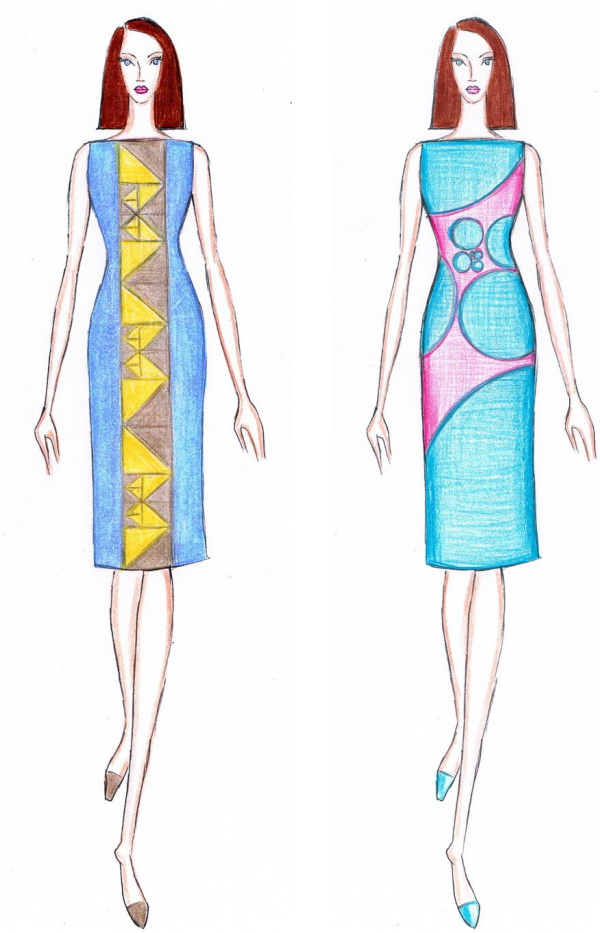
# Fibonacci Square Spiral Tiling

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**Fibonacci series tiling with squares in a spiral pattern** can be used as a base of creating of **spiral forms** with different geometric elements or figures included in the tiling frame. For example, the figure shows circles, entered in the squares, which can be applied in design with or without the frame of the tiling.

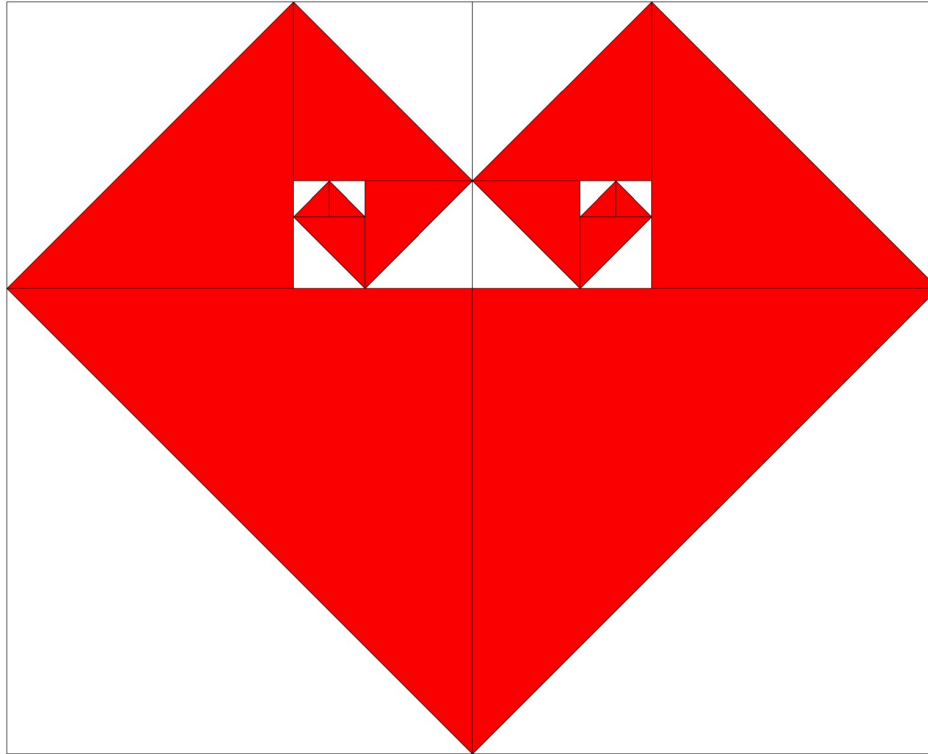




Presented designs of women's dresses are created with application of **spirals** made by geometrical elements or figures entered in squares of **Fibonacci tiling with squares in a spiral form**. The left design applies spirals based on diagonals in squares in the frame of the tiling. The right design is with entered circles without the frame of the tiling.

# Fibonacci Hearth

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Two Fibonacci spirals, made by diagonals of the squares of **Fibonacci square spiral tiling** in connection of a bilateral symmetry create a form of stylized hearth, named **Fibonacci heart**.

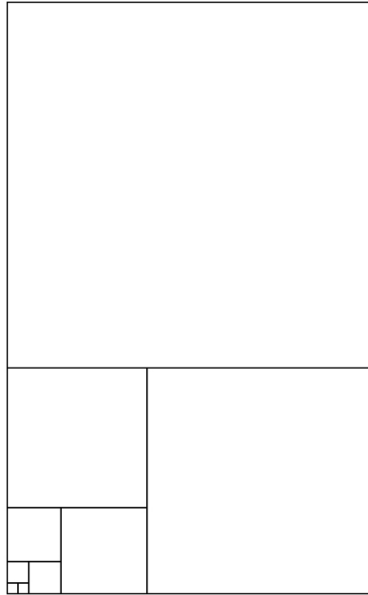
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A women's dress made with application of **Fibonacci heart** in style patchwork.

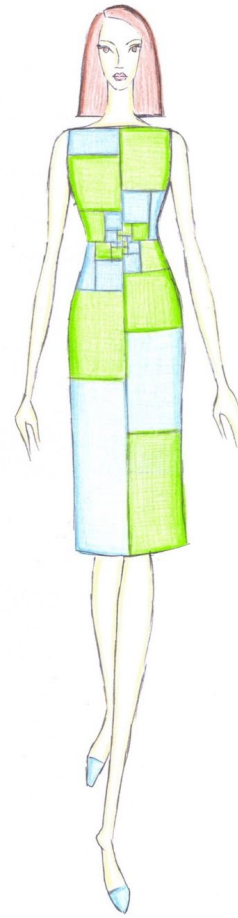
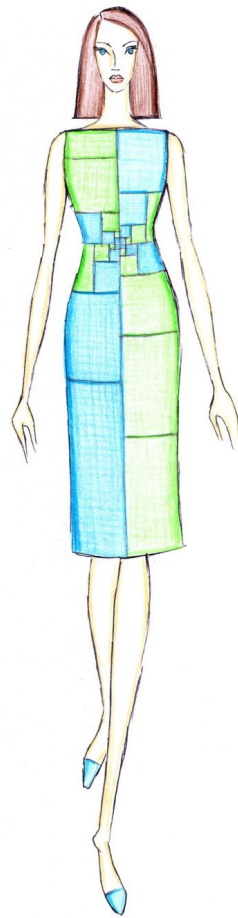
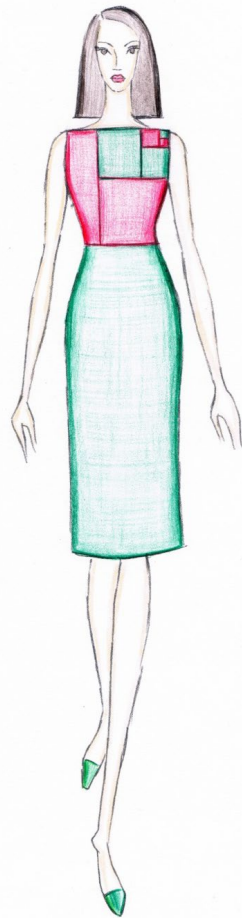
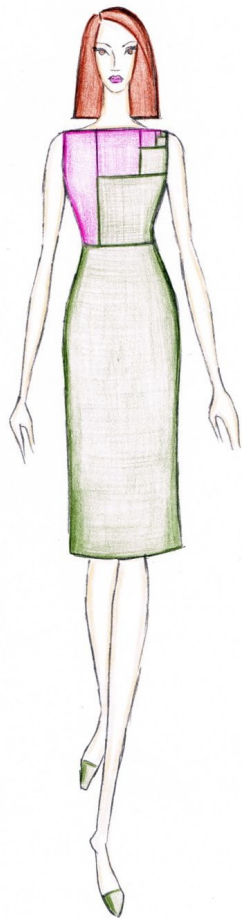
# Fibonacci Tiling with Squares in Perpendicular Direction

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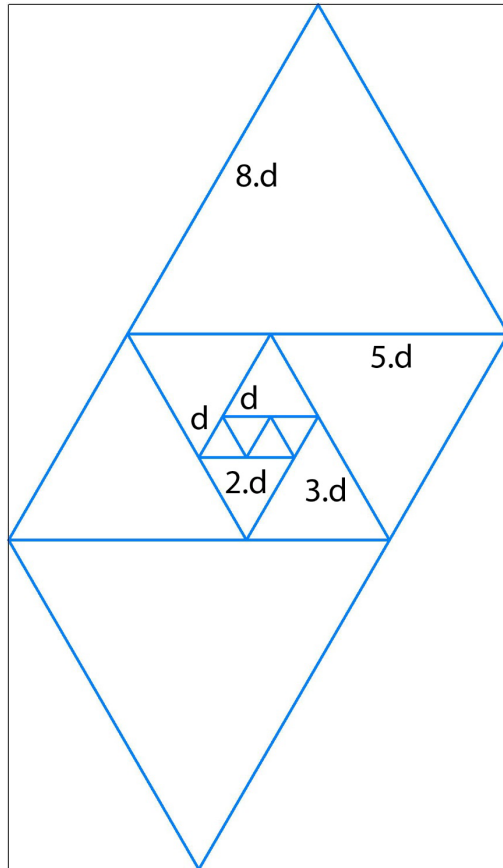


**Fibonacci series tiling with squares arranged in two perpendicular linear directions** (put side by side, or parquet tiling) is not too popular as Fibonacci tiling with squares in a spiral form, but it gives opportunities of use in fashion design too. The tiling's application in women's dresses designs is presented in the next slide.

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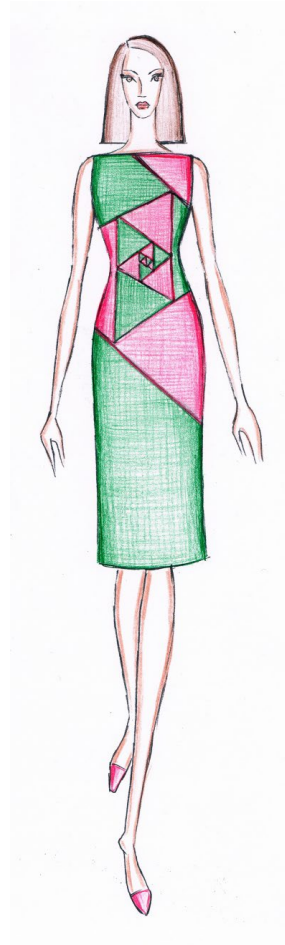
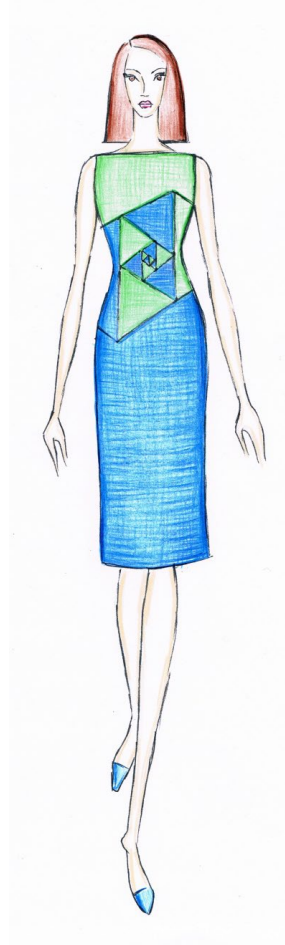
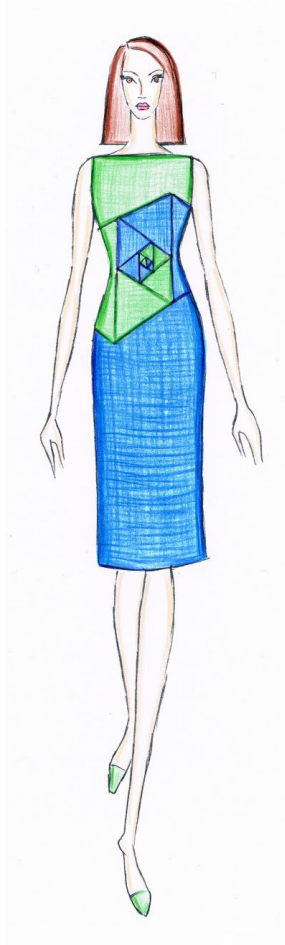


# Fibonacci Series Tiling with Triangles

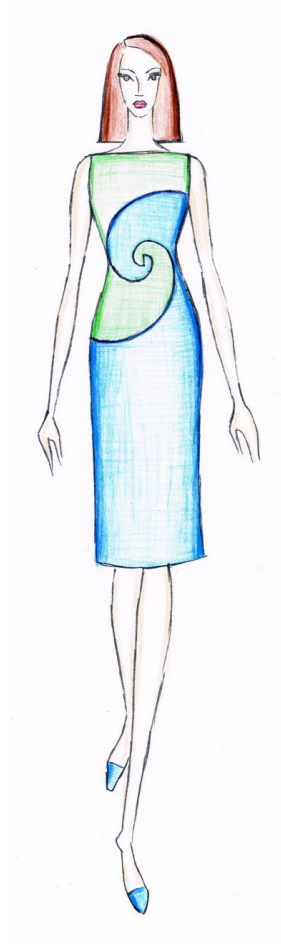
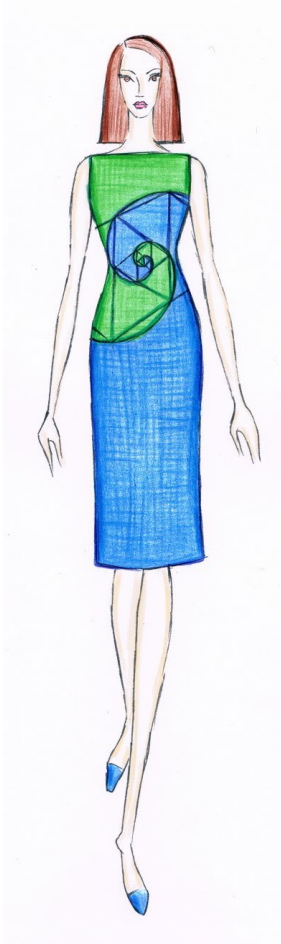


The figure presents the only one possible Fibonacci sequence tiling with equilateral triangles, known as Fibonacci rose.

In Fibonacci rose, the equilateral triangles with sides in proportional relationship of Fibonacci sequence, form two spirals.

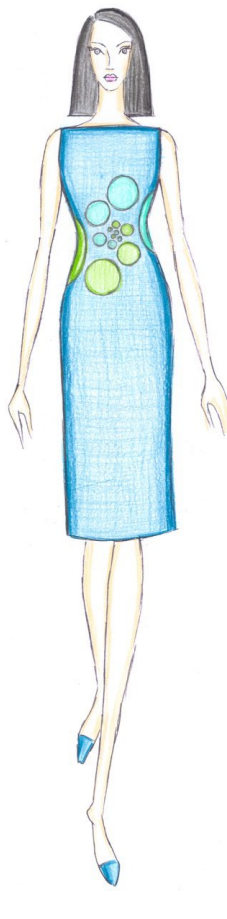


In presented designs of women's dresses, **Fibonacci rose** is used directly in whole.



**Fibonacci rose** is used as a base of creation of a **double spiral**. The double spiral can be applied in fashion design with or without Fibonacci rose tiling.





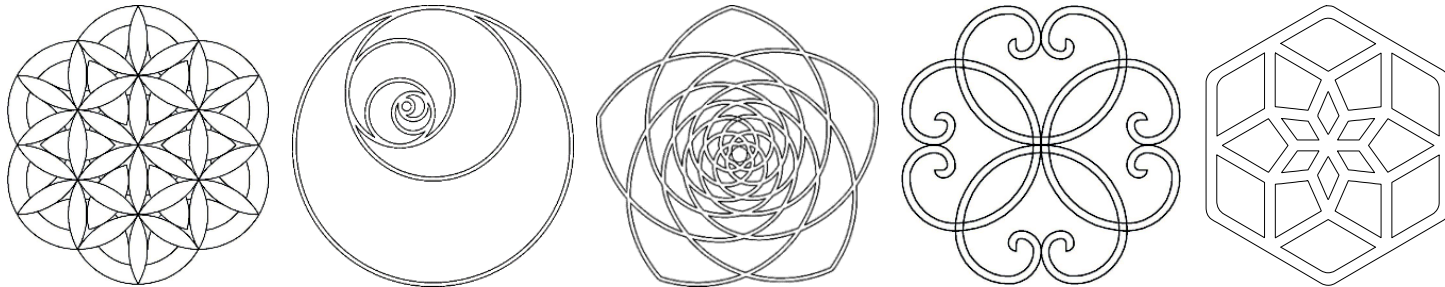
**Fibonacci rose** can be used as a base of creating of **spiral forms** with different geometric elements or figures included in the tiling frame. For example, the figure shows circles, entered in the triangles, which can be applied in design with or without the frame of the tiling.



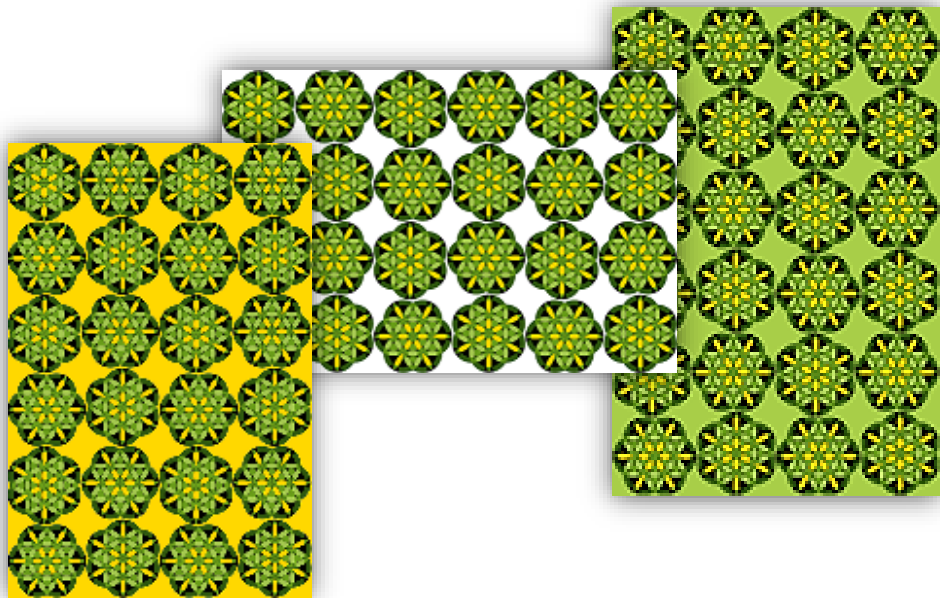
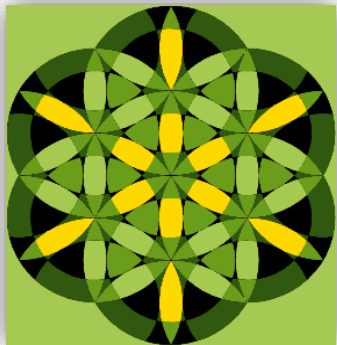
A handbag made with application of **Fibonacci rose** in style patchwork.

# Textile Designs

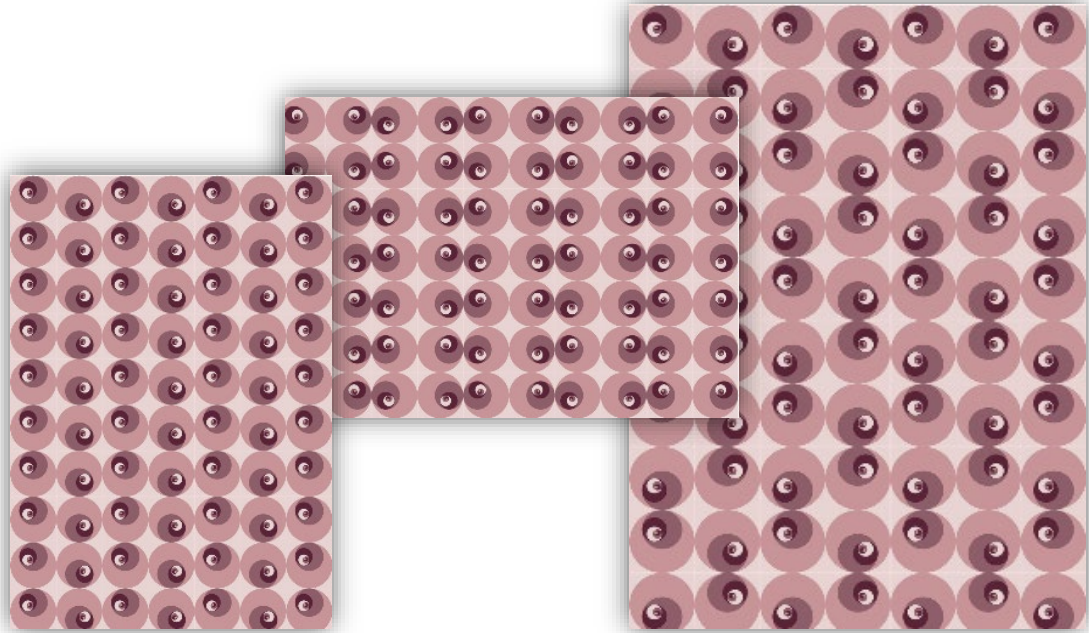
Textile pattern designs can be developed on the base of geometric elements of the golden and Fibonacci geometry. For example, fifth of them are presented. From left to right: a variant of flower of life, one of the most popular geometrical elements, which is floral one too; a rose, result of the golden circles spiral or Fibonacci circles spiral; a Venus flower, created by golden or Fibonacci spirals; a clover, created by golden or Fibonacci spirals; and a flower of life with approximation of circles with straight lines.



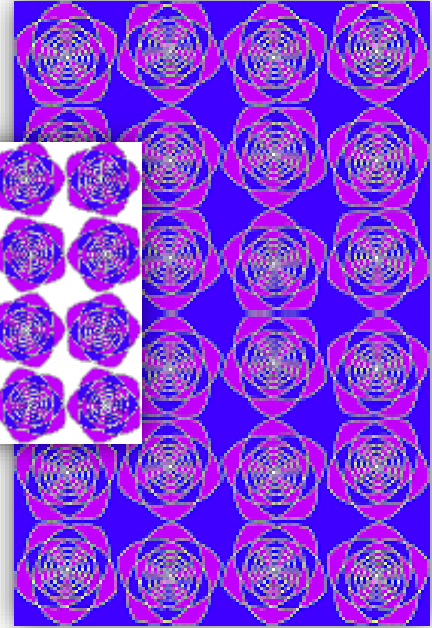
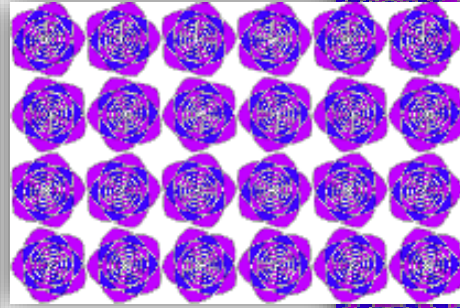
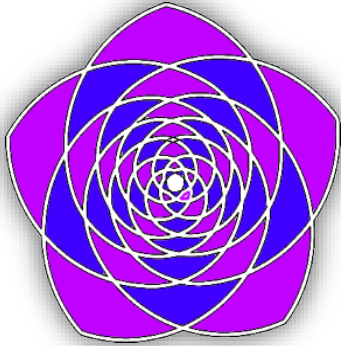
CC BY Ilieva



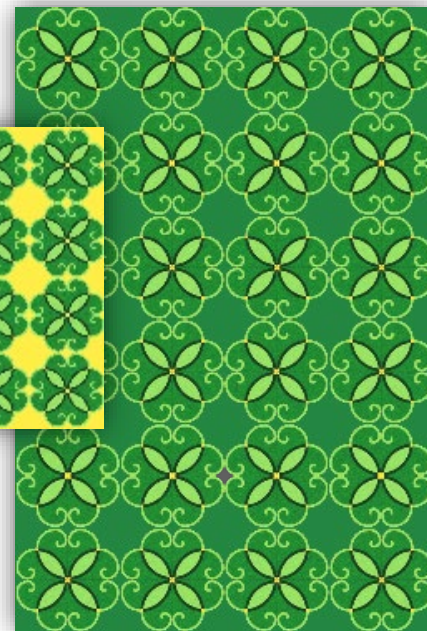
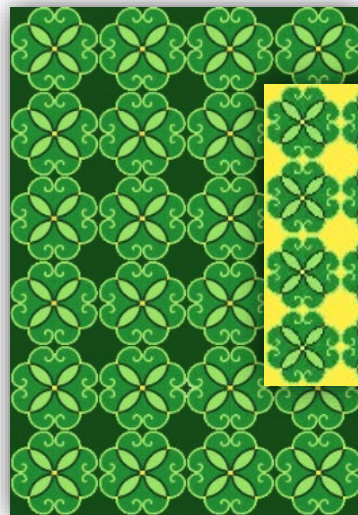
CC BY Ilieva



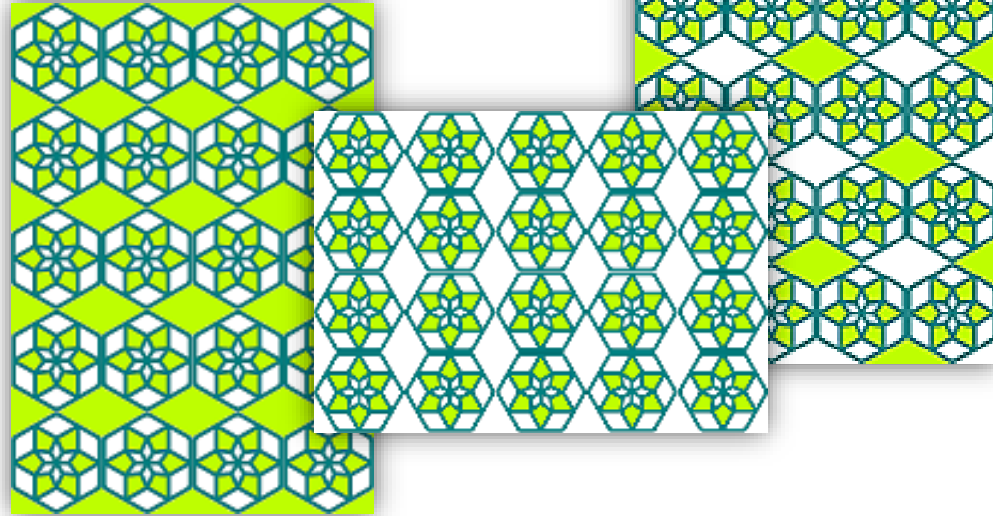
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# Conclusion

A study on the long life fashion elements shows some reasons for their sustainability in trends: They are with high aesthetic value and are elegant and feminine ones. They can be combined easily each other or with other elements of fashion design.

The applying of the sustainable golden ration and Fibonacci sequence proportions gives beauty, harmony and sustainability in fashion design of clothes and accessories, and textile design. The use of the golden section and Fibonacci series bring aesthetics in designs, based on different sustainable conceptions (zero waste, upcycled, circular designs, etc.) and can be applied as emphasizeers of the long life fashion elements.

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