Redefining the drawn body through investigations of proportional techniques

Simeon Gill and Ruth Sanderson

Abstract

The creation of fashion drawing templates provides the initial silhouette and proportions for the conceptualisation of clothing. These templates are usually created according to proportions where overall height relates to 9 heads, often determined as pleasing to the eye, but abstracted from the actual proportions of a population. Initial research utilising data collected by body scanning, suggests an average head to height ratio of 7.5 heads, which would correspond to 8, after elongation of the feet from the scanned position. Within the process of creating figure templates the head length provides the means to calculate not only length relationships but also the widths at key locations, like the shoulder, bust, waist and hips. This provides standardisation which will not develop figure templates that are representative of the actual body, or allow for the accepted variation between bodies of different proportions and silhouettes (shapes).

Utilising an extensive database of body scans, composed of UK women aged 18-30 who were classified as one of seven body shapes according to the FFIT method, different proportions for creating more representative figure templates were explored. Utilising tools within the body scanning analysis software it was possible to determine head to length and width relationships existing within the different figure categories. This provided a foundation for proposing methods to create more realistic figure drawing templates to be used in education and help fashion students design and conceptualise garments on more proportionally realistic bodies.

Key Words: Figure drawing, fashion design, anthropometrics, body scanning, human proportion, body shape.

*****

1. Introduction

Proportion or derived proportional relationships play a role in many aspects of the garment development process. Pattern cutting uses proportions in the creation and development of blocks and styled patterns[1], but preceding this is the use of proportion within the design process. Many sources guiding on figure drawing propose some form of head relationship to body lengths and width, the most well known being the eight head theory [2,3].

It is the argument of this work that the broad use of these simplified and idealized systems presents narrow categories as the foundation for garment design. These figures drawing techniques produce bodies that are not representative of those the garment should fit and misinform all who are involved into a false sense

_____

of similarity between people, which is not borne out by analysis of dimensions of populations. There are further difficulties when the abstract fashion illustration is translated into the pattern and garment for the proportions of a population and the requirement to adjust for shorter lengths and a potentially wider silhouette.

Current methods of figure drawing are analysed and the techniques compared to proportions derived from body scans of a female population and methods for developing different shaped figures is proposed as an initial development from current methods.

2. Literature Review

A   Proportion and the figure

The proportions of the figure in fashion are given in depth consideration by Simons and here we see considerable evidence of prescribed proportional relationships[4]. Discussion by Simons details the early inception of figure drawing by proportion, through to modern techniques that are in some cases informed by measurement surveys of the human body. However it is clear that artistic representation of the body played a larger part in the development of these rules, than did actual scientific exploration, these methods also pre date many of the 20th centuries large scale anthropometric surveys. When considering more recent discussion of proportion in clothing, Kunick who details the development of sizing systems and pattern creation methods, highlights the continued usage of proportional techniques, notably eight heads[5]. It is also clear that many measurements which were difficult to take from the body were often derived proportionally, in some cases with reference to proposed proportional head relationships. Haughton suggests a constant theme to convey a beautiful body through art has been the application of the same golden rules of symmetry by different artists. This raises the question of proportion in representation of clothing against that in the realisation of clothing for real people.

B   Proportional head relationships

Head relationships are central to the creation of fashion figure drawings and whilst there is variation in proposed relationships, the most constant is the use of a head proportions to determine an overall figure height. Whilst the use of head theory is purported to be derived from ancient Greek systems, it still persists in modern techniques[678]. Some authors suggest a theory of eight heads to height whilst others indicate it is less in real people and still some authors suggest a greater number of heads to height, in some cases up to ten.

Abling identifies the difference between 'realism and fashion idealism' when extending the number of heads to create elongation of the 'natural figure'[9]. This

_____

shows a clear awareness of the misrepresentation, but does not address the required altering of proportion to then create the garment for a real person and maintain the aesthetics of the figure drawing.

Other authors suggest nine heads, though in some cases once feet have been added the overall proportions are further increased. There are indications by Szkutnicka and Drudi & Paci that the extended figure creates an appealing silhouette and allows the foot to be viewed successfully [1011]. Analysis of pattern literature shows the influence of eight head theory in the derivation of dimensions for the creation of clothing patterns, indicating that this idealization of the human form is ingrained in clothing development[12].

C   Extension and elongation of the figure.

Drudi & Paci suggest the difference between the 8 headed figure and 8.5 headed figure is the higher position of the waist, that consequently shortens the upper portion of the torso. Abling suggests extension occurs in the legs to add height and also indicates techniques such as lengthening the neck, upper torso and arms. This corresponds with Burkes suggestion that the extra length is added to the legs to create a more stylised appearance and Rieglman who discusses the idea that the figures main function is to display the clothing in the most effective manner possible.

Abling further suggests the alteration of head length to achieve three specific fashion figures: Petite (can also include plus-size); Model – taller and slightly elongated and Elongated – exaggerated and stretched to an extreme 'fantasy' height. Key to this is the suggestion of a relationship between head length and height, an area neglected in research but key to supporting the theories of any head based figure creation system. Importantly within the text these figures are only created to the ankle, so actually the figures total height would be half a head greater and give a total in the elongated figure of ten and a half heads, the largest suggested within the selected guidance. There is also a suggestion of free elongation of the figure to larger heights, but no grounding or appreciation of the difficulties of then aligning this to a wearer at the stage of garment creation. Whilst it is clear that elongation and stylisation is the focus of the nine head figure or croquis, establishing a good basis to design garments on top of, however, accuracy and a realistic perception is not mentioned even though the direct connection of garments to the body is identified.

Riegelman suggests a systematic theory and acknowledges the effect of the figure on the way garments are designed and continues to suggest the nine-headed theory will enable the reader to achieve a 'correct' figure[13]. Drudi & Paci, Ireland and Szkutnickas in contrast provide no direction other than the drawn figure examples without any clear identification of head markers and points on the body. As a result the reader is left to determine the proportions of the figure from analysis of the images.

_____

The idealisation of the figure and influence of artistic interpretation is document by Simons and shown in the depiction of the figure from different historical contexts[14]. It is clear artistic representations of the body can be controversial as the use of actual nudes caused an outcry in the nineteenth century[15]. It is clear that stylisation of the figure is influential in representation of the body, though no identifiable opportunities to align this with guiding on creating actual products for real people.

The application of proportion within figure drawing techniques is subject to a great deal of inconsistency between sources. Some suggest the use of head length (vertex to the chin) for all lengths and widths whilst others indicate widths relative to head widths though these are not controlled relative to other dimensions [16][17][18]. This coupled with the inconstancies between the written guidance and accompanying figures makes it difficult to understand the accuracy and consistency of these techniques in doing anything other than imposing an author informed aesthetic standard on figure representation. Drudi & Paci do not divide the figure as specifically as Riegelman and no widths are indicated, however, they suggest direct proportional connections between measurements of the shoulders and pelvis, determined as of equal width and the waist width being two-thirds of them.

D   Other Figure Types.

Abling acknowledges the use of petite and fuller figures, suggesting they are both to be drawn within the eight-eight and a half head figure, though no guidance on their achievement is given. Szkutnicka also discusses the relevance of using a suitable template for a particular market, suggesting figures which are adapted to a standard template would be too slim, however, no instruction is provided on creating different sized figures. In fact the creation of different figure types is problematic as head lengths which are relative to height, will not be good predictors of widths which are related to girths and correlated little with lengths.

3. Methodology

A   Content Analysis of Figure Drawing Literature

Combining a content analysis and case study approach, this research started by investigating current literature on figure drawing for fashion[19][20][21]. This is often the initial starting point for the development of fashion drawings, key texts were identified within the existing stock of a University library where figure drawing is taught as part of clothing product development. Search terms, 'figure drawing'; 'clothing' and 'human proportion', were used to determine the breadth of texts, further literature was determined from reading lists, an internet search using the

_____

same terms and by shelfmark within a library stocking books on clothing product development and figure drawing.

Identified texts were analysed, initially by index for terms relating to figure drawing and proportion (Croquis, figure, template, 9 heads and proportion) and each text was visually checked page by page to identify guidance on proportions for the figure. Content was analysed for structured guidance on proportion, primarily from visual sources, though text was checked when it was evidently related to proportion and results structured in an Excel spreadsheet to enable comparison of proposed figure proportions. Whilst there exists guidance on the creation of a male and female figure, only guides for the female figure were used in this research as they are more detailed and allow comparison to the large volume of female measurement data accessible to the research team.

B   Analysis of a sample scan population

A sample population of body scans was obtained and these were filtered to include only those who were female, aged 18-35 and classified as one of three body shapes (Rectangle, Hourglass and Bottom Hourglass) according the FFIT shape categories[22]. 93.7% of the population were included within these three shape classifications and a total of 247 scans identified to support this research. As a convenience sample was used, each shape category was not equally represented within the population. Consideration was given to classifying scans by size categories, however focusing only on a single size grouping (size 12 hip from a major UK retailer) did not significantly alter the results of average dimensions of the population (Table 2) and so therefore no further division of the data occurred.

4. Results and Discussion

A   Content analysis of figure drawing techniques

The proposed relationships between head length, and height and width were recorded from the selected figure drawing cases. The average proportions recommended show a consistency of approach to many of the proposed dimensions (Table 1).

_____

Table 1 - Proportions proposed in figure drawing literature

Measurement	Average	Mode	Min	Max	Count
Stature	8.54	8.50	7.5	10	12
Shoulder Width	1.67	1.50	1.5	2	3
Bust Width	1.38	--	1.25	1.5	2
Waist Width	1.00	1.00	1	1	4
Hip Width	1.58	--	1.25	2	3
Knees Width	0.71	--	0.5	0.84	3
Calfs Width	1.00	1.00	1	1	2
Ankles Width	0.50	0.50	0.5	0.5	2
Neck Base (sternal notch)	1.35	1.25	1.25	1.5	10
Shoulder Height	1.43	1.50	1.25	1.5	11
Bust height (nipple or most prominent)	2.06	2.00	2	2.3	11
Armhole Height	1.93	2.00	1.75	2	7
Waist height	3.00	3.00	2.66	3.3	11
illiac crest height	3.25	--	3.25	3.25	1
Hip height	3.64	4.00	3.2	4	9
Crotch point	4.04	4.00	4	4.25	12
Head width	0.66	0.66	0.66	0.66	2
Elbow height	2.86	3.00	2.5	3	6
Wrist Height	4.00	4.00	3.75	4.25	8
Hand length	0.73	1.00	0.5	1	9
Knee height	5.90	6.00	5.5	6.5	11
Calf height	6.64	6.50	6.25	7.5	7
Ankle height	7.98	8.00	7	9.25	10

The average head height to stature is eight and a half, but some methods recommend ten and there is even the inclusion of a seven and a half head technique. Heights of each of the key divisions of the body are given more consistently, whilst widths are specified with much less frequency, however some indications of waist width is given in the pictorial representations accompanying the written guidance. There is a great deal of consistency between the sources suggesting a common origin and the possibility of influence between sources.

It is clear that all twelve guides provide details of the key height relationships of overall height and crotch position, in relation to head length, however, fewer provide details on all lengths and even less on key widths. When guidance is not provided in terms of prescriptive measurement or ranges for the figure it is clear that the drawer will impose their own, or use the accompanying images to determine what would be considered appropriate. For those learning to develop figure images it is unlikely they would be confident in creating their own proportions and so the implicit influence of the drawn figures created by the authors will likely take precedence.

B   Analysis of scan data by shape

During analysis of the proportions derived from the different scan shapes it was considered that each subject should be of a comparable clothing size category.

_____

However, when comparing the average proportions determined from a population of mixed clothing sizes and those meeting a specific hip size criteria, differences between average proportions are lower in nearly all cases than the one decimal place that it is possible to create figure to using current drawing tools (Table 2).

Table 2 - Proportions found from analysis of scan data

No. Participants	Body Shape and Size	Calculation	Stature	Shoulder Width	Bust Width	Waist Width	Hip Width	Shoulder Height	Bust height (nipple or most prominet)	Waist height	Hip height	Crotch point	Knee height	Calf height	Ankle height
106	Rectangle All Sizes	Mean	7.47	1.52	1.37	1.22	1.62	1.31	2.06	2.81	3.68	4.06	5.41	5.96	7.13
24	Rectangle Size 12	Mean	7.58	1.53	1.40	1.25	1.67	1.33	2.08	2.83	3.74	4.13	5.48	6.04	7.23
		Difference	-0.11	-0.01	-0.03	-0.02	-0.05	-0.02	-0.02	-0.02	-0.06	-0.07	-0.07	-0.08	-0.10
80	Hourglass All Sizes	Mean	7.70	1.57	1.42	1.19	1.71	1.33	2.07	2.83	3.81	4.19	5.59	6.14	7.35
24	Hourglass Size 12	Mean	7.70	1.58	1.44	1.21	1.71	1.33	2.04	2.85	3.82	4.20	5.59	6.14	7.34
		Difference	0.00	-0.01	-0.02	-0.01	-0.01	0.00	0.03	-0.02	-0.01	-0.01	0.00	0.00	0.01
49	Bottom Hourglass All Sizes	Mean	7.34	1.48	1.30	1.16	1.68	1.29	2.02	2.74	3.65	4.02	5.34	5.86	7.00
14	Bottom Hourglass Size 12	Mean	7.29	1.47	1.26	1.13	1.62	1.29	2.02	2.76	3.65	4.03	5.32	5.81	6.93
		Difference	0.05	0.01	0.04	0.04	0.05	0.00	0.00	-0.02	0.00	-0.01	0.02	0.05	0.07

There is some suggestions that hourglass subjects are taller than the other two on average and this is shown also in the relative lengths. This link between height and proportional heights would be expected, as height is considered to correlate well with body segment lengths23.

C   Comparison of figure drawing techniques and proposed shape proportions

When the averages of the scan population by shape are compared with that proposed by current figure drawing techniques, there is clear evidence of elongation of the heights. However some of the lengths are comparably similar, with elongation predominantly occurring in the lower portion of the body (Table 3).

_____

Table 3 - Comparison of proposed proportions from figure drawing and scan data

	Figure Drawing		Population Analysis		
Measurement	**Average**	**Mode**	**Rectangle**	**Hourglass**	**Bottom Hourglass**
Stature	8.54	8.50	7.47	7.70	7.34
Shoulder Width	1.67	1.50	1.52	1.57	1.48
Bust Width	1.38	--	1.37	1.42	1.30
Waist Width	1.00	1.00	1.22	1.19	1.16
Hip Width	1.58	--	1.62	1.71	1.68
Shoulder Height	1.43	1.50	1.31	1.33	1.29
Bust height (nipple or most prominent)	2.06	2.00	2.06	2.07	2.02
Waist height	3.00	3.00	2.81	2.83	2.74
Hip height	3.64	4.00	3.68	3.81	3.65
Crotch point	4.04	4.00	4.06	4.19	4.02
Knee height	5.90	6.00	5.41	5.59	5.34
Calf height	6.64	6.50	5.96	6.14	5.86
Ankle height	7.98	8.00	7.13	7.35	7.00

There is a narrower shoulder width suggested from the scans, though this may be influenced by the different techniques of defining the shoulder point between the body scanner and the author defining the figure.

5. Conclusions

Figure drawing texts, whilst being highly prescriptive of head lengths for height, have little consistency in terms of clearly indicating other related body proportions and seem to expect the reader to impose their own judgment in the creation of the figure. This means that the figure images created by the author become a heavily prescriptive tool in how the reader will create their figure image and influence the proportions of the garments they create.

When comparison is made between the figure developed by figure drawing guidance and that suggested from analysis of body scan data, it is clear that elongation occurs to differing degrees in current texts.

Extraction of key dimensions and statistical analysis of the body scans has enabled the proposal of different head to length and width ratios for the development of the different shapes, rectangles, hourglass and bottom hourglass. These shapes covered almost 94% of the population, though there is still the opportunity to develop proportions for the remaining shapes defined through the FFIT system, these require a larger population of scans to be suitably representative within the analysis.

The results of this research question the premise of using the head length as a basis for the creation of the figure template. Although different proportional or shaped figures can be produced, any change in body size would require a change in

_____

height and head length. Whilst head length may have a relationship to height, that appears to be supported within this work, the width of the body, related to girths, have not been found to correlate to heights. This suggests a need for a more evolved figure drawing technique that allows more flexible creation of fashion drawing figures that better represent real people and the variation of shape and size within a population

Notes

[1] Philip Kunick, *Modern Sizing and Pattern Making for Womens, Mens and Childrens Garments*.
[2] Patrick John Ireland, *Figure Templates for Fashion Illustration*.
[3] Basia Szkutnicka, *Technical Drawing for Fashion*.
[4] Harry Simons, *The Science of Human Proportions*.
[5] Kunick, *Modern Sizing*.
[6] Kunick, *Modern Sizing*.
[7] E. Drudi and T. Paci. *Figure Drawing for Fashion Design*.
[8] Ireland, *Figure Templates*.
[9] Bina Abling, *Fashion Sketchbook*.
[10] Szkutnicka, *Technical Drawing*.
[11] Drudi and Paci. *Figure Drawing*.
[12] Kunick, *Modern Sizing*.
[13] Nancy Riegelman, *9 Heads: A Guide to Drawing Fashion*.
[14] Simons, *The Science of Human Proportions.*.
[15] M. Postle,"Pygmalion, Painted Flesh, and the Female Body." In *The Body and the Arts*.
[16] Riegelman, *9 Heads: A Guide to Drawing Fashion*.
[17] Sandra Burke, *Fashion Artist*.
[18] Ireland, *Figure Templates*
[19] Klaus Krippendorff, *Content Analysis*.
[20] K.A. Neuendof, *The Content Analysis Guidebook*.
[21] G.Thomas, *How to Do Your Case Study*.
[22] J. Y. Lee, C. L. Istook, Y. J. Nam, and S. M. Park. "Comparison of Body Shape between USA and Korean Women.
[23] John Winks, *Clothing Sizes International Standardisation*.

_____

Bibliography

Abling, Bina. *Fashion Sketchbook*. New York: Fairchild, 2012.

Burke, S. *Fashion Artist*. 2nd ed.: Burke Publishing, 2006.

Drudi, E., and T. Paci. *Figure Drawing for Fashion Design*. Amsterdam: The Peppin Press, 2006.

Ireland, Patrick. John. *Figure Templates for Fashion Illustration*. London: Batsford, 2000.

Krippendorff, Klaus. *Content Analysis*. 3rd ed. CA, USA: Sage, 2013.

Kunick, P. *Modern Sizing and Pattern Making for Womens, Mens and Childrens Garments*. London: Philip Kunick, 1984.

Lee, J. Y., C. L. Istook, Y. J. Nam, and S. M. Park. "Comparison of Body Shape between USA and Korean Women." *International Journal of Clothing Science and Technology* 19, no. 5 (2007): 374-91.

Neuendof, K.A. *The Content Analysis Guidebook*. CA, USA: Sage Publications, 2002.

Postle, M. "Pygmalion, Painted Flesh, and the Female Body." In *The Body and the Arts*, edited by C. Saunders, U. Maude and J. Macnaughton. 165-85. London: Palgrave Macmillan, 2009.

Riegelman, N. *9 Heads: A Guide to Drawing Fashion*. . Vol. 3 revised, LA, USA: 9 Heads Media, 2010.

Simons, Harry. *The Science of Human Proportions*. New York: Clothing Designer CO., Inc., 1933.

Szkutnicka, Basia. *Technical Drawing for Fashion*. London: Laurence King, 2010.

Thames, Bill. *Drawing Fashion*. New York: McGraw-Hill, 1985.

Thomas, G. *How to Do Your Case Study: A Guide for Students and Researchers*. Los Angeles: Sage, 2011.

Winks, J. *Clothing Sizes International Standardisation*. Manchester, UK: The Textile Institute, 1997.

_____

Simeon Gill is a senior lecturer in fashion technology at Manchester Metropolitan University. His research focuses on measurement of the body and the application of measurement in pattern construction, this research has enabled data collected for this purpose to further inform fashion practice.

Ruth Sanderson is a senior lecturer at Manchester Metropolitan University. Her research focuses on the drawn body and methods for creating accurate representations of the figure to support design and conceptualisation of garments for real people.