Abstract:
Contemporary design and research into design is a century young field. But design before twentieth century can trace its lineage to art and craft. Even before the birth of constructivism the issues of usability, customization and user experience were part of the domain of art and craft practices. So the re-examination of ancient art will lead us to the traditional knowledge about design. This paper is an effort to bring to the attention of graphic designers an interesting method of preparing grid for dynamic layouts.

Grid is a well known and well studied tool in graphic design, especially in print media and typography. The paper will throw light on two pre-modern concepts, radial grid and oblique grid, from perspective of graphic layout. The phenomenon is observed in ancient Indian art by an artist-art historian, Alice Boner. This is a synchronic study with the review of early medieval texts, analysis of medieval artworks and reflections on contemporary design. The effect of oblique grid on the pattern of viewing the image is validated by experiment conducted with Eye-movement recorder. We will discuss the oblique grid against the well known Cartesian grid.

This new grid will put the challenges for the current digital technology used in graphic design and at the same time will open up the innovative possibilities for the practicing designers.

Key words:
Design tool, Grid, Radial grid, Graphics layout, Art and design

1. Introduction
In historic time grid based or modular design in architecture can be traced back up to Vitruvius in the first century BC or more complicated mandala based planning in case of Indian Hindu temples. [1] In ancient art, Greek wall paintings [2] or Indian temple murals [3] are the effective examples of implementation of grid with great creativity.

The grid is a commonly used term in many fields like architecture, mathematics, engineering and design. The grid we are discussing here is applicable in visual design and can be defined as ‘a system of geometric pattern which guides the designer in creating a visual with better layout’. The grid in graphic design has evidences from early fifteenth century in Europe. This early form of grid was mainly point based which during the renaissance period gained the form of field based Cartesian grid. The modern grid, in its current form
and function, was fully developed by second decade of twentieth century. The last few centuries the meaning of grid has shifted from interface between physical and super-physical worlds to interface between physical world and its perception by the rational cognition. [4] Interestingly in the era of post-modernism when fine art was taking depart from grid for experimentation and flexibility the design started accepting it as a part of philosophy for the sake of industrialization and minimalism.

In the early twentieth century, the philosophical trend which denies ‘art for art sake’ started emerging in the form of constructivism. This concern for usability contributed to the foundation of new design. Around the same time, the first design school- Bauhaus school started in Germany which has a great impact on the modern design. This new design philosophy was inclined towards rationalism and minimalism. Bauhaus, departed from traditional patterns of decoration style, was quite open for experimentation. Soon it got influenced by Theo van Doesberg’s Stijl movement with strong dogma of geometry. This had established the beauty in simple forms with straight lines and right angles removing the all unnecessary curvatures and angularity. Obviously, such design identified the rectangular grid with vertical and horizontal guidelines as a very essential tool and became popular in the group of theoreticians in academia. It was Jan Tschichold, trained as a calligrapher through the craft tradition, who was responsible in popularizing the use of grid in typography. Inspired by him, many graphic designers like Max Bill, Emil Ruder, and Josef Müller-Brockmann started practicing and advocating the rectangular grid. It is the field of typography which exploited this tool the most. [5]

2. Grid in graphic design
European designer Massimo Vignelli mentions the definition of grid given in the NASA standards manual as ‘a predetermined understructure that designer can employ to give the publication cohesive style and character.’ [6] Grid is commonly used in Newspapers and Publication design as an essential tool. Even websites are being designed based on the grid. Most of the design applications use or may use grid for effective planning of visual information.

Many experienced designers talked about the use of grid for efficient designing but still lot of students and even professionals consider it as a boring mechanical tool which constraints the creativity. Books which demonstrate the grid and its use mention the fear of designs becoming dull and lifeless unless used imaginatively. Authors like Alan Swann while accepting the importance of grid mentions the need for freedom from the rigid grid to achieve dynamic and creative effects. People who don’t know how to use the grid ‘creatively’ or where to break the grid to achieve the dynamism may get trapped into the monotonous repetition resulted out of grid of rectangular blocks. [7] So in designer community, it is not rare to experience the dependency on the grid for effective design on one side and the resistance to use it for the sake of creativity on the other.

2.1 Advantages of using grid in graphic design
Grid is an important tool useful in decision making while creating visual layouts. There are many advantages of using the grid in design practice but mainly for visual and managerial decision making.

a) Visual decision making
Controlling the space, as it leads to achieve the balance, structure and unity, is always a main concern in the graphic layout. Grid can be used to create a hierarchy through the careful control of measured space in the form
of modules. [7] Use of grids trains the mind to think in terms of modules. [6] It is much easier to design a layout when there is a little matter to display. But when there is ample of content and variety in the type of content, it is a challenge for the designer. Grid helps in content management by semantic space distribution and creates a sense of compact planning, intelligibility and clarity, and suggests orderliness of design. [8] Grid helps to maintain the consistency of identity both across the time and across the products. [9]

b) Managerial decision making

Design, being interdisciplinary, most of the time is of a collaborative nature. If more than one person working independently which finally has to merge in to a single design then grid provides the platform to merge these parts together. When many people are working on a same project then grid acts as a helping aid in interaction among them which ultimately brings the cohesiveness in the design. As the grid is useful in managing space and content it is obvious that it saves a lot of designer’s time as it reduces the guess work by creating possible nodes for placement in layout. It also reduces the probability of rework. Ultimately this results in improvement of efficiency saving the production cost. [6, 8, 9]

2.2 Changing needs for application of Grid

The concept of grid in contemporary design is almost a century old. The grid is matured over the period of time but did not evolved much in any new dimension rather more or less it is still restricted to typographic applications. The grid in use is limited to create rectangular space distribution which is used to decide the placement of elements and their alignment in vertical and horizontal direction. Hence most of the elements attain a rectangular form and if not they are dominated by other rectangular elements. Grid guides only the arrangement of different elements but the internal structure of element is remain unaffected. The Cartesian grid determines the static positions rather than the flow or the contours along the time. Due to all these reasons the use of grid in modern design many times is limited to the static applications and hardly stretched beyond for the dynamic applications. Now in last few decades, obviously the medium has changed, tools have changed, subject matter has changed and the requirements have changed a lot.

New digital technology has created tremendous virtual space and with it created a lot of challenges to manage it. Surely, the use of grid is in demand for web designing but it is more for the convenience of the fast paced readymade computer graphics than for better design solutions. The two major opportunities created by this new technology are in the field of dynamic media and interactive media. The layouts, where the viewer is allowed to interact and as a response the interface is changing the visual, the semantic distribution of space is no more static. It exerts extra pressure on the grid to change onsite. With the changing scenario of overpowering motion graphics the functions of the grid should be exploited to the level of new dimension. With the new technology, the new needs emerging are: demand for high pace production, continuous thrust for change in content and layout, image heavy information panels, dynamic and free flowing visuals and easy customization.

This indicates the great demand for more fluid, flexible, information heavy, customizable, ever changing but still homogeneous graphic solutions within least possible time. This is the challenge for today’s designer.

Here we will try to go back in the history of Indian art and bring up unconventional possibilities for space distribution which might lead to new explorations in the search of better visual design. Taking the formalists approach, we will concentrate more on the syntactic aspect of the grid. Other symbolic influences on
philosophical or social platform are not considered due to limitation of space. Please note that the mention of “Indian art” in this paper is in the context of the oriental art.

3. Grid in ancient Indian art

The role of geometry in art is nothing new as we can observe in Greek art or Islamic art or in Renaissance art. In Indian art, ritualistic art like Mandalas is highly geometric. The use of Vastupurusha grid for the architectural purposes is given quite an attention with both appreciation and critique. [10,11] It is not at all difficult to find the references of compositional diagrams for painting and sculptures in ancient Indian art.

We may find the references of grid like in a verse from the text Shilparatnakarakosha where it is mentioned that the grid of various lines and the centre point is very much essential to start an image making process. [12] Koshthaka, a rectangular compositional skeleton, is used to divide the space in rectangular modules. These modules are then semantically loaded (refer fig. 1) or just used as a skeleton for placing and aligning the different elements of the layout. There is no need to explain the Koshthaka grid as it is comparable to the Cartesian grid which is well in practice. This paper will focus more on another type of grid which is evident in Indian art- Oblique grid.

![Image of Koshthaka with a Ganesh Murti](image)

3.1 Concept of Radial grid

There is hardly any formal study done on geometrical principles in homogeneous narrative cave temple panels before Alice Boner. The geometrical analysis done by Alice Boner in her book Principles of Composition in Hindu Sculpture [3] suggests that although the panels are rectangular, the primary compositional geometry is based on a single circle. The circle is divided into equal sectors by 6, 8 or 12 diameters. She had divided the panels in two ways one with vertical and horizontal lines which she calls as space division and other is an oblique grid which is called as a time division. Figure 2 demonstrates these two types of grids with a roughly life size panel of Narasinha Avatara from Ellura cave temple dated 8th century. The grid for space division is equivalent to the Cartesian grid. An oblique grid obtained by selecting two or three families of parallel chords, demonstrated by Boner is very much insightful and has a tremendous potential. [13] It is this grid that determines the direction of the movement. The direction of force in the image depends on which two of the diameters are chosen. We can find some suggestions for the mood assigned to type of direction of movement in Knowledge of grid, second chapter of Vastusutra Upanisad (verse 24,25,26). On the fire lines (vertical) upright forms are
produced. On the water lines (horizontal) forms expressing longing are produced and on the wind lines (oblique) energetic forms are produced. [14]

Figure 2: Space(a) and Time(b) divisions for Narasinha Avatara

In the shown example of Narasinha Avatara, a fierce clash between two characters is sculpted out from a single stone wall. Here the radial grid is consists of eight intersecting diameters which divides the circular field in sixteen equal parts. These eight diameters provide the possible directions to align the gestures, postures and orientations of the characters in the panel. The important point to notice here is the radial division is used to fix the orientation of diameters rather than putting it in any random angle. Hence the geometry is maintained through all the sculptures along the space and time. The radial grid is actually a second level grid which helps to create the oblique grid.

In this panel, the contending enemies are approaching towards one another along the converging oblique lines from lower corners of the panel. The selection of two sets of oblique diameters as a guiding grid made the composition dynamic. Also the steeper diameter makes the protagonists dominant over the demon Hiranyakashyapu. (refer fig. 2b)

As demonstrated with this example the movement, force and power can be managed by geometric combinations of overlapping set of grids. Various effects which can be achieved by these combinations are-

1. To achieve static and steady composition the diameters should be selected are vertical and horizontal
2. For static but energetic composition balanced forces can be added along the symmetric diagonal diameters along with the vertical and horizontal one
3. For dynamic and balanced composition oblique but symmetric diameters should be used
4. For dynamic and energetic compositions oblique but unsymmetrical diameters should be used
5. For dynamic and unidirectional compositions the elements should be aligned to the single dominating oblique diameter

Combination of different sets of diameters as primary and secondary guide lines may give large variety of possible compositions. The hierarchy, movement and power of the element can be defined as a function of its position and the direction of its primary diameter. Designers many times mention the breaking of grid to get the dynamic output. This is the grid which gives the dynamic layout without breaking the grid.
3.2 Oblique grid and Mughal miniature paintings

Oblique grid as demonstrated by Alice Boner has taken further by hardly anyone else in Art History. Our ongoing study of Sixteenth century Mughal miniature surprised us with the evidence of the similar structure of oblique grid. Although here the radial divisions are not used to decide the angle of oblique grid, the application of grid to align gestures, postures and orientations is very much similar to that of murals studied by Boner. Additionally the background also follows this grid to add the effect. Gazes, thoughtfully planned by the artist, play an important role in Mughal miniatures [15]. These gazes validate the use of the oblique grid by coinciding their directions. Not all paintings from this genre are found to follow this grid but the few of them certainly do. Seven such miniatures are analyzed for their composition based on oblique grid and the effect of this grid on the image viewing pattern is observed with an eye movement recorder.

Let’s take an example (Refer fig.3) of a war scene for the convenience to connect with the analysis of previous example. Here shown is a miniature from Harivamsha dated to around 1590.

Figure 3(a,b,c): Oblique grid in the Mughal paintings

It illustrates the combat between Krishna and Indra for the heavenly tree called as parijata. In the image, Indra sitting on Airavata is dominated in the battle by Krishna sitting on his mount Garuda. In the previous case, the enemies are rising towards each other and dominating Narasimha is following the chord inclined more towards the vertical. Here two opponents are diagonally descending where dominating Krishna is more forceful as he follows the set of grid more inclined towards vertical. Aggressive stance of Garuda and defensive posture of Airavata is enhancing the effect to indicate the probable outcome of the battle.

3.2.1 Effect of oblique grid on image reading

The experiment with eye movement recorder had produced some interesting results which indicates the effect of the oblique grid on the viewing pattern of the viewer. The experiment recorded eye movement of 22 subjects when they are exposed to these miniature paintings one after another. The narrative of the painting is not told to them before hand and they were seeing these images first time so the scanning of image is more like productive thinking. Since the narrative is not known the syntax plays an important role in experiencing and understanding
the image. Then from the data recorded the fixations and saccades are analyzed for angle of scan paths. After basic analysis the graph is plotted for number of occurrences against consecutive interval of slope.

![Graph showing frequency distribution of saccades versus slope of saccade.](image)

**Figure 4:** Frequency distribution of saccades versus slope of saccade

The graph (Refer fig.4) shows the maximum number of saccades near 0 degrees and +/- 90 degrees means along horizontal and vertical axis. There are secondary crests in the curve at interval of angle +30 to +50 degrees and -50 to -70. It means there are more saccades along the two sets of oblique grid. First one is indicating the grid angle of Indra and second is indicating the grid angle of Krishna.

From the nature of these paintings and the way the oblique grid is exploited to achieve variety of interesting and dynamic layouts, we can comment that there is lot of opportunity as an graphic designer to study and experiment with this kind of grids.

### 4. Application of Radial grid in design

As mention earlier in contemporary design, the Cartesian grid is extensively in use especially for publication design and typographic designs. To achieve a dynamic and homogeneous layout, designers use the technique to break the grid occasionally and no doubt it produces some good results. But that effective breaking of grid without becoming chaotic needs a lot of practice and experience. In this scenario is it possible to take the advantage of the oblique grid for better and faster design solutions?

The radial grid is not much in use mainly because its use is not properly known to the design community. Despite of the potentials it has a primary difficulty as the typographic applications as a torch bearer field for the use of grid has the limitation of direction and linearity due the readability issues of text. It goes well with modular structure of Cartesian grid. Secondly, the dynamic mediums are not used to any grids and last but not least is with the digital technology Cartesian grid is well adopted but technology should separately develop for the use of oblique grid. Day by day static mediums are becoming interactive and all dynamic mediums are overpowering the visual communication. In this high pace virtual world it is worth to give a try to this lost device of ‘time division’.

It’s not like oblique guidelines are never been used in design but they never got the proper attention as a compositional tool. The Olympics signage system in Munich 1972 (fig. 5) designed by Otl Aicher, one of the founder of Ulm school of design, is an affective example of use of diagonal guidelines for dynamic, balanced and homogeneous pictorial system. This is nothing but a simplified case of radial grid where diagonal axes at 45 degrees are used to create dynamic sporty effect. Figure 6 illustrates an example of typographic layout for a
poster designed along oblique grid by Karl Gerstner. The oblique grid in design (refer fig. 7) is considered as deconstruction rather than a different form of grid. [5] In comparison to the examples in Indian art, the use of oblique grid in design has not reached to that level complexity. In her book, Kimberly Elam does talk about the oblique grid and considers it as the complex activity. [16]

Figure 5: Simplified radial grid in Munich Olympics (1972) signage system

Figure 6: Poster for a News Paper- National Zeitung, 1960

Figure 7: AIGA poster (1987) categorized under ‘breaking of grid’ by Samara (2005)

As a layout tool both the grids have their advantages and disadvantages. Cartesian grid is more rigid and hence can be used for steady and static layouts. It helps in positioning the data according to the hierarchy. It is useful for the arrangement of the data units in the heterogeneous system. Oblique grid gives more freedom to achieve fluid and dynamic layouts. It readily allows the interaction within the different elements of the visual. It is more useful to create flow or force in the homogeneous systems. The combination of these two grids gives control to the designer to create interesting layouts.

5. Challenge for the technology

Digital technology is a boon for the designers. It has made the design process faster and flexible. In very short time the designer can try out for various options before the actual production or publication. She can easily shuffle the elements within the layout to judge for the best option. There are vertical and horizontal guidelines readily available in all CG applications. There are alignment and snapping tools which helps in arrangement of
elements with proper discipline. Even there are distribution tools helping to distribute the elements within the layout space with equal spacing.

In most of the page layout software, there is provision to create your own Cartesian grid. You have the freedom to do it manually or the software can do it for you if the parameters are set. But you can create the grid only with vertical and horizontal guidelines. The technology develops according to the need and demand. As radial grid was not in practice there was no development in that direction. Digital applications are more comfortable with Cartesian system than polar systems.

For the use of oblique grid, more control need be given to the designer while creating grid. Many parameters are required to define like number of radial divisions, angle of primary diameter and secondary diameter, number of parallel chords etc. Unless the technology will adapt and geared itself for this new layout technique it will not come in practice for industrial design.

6. Conclusions
The detail discussion on the importance of grid certainly allows us to conclude that the grid is very essential tool in graphic design for faster designing and effective design. It is the best helping aid to deliver the information through visual medium.

Although the settings, medium, requirements and philosophy of ancient art are different than that of modern design, it is worth to look into the process and methodology behind it for the usability and aesthetics. The historical narrative panels full of interesting dynamic compositions demonstrate the effective way of using grid. It clears all doubt of grid being restrictive or monotonous. It gives a lot of inspiration and a new technique to formulate the grid to achieve the dynamic layouts.

Oblique grid, a lost technique of layout design, seems to have the great potential to create free flowing, energetic graphic compositions. It will need the enthusiasm from the designers and a hand from technology to explore this lost tool. In the emerging scenario of complex, information heavy, homogeneous, dynamic graphic representation this oblique grid may create magic!

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8. Illustration credits
Figure 1: From Boner A., Sarma S., Baumer B. (2000) Vastusutra Upanishad, pp 99-100.
Figure 2: From Boner A. (1962) Principles of composition in Hindu sculpture, Plate IIIa, IIIb.
Figure 7: From Samara, T. (2005) Making and breaking the grid- A graphic design layout workshop, pp 136.
9. References


