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Design-Based Adaptation of a Facial Analysis Model for Sri Lankan Kolam Masks

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Abstract – Sri Lanka's Kolam mask tradition is a vivid fusion of sculpture, storytelling, and performance, where each mask communicates character through expressive exaggeration, humor, and stylized form. Although widely documented through cultural and ethnographic studies, few researchers have examined Kolam masks using methods that allow their visual structure to be measured and compared. This study introduces a new approach by adapting the morphometric system developed by Liu, Chen, and Chang (2019) (Liu et al., 2019), originally created to analyze stylized cartoon characters, to the study of three-dimensional Kolam masks. The adaptation demonstrates how digital measurement and visual analysis can be applied within a heritage context, linking modern design methods with the study and preservation of traditional craft. The research transforms a two-dimensional analytical framework into one suited for three-dimensional cultural artifacts, offering a structured way to identify Kolam masks.

The study aims to explore how Liu, Chen, and Chang's (2019) (Liu et al., 2019) morphometric model—originally designed for stylized two-dimensional characters—can be adapted and applied to the study of Sri Lankan Kolam masks as a consistent and repeatable digital method for examining their facial structure and stylistic variation. The study modifies the analytical system to accommodate the three-dimensional characteristics of handcrafted Kolam masks, identifies measurable facial features, such as lengths, angles, and areas, that reveal artistic exaggeration of Sri Lankan masks.

In (Liu et al., 2019) original framework, cartoon faces were analyzed using vertical, horizontal, and angular measurements that connected nineteen fixed points around key facial features such as the eyes, nose, mouth, and chin. This study follows the same geometric logic but adapts it for handcrafted masks, which differ in material form and spatial depth. It replicates the original model, incorporating nineteen reference points, eleven vertices, six horizontal measurements, nine angular measurements, and seven facial areas—eyes, nose, mouth, Ears, Jaw, Chin, and overall face—selected for analysis (Figure 01)(Prendergast, 2012).

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To adopt the above method, the masks were incorporated into a grid to establish a common framework for analytical purposes. For this, photographs of Sri Lankan faces were taken to determine an average. The vertical measurement extended from the hairline to the chin, while the horizontal measurement spanned from one ear edge to the other.

In the next stage, twelve masks representing three well-known *Kolam* characters—Adabera Kolam, Mudali Kolam, and Police Kolam—from the four regional mask traditions (Ambalangoda Tradition, Benthara Tradition, Mirissa Udupila Tradition, Mirissa South Tradition) (Bentaragē, 2014) (de S. Manukulasooriya, 2005) (Shmagalo & Xian, 2023) were photographed under even frontal lighting. The photographs were then converted into line drawings using the software *Adobe Illustrator* to calculate measurements and ensure visual clarity. These line drawings were positioned on the grid, and nineteen fixed points were marked. Subsequently, each point, along with its vertical, horizontal, angles and corresponding facial areas, was measured and tabulated. A sample of this process is illustrated in Figure 02, using the Police character from the *Police Kolama*.

The data were analyzed by uploading the grid containing the line drawings of the masks to calculate proportional ratios. For this purpose, the online measurement tool Eleif.net – Measure in Photo Online (*Measure in Photo Online - Eleif.Net*, n.d.) was used for vertical and horizontal measurements, while the Ginifab Online Protractor (*Online Protractor*, n.d.) was employed to calculate angular measurements. The width of the grid—marked as the distance from the edge of one ear to the other—was identified as the base reference (ratio = 1). The facial areas were measured manually. Each of the nineteen marked points was then measured across the representative masks (for example, the Police character mask from the *Police Kolama*) of the four regional mask traditions to determine corresponding proportional values and angular variations (Figure 03). Comparative findings revealed that masks from Mirissa South Udupila exhibited the greatest exaggeration of facial features, while those from Bentara displayed the least. These results confirm that the adapted analytical system effectively translates visual impressions of expressiveness into measurable data, thereby revealing distinct stylistic variations among regional traditions.

The findings establish a clear and repeatable process for examining stylization in folk art, providing a foundation for future integration with advanced digital tools such as 3D scanning and photogrammetry. The method creates a practical framework that links digital design techniques with the documentation and interpretation of traditional craft. However, certain limitations were identified: only frontal photographs were analyzed, excluding side profiles and spatial depth variations; the dataset of twelve masks limits broader statistical generalization; and the manual plotting of reference points introduced minor variations that could be minimized through automated processing in future studies.

By adapting Liu, Chen, and Chang's (2019) facial-analysis model (A Study of Facial Features of American and Japanese, n.d.) to Sri Lankan Kolam masks, this research establishes a design-based approach for documenting and interpreting heritage artifacts. The process translates visual interpretation into quantifiable information and provides a foundation for comparing artistic styles across regional traditions. Beyond its immediate cultural relevance, the study illustrates how analytical systems developed in design contexts can be reinterpreted to preserve, analyze, and understand vernacular art—reaffirming the enduring creative and cultural significance of Sri Lanka's Kolam mask tradition.

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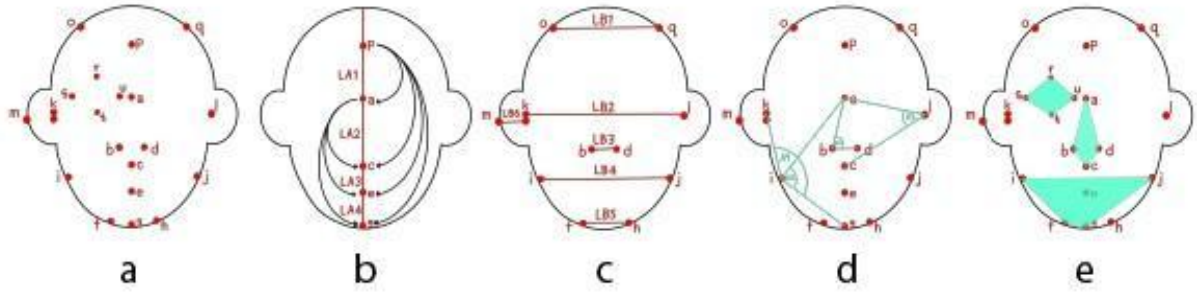
Keywords: *Design Ethics; Prototyping; Responsible Design; Sri Lankan Kolam Mask*

Figure 1

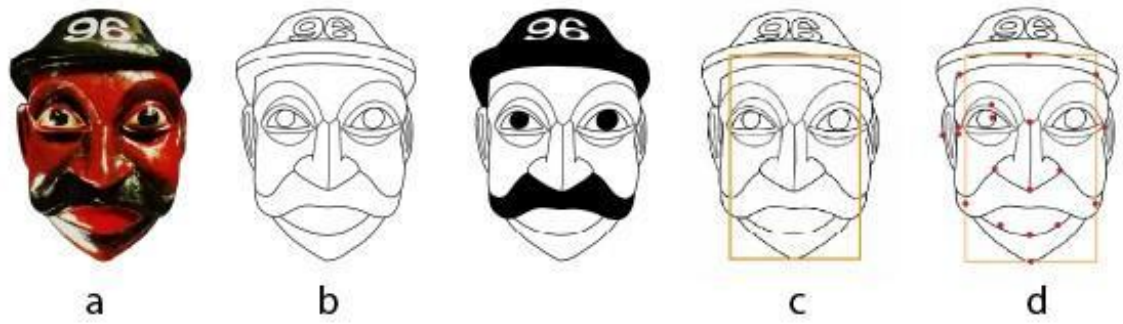
Liu, Chen, and Chang's (2019) morphometric model



a.Nineteen Reference Points, b.Vertical Measurements, c.Horizontal Measurements, d.Four out of Nine Angles, e.Three out of Six Face Areas (*A_Study_of_Facial_Features_of_American_and_Japanes*, n.d.)

Figure 2

The visual analysis process



a.Photographed Mask, b.Outlined Mask, c.Placing of the outlined changing into the common grid, d.Marking of the Nineteen points

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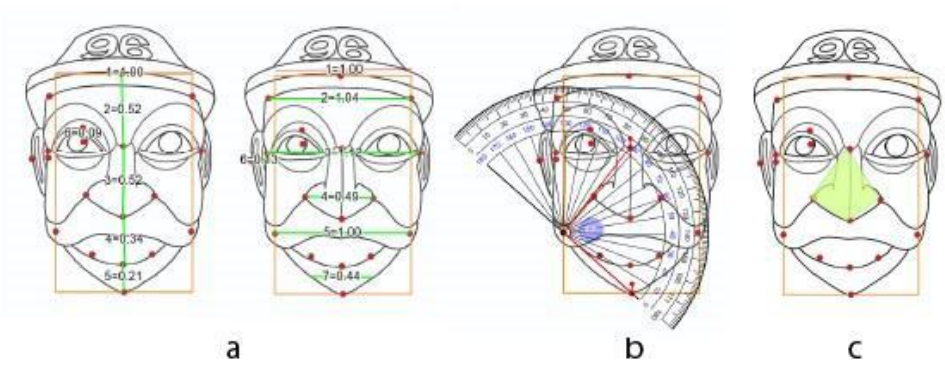
Figure 3

Sample application of the calculation from the Police Kolam



a.Sample results of the vertical and horizontal measurements generated by Eleif.net – Measure in Photo Online (*Measure in Photo Online - Eleif.Net*, n.d.) , *b.Sample result angles of the chin generated by Ginifab Online Protractor* (*Online Protractor*, n.d.) , *c.Sample of the Nose calculated manually*

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