

# A slim figure and a narrow waist: using vertical or horizontal lines in a dress to enhance appearance

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## ABSTRACT

This study explores the use of different dress styles through which women can give the impression of being slimmer. In particular, this study focuses on the principles of design, and examines the use of different lines and proportions to create the optical illusion of waists. The participants were 482 undergraduates. Six dresses were designed. Pictures were taken and a scale developed. The results suggest that the participants selected style C as the most effectively. Both genders agreed that style E has the best effect. Finally, female participants felt that women may appear to have a narrower waist by wearing style D, while male participants felt that is style F made women seem to have a narrower waist. Female and male participants have same opinions of style E.

**Key Words :** Optical illusion, Line design, Dress design, Body image

## INTRODUCTION

People involved in the fashion industry (such as models, contestants in the Miss World Beauty Pageant and movie stars) promote the idea that being slim is desirable and that a narrow waist is an indicator of beauty (Heiman *et al.*, 2015). This idea has led to the situation where models need to fit into size zero clothes to appear on catwalks (Volonte, 2017). To counteract this, several countries with flourishing fashion industries, such as Italy, France, and Spain, have introduced laws to protect the health of young models (Zancu and Enea, 2017). The question to be asked is whether there are techniques that can be used to give the impression of slimness and a narrow waist. While it is possible to disguise flaws in women's figures by the use of garments, women find the process of shopping for clothes difficult in terms of finding clothes that suit them. This study, focusing on the basic concepts of fashion design, aims to present a theory of design principles. It will help women who are unhappy with their appearance to use of lines of the garment to create different ratios and proportions (area) to create

an optical illusion that disguise their body.

According to the theory behind the principles of fashion design, it is possible to create an optical illusion of slimness and a narrow waist by using different lines in the design of the dress. This study discusses how vertical or horizontal lines can be used effectively to flatter larger women.

### Vertical lines:

According to the proportion theory of fashion design, two vertical lines (as in the two sides of a rectangle) produce a different effect, depending on their width apart and position. The usual presumption is that the narrower, the more slimming would be the effect (Alexander, 2001; Koike, 1992; Stout, 2000). In the design of the skirt of a dress, the impression of slimness is achieved by two vertical lines that extend from the waist to the skirt's hemline, giving a ladder-like shape. Because Alexander (2001) indicated that the illusion of an hourglass figure could be achieved by using an X-line which disguised big hips and a large upper body. In the upper section of the three dresses, different widths in relation to the

neckline or shoulder gave three different styles. Thus, the first aim of the present study was to discuss the effect of the three styles. This study presents the following hypothesis:

**Hypothesis 1:**

The gap between two vertical lines in the upper section of a dress is significant in determining how flattering a garment is when worn by women.

Horizontal lines: according to the proportion theory, horizontal lines as in a rectangle that produce a different effect, depending on their height position. The usual presumption is that the lower the horizontal line, and the bigger the ratio and proportion (area) in the top half of a rectangle, the longer an optical illusion is achieved (Alexander, 2001; Chronologie Vintage, 2011; Koike, 1992; Stout, 2000). This proportion can be determined by applying the “golden ratio”. The golden ratio, approximately equal to 1:1.618, but commonly simplified to 1:1.5 or 2:3, was first studied by ancient Greek mathematicians because they noticed that it frequently appeared in geometry, because of its aesthetically pleasing appearance (Chronologie Vintage, 2011).

Applying the golden ratio to clothing can be very effective, dresses with panel proportions at the waist, according to the golden ratio, if the ratio of the length of the outfit’s upper part to the skirt is 2:3 ratio, a pleasing effect can be achieved. While it there is agreement between men and women that a slim figure is desirable, this study discusses the opinions of men and women regarding the ratio of the length of the upper part of the dress (the bodice) and the length of the skirt. Hence, the next aim presented the following hypothesis 2 and 3:

**Hypothesis 2:**

Males and females had different opinions that the different ratios of the length of the bodice to the skirt length on females that can be significant.

**Hypothesis 3:**

Male and females’ opinions of the same dress can be significantly different.

**Hypothesis 3a:**

The opinion of male and female respondents is significantly different for style D, where the ratio of the length of the bodice to the skirt length is 2.7:7.3.

**Hypothesis 3b:**

The opinion of male and female respondents is significantly different for style E, where the ratio of the length of the bodice to the skirt length is 3.5:6.5.

**Hypothesis 3c:**

The opinion of male and female respondents is significantly different for style F, where the ratio of the length of the bodice to the skirt length is 2:3.

In order to show an expectant body shape, females attempt to create the illusion of being slim and having a narrow waist by using permutations or combinations of different patterns or lines. The present study discusses, examines and demonstrates the above-mentioned vertical and horizontal lines and differences in opinions about body shape among people from Taipei.

## METHODOLOGY

The participants in this study were 482 undergraduates enrolled in two universities in Taipei. This study aimed to determine the effect of different vertical or horizontal lines in a dress for females. In addition, according to the Ministry of Health and Welfare (2012) classification, women whose waists measure more than 80 cm are obese. The present study focuses on non-obese women who have a waist measurement of nearly 80 cm. Moreover, in 2011, the average height of 13- to 22-year-olds was 159 cm. This study discusses females who are 159 cm tall. It employed a woman as a model who had the desired characteristics, and who was observed wearing real dresses.

The present study integrated the literature review of dress design with statistical analysis. First, using optical illusions and lines, three dresses were designed with two vertical lines of three different widths, and three other dresses were designed each with a different waist line to give the visual impression of a slim figure.

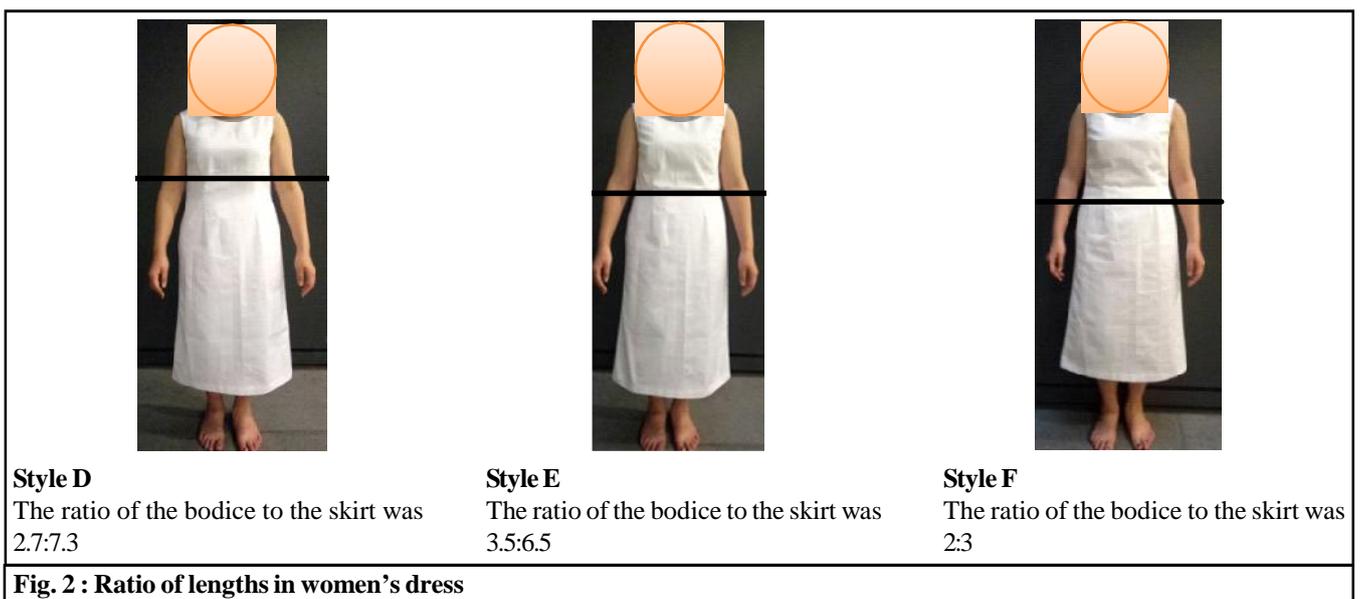
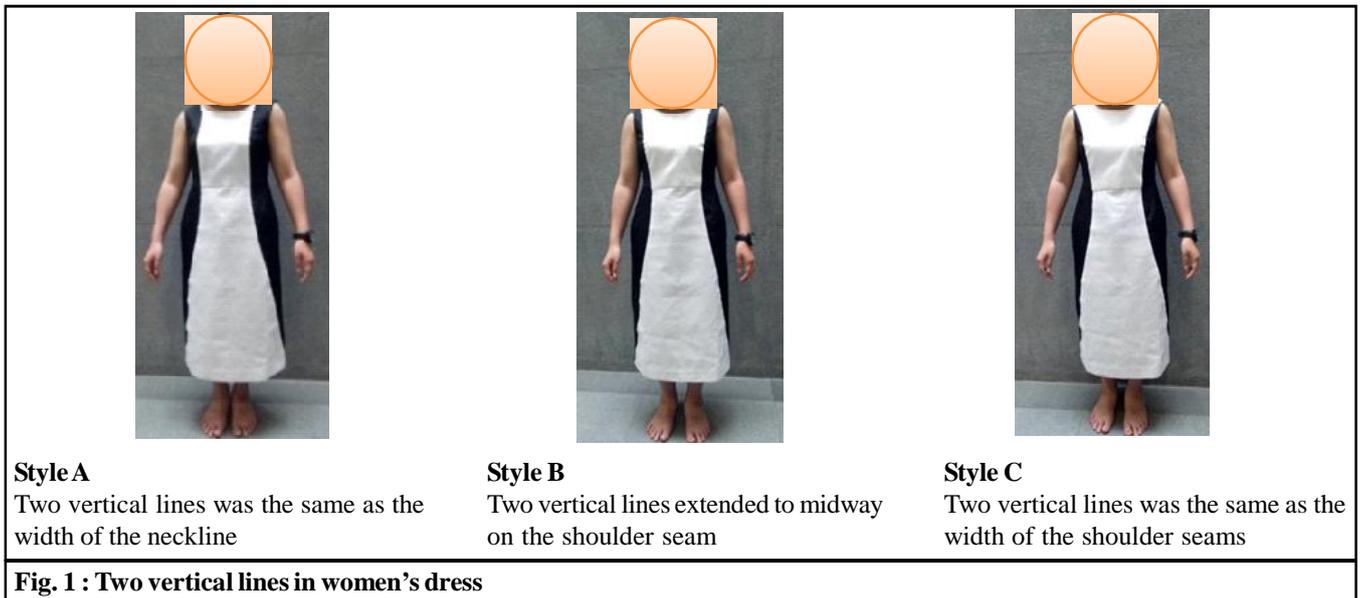
Regarding use of vertical lines, according to the theory of the principles of fashion design, in terms of proportion, if two vertical lines are cut parallel to each other, it has been presumed that the closer the lines, the more slimming the effect (Alexander, 2001; Koike, 1992; Stout, 2000). For a woman who is 159 cm tall, the length of the dress should be 113 cm and the back, 39 cm. This would cover her legs, as previous research has found that women are dissatisfied with their legs and do not wish to expose them (Vianna and Quaresma, 2015). To emphasize the effect of the line, the present study used

fabric that was black and white for a strong contrast. White was used between the two vertical lines while black was used at the sides of the dress. There were three styles of dress such as Fig. 1.

Regarding use of horizontal lines, this study we decided to design a white dress with no stripes that was 113 cm long and calf-length. Moreover, the dress would have cuts at the waist, positioned on the basis of the golden ratio of 2:3. Additionally, the empire style was introduced in the late 18th century. In this style, the bodice ends just below the bust and well above the normal waistline. This style hides a thick waist or flatters those

women who have a pear-shaped body (Sorger and Udale, 2017). We also decided to create an empire dress with a 2.7:7.3 ratio and a dress with a normal back length that had a 3.5:6.5 ratio to determine whether these designs are capable of hiding a thick midriff and portraying a smaller waist (Singh and Young, 1995; Sorger and Udale, 2017). There were three types of dresses such as Fig. 2.

Next, the dresses were made and worn by a model. Pictures were taken and a scale developed. In terms of vertical lines, respondents were asked to answer three questions about style A, style B, and style C (Fig. 1) that are were presented on the same page. In terms of



horizontal lines, respondents were asked to answer three questions about style D, style E, and style F (Fig. 2) that are presented on the same page.

Results were performed through two-way mixed-design ANOVA, repeated measurement of ANOVA, one-way ANOVA, independent samples, and LSD post hoc to check whether there was a significant difference.

## RESULTS AND DISCUSSION

### Preliminary analysis:

A total of 482 subjects submitted completed questionnaires, the final effective response rate was 79.46%, as 99 (20.54%) participants were excluded either for refusing to answer certain questions or for providing invalid responses, such as by choosing same opinions for all dresses. The total sample in this study comprised 383 students, 54.05% of whom were women and 45.95% men.

### Data analysis:

In the present study, the dresses were independent variables while females were the dependent variables to be assessed for disguising body shape.

### Hypotheses 1:

In the statistical analysis of the opinions of respondents and differences among them, a two-way mixed-design ANOVA and LSD post hoc was used. These are shown in Table 1. Table 1 reveals that gender was not a significant factor when considering the three dress styles ( $p = 0.179 > 0.05$ ). The results indicate that there is not interaction between the dress style and gender. Therefore, it was necessary to consider the main effect of gender on different style of dress. Table 1 was shown that the main effect of gender on different style of dress was significantly different ( $p = 0.012 < 0.05$ ). The

results indicated that because there may be differences for the three styles of dress, LSD post hoc analysis was required. The analysis indicates that style C was higher than style B and A, and style B was higher than style A. In other words, participants' opinions revealed that style C made the model look the most slim and appeared to give her the narrowest waist ( $M = 3.67$ ), rather than style B ( $M = 3.58$ ). Style B was better than style A ( $M = 3.18$ ) which was considered to be the least flattering.

Hypotheses 1 was supported as it is apparent that the use of lines can be used to design garments that will disguise the body shape of women. Vertical lines extending from the waist darts made the width narrower, while lines extending to the hemline with the same width as the shoulders made the waist looking slimmer. Not surprisingly, participants considered that style C was the most effective way for females. The result confirmed the theory of Alexander (2001) and Koike (1992) in that the closer two vertical lines are, the more slimming the effect; the wider they are, the less slimming the effect. Vertical cutting lines that were shoulder width apart balanced the special hemline, thus achieving symmetry. This made the waist appear to be narrower and disguised wider hips. This result is consistent with Alexander's (2001) X-line theory which states that an X-line hides big hips and upper body, giving the impression of an hourglass figure. For this reason, women should not ignore the importance of lines in making clothing choices. Nevertheless, many consumers who can only buy ready-made clothes would not find it easy to buy clothing that conformed to style C and would contrive to achieve the effect by wearing an open front vest or jacket with a collar. Consequently, Hypotheses 1 was supported.

Two-way mixed-design ANOVA and LSD post hoc was used to understand the opinions of participants regarding the statistical results of dresses, and statistical

**Table 1 : The opinions of respondents regarding the slimming effect of styles A, B and C for females: Summary of ANOVA results**

Source	SS	df	MS	F	p	LSD Post Hoc
<b>Within sum of square</b>						
Style * gender	2.97	2	1.49	1.72	.179	
Style	42.01	2	21.01	24.34	.000	3>2>1
Error	657.49	762	0.86			
<b>Between sum of square</b>						
Gender	4.83	1	4.83	6.32	.012	2>1
Error	291.15	381	0.76			

\* $p < 0.05$ , \*\* $p < 0.01$ , \*\*\* $p < 0.001$

differences condition shows in Table 2. Table 2 reveals that the interaction of the dress style and gender are significantly different ( $p = 0.000 < 0.001$ ). The results indicate that there is interaction between the dress style and gender. Therefore, it was necessary to consider the simple main effect of gender on different style of dress.

**Hypothesis 2:**

Repeated measurement of ANOVA and LSD post hoc was used to understand the opinions of participants regarding the statistical results of dresses, and statistical differences condition shows in Table 3. Regarding dresses with varying ratios of the length of the upper part of the clothing to skirt length for females, Table 3 shows that the opinions of the male participants are significantly different ( $F = 10.010; p = 0.000 < 0.001$ ). Specifically, the results reveal that the male participants considered significant differences between the three styles of dresses. However, different results may exist for comparisons of the dresses’ waistlines alone, so post hoc analysis was required. The analysis indicates that the male participants felt that females could reduce the appearance of their waist by wearing style F ( $M = 3.19$ ), rather than style D ( $M = 3.11$ ). Meanwhile, they determined that the females wearing style E ( $M = 3.55$ ) appeared slimmer than those wearing style F; further, those wearing style E appeared slimmer than those who wore style D. Consequently, these findings reveal that the male participants considered style E to have the best effect.

In terms of the female participants, Table 3 shows that the opinions of the participants are significantly different ( $F = 27.503; p = 0.000 < 0.001$ ). Specifically, the results reveal that the female participants considered significant differences between the three styles of dresses. However, different results may exist for comparisons between the dresses’ waistlines alone, so post hoc analysis was required. The analysis indicates that the female

participants felt that females could reduce the appearance of their waist by wearing style D ( $M = 3.42$ ), rather than style F ( $M = 2.78$ ). Meanwhile, they determined that the females wearing style E ( $M = 3.44$ ) appeared slimmer than those wearing style D; further, style E appeared to have a greater slimming effect than style F. Consequently, these findings reveal that the female participants considered style E to have the best effect. Consequently, Hypothesis 2 was supported.

In terms of variations in opinions according to gender, tested by Hypothesis 2, it is found that both male and female participants considered style E to have the best effect; male participants considered style F, to have the next best effect, whereas female participants considered style D to be the next best. The results from the male participants are consistent with Alexander (2001), Chronologie Vintage (2011), Koike (1992), Stout’s (2000) theory of line, proportion and optical illusions and Livio (2002), Vico-Prieto *et al.* (2016) golden ratio, as presented in the literature review. Consequently, the results indicate that women, when purchasing clothes, must ensure a perfect fit, especially when buying dresses. Women must try on the garment to make sure the waist line is in the correct position and that the proportions are correct.

**Hypothesis 3a, 3b, and 3c:**

Repeated measurement of ANOVA, LSD post hoc, one-way ANOVA, and independent samples were used to understand the opinions of participants regarding the statistical results of dresses, and statistical differences condition are presented in Table 3. The explanations for male and female participants’ opinion are as follows.

First, regarding dress D, Table 3 indicates the existence of a significant difference in male and female participants’ opinions ( $F = 8.073; p = 0.005 < 0.01$ ). Specifically, the results reveal that male and female

**Table 2: The opinions of respondents regarding the slimming effect of styles and gender for females: Summary of ANOVA results**

Source	SS	df	MS	F	p
<b>Within sum of square</b>					
Style * gender	49.64	2	24.82	24.43	.000
Style	25.00	2	12.50	12.31	.000
Error	774.15	762	1.02		
<b>Between sum of square</b>					
Gender	1.54	1	1.54	2.04	.154
Error	287.76	381	0.76		

\* $p < 0.05$ , \*\* $p < 0.01$ , \*\*\* $p < 0.001$

**Table 3: Significant difference in the opinion of a better effect by respondents with different genders for different ratios of length of the bodice to the skirt length: Summary of ANOVA results**

Effect	Mean (SD)		F	p value	Post Hoc (LSD)
	Male	Female			
<b>Panel proportions at the waist</b>					
1 Style D	3.11 (1.100)	3.42 (1.011)	8.073	.005**	2 > 1
2 Style E	3.55 (0.820)	3.44 (0.833)	1.730	.189	
3 Style F	3.19 (0.954)	2.78 (1.033)	16.492	.000***	1 > 2
F	10.010	27.503			
p value	0.000***	0.000***			
Post Hoc (LSD)	2 > 1	1 > 3			
	2 > 3	2 > 3			

\* $p < 0.05$ , \*\* $p < 0.01$ , \*\*\* $p < 0.001$

participants considered significant differences in style D. Post hoc analysis indicates that female participants felt that females could reduce the appearance of their waist by wearing style D but this opinion was not shared by the male participants.

Next, regarding dress E, Table 3 indicates the existence of an insignificant difference in male and female participants' opinions ( $F = 1.730$ ;  $p = 0.189 > 0.05$ ). Specifically, the results reveal that male and female participants considered an insignificant difference in style E. The analysis indicates that male and female participants reported a similar opinion.

Finally, regarding dress F, Table 3 indicates a significant difference in male and female participants' opinions ( $F = 16.492$ ;  $p = 0.000 < 0.001$ ). Specifically, results revealed that male and female participants considered significant differences in style F. Post hoc analysis indicates that male participants felt that females could reduce the appearance of their waist by wearing style F but female participants did not concur. Therefore, Hypotheses 3a and 3c were supported.

Hypothesis 3, regarding the same style, in terms of style F, the results from the male participants are consistent with Alexander (2001), Chronologie Vintage (2011), Koike's (1992) theory of line, proportion and optical illusions and Livio (2002), Vico-Prieto *et al.* (2016), Stout's (2000) golden ratio, male participants considered style F had the best effect. With regard to the female participants' different opinions, style D was considered to be the most effective. This could be due to female participants focusing on the skirt which has the longer ratio and proportion (area), compared with males who consider the whole garment. In fact, females should consider all aspects of the garment, such as its fabric, color, pattern and their accessories.

**Conclusion:**

The results demonstrate the link between clothing and body shape variables through optical illusion and which disguise the body shape. The conclusions reached are as follows:

**Vertical direction of lines:**

Woman can do this by choosing lines that are closer together in the waist. Both males and females can use an open-fronted vest or jacket with a collar to cover their wider body shape and to achieve a slimming effect.

**Horizontal direction of lines:**

If women have a larger body, they should ensure that their dresses have a normal waistline and that the skirt covers their legs. Optical illusions can generally be applied to the collocation of length and proportion of blouses, coats, skirts and trousers worn by women. However, it's worth noting that a larger woman should wear slightly longer, wider skirts and trousers and should then ensure that she chooses the correct length for her blouse or coat to achieve the correct total length. In the case of men, it is important to pay attention to the balance between shirt, vest or coat and the length of the trousers. Similarly, men can do well to pay attention to the length and proportion of their clothes.

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