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Invisible Formulas: From Structural Knowledge to Procedural Craft in Lahori Kite Design

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ABSTRACT

The traditional fighter kites of Lahore carried secrets of manufacture, which the kite makers guarded zealously from generation to generation. These sophisticated methods are an under-documented, inherited body of craft knowledge. Kite flying has historically been celebrated as a seasonal rooftop festival across Punjab. Yet the structural geometry remained unaddressed in the design literature. This research focused on the structural geometry and proportional methodology followed by the makers of traditional Lahori kites. The study draws on craft ethnography and field observations to analyse the structural and shape design of the Tukkal (meaning lantern) butterfly-shaped (Keller, n.d.), which were used to lift lanterns. The research identifies the typologies of several Lahore's fighter kite variants. This examination of kite designs highlights the native design formulas, including bamboo types, sizes and the mould/frame locally called Farma. The research explores the design methods developed indigenously for Lahori kite-making. The study aims to preserve and transmit the intangible cultural heritage that is visibly declining due to regulations and restrictions on kite flying in Lahore. The research documented and proposed diagrams of structural principles to preserve the endangered design and craft knowledge. It offers fresh insight and minute details for future apprentices into heritage living design practices through vernacular and cultural craft and design legacies of South Asia.



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Introduction

The tradition of kite-making is locally known as *Patang sazi* and is embedded in Lahore's cultural history. Historically, kite flying has been an urban festival marking the arrival of spring. In the province of Punjab, it has been a vibrant social celebration, encompassing many activities besides kite-flying. Kite flying has been popular in the media and historical accounts; however, traditional kite-making practices remained undocumented for design scholars and kite

enthusiasts. The kite flying is the central feature of the Basant festival. This sport has evolved into a fine art, with techniques that were probably introduced to South Asia through China, which may have used it around 300 B.C. as part of military signalling (Minhas, 2006). Early accounts of kite flying mention that in 206 BC, Heuin Tsang flew a kite to overawe Liu Pang's army. Multiple sources suggest that, in 169 BC, the Han dynasty used a kite to measure the distance for the army to build a tunnel under the besieged city wall. Over time, as commodities were shared with other cultures, kites reached the Indian subcontinent. The Ramayana and the Vedas also mentioned kites. Mughal patronage elevated kite flying as a sport among the nobility. When the emperor Jahangir returned to Delhi after his exile in 1812, the residents celebrated his return with kite flying. Maulana Abul Halim Sharar's *The Last Phase of an Oriental Culture* notes that kite flying flourished during the reign of King Shah Alam I in the 18th century. It reveals that *Tukkal*, a kite similar to Chinese lanterns, was a favourite fighting kite in the 18th century, and the word Patang emerged to denote the best type of *Tukkals*. (Kapoor, 2024)



Fig 1: Two Ladies flying kites, 1750 CE, Kullu School of Art, Photo 5 from National Museum of New Delhi, India

<https://www.wisdomlib.org/gallery/new-delhi-museum-paintings/9106>

Kite fighting is practiced in many countries around the globe. The most popular countries for kite fighting are Afghanistan, Bangladesh, India, Nepal, and Pakistan in Central Asia and the subcontinent. There are several varieties of fighter kites, among which *Tukkal* is the most formidable kite in a skilled pilot's hands. *Tukkal* is framed by three roasted bamboo bows and a spine. A much heavier type compared to a single bowed and spine fighter types. The sailing material is paper between 16 and 24 gsm (White, 2017). The *Tukkal* kite-making is very specific to Lahore, as it once sustained traditional folk-art forms of Pakistan. *Tukkal* models were ordered and made in massive quantities for competitions in different decorative patterns created by fine cut papers, like rosettes. This art was passed down through generations. (Karine Boitrelle, 1998)

The research explores native Lahori kite-making as a form of vernacular design system. It has evolved through experimentation with materials, weather conditions, and the requirements of the kite-fighting game. The study reveals the geometry and variables of kite shapes to disseminate the design principles enabling the construction methods used for kite forms. The knowledge

shared by the craftsmen includes techniques for bamboo and paper frames that support the performance of the kites.

The research methodology embodies craft ethnography, visual documentation, and structural analysis. The diagrammatic presentations provided qualitative insights into specific kite specimens, enabling the identification of proportional design schemes. The study translates the craft practice into a visual framework that bridges the gap between traditional craft and design knowledge and contemporary design research. Thus, this research aims to provide cultural heritage, material intelligence and design practice. (Karine Boitrelle, 1998)

The walled city of Lahore is the core area for field observation of kite production. The semi-structured interviews helped gain insight into the kite-making processes, including material selection, frame designs, and paper-cutting techniques. The study involved observation of kite-making processes to document construction techniques and material practices, rather than being briefed verbally or in writing. The critical adjustments are noted during bamboo shaping and frame-making by the artisans making kite constructions.

Literature Review

The kite design is an underrepresented design tradition of Lahore that design scholars rarely study. Most of the literature about kites focuses on historical studies and chronologies of kites' arrival in South Asia. The research paper 'Patang: The Fighter Kite of Punjab, Pakistan, Material, Structure and Making' by Amjad Parvaiz, published in the *Khoj* journal in 2018, provides information regarding material and local terms and surface design names. However, the proportional information for *Tukkal* and the drawing has gaps. This study addresses inaccuracies for design researchers. Due to errors and ambiguous proportional details, the gap in identifying the accurate proportions of the traditional *Tukkal* remains.

The book *Patang aur Tarikh-i-Patang Bazi* by Shuja Uddin Malik provides a detailed overview of families of craftsmen who were involved in manufacturing and designing kites in Lahore (Malik, 2004). It also provides a catalogue of typologies of Lahori kite designs known in the city. Apart from the information regarding the *Ustads* (kite-making masters), it has no details about the formulas and frame-making followed by those expert kite makers. Thus, the literature helps us understand the cultural context and the people involved in this craft industry.

There are renowned YouTube channels such as Kites Korner and SS Kites for sharing kite-making craft information. The Kite Korner YouTube channel provides handy information regarding the making of *Tukkal* Patang and its frame (*farma*); however, it is missing crucial information regarding the *Paindi Chuk* (width of *Paindi*). The SS Kites states a formula for *Paindi Chuk* area dissimilar to that of the Kites Korner making method. The research paper by Amjad Parvaiz, "Patang: The Fighter Kite of Punjab, Pakistan, Material, Structure and Making," published in the national journal *Khoj* (Vol. 80, 2018), provides a few details about *Tukkal*; nonetheless, it lacks the thorough proportional procedures followed for centuries by the native *Ustads* of Lahore. Subsequently, it does not assist the learner to understand the authentic traditional formula for making *Tukkal* as it existed and still is in practice today.

The lack of proper documentation of structural information does not help to learn the design methodology of the traditional *Tukkal* kite making. To address this gap, this research explains the

design method for achieving the accurate shape of the *Tukkal*. The existing literature focuses on the historical context and symbolism of kite traditions in South Asia rather than providing structural knowledge and guidelines for kite design development. The documentation of such craft studies will safeguard the knowledge that exists orally.

Stan Keller gives a detailed overview of Pakistani *Tukkal*. It describes the design details visually with minute features. Some of the diagrams are used with credits. However, Keller hasn't provided proportional documentation through visuals to document the information related to the shape construction of the *Tukkal* kite for beginners and researchers.

Lahori Kite Jargons

There are four major components of the *Tukkal* kite, unlike the Rhombus kite types, called *Gudda*. The top portion of the *Tukkal* consists of a nose called *Nuka* at the top like a spear shape, the second part is the main chest area called *Peta / Dhol*. The Ustads (masters of kite making) advise that the measurements of all the areas of the *Tukkal* be extracted from the *Peta* area for the proportional relationship in the whole construction. This canon has been followed for ages for manufacturing aesthetically and aerodynamically perfect *Tukkals*. The third portion is called *Paindi*, which resembles a boat shape. The fourth last part is called *Jhumka* (tail), which aesthetically balances the whole structure and looks pleasing to the eyes.

Tukkal Kite Details

The kite sticks are tapered towards the edges and end in a sophisticated way so that they look tidy and finished. The spine of the *Tukkal* is round, thicker at the top and thinner at the bottom. The thickness of the spine is divided into three equal sections for bending: the top portion bends 30%, the centre bends 50% and the bottom section bends 20%. (Fawad, 2021) The paper skin side is mounted towards the outer edge to face the wind's thrust. The matte side of the paper faces the wind, and the glossy side is tapered at the back of the kite. The spine appears on the back side, tied on top of the wings and at the bottom of the base, only appearing in front of the spearhead called *Noke/Nukka*. (Keller, n.d.). *Tukkal* has a total of five points around the shape, ten main points for knotting, and six points to be covered from the front side and two from the back side (see figures 2 and 3).



Fig 2. Front view of *Tukkal* Shape Design,

https://www.pakistanikite.com/index.php?route=product/product&product_id=463



Fig 3. Back view of *Tukkal* Shape Design,

https://www.pakistanikite.com/index.php?route=product/product&product_id=463



Fig 4. Front view of *Nuka* (Nose)



Fig 5. Back view of *Nuka* (Nose)



Fig 6. Kaman Joint at edge (Wings tip spot)



Fig 7. Mid joint on Gaz (Spine),

<https://www.kiteplans.org/planos/tukkal/tukkaldetails.htm>

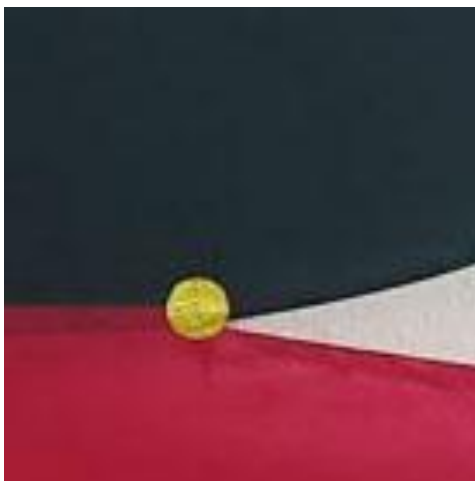


Fig 8. Joint spot at the front covering *Peta* (body) with *Paindi* (base)



Fig 9. Joint spot at the back covering *Peta* (body) with *Paindi* (base)



Fig 10. Paper tassel, Natively Called *Jhumka* / *Dum* (Tail), Skilfully Trimmed in Lines

The construction of *Tukkal* involves a delicate use of materials such as fine split bamboo, paper and adhesives. The technique of assemblage has been developed and refined over generations of craft practice. The structure is the result of something deceptively simple in appearance, yet it involves a precise traditional formula for proportional relationships governing the length, wing span, curvature and frame. Knowledge of the structure has historically been transmitted through workshop practice and training rather than through written documents or design education. This craft of design embodies expertise through experiential experimentation and feedback from kite fighters to kite makers. The Lahori kite construction has rarely been analysed through design principles and proportional analysis.

Tacit Geometry and Indigenous Design Acumen

A sample of traditional *Tukkal* kites was examined and measured. The structural measurements are examined and analysed by collecting information from interviews with kite makers, including Ustad Javaid Bhatti, patron in chief Safe Kite Flying Association (SKFAP), and also an award-winning *Tukkal* maker in 2002, Ustad Muhammad Ali Khokhar president (SKFAP), Ustad Tahir Iqbal from Minto Park Lahore as well as from widespread YouTube channels such

as Kites Korner, SS Kites, MS Kites, SM Kites, and Kite Design & Art. These sources helped discover the proportional relationships that shape the design of the traditional *Tukkal* kite. This collection of measurements helps understand the anatomy of the *Tukkal* structure and the ratios used by kite makers.

There is a rarely shared formula ‘7-8-9’ to calculate the stick sizes for the *Tukkal* patang. The vertical spine (*Gaz*) height is further divided into four sections. The first top section is devoted to the Nose; the following two sections are dedicated to the body; and the last section is allocated to the base of the *Tukkal* Patang. The spine stick is heavier and firmer than the agile sticks of the body (*Peta*) and base (*Paindi*). The body (*Peta*) sticks pair’s combined weight is equal to the base stick. The combined weight of the body and base sticks equals the spine. There is another infrequently known method of calculating the stick size of *Tukkal*. The size of the *Tukkal* in *Githi* (hand span size) is converted into inches to measure the size of the stick of *Paindi* and *Peta*. For example, a four-Githi Patang has a *Gaz* stick size of 28, adding four inches to the *Paindi* stick size and adding eight inches makes the *Peta* stick size.

The formula applies to build any size of Patang. The sizes of Patang are calculated based on the span of this hand span as a measuring unit. The most commercially famous Patang sizes are 3 *Githi*, 4 *Githi*, 4.5 *Githi*, and 5 *Githi*. For a standard 4 *Githi* Patang, professionals often use the 7-8-9 multiplier rule: $7 \times 4 = 28$ Spine (*Gaz*), $8 \times 4 = 32$ Base (*Paindi*), $9 \times 4 = 36$ Body (*Peta*). Typically, the *Gaz* is divided into four sections in height to divide the Patang sections, with two sections allocated for the *Peta/Dhol* and one segment each for *Nuka* (nose) and *Paindi* (Tahir, 2020). Modern *Tukkal* makers nowadays keep the *Nuka* size slightly larger than half the height of *Peta* and use the same size for the height of *Paindi*, as well as for the tying thread of *Paindi* sticks to the *Peta* (Kites, 2021). This proportional adjustment does not change Patang's appearance; however, the *Peta* height is statistically adjusted to be less than the standard division of spine height into four sections. Many *Tukkal* makers have their distinct ways of making and minor differences in sizes. The information mentioned here refers to the masters (*Ustads*) *Javaid Bhatti*, *Saleem Ud Din*, and *Tahir Iqbal*, who are famous for generations of *Tukkal* kite manufacturing in Lahore.

The *Tukkal*-type *Kup* is another form, and the formula changes with the shape and stick sizes. The height of the spine (*Gaz*) of *Kup* is larger than that of Patang. The size of the *Gaz* stick is equal to the stick size of the *Paindi*, also, the *Paindi Chuk* (width from *Gaz* to the *Paindi* joint to *Peta*) is $\frac{3}{4}^{\text{th}}$ of the height of the half *Peta* (see figure 11). These structural findings are translated into a diagram as a proportional model to reveal the underlying design guidelines for constructing *Tukkal* kite types. The *Kup*-making process combines *Gudda* and Patang-making skills. The upper portion of *Kup* resembles Patang, and the lower base stick is shaped into a bow called *kaman*, similar to that used in *Gudda* as wings. There is a slight difference in the lower base stick of *Kup*, which is similar to the shape of the alphabet ‘D’ compared to the shape of the *Kaman* of *Gudda* as ‘C’.

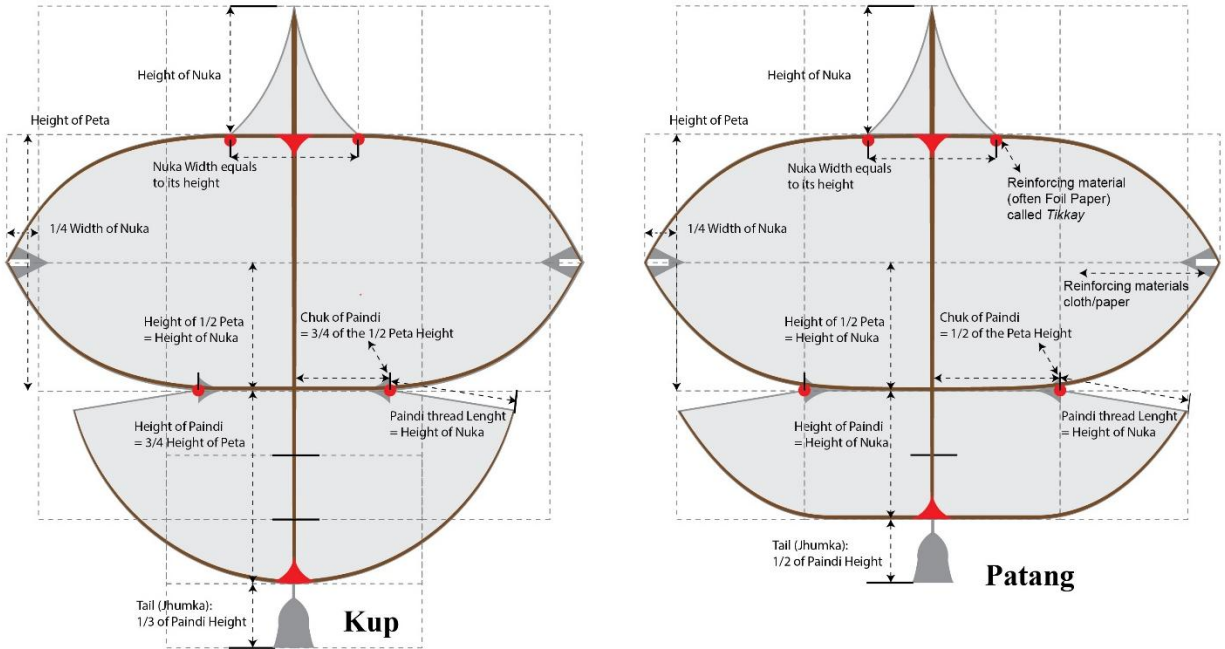
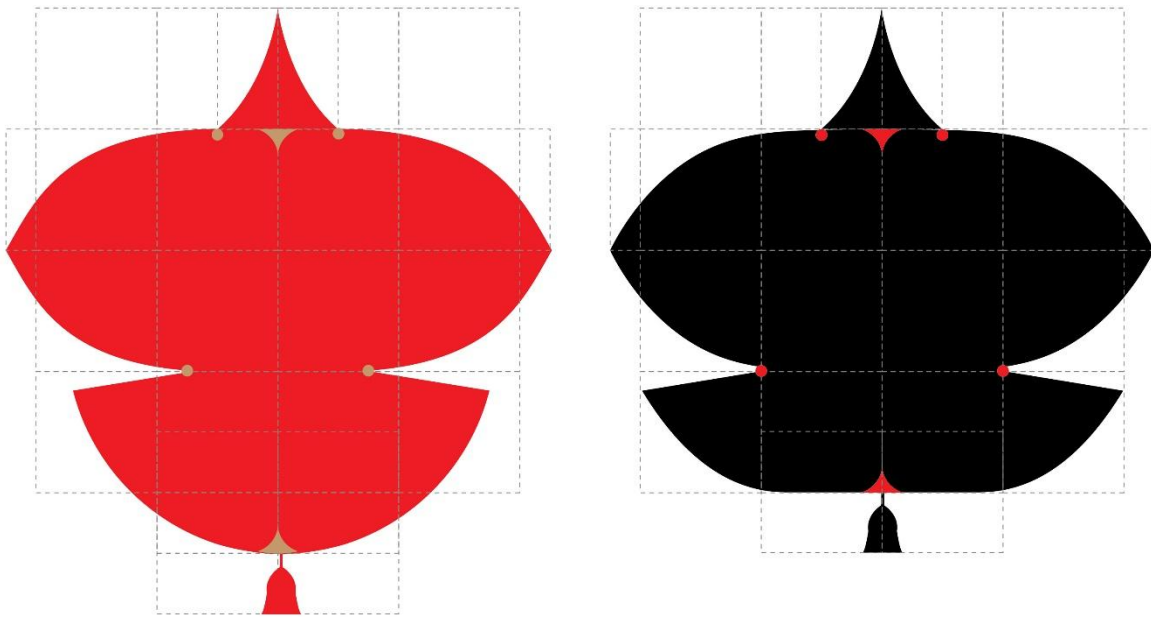


Fig 11 (a). Graphic Details of Modular Design and Proportions of Traditional Pakistani *Tukkal* Types, drawing by the author using Adobe Illustrator, 27 March 2026.



(b). Graphic Details of Modular Design and Proportions of Traditional Pakistani *Tukkal* Types, drawing by the author using Adobe Illustrator, 27 March 2026.



Fig 12. Students Studying Structural Design of *Tukkal* Type *Kup* 1900, Mayo School of Industrial Arts, now National College of Arts (NCA), Lahore. Photograph from the Cover page of Newsletter Vol 03 Issue 10, 19 Nov 2016.



Fig 13. *Tukkal* Shape Assessment: on the left, the spine is divided equally into four divisions vertically as per the traditional school formula, whereas on the right, the nose and *Paindi* are slightly bigger in vertical partitions,

https://www.pakistanikite.com/index.php?route=product/product&product_id=467

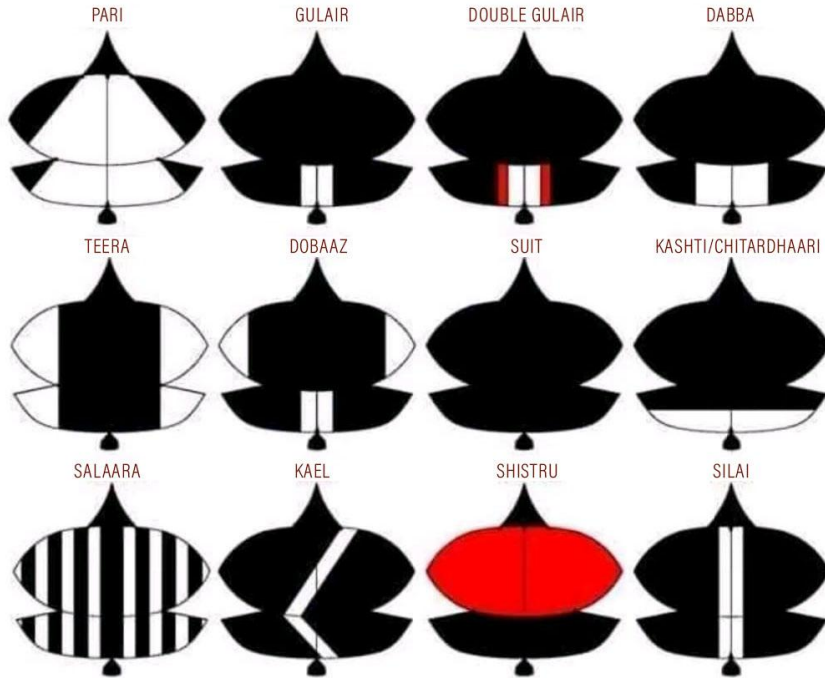


Fig 14. *Tukkal* Lahori Traditional Designs and Names,

<https://www.facebook.com/photo.php?fbid=221085149248601&set=pb.100063503083703.-2207520000&type=3>

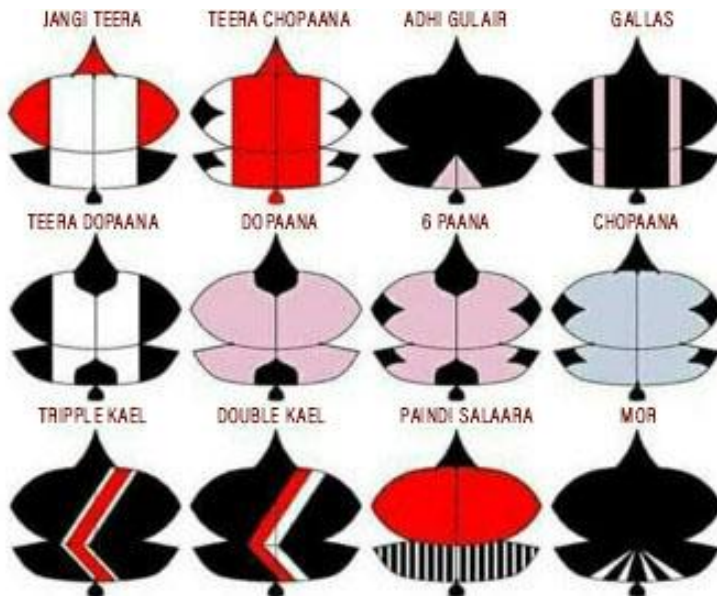
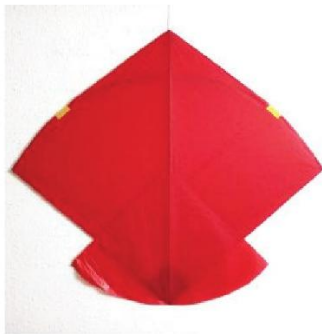


Fig 15. *Tukkal* Lahori Traditional Designs and Names,

<https://www.facebook.com/photo.php?fbid=221085149248601&set=pb.100063503083703.2207520000&type=3>

Lahore's Popular Traditional Kite Classifications

Fighter kite types in Lahore are classified by their use in the region. Although there are claims that many types of kite structures existed in South Asia, the types mentioned are the most famous, and, with size variations, the primary choice of kite flyers (Quotidiana, 2006). One type mentioned here is a unique form, readjusted in length relative to the standard Gudda types, called *Cheel Kat* or *Mendha*, which is rarely discussed in the literature or scholarly references. Based on field observations and research, the most traditionally popular kite forms are *Pari*, *Gudda*, *Cheel Kat*, *Mendha*, *Lakhnow Kut*, *Patang*, and *Kup*. The types of kites present structural variations related to the aerodynamics of kites used in fights. The small-sized kites are highly manoeuvrable yet lightweight during combat. The larger kite is heavier and less manoeuvrable, but it dominates kite combats due to its strong pull and tension on the *Manjha* (glass-coated thread). The *Pari* types of kites are elegant due to the combination of multicoloured paper collage called *Kaat Daar/ Kaat Wala* designs. It is due to their multi-coloured composition that it is not covered with the paper tails called *Paan* used for *Gudda* type kites (see figure 16).



Gudda



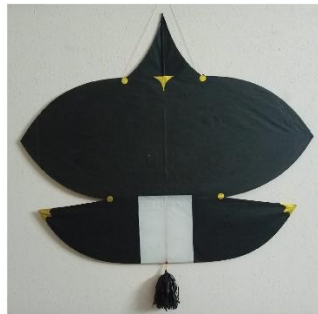
Lakhnow Kat



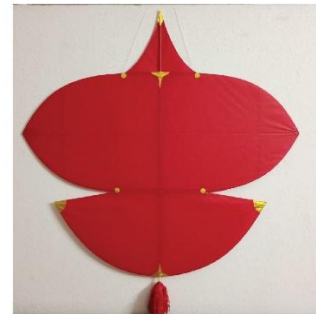
Pari (Type: Kaat Daar)



Cheel Kat / Mendha



Patang



Kup

Fig 16. Famous Traditional fighter kite types of Lahore, <https://www.pakistanikite.com/pk-fighter-m-medium-red-lakhno-kat>

Materials Used in Traditional Lahori Kite Making

The following is the list of basic materials used for kite-making in Lahore

1. Bamboo Types: “Matya” (*Dendrocalamus strictus*) preferred for *Tukkal* making and “Sarancha/Burmese bamboo” (*Bambusa polymorpha*) preferred for *Gudda* making. These types have larger internodes (Bhattacharyya, 2014)
2. Bamboo splitting knife, peeling knife
3. Scissors, Paper cutter
4. Kite Paper (German/Chinese, Glassine Paper): 18 to 25 GSM
5. Leaf Foil Paper
6. Measuring tape (locally known as *Feeta/Inchi* tape)
7. Glue (Levi powder / *Atta Sales*): formulated with wheat, Gond Babool/Keekar/Kikar powder¹, salt, sugar and water
8. Tear-resistant tikken cloth (specially used at *Tukkal* joints)
9. Thread Types: (for bigger kites: Piquing 5-8 fibres, for smaller kites: cotton 2-3fibres)
10. Candle wax and Sea shell/Glass paper weight spherical for smoothing paper joints

Size Classification Gudda/Pari

The rhombus-shaped kites are more cost-effective because they use two bamboo sticks, compared to *Tukkals*. The proportions of stick sizes of rhombus-shaped kites are a 2:3 proportion by using the greatest common divisor. The Gudda kite sizes are based on the paper sheet size (Hussain, 2026). One sheet is called *Taa* by local makers, so one Tawa means made using one sheet of paper. The following diagram illustrates the proportional relationship between kite sizes and sticks (see figure 17). Traditionally, Lahori kite sizes are measured in *Tawa*. These are named *Adha Tawa* (small), *Pona Tawa* (medium), *Tawa* (large), *Dedh Tawa* (extra Large).

Table of Rhombus Kite Sizes Gudda (Paper sheet locally called Taa):

Gudda	Names	Sheet Sizes in Inches
½	Adha	18” x 28”
¾	Pona	20” x 30”
1	Tawa	26” x 30”
1.5	Tawa	30” x 30”
2	Tawa	36” x 36”
2.5	Tawa	40” x 40”

Table of Popular Rhombus Kite Stick Sizes with Frames:

Gudda/Pari	Spine (Gaz)	Bow (Kaman)	Frame Height and Width
¾ Tawa	24	34	24 x 27
1 Tawa	28	42	28 X 32
1.5 Tawa	32	38	32 X 38 (Medha/Cheel Kat: G 32 > 28)
2 Tawa	38	46	38 X 46
2.5 Tawa	45	52	45 X 52

¹ Babool/Keekar/Kikar Gum Powder is a natural water-soluble plant gum made from the dried exudate of the *Acacia nilotica* tree. It is cleaned, dried and finely ground.

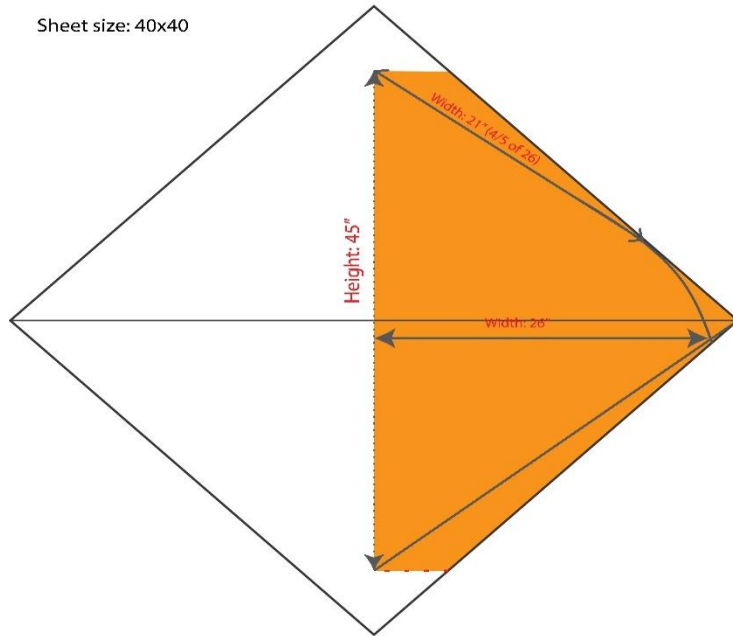


Fig 17. Frame template (*Farma*) for 2 ½ Tawa Gudda folded sheet view, drawing by the author using Adobe Illustrator, 12 March 2026.

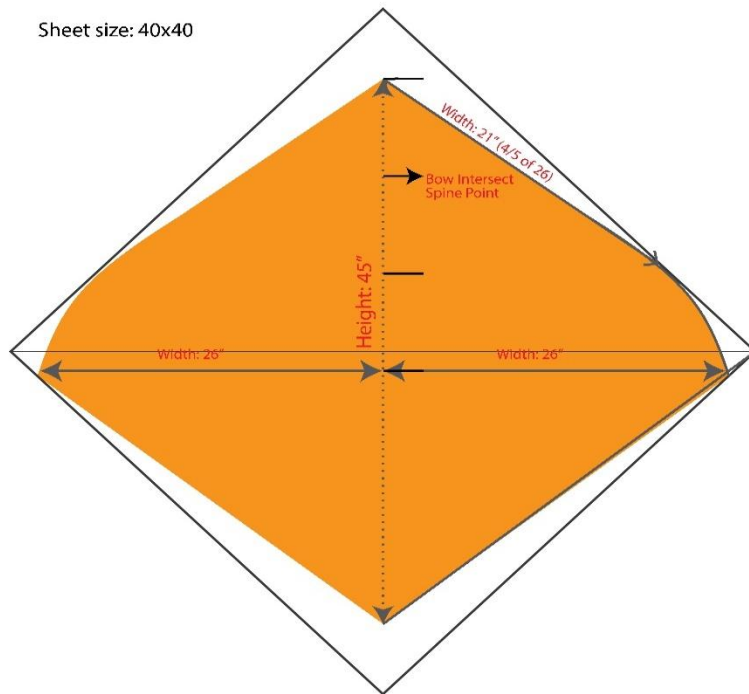


Fig 18. Frame template (*Farma*) for 2.5 Tawa Gudda layout, drawing by the author using Adobe Illustrator, 12 March 2026.

Conclusion

The research is a contribution to preserving the structural knowledge of traditional kite craft and making in Lahore. The focus of the study provides an understanding of proportional systems and design methodology around the construction of *Tukkal* and typologies of kite categories. There are many variations in the kite-making methods, yet this investigation provides a qualitative standard agreed and recommended by the old masters of kite makers in Lahore. Through the documentation of the geometric relationships of proportions, vernacular terminologies and craft techniques, this research paves a foundational vernacular design method that has progressed over generations and experiences.

The primary finding of *Tukkal's* formula is shared as the 7-8-9 traditional formula, besides the measurement system of hand spans (*Gith*) for *Kaman* (bow) and template frames called *farma*. The sizing guideline describes the proportions of the spine (*Gaz*), body (*Peta/Dhol*), and base (*Paindi*) of the *Tukkal* kites. The documentation provides tacit craft knowledge for future researchers and designers to study the structural armature and traditional design shapes of Lahori kites. The documentation translates orally transmitted craft through visual diagrams for designers, historians and future practitioners.

Recently, the example of the Coca-Cola Basant festival campaign 2026 used *Gudda* kite design as a major brand element to capture the attention of the audience. Besides the successful advertisement, the anatomical error in the shape of the Gudda design was obvious. The design of the Gudda has a tail called *Pan* that appears shifted below from its actual position on the ending point onto the actual frame, besides the cross-pollination of traditional kite folk art motifs with truck art adaptation. The same is the case with the *Tukkal* design shape. An expert eye of kite makers and flyers can easily observe these distortions in the design shapes of traditional Lahori kites. (see figure 19-20)



Fig 19. Deformed *Gudda* shape and cross-pollination of kite folk art motives on the Billboard of Coca-Cola X Basant,

https://www.instagram.com/p/DUWiPagiDLK/?img_index=5



Fig 20. Deformed *Tukkal* shape at the gate design by Coca-Cola Basant Festival at Haveli Restaurant, Food Street, https://www.instagram.com/p/DULbJiwDO67/?img_index=5

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