FASHION RECOMMENDATION STUDY ON THE CLOTHING STYLE FOR THE PERSONAL BODY SHAPE

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Abstract -Clothing is an integral part of life. Also, it is always an uneasy task for people to make decisions on what to wear. An essential style tip is to dress for the body shape, knowing one's own body shape e.g., rectangle, hourglass, round and inverted triangle and selecting the types of clothes that will accentuate the body's good features. In this paper, therefore, proposed a first framework for learning the compatibility of body shapes and clothing styles with the goal to recommend a user about what to wear better in relation to his/her essential body attributes.

Keywords-Fashion styling, user evaluation method, body shape

1. INTRODUCTION

Nobody is perfect. Everyone has flaws and strengths, without exception to their body parts. Accordingly, everyone may have areas on their body they love to highlight the area and areas they feel like covering up (David Bainbridge 2015.). By understanding the type of body shapes and what styles complement and flatter particular body shape, everyone surely can work with their body to give off amazing looks. Body shape is the first thing to consider before choosing the perfect clothing styles. In particular, determining the type of body shape is all about the proportions between body measurements. There are several methods to determine body shapes, eg, known as body shape calculators. They use different representations to describe the type of body shapes, such as in terms of alphabetical letters, fruit shapes and geometric objects. Most common shape are the five basic body shapes, as shown in Figure 1. Therefore, determining the type of body shapes is still a challenging analytical task (Husnul, Hidayati, cheng-chun-Hsu, Kai-Lung, Hua, Yu-Ting Chang.2018). knowing the type of body shape, we can find out what kind of style fits the best.

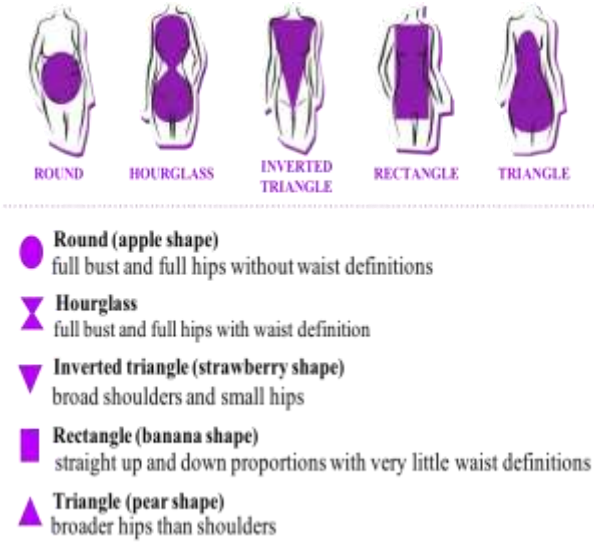


Figure1: Visual illustration of five different body shape
(Image courtesy of styleangel.com)

2.OBJECTIVE

To understand the type of body shape and what style flatter and complement particular body shape

3. LITERATURE REVIEW

FEMALE BODY SHAPE CLASSIFICATION METHODS

2.1 The history of body shape classification

Body Shape classification has evolved over the years. In the 1930-40s, Sheldon used the somatotyping technique to classify and come up with distinct body shapes. These are: endomorph, mesomorph and ectomorph. Endomorph refers to a body that is round, soft with little muscle development and tight skeletal frame. Mesomorphs have massive skeletal development, heavy bones, broad chest and resilient muscles. Ectomorphs have a frail skeletal frame, lightly boned, and delicately muscled, with narrow chests (Marshall *et al.*, 2004:138). Douty (1954; 1968a; 1968b; 1968c) adopted and further developed Sheldon's body shape classes, and came up with graphic somatometry or photography as a less invasive method of analyzing body build and posture. Silhouettes of female subjects were projected through a grid screen. Thereafter the somatographs were analyzed for posture, general body mass, proportion, contour, balance, and symmetry of the body. This was achieved by adding 5-point body build and 5-point posture scales, using front and side views respectively. This method was able to identify body variations in forms and shapes (Kwong, 2004:201).

Later on, Minot (1974; 1978) categorized and analyzed the lower and upper bodies using the hip shape and posture type for lower body as well as posture, neck width and length, shoulder width and height or slope, chest

shape, bust size and bust location, back width and back curvature and arm size as well as waistline characteristics for upper body. The whole body was classified using prominence of the bust, buttocks, abdomen, as well as shoulder, back, arm, hip, leg types, bust and back relationships. While some of these physical characteristics within these experts‟ scales could be determined by tape measures, other shape variations could only be distinguished visually. Gazzuolo (1985) explored the visual dimensions of female shapes based on variances in pattern shapes from the central plumb line. Subjects‟ bodies were classified based on the frontal and side views. The same study further anticipated the use of both 2-D and 3-D tools to understand female body shapes relevant to pattern development. This combination resulted in a more precise body shape analysis than anticipated by Gazzuolo (1985).

Thereafter, the Body Shape Assessment Scale was developed, which defined four body shapes, namely: hourglass, pear/triangle, rectangle and inverted triangle. It also included a scale for whole body analysis, body build, body shape, posture and component body part analysis for torso shape, hip shape, shoulder slope, bust shape, buttocks shape and back curvature. The Body Shape Analysis Scale was created using expert analysis of 3-D body scan data, and was validated through practice and implementation of the scale to classify body scan data (Simmons *et al*., 2004a; 2004b; Connell *et al*., 2006)

The Female Figure Identification Technique (FFIT) was developed and validated in the US. This software uses body scan measurements data as input and classifies subjects into one of nine distinct body shapes. These body shapes are: hourglass, bottom hourglass, top hourglass, spoon, rectangle, diamond, triangle and inverted hourglass. The FFIT uses six circumferential measurements to classify subjects‟ bodies, namely: bust, stomach, waist, abdomen, hips and high hip (Devarajan & Istook, 2004; Simmons *et al*., 2004a; 2004b).

Connell *et al*. (2006) classified body shapes using drop-values, i.e. the relationship between bust, waist, hips as indicators of shape differences. Other studies identified landmarks to aid computational and visual shape analysis (Gazzuolo, 1985). However, with the technological advancement of the 3-D body scanner, there is now no need to landmark the body since a body scanner has predetermined landmarks that are used to plot data points of the participants‟ images. Connell *et al.* (2006) further suggested the moderate revision of body shape classification by introducing the visual analysis of body built, posture and expansion of shoulder height, hip shape, abdominal shape, shoulder blades/back shapes, and the addition of bust prominence and buttocks prominence to come up with more variations within each shape.

The drop values were incorporated into the mathematical description of body shapes classification parameters, as used in a study by Lee *et al*. (2007). This study combined two or more mathematical formulae to define each body shape category. For instance, the classification of the hourglass shape was based on the drop value bust – waist ≥ 22.9 cm or hips – waist ≥ 25.4 cm; for the triangle shape the drop values hips – bust ≥ 9.1 cm and hips – waist < 22.9 cm were used; to classify the inverted triangle, the drop value bust – waist < 22.9 cm was used; and the rectangular shape had drop values bust – waist < 22.9 cm and hips – waist < 25.4 cm. Mastamet-Mason (2008:151) modified and used the above parameters, formulae and drop values of a different sample to successfully classify the body shapes of Kenyan women. The drop values were used in combination with the formula Mean ± Standard Deviation within the minimum and maximum drop values to differentiate the body shapes. The resulting formulae for the five predominant body shapes were 14.0 cm ≤ hip – bust ≤ 26.0 cm for

triangle; 8.0 cm ≤ hip – bust ≤ 3.2 cm (min) for inverted triangle; 23.0 < bust – waist ≤ 36 cm (max) for hourglass; 4.7 cm < bust – waist ≤ 23.0 cm for rectangle; and 13.0 cm (min) ≤ bust – waist ≤ 4.7 cm for apple. Mastamet-Mason further suggested that body shape defining parameters should be based on the populations‟ measurements.

2.2 Established main body shape categories

The hourglass figure shape- An hourglass figure shape is the one that has the bust and hip circumference equal in width and a distinctly smaller waist. Its bust ranges from medium to large, with a midriff and upper hips that taper towards a smaller indented waist, and it has smoothly rounded hips. Even though the hourglass figure has a balanced top and bottom, it is not considered proportionate figure because of the very small waist that makes the bust, hip and buttocks appear proportionately larger. The hourglass figure has two figure variations, namely the top heavy and the bottom heavy hourglass. The top heavy hourglass figure has a wider bust than hip circumference, and the bottom heavy has a wider hip than bust circumference, both of which have a small, defined waistline. To minimize any confusion around these terms, the hourglass figure referred to in this study is the typical hourglass figure with hip and bust circumferences that are almost equal and a smaller waist. (Zangrillo, 1990:5; Rasband, 1994:13)

Some literature reveals that fuller figures have a slightly different hourglass shape that is considered the most evenly proportioned of all plus size figure shapes, as it has well-developed shoulders and gentle curves that are in harmonious scale with the rest of the body. It is full and rounded in the bust and hip areas, but appears proportionally smaller around the waist. Just like the average hourglass, the fuller figured hourglass has bust and hip circumferences that are almost equal in width and in most cases the length of the legs equals the length of the torso, and well-proportioned arms (Zangrillo, 1990:5; Rasband, 1994:13; Rasband & Liechty, 2006:210), as illustrated in Figure 1.

Figure 1: Hourglass figure shape
(Source: Liddelow, 2011)

Triangular figure shape-The triangular shaped figure appears narrower above the waist, i.e. shoulders and bust and widens below the waist, from the abdomen to the lower body (hips, buttocks and hips). The lower body measures slightly more than the waist circumference, which shows an imbalance between the top and the bottom torsos. The figure's wide hips give an illusion of a smaller waistline and shoulders that are sometimes sloped make the top appear even narrower. Many triangular figures have rounded hips, smaller full cup breasts, full rounded upper arms and legs tapering from the knee to ankle, and also at the arms from elbow to wrist. A substantial number of triangular shaped women have smaller shoulders and bust, with hips or thighs that seem to curve out abruptly below the smaller waist (Rasband & Liechty, 2006:24), as shown in Figure 2 Weight gain on a triangular figure accumulates on the lower torso first; even with weight gain, the feminine shape of a smaller bust, accentuated waist and full hips are still well defined. (Zangrillo, 1990:5; Rasband, 1994:13; Spillane,1995:33; Rasband & Liechty, 2006:24).

Figure 2: Triangular figure shape
(Source: Liddelow, 2011)

Rectangular shaped figure- A rectangular figure is characterized by a thick, short, wide torso, wide hips, with no visible waistline indentation and usually long legs. This figure appears to be nearly the same width at shoulders, waist and hips. This is often due to the figure having a broad rib cage and possibly a short waist that is not noticeably indented at the sides and appears proportionately wider than the hips. The bust size may be smaller or flat, with broad shoulders and big upper arms that taper to thick lower arms Figure 3. The rectangular figure is common to women who are overweight as well as women who have large and tall frames.

A slimmer variation of the rectangular figure is the tubular figure. It has a similar shape as the rectangular figure except that it is thinner with comparatively narrow shoulders, hips, smaller bust, waist, and buttocks. The arms and legs of a tubular figure are relatively thin due to little flesh covering the bones and the below average body weight Figure 3. Weight gain on a tubular figure is likely to result in a different figure shape than the rectangular shape. Extra weight for the rectangular figure often accumulates in the midriff area. (Zangrillo, 1990:5; Rasband,1994:13; Spillane, 1995:29-30; Rasband & Liechty, 2006:25).

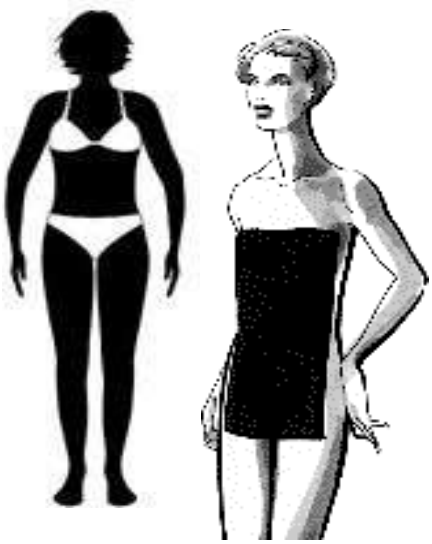


Figure 3: Rectangular figure shape
(Source: Liddelow, 2011)

Inverted triangular shaped figure-An inverted triangular figure is the opposite of the triangular figure in that it has broad straight shoulders, a full bust line and a narrow waist, with even narrower hips. This figure shows an imbalance as the shoulder area is comparatively wider than the hip area, with a bust size that ranges from medium to large. It has a normal hip curve with straight lower hips and thighs. The buttocks are often flatter and the bust circumference is slightly larger than the hip circumference Figure 4. An inverted triangular shaped figure accumulates weight around shoulders, upper back, bust, and slightly at the upper hip.(Zangrillo, 1990:5; Rasband, 1994:12; Spillane, 1995:27; Rasband & Liechty, 2006:24-25).

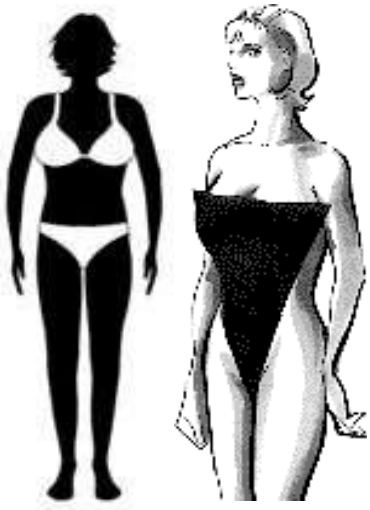


Figure 4: Inverted triangular figure shape
(Source: Liddelow, 2011)

Oval/Rounded(apple)body shape-This figure is referred to as an oval, round or apple shape because all the body areas are fully round. The weight of this figure is above average and the upper back and upper arms are larger and round. The bust, stomach, waist, abdomen, buttocks, hips and upper legs are also round and large. An oval/round body shape has a fuller midsection. This body shape has a tendency to gain weight around the stomach, back and upper body, with an undefined waistline that is the widest part of the body Figure 5. The oval/round figure also has a full, shorter neck and a full face, with somewhat flat buttocks and slender legs. When an oval/round figure shaped woman loses weight. (Rasband & Liechty, 2006:25-26).

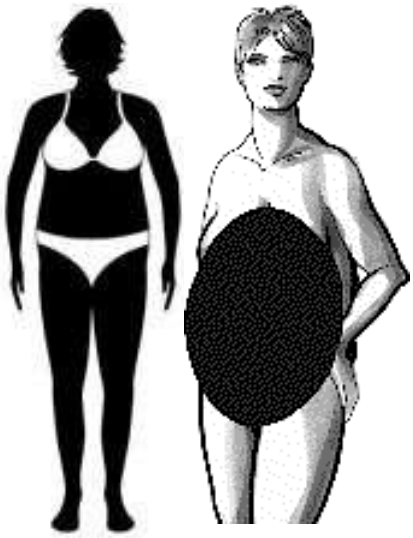
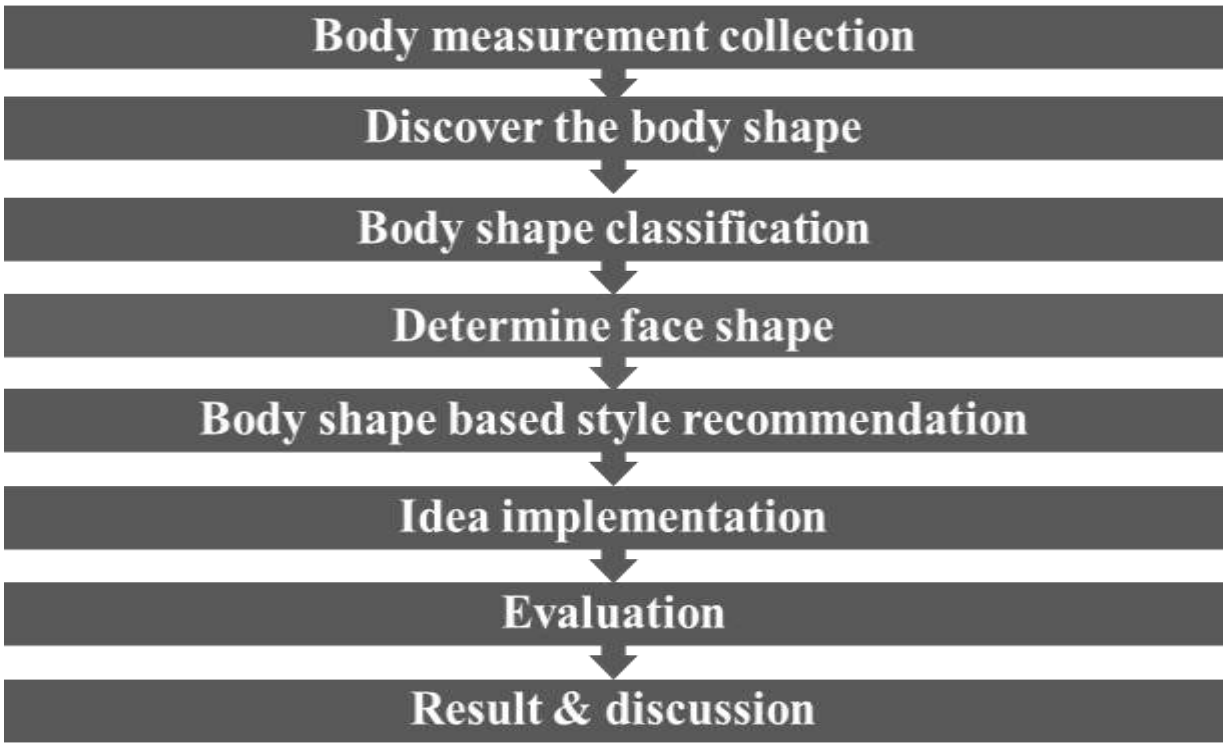


Figure 5: Oval figure shape
(Source: Liddelow, 2011)

4. METHODOLOGY



4.1 Body measurement collection

Using correct type of tape, the required body measurements were recorded. To measure the body flexible plastic, rubber tape such as used in sewing, metal measuring tape should not be used. The models were asked to stand straight, tall and breath normally while taking measurements. Make sure the tape is straight and in line with the appropriate body part. while taking the circumference measurements the tape should be parallel to the floor in lengths the tape should be parallel. The models were asked to wear clothes which fit closely, wearing tight fitted clothing, unpadded bra the measurements will be accurate. The measurements are noted in inches.

4.2 Discover the body shape

Your body shape is the best starting place for creating a wardrobe that you love. The colour of an outfit might be your favorite but if the style simply does not suit your shape, you are not bringing out your best. The secret is that there is no perfect body shape as each one of five body shapes has parts that need balancing out. the models were asked to remove their clothing or wear a camisole and pair of underwear to get an accurate measurement, it helps little no clothing on. strip down to their underwear if they are able to or put on something light and form fitting such as tank top and pair of leggings. Fullest part of the chest is measured. Using a soft, flexible measuring tape measurements were noted in inches.

The measuring tape was warped around the fullest part of your bust, which is usually the area of your chest level with your nipples. The measuring tape was kept snug around the chest; the measurements were recorded. Smallest part of your waist is measured and recorded its usually just below the ribs about 2-3in(5.1-7.6cm) above the belly bottom (Justine leconte 2016). The measuring tape was wrapped around the body and measurements were noted in inches. The measuring tape should not be too tight, ensure 1 finger should fit in measuring tape and the body. Widest part of the hip was measured using measuring tape warping it around the hip and then the measurements were recorded in inches.

4.3 Body shape classification

Compare the 3 measurements to determine which is the largest and smallest helps to visualize the shape of your body. If bust and waist are smaller than hip its identified as pear-shape. If hip measurement is largest out of 3 measurements and bust and waist are equal in size or smaller than waist, it’s also known as triangle shape. If bust is bigger than waist and hips its inverted triangle. The chest/ shoulder is wider than the waist and hips. If bust, waist, hip is all in the same size it’s called as square-shape. If waist is wider than bust and hip, also might have full bust size it’s an apple-shape. If waist is smaller than bust and hip, usually the bust and hip measurement are of same size, this creates a noticeable curing silhouette.

4.4 Body shape based style recommendation

1.Rectangle body shape

This body type, have long, thin body that tends to lack curves. Wear clothes that flatter the profile, break up, your silhouette, and create curves that moves up and down from the waist area. This body type, you can pinch in your waist to exaggerate curves. Go with ruffles and frills to add texture, Volume, and femininity to your figure. Miniskirts and bright tights to make the most of your greats legs. This will also add more shape to a straight body Use shapewear. A rectangle body type benefits from shaping undergarments. Choose form-fitting tops and jackets that you at the waist. Tops and jackets that contour to your body and it hits at the waist to create curves. Denim jacket and bomber jackets are short jacket that generally hit at the waist. Wear shirts with scooped necklines to show off your collar bones.

Rectangle body shapes have prominent collar bones. Choose shirts with wide or scooped necklines to accentuate your neck and collar bones. Off shoulder tops will also emphasize your collar bones. Tuck your shirts in to accentuate your waist. Rectangle body shapes people often have trouble defining their waist. Tuck in long shirts into your bottoms, or buy shirts that hit your waistline to create a waist for yourself. Your natural waistline sits just above the hips, right along your belly button. Try pairing a solid dark color shirt with light wash jeans, a skinny belt, and a large handbag. Use a good-fitting bra. Rectangle body shapes often has busts that can be lost in baggy shirts or blouses. Purchase a bra that fits you good to define your bust. Define your body by wearing different colors on the top than the bottom.

Rectangle shape bodies have the tendency to become one straight line. Avoid it by wearing different colors on the top and bottom so that it draws attention to the individual parts of your body. Avoid wearing a monochromatic outfit, like red from head to toe. Try using large, bold patterns that draw attention. Don’t wear shoulder pads or boxy-fitting tops and coats that can make your shoulders look wider or make your torso seem boxy. Instead choose tops that are more flowy and soften your shoulders and overall torso.

Avoid shapeless dresses that don’t accentuate your waist. Since rectangle body shapes can be boxy, don’t wear dress that have no defined shape to them. Instead, choose ones that comes in slightly at the waist and flare out at the bottom to give your body shape. Add a belt to the shapeless dress to define your waist. Add some curves to your body by wearing skinny jeans and pencil skirts that from to your legs. Pair from-fitting bottoms with a flowy top to create balanced look. A pencil skirt with loose top. Wear thin belts to define your waist with your bottoms. Make sure your pants and skirts are hitting your natural waistline. Shorts have longer in seams so they go well with a straight body type. Avoid high waist shorts that might create bagginess in your hips or thighs.

2.Hourglass body shape

Avoid anything that makes the look boxy. Use the waist as the focal point when dressing. Wear snug accessories and cloths around the thinnest part of your waist so that curves stand out more. Tailored clothing is usually more flattering than ready-made garments. Shapeless/drape clothing tends to focus more on bust and make hourglass shape look heavier. Draw attention to your waist with dresses and belts. Women with curves can end up revealing too much of bust. Avoid deep neckline. wear a supportive bra so that your chest does not look droopy and saggy. Don't show more cleavage than appropriate to the situation.

Hourglass figure is slimmest at the waist. Choose Tops and dresses that wrap around waist or tie at the waist are especially flattering as are belted trench coats, fit-and-flare dresses, and peplum blouses. A slim fitting top tucked into high waist pants or a skirt can be another great way to emphasize your waist. The top fits you comfortably in the bust. Avoid shapeless or light clothes wearing baggy, shapeless clothing it will make you the look boxy instead of curvy. Wearing to tight will draw attention to areas where were you carry more weight instead wear a skim lightly across your figure. Go with V-neck, scoop neck, or boat neck in horizontal line shoulder to shoulder it will show show of the curve of your collarbone. Avoid high neck style. Avoid wearing pleats, ruffles around your hips, since your figure is already curvy. Use belts do draw attention to the waist If you are wearing a dress, top, or jacket that's a little flowy, you can add extra emphasis on your waist by adding belt. you might add a glamorous skinny belt on top of a flowy dress, or you might wear a bold, wide belt on the top of a stylish trench. For the most impact, wear the belt cinched over the smallest part of the waist.

If you have a larger belly, a belt might emphasize that rather than the curve of your waist, in that case consider highlighting the sides of your waist by wearing bottoms. T-shirt on the top, is fitted at the waist, and then flares out at the hips along with that add choker necklace trendy. Bomber jackets have a stretchy band around the waist is perfect for drawing attention to that area. They are comfortable and causal, and you can make them work with almost any style. Go with peplum tops and dresses to emphasize your waist because Peplum tops typically fit perfectly at the waist, then flare outward near the bottom hem, while peplum dresses often look similar to a peplum top with a pencil skirt.

Garments with a peplum already mimic the shape of an hourglass, so that will accentuate your curves perfectly. Use crop jackets to draw attention at the waist if you wear a jacket that ends at the natural waist, it will draw the eye to that area you might wear a satin tank top tucked into an A line skirt then top that with a cropped brocade jacket for an outfit perfect. Bodycon dresses will fit closely to your figure, so that will be a great way to show off your hourglass figure. If you have any areas you would rather not show as much, consider choosing a bodycon dress made from heavy stretch material that will hold you in. Style the bodycon dress with dark eye makeup, ankle boots, messy hair.

Table 1: List of clothing items considered in this work.

Category	Items
Dress	Dress
Outwear	Jacket
Pants	Shorts
Skirt	Skirt
Top	Crop top

4.5 Idea implementation

The recommended style is worn by the participant(models) which perfectly flatter their figure and make them look good. Click the below link to view the fashion portfolio.

http://www.mediafire.com/file/5zq7zp81z6t8nlo/file

4.6 Evaluation

I Conducted a user study to measure the user preference towards recommended style by proposed and comparison methods. After finding the recommended styles of the each of the body shapes. I recruited 25 female students as the participants. The study process is divided into two phase: **pre-study phase** and **on-study phase**.

The objective of pre-study phase is to give the participants some general idea of the correlation between fashion style and body shapes. I firstly collected a number of online tips on dressing to flatters body shapes and showed them to all the participants and they were freely allowed allow to explore the web pages, after that the participants started to perform the next phase. In the on-study phase, I used the body measurements of two models and then styled them for a party wear co-relation with their body shape. I further asked the participants to give the rating from 1 to 5 in Likert scale to indicate how suitable each recommended style for their body style, with 5 being the highest suitability.

5.RESULTS AND DISCUSSIONS

A visual summary of clothing is necessary to gain a deeper Understanding of fashion style. In this paper I used two models to capture the correlation between fashion style and body appearances. My goal is to help users to find the most suitable clothing which can perfectly flatter their figure and make them look good. There all multiple factors involved in enhancing the overall look of a person, currently my analysis focus on body measurements.

6. CONCLUSION AND FURTHER WORK

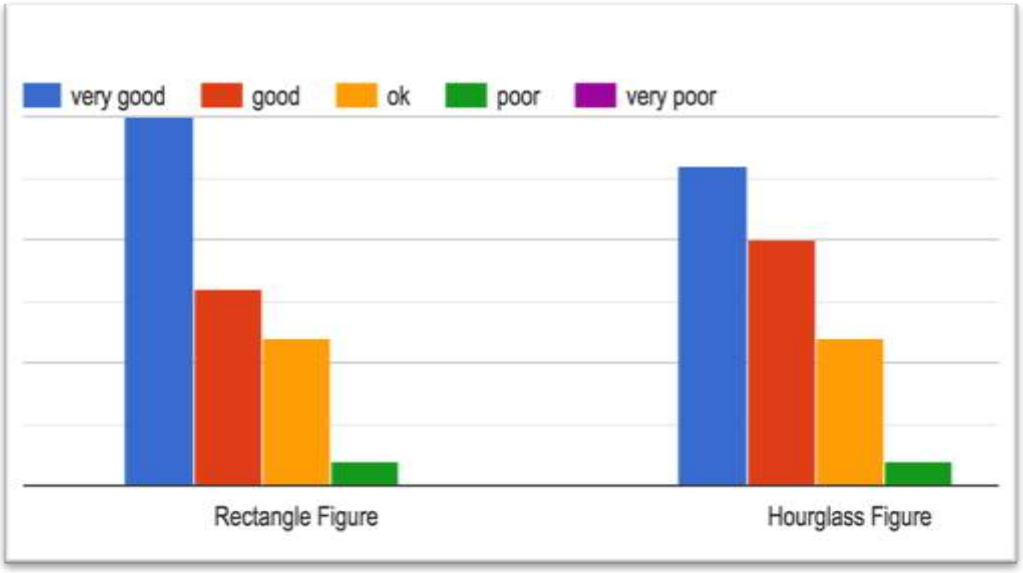


Figure 6.1: Respondent chart

User evaluation results it shows that how suitable each recommended style for their body shape, thus it verifies recommended style suits for their body shape. Based on the created look one questions to fashion tips can be addressed, body shape and best suited clothing outfit, several research topics are open for future investigation. current Research focus on the body measurements and clothing style for the particular body shape. The incorporation of other factors, age, skin colour ,face shape, eyebrow shape, Hair texture ,eye colour might be used in further work for the improvised version.

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