Grids as important elements for Good Design

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1. Abstract.

These papers mention grids as basic elements in teaching design for designer for many reasons :

- Separation of concerns leading to independence.
- Reuse of Independent units
- Efficiency in combining pre-existing units .
- Visual consistency through constraints.

As it has been criticized for placing the designer at the heart of solution , gives meanings for

grids through first five hundred years and then through next hundred years . these papers also will concentrate on proportion , geometry and different ways to use them for making best grids in Design .

Then shows the proposal solutions of Grids for different spaces as the following :

- Grids in layout Design .
- Subdivided and superimposed Grids .
- Rectangular grids .
- Interface grids .
- Several related grids .

After that it will show the relations that are established by grids , the applications of grids in Interior design works and the benefits of using them in different spaces , it shows good example of using grids in Design .

At the end , there is the conclusion of main points of the research that serve design and help in teaching best ways for making good forms with good function in Design using Grids , it talk about Grid as a bit like magic that help designer decide where to put things .

grids – Interface conditions of grids – several related grids

الملخص :

يتناول هذا البحث الشبكات كعناصر أساسية في تعليم التصميم للمصممين لأسباب عديدة:

- فصل الشواغل المؤدية إلى الاستقلال فى الفكر التصميمى .
- إعادة استخدام الوحدات التصميمية المستقلة.
- الكفاءة في الجمع بين الوحدات التصميميةالموجودة مسبقا.
- الاتساق البصري من خلال الألتزام بمقاسات تصميمة محددة .

كما تم انتقاد لوضع المصمم في قلب الحل، ويعطي المعاني للشبكـــات من خلال أول خمسمائة سنة ثم من خلال مائة سنة المقبلة. هذا البحث أيضا سوف يركز على النسبـــة والأشكال الهندسيــة وطرق مختلفة لاستخدامها لصنع أفضل الشبكات في التصميم.

ثم يظهر الحلول المقترحة من شبكات لمساحات مختلفة على النحو التالي:

• شبكات في تخطيط التصميم.

• أعادة أستخدام وحدات مستقلة للشبكية .

• شبكات مستطيلة.

• شبكات الواجهة.

• العديد من الشبكات ذات الصلة.

بعد ذلك سوف تظهر العلاقات التي يتم إنشاؤها بواسطة الشبكات، وتطبيقات الشبكـات في أعمال التصميم الداخلي وفوائد استخدامها في مساحـــــات مختلفة، فإنه يدل على مثال جيد لاستخدام الشبكات في التصميم.

في النهاية، هناك استنتاج من النقاط الرئيسيـة للبحث التي تخدم التصميم والمسـاعدة في تدريس أفضل الطرق لصنع أشكال جيدة مع وظيفة جيدة في تصميم باستخدام شبكـات، فإنه يتحدث عن الشبكة قليلا مثل السحر الذي يساعد مصمم أن يقرر بدقة أين يضع بالضبط أشكاله وتكويناته .

2. Introduction.

grid is used to organize space and information for the designer , In addition, a grid is a holding pen for information and a way to ordain and maintain order.

Although grids have been used for centuries, many graphic designers associate grids with the Swiss. The rage for order in the 1940s led to a very systematic way of visualizing information . Decades later, grids were considered   monotonous and boring— the sign of a "designersaur."

It is one of the easiest way to achieve and organize design , to apply grid system ,it is tired and tested technique that first found favor in print project.

It consider   Low –tech and cheap , in these papers we will concentrate on grids as good guide for designer and consider top tool in the designer office , grids in interactive design can

Also help provide a consistent experience across multiple device sizes , users are happy when see familiar features laid out as they would expect to find them .

A grid system helps align interior design elements on sequenced and in consistent way through out the design , every element of design has its place , and we can see it instantly and reproduce else where , first it was used by graphic designer to arrange hand writing on paper and then it spread and used in design to organize plans and layouts.

Villard De Horrecourt in 13 th century , French artist , merged the grid system with the golden ratio , so it cause big progress in design field , in our digital world , the grid system acts to organize the   elements of design   in projects , as it provides a guide   for designers to create multiple choices that support responsive themes for different sizes.

Today , grids   are   again   viewed   as essential tools, relied   upon   by professionals who are both new to the practice and seasoned by decades of experience.

Each grid illustrated by a project designed and published (in old or new media) in the last few years make design more organized .

The whole business of grids is so important for designer , most of Interior designers love these , but we `re scared of revealing any nerdy or worse still , despotic tendencies so we jump nervously from foot to foot , simultaneously belittling and venerating the grid , we `ve got to appear to be casual about it , The problem is partly one of association . A grid is generally a series of straight vertical and horizontal lines , so if you `re interested in grids are you ( straight ) in other ways too ? ultimately , it `s not the notion of the grid that is important , it`s the hand that constructs , the brain that computes , and the precacious eyes that exploits these invisible structures .

first it was used by graphics to arrange their handwriting on papers and then spread and used in design to organize plans, layouts, Villard De Honnecourt in 13 th century , French artist ,merged the grid system with the golden ratio so ,it comes big progress in design field In our digital world the grid system acts to organize the elements of design in the project , as it provides a guide for designers to create multiple choices that support responsive themes for different sizes .

The Interior designe grid is a bit like magic (now you see it , now you don`t) , Sets of intersecting lines that help designer decide where to put things , but that generally no one else sees , The benefits of using grids are multifarious , ranging from the psychological to the functional , and of course , the aesthetic . The grid

embodies all The contradictions that designers struggle with . This is the designer`s very own enigma code that can elevate design discourse to that of a science

and eradicate the creative block by (Virtually) filling the bank page . The history of the grid was about from fourteenth century , so we must study it more interest and the grid system because grids consider one of the easiest way to achieve organized designs ,first

We found favor in print project ,low –tech and cheap , in these papers we will concentrate on grids as good guide for designer and consider top tool in the designer office .

Grids in interactive design can also help in providing a consistent experience across multiple device with different screen sizes , users are happy when they see familiar features laid out as they would expect to find them .

A grid system helps align interior design elements on sequenced ,and in consistent way throughout the design , every element of design has its place ,and we can see it instantly and reproduce elsewhere and consider easy way to create and practically free , also give us the ability to layout the design more organized and in precise manner , by enabling us to insert interior elements in boxes created by their intersecting lines, grids that enable us to make

a consistent user experience across multiple device , for example the dimensions and layouts of our computer and smart phone screens differ , planning our work so that it can adjust to appear on different plat forms keeps our designs in proportion and in the places where our user expects to find them .

Designer use columns and rows ,shaped according to set column wide than row height proportions   (such 3:2 or 4:3), and gutters   (the spaces between these boxes)   to presents elements for our designs in the best way .

3 .The research problem .

Sometimes design be not organized and not flexible enough , also designer feel that design is so complex for him and doesn't know where is the start point to do his design , he can break up a large   amount   of space into smaller units that   later get combined in flexible ways by using grids , when we don`t use grid the design seems to be clearly separate from other units and more independent .

We can summarize the important reasons in using Grids in design .
• Separation of concerns leading to independence
• Reuse of independent units
• Efficiency in combining pre-existing units
• Visual consistency through constraints
• Grids create areas where we place elements and areas   that are left as space, With grids we aren't literally reusing the space. We're reusing the characteristics

of a division of space.The gutters and flow   lines in a grid   separate the information   placed in   one module from the information   placed in another. Through some elements are grouped   together   connecting them ,

while other   groups are clearly separate and independent from the first. The structure of a grid allows us to separate and connect information so it can be more easily digested.

• Without   grids we   are   literally difficult reusing   the   space. And can`t reusing   the   characteristics of   a division of   space. We   also   suffer   from reusing the characteristics of various combinations of these   divisions of space without Grids . You might then decide by using   grids to   combine 2 modules horizontally to create a 100 px   wide column. You'd   reuse that with another 100px column right next to it and another next to it to create.

• A grid not only makes it more   efficient for us to design the space ,   it makes it more efficient for viewers to absorb   what we place in the space. It   enables easier scanning. It creates predictable at terms   for   where   to   look   for information and even better specific types of information.   A grid enables us to present complex information through a clarity of organization .

• Even when the structure of a grid is invisible, it's structure is still felt and perceived by the viewer. It directs people where to look and it holds elements in familiar locations.Grids aren't arbitrarily designed. There's a behind them. The size of a module, a field, a column are based on a set of consistent guidelines. Grids impose a consistency in how we use space.

4. Aim of research.

▪ These papers will concentrate on Grid in design as basic element before design , although grid considers one of the oldest architectural design tools, this study will concentrate on grids to be wide uses for many numbers of designers as useful device for controlling the position of building elements .

▪ Focus on grids to be use in all manners of layout tasks for urban design .

▪ Study grids in deep studying to be used flexibly to achieve any numbers of strange shapes in layout – plans- sections and elevations .

▪ Certainly can benefit from this as it can use as graph proto types in Interior design tasks as grid relations could be expressed as al design expressions in geometric shapes according to constant modules .

5. Research methodology.

▪ This study is based on two main approaches the first approach is , **a theoretical a spect** ,which concentrate on the meaning of grids ,its important for designer , its meaning in design in the first five hundred years and in the next hundred years.

▪ The importance of grids in design by mention general ways with its

regular sequence which used to make grids.

▪ Grids as tool for design which include grids in layout design , plans ,these will include types of grids used in design as subdivided and superimposed grids, Rectangular grids ,Interface grids ,Several related grids ,grids between elements and Tertian grid.

▪ **The Second is practical aspect** ,this concentrate on the different elementary uses of grids in layout designs ,and the application of grids in different forms of design

6. keywords

Grids and flexibility – grids as tools for design – subdivided and superimposed grids – rectangular grids – several related grids –proportion and Geometry in grids .

7. The first five hundred years .

Philosophers and linguists have argued that nothing exist in our consciousness unless it is named and we have a language with which to discuss it , Neither (Interior design) nor (grids) were talked about until the mid-twentieth century , one name , complex grid structures comprising multiple columns , fields , baseline grids , and so on poured forth as never before , but it`s not true to say that designers or their predecessors – commercial artists , printers , and scribes hadn`t been thinking about content , proportion , space , and form before this .

Even prior to typesetting and printing there were texts available to read , these were religious texts laid out scribes in calligraphy . the pages were surprisingly modern , often using more than one column , with lettering that was ranged left

, and color and variations in letter size used for emphasis but over time one major difference was introduced –justified setting , in this , spaces between words in continuous texts are adjusted in each line so that columns align on both left and right sides. Although manuscript pages were symmetrical when viewed, as spreads, the ranged – left lettering made them essentially asymmetric, with justified setting came 450 years of symmetry , and it wasn`t until the twentieth century that this convention was truly challenged .

7.1 The Next Hundred years .

The industrial Revolution marked the beginning of a capital – based economy , will mass production at its heart .Graphic design was born ,although still not named as such . Its job was to communicate diverse message to an increasingly literate people . the rise in print output was phenomenal – posters , leaf lets , and advertising of all

kinds , newspapers ,time tables , and all manner of information – based design , suddenly design competed for attention . Images , initially in the form of engravings and then a photographs , had to be in corporated along with an ever expanding array of

display typefaces , highly skilled and educated printers stayed firmly in the land of the book , while jobbing printers and compositors struggled to lay out this diverse material for which the classical book was n`t useful precedent .

Toward the end of the nineteenth century , artists and thinkers identified this as a problem that had to be solved ,although the work produced by William Morris and the Arts and Grafts movement may appear very different from that of modernism , Arts and Grafts was its forerunner in one important respect , Morris believed that form and function were invariably inextricably entwined ,Running almost concurrently

with these Ideas were the volutionary cubist experimets of Picasso and Braque , who were exploring how to represent 3-D forms on 2-D Planes , producing increasingly abstract result.

Artists , and then designers , were influenced by this work , and re -evaluated composition as a result , the early twentieth – century art movements – futurism Dadaism , surrealism , constructivism , supremacist , and expressionism also had an influence on the development of the grid . Artists were united in represent a new , for the first time , space was used as dynamic Component in typographic layout . The ethos that underpins this work was the antitheis of the rational and logical approach implicit in the grid . But in drawing such resolute line under the past , it opened the door to de Stjl , the Bauhaus , and typographers like Herbert Bayer and Jan Tschichold who called for some order to be imposed on what seemed like fractured chaos .
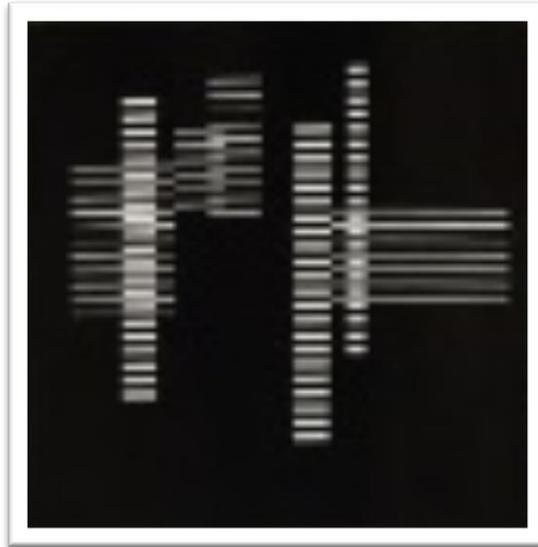
Figure 1: Tschichold explains the parallels between abstract art and typographic layout parallels

8. The research.
What`s a Grid ?

A grid subdivide a page vertically   and   horizontally into   margins,   columns , inter – column , spaces , lines of type ,and   spaces between blocks   of type and images. These subdivisious from   the basis of a modular and systematic approach to the   layout , particularly   for multipage documents,   making the design   process quicker , and ensuring visual consistency   between related pages .

At its most basic ,   the size of a grid `s component are determined by easy of reading   and   handling ,   from the   size of type to the   overall   page   sheet   size , decision making is derived from   physiology   and   the psychology of   perception as   much as   by aesthetics , Type size is generally determined by hierarchy –   captions smaller than body text and so on column   width   by optimum word counts of eight to ten   words to the line   , and overall   layout by the need to   group related   items , this   all sounds   rather formulaic ,   and easy ,   but   designer   whose grids produce dynamic   or very subtle   results take these rules   as a starting   point only , developing   flexible structures in which   their sensibility can flourish .

8 .1 Proportion and Geometry.

From   the   beginnings   of printing   (from the mid - fifteenth century)   until the Industrial   Revolution (late eighteenth century),   the   book   was   the   primary output of printing , apart was generally set   in   one justified   column   per page , placed symmetrically on the spread with larger outer margins than inner   and   larger margin   at the foot than at the head , but just as each decision made in minimal art is hugely significant , so too were   the relative relationships of   these few elements on the   page , the proportions of these pages and   margins   were determined by geometry , concerned with the   relation of points , lines , surfaces , and solids to   one another rather than their measurement .

There are many geometrical constructions than can produce a beautiful page , but the golden section is usually cited as the most successful . As it is geometrically derived form , it can be drawn with a setsquare and a compass , no measuring required ,for those who do like to know measurements, the relationship of short to long side of a golden rectangle is 1:1:618 ,many contemporary designers find this apparently irregular ratio unsettlingly chaotic , but others feel that core has almost magical properties ,by adding the length of the long and short edges it is possible to arrive at the next measurement in the sequence to give a bigger rectangle of the same proportions , this also work in reverse in order to make a smaller rectangle , adding two numbers to find the next in a series is also the basis of the number progression of the Fibonacci sequence , named after the thirteenth – century , Italian mathematician who first identified it in many natural forms ,from the arrangements of petals to

the spirals of seashells , a combination of golden section and Fibonacci sequence (1,2,3,5,8,13) was often used to determine the overall proportion of the page and margins of the classical book .

The Grid and Swiss Typography 8.2

Early modernists had explored layout , space , and scale. They had talked of the democratizing benefits of mass production , and had used the language of science as much as art. They had argued for consistency and minimalism as a mark of design confidence and greater accessibility . During WWII, and in the decades that followed, these ideas coalesced into a coherent design manifest to with a new design device at its core —the grid.

The grid and Swiss typography are synonymous. Switzerland was neutral during the war . Not only did it attract many intellectual refugees, including designers like Jan Tschichold, but also most peacetime activities continued as normal, and supplies of such things as ink and paper weren't rationed. Added to this, publications had to be set in its three official languages—French , German, and Italian— which called for a modular approach , using multiple column structures.

Several Swiss artist / designers, most notably Max Bill and Richard Paul Lohse , explored systematic forms in their paintings concurrently with graphic design, while the graphic designers Emil Ruder and Josef Müller- Brockmann both wrote educative texts explaining what grids were and how to use them . They approached the subject with great rigor, arguing passionately that "integral design" required structures that would unite all the elements in both 2-D and 3-D design: type, pictures, diagrams, and space itself. Despite their enthusiasm for order and precision, they both understood the value of artistic intuition.

"No system of ratios, however ingenious, can relieve the typographer of deciding how one should be related to another… He must spare no effort to tutor his feeling for proportion… He must know intuitively when the tension between several things is so great that harmony is endangered. But he must also know how to avoid relationships lacking in tension since these lead to monotony."

8.3 The importance of the movement to the grid in Design .

In 1917 Dutch architect, designer, and painter Theo van Doesburg founded de Stijl the importance of this movement to the grid is that it explored form as determined by function, and placed this in a political context. Arguing that simplicity of form was accessible and democratic , its members advocated minimalism, using only rectilinear forms, and dictating surface decoration other than as a byproduct of a limited color palette: the primaries plus black and white. The typographers affiliated to de Stijl wanted to apply these ideas in the real world, not just for their artistic cause. Designers like Piet Zwart and Paul Schuitema used these principles to produce commercial advertising and publicity materials.

The Bauhaus opened its doors in Weimar, Germany, in 1919, with the architect alter Gropius as its Director . His belief that architecture, graphic art, industrial design ,painting, sculpture, and so on were all interrelated had a profound impact on the development of typography and graphic design long after the school was forced to close by the Nazis in the 1930s. Within an astonishingly short period of time, graphic artists were marrying analytical skills with abstract form to arrive at mass-produced designs determined as much by political idealism as by a desire for self-expression . In 1925, Herbert Bayer was appointed to run the new printing and advertising work - shop He paid attention to typographic detail , experimenting with a limited typographic palette in order to achieve greater visual clarity and easily navigable pages.

During the late 1920s and the 1930s , typographer Jan Tschichold set out his typographic principles in two seminal books: *The New Typography* (1928), and *Asymmetric* Typography (1935) . Tschichold's work was more refined than much of that which had preceded it . He wrote of typographic consistency as a necessary precursor to understanding, described designers as akin to engineers, and argued compellingly for asymmetry as a central tenet of modernism . It was the logical way to lay out text that is read from left to right, and produced "natural" rather than "formalist" solutions to the new design challenges than classicism, with its enforced central axis. In his work Tschichold explored subtle horizontal and vertical alignments, and used a limited range of fonts, type sizes, and type weights.
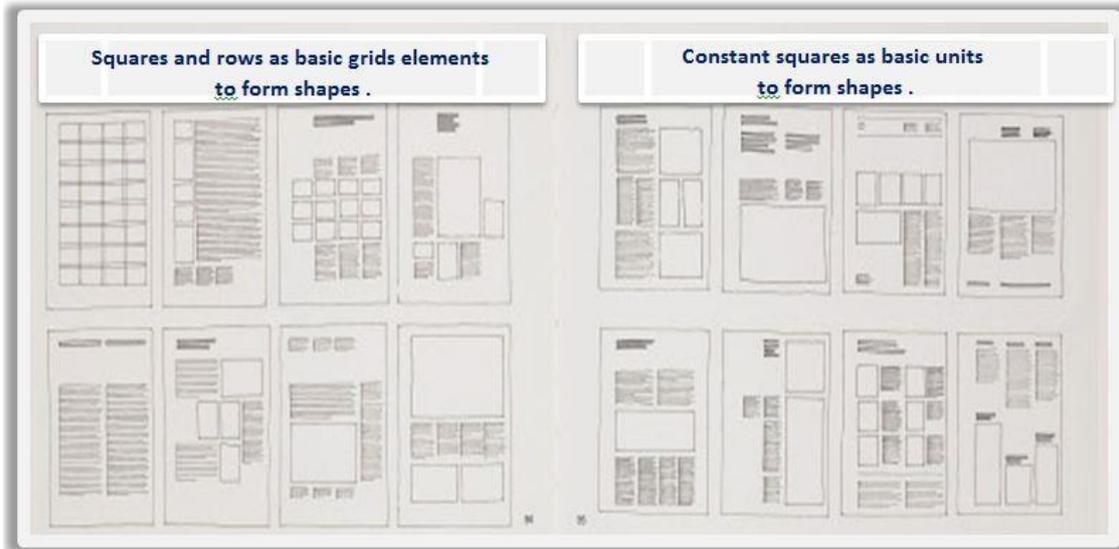
Figure 2: the best-known exponents of the grid .

everal post - War Swiss designers are the best - known exponents of the grid. This spread is from Josef Müller -Brockmann's *Grid Systems in Graphic Design*, in which he explains, in meticulous detail , how multicolumn and field - based grids can be used flexibly to achieve any number of different layouts, in both 2-D and 3-D work.
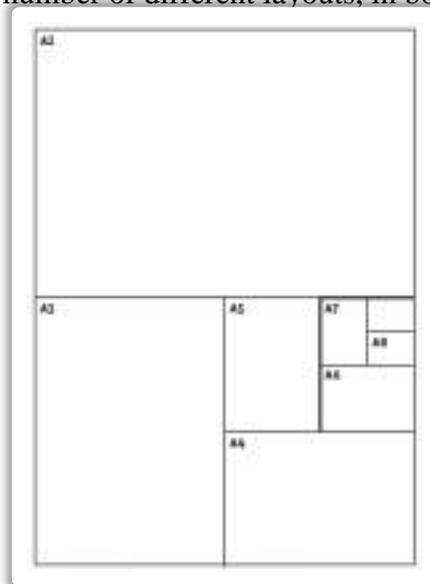
Figure 3: Countless ways to subdivide the sheet size at more unusual formats.

The grid and the design philosophy of which it is a part have been criticized for placing the narcissistic designer at the heart of the solution, and generating formulaic solutions that are mechanistic, unyielding , and rigid . But for Ruder, Müller- Brockmann, and many other designers since, the grid was the natural response to a design problem . It was also a metaphor for the human condition, and was found in all areas of human endeavor.

"Just as in nature, systems of order govern the growth and structure of animate and inanimate matter , so human activity itself has, since the earliest times, been distinguished by the quest for order. The desire to bring order to the bewildering confusion of appearances reflects a deep human need."
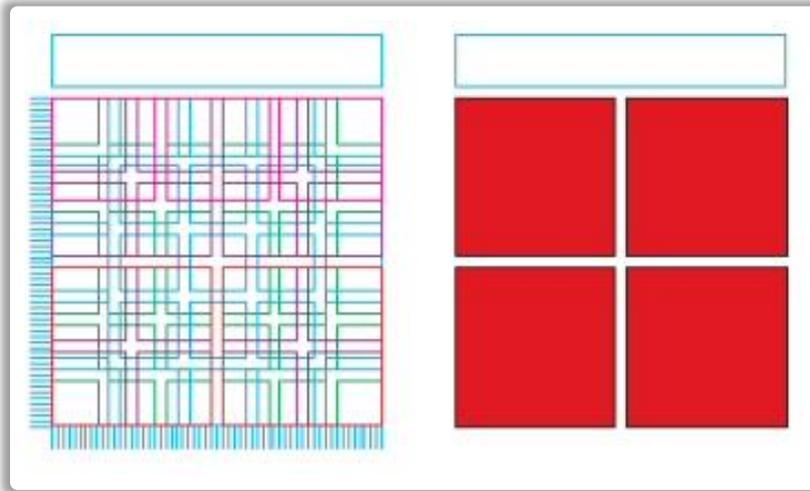
Figure 4: Jose Müller-Brockmann, *Grid Systems in Graphic* Design.

9. The research proposal solutions.
9.1 Grids as Tools for Design.

The grid , one of the oldest architectural design tools, is a useful device for controlling the position of building elements. Grids have been and continue to be used in all manner of layout tasks from urban design to building construction . A grid can help designer control the positions of built and space elements, making the layout task more Systematic. By determining positions of different building elements in relation to a grid or to a set of grids, the designer can specify design rules that describe a typology of physical forms. Many interesting architectural 'form families' can be described this way. The grid based coordination of layout design can also support a team of designers where each designer

is responsible for deploying a different subsystem. In laying out plans for new towns and cities, the use of grids permits the designers at the urban scale to make decisions, yet allow relative freedom at the block and lot scale for individual developers and house designers.

Most Computer-Assisted Drafting (CAD) programs offer a simple grid capability, where a designer can overlay a grid on a drawing, and can snap points and other graphic elements to the grid. Unfortunately most CAD programs fail to take full advantage of the grid as a design tool. Often the designer is limited to square grids and grid gravity is either "on" or "off" for all elements.

We have developed the Cod raw Grid Manager to explore how a drawing program might better support the use of grids in layout design. Inco Draw, grids are first class graphics objects and as many of them may be used in a design as needed. Grid parameters include two sequence variables that pacify the grid's horizontal and vertical spacing units. A grid may be limited in extent, or it may fill the design work area. Grids may be selected and moved about the work area, and they may be grouped into aggregate grid configurations.

The concept of *element class* is essential for the applications of grids discussed here. The Co Draw program uses an object-oriented scheme to organize its database of elements. Every element belongs to a class which defines its generic properties, for example shape, color, and material. Class definitions are structured in a hierarchy, each level providing more specific.

Definition for levels below. This scheme can be used in various ways. For example, the designer could define classes by color, e.g. "blue things, "red things. " Another , perhaps more useful, application defines each building subsystem(concrete foundation, structural steel, partitionwalls) as a class, and within each class defines different component types as ubclasses. Then we can express generic placement rules for each class and subclass. For example, structural steel elements may be programmed to limit placement to relate to a certain grid, with different particular relations for I-beams, angle-iron, and C-section steel. Using this organization of element classes, CoDraw can be programmed to enforce design rules expressed in terms of grid relations.

We begin with examples of how grids can be used to express layout rules for architectural design. Then we introduce the CoDraw Grid Manager, and describes how this program supports the use of grids to express layout rules. Finally we discuss

this approach to programming layout rules in a CAD program, comparing it with other representations for rules about shape and form in architectural design.
Unlike shape grammars, for example, this approach is not generative. The drawing environment can be programmed with layout rules; within these rules the designer works freely. The rules are programmed interactively; should they prove too limiting the designer canchange them.

9.1.1 Grids in Layout Design.

To understand the CAD support we want, let's look at how grids can be used as a layout tool. Three main concepts will emerge: (1) a variety of kinds of grids are used , from the simple square grid, to rectangular and tartan grids. (2) grids can be grouped and used together, and (3) rules about element placement can be expressed in relation to a grid or grids.
In layout design a grid is most often used as an underlay to a drawing, to organize the positions of elements. The grid-size is chosen carefully.
It is usually related to the dimensions of the spaces to be laid out or the components to be placed. For example, in laying out wood framing members in a stick-built dwelling, a 16" or 24" grid is useful because in that system 16" or 24" is the on- center spacing between studs and joists, and other components in the construction system are compatibly sized.

9.1.2 Layout rules govern placement on a grid.

Figure 5. Different element -grid relations To use a grid as a design tool, the architect must determine rules for placing elements relative to the grid. The simplest and most obvious placement rule is that elements center on grid crossings. However , other rules can be formulated: elements center only on one of their dimensions ; elements center in grid squares; or their edges align with grid lines. For example, figure 5 shows different position relations for elements on a simple square grid.

Figure 6. Various relations between an element class and a grid.

Figure 6 shows what happens when different grid positions are assigned to different types or classes of elements. In this example, wall centerlines run along grid lines; concreten columns are offset on grid crossings, and space boundaries (shown in gray) fall along grid lines.
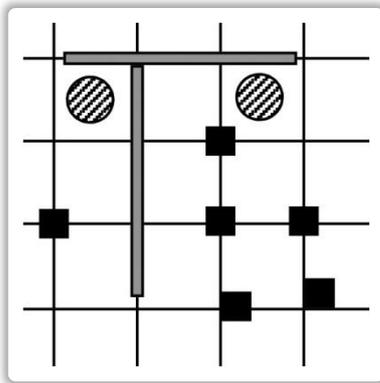
Figure 5: Different element –grid relations.
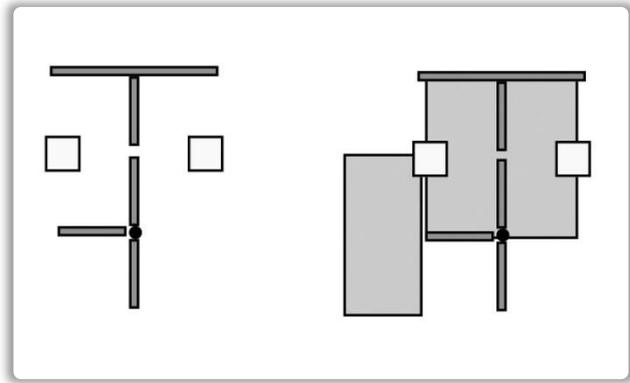
Figure 6: Various relations between element class and grid .

9.1.3 Subdivided and superimposed grids

Often it is useful to work with one grid at a large scale, and a subdivision of that grid at a smaller scale. The two grids are superimposed and registered (figure 4). For example, in the 2x4 stick building system, in addition to the 16" grid,a larger 48" (4') grid is useful for positioning larger elements such as gypsum board and plywood panels. A smaller 4" grid can also be used to place light switches, electric outlets, and other hardware.

**Figure 7: Grids can be subdivided and superimposed .**

9.1.4 Rectangular grids.

Grids need not be square. More often than not the landscape , building system, or the directionality of the design itself suggests a rectangular grid. A common use of a rectangular grid is to position members of a directional structural system, for example the post and beam construction in figure 8.

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Figure 8: A rectangular grid is abasis for post and beam construction .

9.1.5 Interface conditions where grids meet.
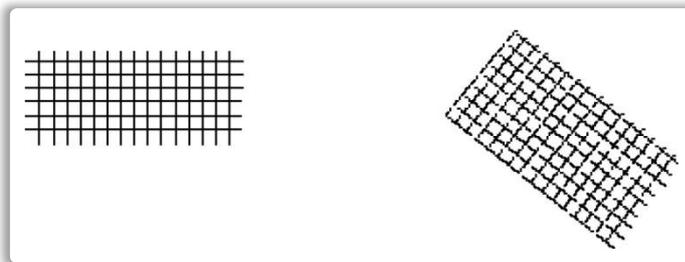
Figure 9: Grids in different parts of the building meet

Complex designs often involve different grids in different parts of   a building (figure 9). When two or more grids are used, the designer must consider the interface condition where they meet. In some cases special interface   elements   and rules are used. For example, a special, round   column might   be employed   to   make   and mark the transition   between two grids at different orientations (figure 10).
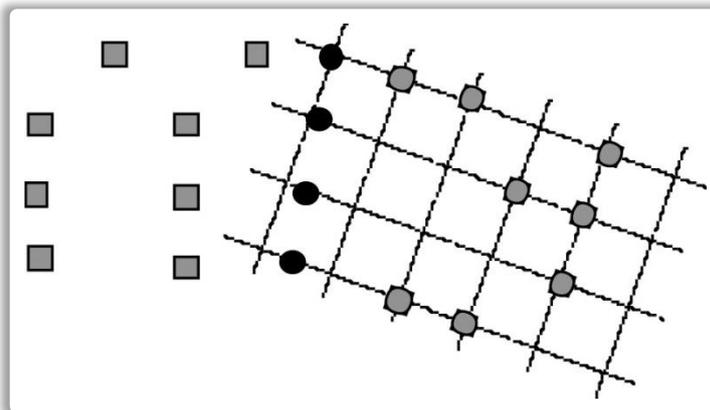
Figure 10: Special elements and rules may apply at interface condition .

9.1.6 Several related grids.

It is   often useful to   work   with several related grids   when   placing   different elements in a layout. We can say that each building subsystem   defines   a class of elements, and we can use a different grid for each different class of element . For example, (figure 11) we can restrict placement of concrete   columns to the crossings of one

grid, and program partition walls to take their places on the lines of another, offset, grid. A similar effect was obtained in (figure 6), where each element class was assigned a different grid relation. In this case, the offset relation between these per imposed grids represents an important design decision.
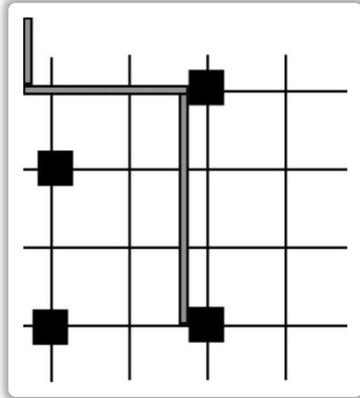
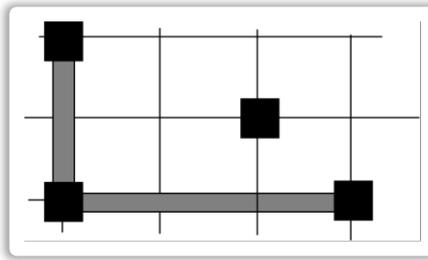**Figure 11: Element classes center on different structure and partition systems .**
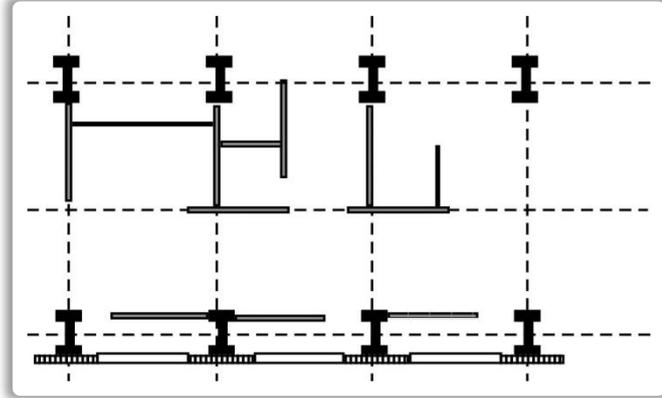
Figure 12: Different grids are used for grids .

In another example, the major structural columns, beams, and bearing walls are placed on a large, master grid ; interior partitions on a second grid that subdivides the master (figure12) , and curtain-wall or skin elements on a third , related , grid. Although the different systems are manipulated separately in the design process , perhaps by different designers, the coordination of the grids allows decisions to be made relatively independently.

In large projects, the layout design of different building subsystems and services (structural steel, partitions, water, electricity, HVAC) may be assigned to different experts from different firms or different work groups. It is important that each expert be able to proceed without constantly checking with other members of the team. By setting up an initial set of agreements or rules that govern the placement of elements of each subsystem, the designers can proceed
Relatively independently. The initial selection of grids and assignment of subsystem elements to certain grid relations represents this set of agreements. Once the team agrees to work within these rules, interference conflicts will be Limited to a finite and predictable set of locations and conditions.
The initial steps of choosing grids and setting rules about the relations of grids and subsystem elements are crucial to the successful application of this method. Some testing of the grids and rules can be valuable at the early stages, to check That the rules permit certain desired configurations'. Although simple in concept, the application of grid techniques in large design projects requires some experience.

9.1.7 A grid establishes relations between elements.

Figure 13: The grid is a device for controlling the joining condition of elements.

By programming different element classes to take different positions relative to a grid, the designer indirectly controls the relationships of elements with respect to one other. Rather than specifying assembly rules that describe how elements are to join, elements are related to a common grid. I crossings and walls are centered only along their lengths, giving each
Element class a direct relationship to the grid, which indirectly defines the position relations between columns and walls.

9..8 Tartan or band grids.
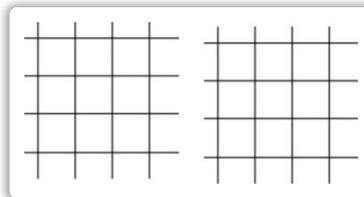
Figure 14: A tartan grid can be combined with agrid marking band centerlines.

Grids need not be always unitary; an alternating sequence of dimensional units can be used, fto form a tartan or band grid (figure 11a,b). A tartan grid can be superimposed on a simpler grid that marks the band centerlines (figure14). A rule can be expressed that requires or prohibits the placement of an element class in a band of the tartan grid , for example "partition walls must be located only in the 10 cm bands of a 10-20cm tartan grid.
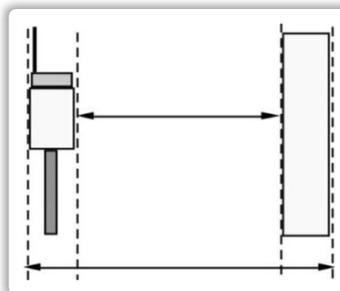
Figure 15: Tartan grids allow for variation in size of built elements.

Elements can be restricted to center on the centerline grid, and limited in dimension to stay within the tartan bands (figure 15). Specifically , their edge coordinates would be constrained to lie within the same band, or range of values. By expressing a rule about element dimension, the actual selection of components can be delayed and alternatives evaluated, so long as the components eventually chosen fit within the tartan band.

Figure 16: Each band can house a different service.

Similarly, building services such as electricity, plumbing, and ventilation can be routed in restricted zones. This is shown in figure 16. The tartan grid is an important part of a specific design methodology for dwelling design (Habraken et al. 1976) (Kroll 1987) and it is also the basis of description in the Dutch building code standards.

## 9. **The application of grids in Interior design works .**

We have reviewed some elementary uses of grids in layout design. For many architects, these applications will be familiar; however, most drawing programs cannot support them.

From this brief review, we take a list of features that we would like to see supported by architectural drawing software. We would like to make grids of various proportions and dimensions: rectangular grids, tartan grids, and grids with bounded extent (e.g. a grid inside a room for laying out furniture). We would like to make grid aggregates, or configurations of several grids. We would like to define relationships between grids and classes of elements, so that different element classes can be programmed to take different positions relative to a grid or grids.
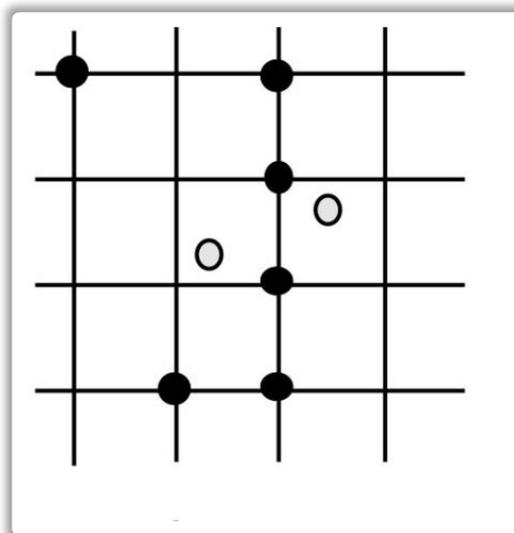
Figure 17: The white columns are exceptions to the class position relation.

When the designer establishes a position relation between a grid and an element class, it is understood to mean that this is the way elements of this class are to be placed. That is, every occurrence of the element on the grid must take the specified position r elation . However , the designer can override the grid relationship defined in the class to make a particular element an exception. For example, the two white columns in figure 14 are exceptions to the class relation, which allows columns only on grid crossings.
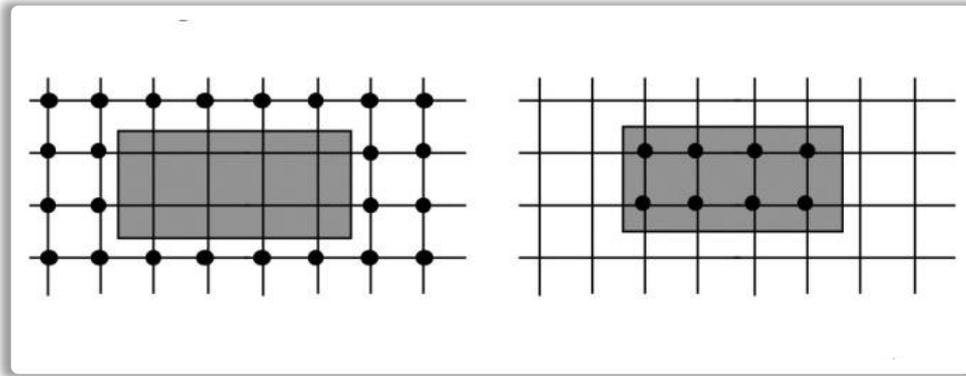
Figure 18: a) columns on grid except inside rectangle; b) columns on grid only inside rectangle.

Normally, a grid-element relation means that if an element is placed on the grid, it must take its proper position. Another way to treat an element - grid placement relation is that for every occurrence of the grid condition, an instance of the element should be found. Thus, the rule "columns at grid crossings " would produce a field of columns, limited only by the extent of the grid. This treatment can be useful, combined with the ability to restrict, or bound, the deployment of the grid to certain regions. For example , figure 18 shows two bounding relations: columns on all grid crossings inside the rectangle (b) and columns on grid centers except inside the rectangle (a).

Let's look at a simple example of the use of grids in schematic building design. The first step is the design of a basic grid for layout. The decisions to be made are the choice of dimensions of the grid units. The criteria for making these decisions are primarily programmatic —!the use dimensions of spaces to be made in the building, and technical — ! the dimensions of components in the building system that is to be employed.
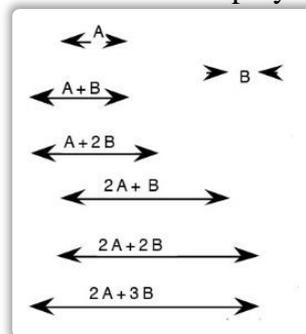

Figure 19: Use dimensions suggested by atartan grid.

Figure 19 shows the different dimensions that a tartan grid provides . Comparing these dimensions with the use dimensions required for the functional program can give

the designer a good idea   of how   well the grid will work.   For example, A is 5',   and   B is 2',
then the grid will suggest   room   widths of   5', 7', 9', 12', 14', ...,   a fairly good match for a housing design project.

Of course, the actual space available between walls will be diminished by thickness of the walls. An experienced designer or design firm may well have a standard grid or set of grids for basic layout design.
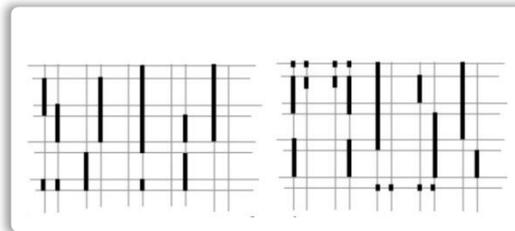
Figure 20: Once a basic grid   Alternative bearing wall layouts.

for layout has been designed, a next step may be to experiment with the placement of bearing walls. Adopting a rule that locates bearing walls only on vertical grid lines, and limiting bearing wall dimensions to grid Modules, the designer can rapidly explore the range of options that this system permits.

Although at first these restrictions might seem to overly constrain the design, in fact a reasonable variation can be achieved. Figure 20   shows studies for two bearing wall layouts.
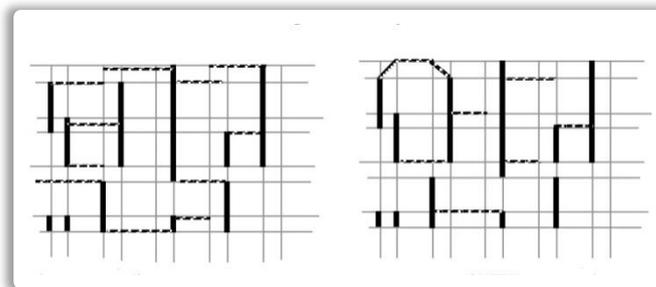
Figure 21: Infil wall variations on bearing wall alternative 'a'.

The next step in the design might be the location of infil walls. Each alternative placement of bearing walls will offer several variations in the placement of infil walls. Figure 18 shows infil wall variations.

The role for the grid in designing is to support , not to make, design decisions. By limiting the placement of   elements to certain places, the grid simplifies decision - making, allowing the designer to work with and compare a relatively small number of alternatives. However, the designer must ensure that   the grid and placement permit a sufficiently rich range of variation. If it doesn't, the designer must redesign the   grid, or relax the placement rules.

Also, the designer must ultimately do the designing, determining where to place each element to realize a functional program and other design criteria. The grid is simply a tool that supports and organizes the decision-making.

9.1 Implementation of Grids in Interior Design.

The Grid Manager is embedded in CoDraw and takes advantage of CoDraw's prototype inheritance scheme; it also uses CoDraw's graphics . The organization of CoDraw's elements into a graph of prototypes and individuals that inherit constraints enables the assignment of grid behavior to different element classes.

At present, grid relations are implemented separately from CoDraw's general constraint management routines, which implement multidirectional value propagation and simple algebra on the constraint ne t. Grid relations could be expressed as algebraic expressions and managed along with other algebraic constraints.

However the algebraic constraint manager cannot handle the discontinuity and the multiple values that grid constraints require. These grid relations should be incorporated into CoDraw's general constraint management scheme.

When an element or element class is assigned a grid-relation, both the grid and the relation are stored with the element or element class, in special 'snap - to-grid' variable and a special relation named 'grid-relation'. When the element is placed, sized, or moved in the Work Sheet, if the element is over the grid, then the 'gridrelation' is used to calculate a rectified position.

The arithmetic for grid-relation behavior is simple. Think of a grid as of a set of modules, in both horizontal and vertical dimensions; each module contains one set of bands. Figure 22 illustrates the concept of module in one dimension of a simple tartan grid.
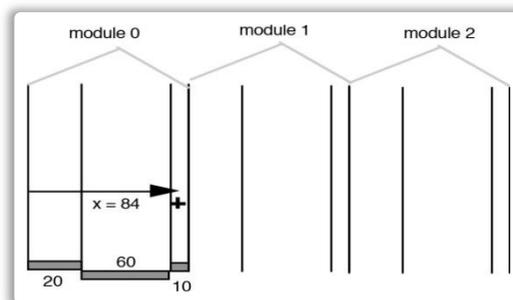

Figure 22: **Horizontal modules of tartan grid .**

The function ' totals' converts the sequence of spacing units (HSeq) to a sequence of running totals (HCoord) giving coordinate values: HCoord <- totals (HSeq); (20 80 90) <- totals (20 60 10) The width of the module is the last HCoord value, the sum of spacings in the module:

X_module_width <- last (HCoord) ; 90 <- last (20 80 90) Then the function floor (modulo) is used to calculate the module number of the coordinate:

(module_number, remainder) <- floor (x, X_module_width) and the remainder, or offset into the module is simultaneously computed.   In this example, if x = 84, then module_ number will be 0 and remainder will be 84. Finally , we use the Nearest function to find the coordinate of the nearest grid line in the module.

Nearest (remainder, HCoord) ; 80 = Nearest (84, (20 80 90))

## 9.2 **Define spaces with color in grids .**

color is   a way to make modules or sections stand out. Color defines space as well as helps to organize elements within a space. Color also enlivens a page and provides a psychological signal for the kind of message that's being conveyed. When setting up colors, consider the audience. Saturated colors attract attention, while desaturated colors support the material in a more understated way. Too many colors can cause a piece to be   busy   and hard to naviagate.

We   live in an RGB world,   in which both clients   and designers view almost everything on screen. Colors on screen are luminous, saturated, beautiful, and RGB.

However, there is a big difference between color on screen and on paper. Be aware that traditional four color printing will require the careful choice of paper   and a good amount of color correcting to approximate the luminosity of the color seen on screen.
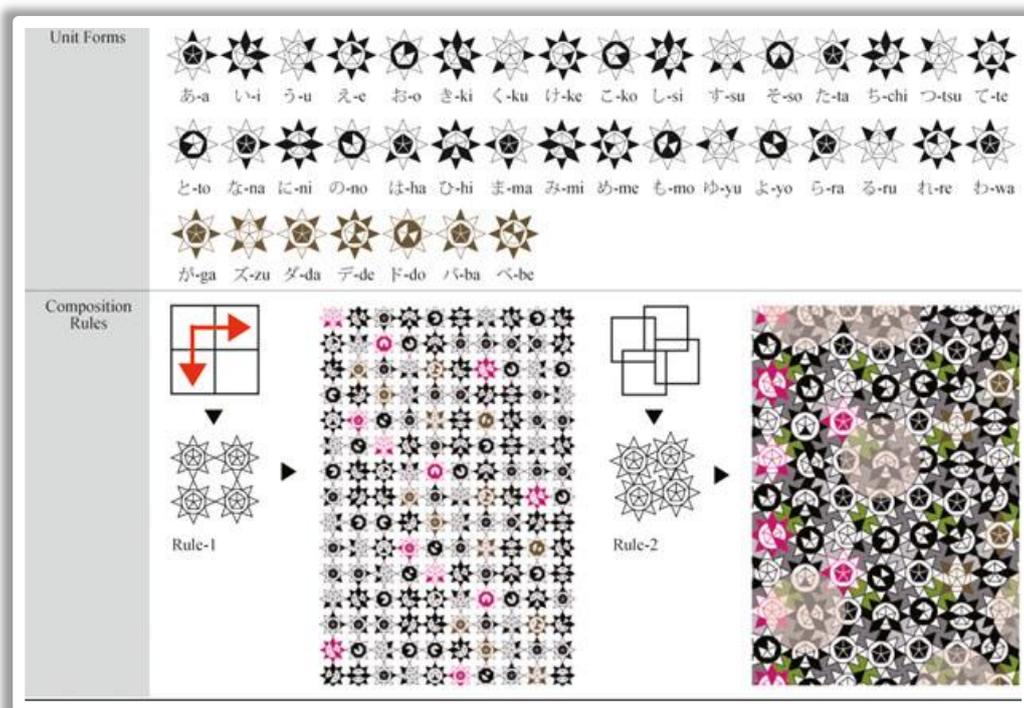
Figure 23: **Using colors in design of grid**
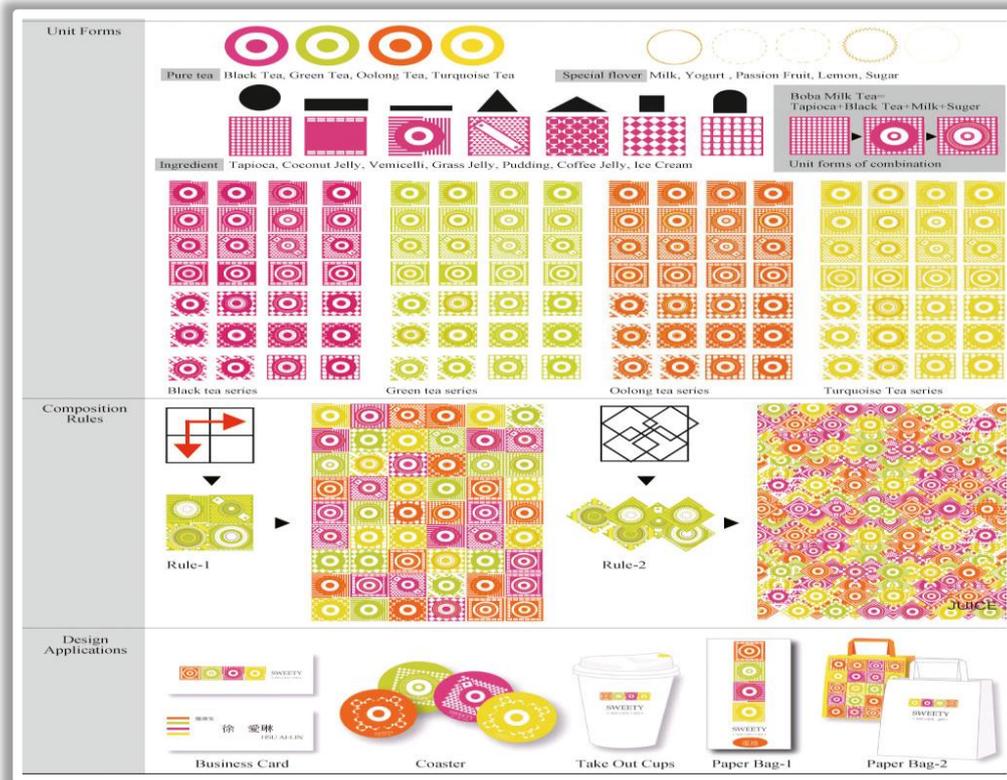
Figure 24: **Contrast and Harmony Colors in Grids Designs .**

9.3 Grids and placement rules as constraints.

Using grids and placement rules, a designer can program a CAD system to enforce desired spatial relationships among building components and spaces. These spatial relationships are constraints on the design and they represent decisions that the designer makes about how to organize the building. The constraints do not prescribe or generate particular forms; rather they circumscribe or bound a space of alternative arrangements without specifying a solution. The constraints

structure the manipulations that the designer can make by restricting the placement of pieces. Within these self- imposed constraints, the designer explores alternative layout designs.

The constraints provide a means to program placement rules for elements and spaces, using grids as a basis for positioning.

To use the tool effectively requires a discipline and an understanding of this design method.

The use of grids as positioning devices for layout design has been discussed by N. John Habraken, in a number of publications (Habraken et al. 1976) , (Habraken 1980),(Habraken and Gross 1988) and through a series of "thematic design " workshops at MIT.

Once the approach is understood, the tool can be an effective way to organize spatial decisionmaking.

Grids, as a kind of constraint on the placement of elements in a layout, are a way of embedding knowledge in the design environment. By programming the behavior of element classes into the layout editor, the designer no longer must check the design against

Another, rather different, way to represent knowledge formally about layouts is a shape grammar . A shape grammar is a generative system, in which regularities of a family of

shapes are expressed as of a set of production rules (Flemming 1987). The production rules generate a constrained set of possible shape arrangements. The set can be generated by exercising all legal sequences of the rules, which may be infinite. Our grid- relationships also constrain a set of physical arrangements.

However , unlike a grammar, they do not suggest an order of form-generation.

The Grid Manager program was built as a module of Co Draw, a constraint - based drawing program that maintains design relations that the designer asserts . CoDraw's goal is to demonstrate a flexible and interactive graphically oriented constraint- based construction kit, within which designers can define and work within their own rules, or constraints . Other constraint based drawing kits have also been developed (e.g. Nelson 1985) and constraint - based programming environments are an active area of research related to Computer Assisted Design (see for example, (Sapossnek 1989; Murtagh and Shimura 1990)). Interactive grid snap has been proposed as a means to achieve some of the functionality of a more general constraintbased design system with less computational overhead (Bier and Stone 1986) and this napdragging"

approach has also been extended to three- dimensions (Bier 1990). However implemented, grid – snap is surely a kind of spatial constraint that a CAD program can be programmed to understand, and it is useful in layout design.

9.4 Using Golden proportion as rule of Grid .
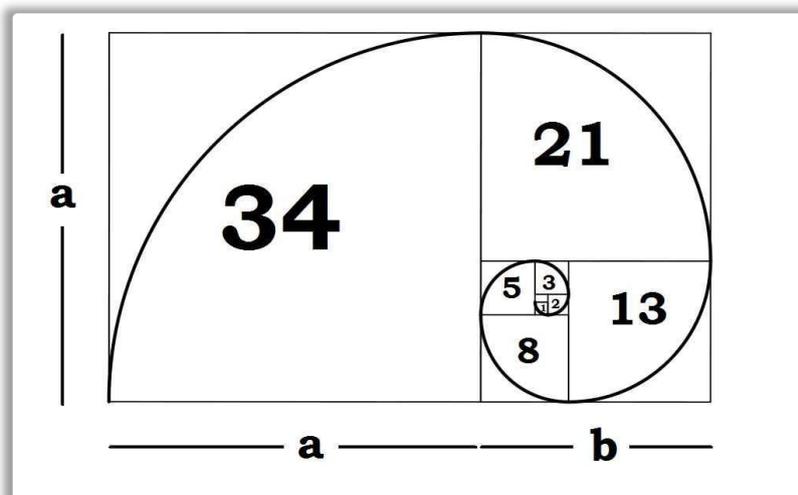
Figure 25: using golden proportion in design

The Golden ratio is a special number found by dividing a line into two parts so that the longer part divided by the smaller part is also equal to the whole length divided by the longer part. It is often symbolized using phi, after the 21st letter of the Greek alphabet. In an equation form, it looks like this:

a/b = (a+b)/a = 1.6180339887498948420 As with pi (the ratio of the circumference of a circle to its diameter), the digits go on and on, theoretically into infinity. Phi is usually rounded off to 1.618. This number has been discovered and rediscovered many times, which is why it has so many names — the Golden mean , the Golden section, divine proportion , etc. Historically , the number can be seen in the architecture of many ancient creations, like the Great Pyramids and the Parthenon. In the Great Pyramid of Giza, the length of each side of the base is 756 feet with a height of 481 feet. The ratio of the base to the height is roughly 1.5717, which is close to the Golden ratio.

9. 5 Grid based design rules can mediate group work.

The use of grids and placement rules is particularly suited as a means to mediate group design work . Layout of different subsystems can be divided among members of a design team and each team member can work relatively independently. Placement rules allow each designer to know where to put elements , and where to expect other designers to place elements of different subsystems. Each designer on the team can explore alternative layouts, knowing that when the time comes to integrate the subsystem designs, the grid-based positioning rules ensure that interference problems are limited and controlled. If plumbing elements are always found in band "alpha" and HVAC ducting in band "beta," then plumbing and HVAC can only interfere in an intersection between the two bands. Knowing the location, we can define interface conditions.

For the limited combinations that occur. The publications of the S.A.R. (Habraken et al. 1976), the OBOM, and the Dutch housing design standards (NEN 2883, 1981) outline these methods in detail. They argue that by regularizing the positioning of elements of different subsystems according to a grid, the designer can render the building quicker to build, easier to maintain, and more flexible for remodeling.

Phidias (500 B.C. - 432 B.C.) was a Greek sculptor and mathematician who is thought to have applied phi to the design of sculptures for the Parthenon. Plato (428 B.C. - 347 B.C.) considered the Golden ratio to be the most universally binding of mathematical relationships. Later, Euclid (365 B.C. - 300 B.C.) linked the Golden ratio to the construction of a pentagram

Around 1200, mathematician Leonardo Fibonacci discovered the unique properties of the Fibonacci sequence. This sequence ties directly into the Golden ratio because if you take any two successive Fibonacci numbers, their ratio is very close to the Golden ratio. As the numbers get higher, the ratio becomes even closer to 1.618. For example, the ratio of 3 to 5 is 1.666. But the ratio of 13 to 21 is 1.625. Getting even higher, the ratio of 144 to 233 is 1.618. These numbers are all successive numbers in the Fibonacci sequence.

These numbers can be applied to the proportions of a rectangle, called the Golden rectangle. This is known as one of the most visually satisfying of all geometric forms – hence, the appearance of the Golden ratio in art. The Golden rectangle is also related to the Golden spiral, which is created by making adjacent squares of Fibonacci dimensions.

In 1509 , Luca Pacioli wrote a book that refers to the number as the "Divine Proportion, " which was illustrated by Leonardo da Vinci. Da Vinci later called this *sectio aurea* or the Golden section. The Golden ratio was used to achieve balance and beauty in many Renaissance paintings and sculptures. Da Vinci himself used the Golden ratio to define all of the proportions in his Last Supper, including the dimensions of the table and the proportions of the walls and backgrounds. The Golden ratio also appears in da Vinci's Vitruvian Man and the Mona Lisa. Other artists who employed the Golden ratio include Michelangelo, Raphael, Rembrandt, Seurat, and Salvador Dali.

The term "phi" was coined by American mathematician Mark Barr in the 1900s. Phi has continued to appear in mathematics and physics, including the 1970s Penrose Tiles, which allowed surfaces to be tiled in five-fold symmetry. In the 1980s, phi appeared in quasi crystals, a then-newly discovered form of matter.

Phi is more than an obscure term found in mathematics and physics. It appears around us in our daily lives, even in our aesthetic views. Studies have shown that when test subjects view random faces, the ones they deem most attractive are those with solid parallels to the Golden ratio. Faces judged as the most attractive show Golden ratio proportions between the width of the face and the width of the eyes, nose, and eyebrows. The test subjects weren't mathematicians or physicists familiar with phi — they were just average people, and the Golden ratio elicited an instinctual reaction.

10 .Good applications of grids in Design .
There are many examples of building interest in grid concept .

10.1 using grids in planes design
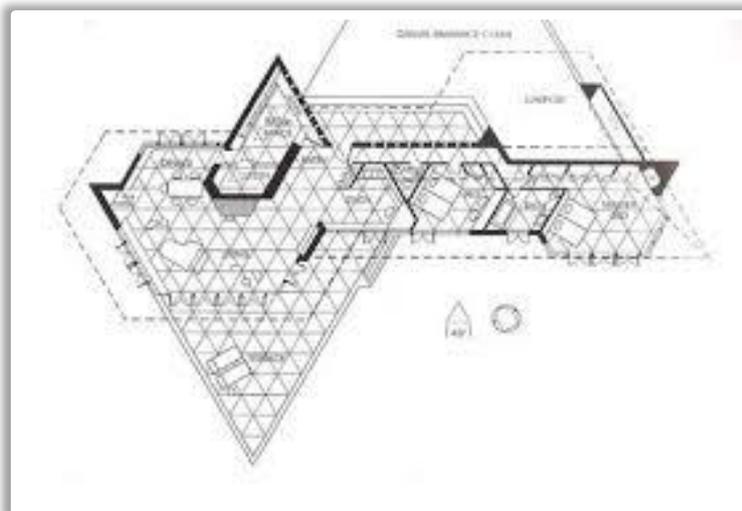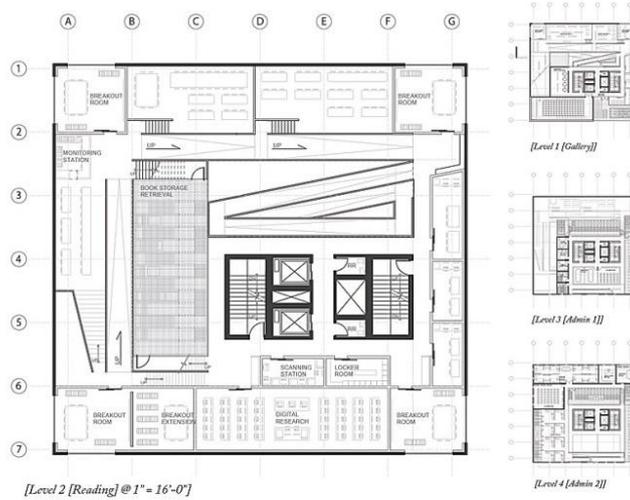

Figure 26: using grids in designing planes of hotel .
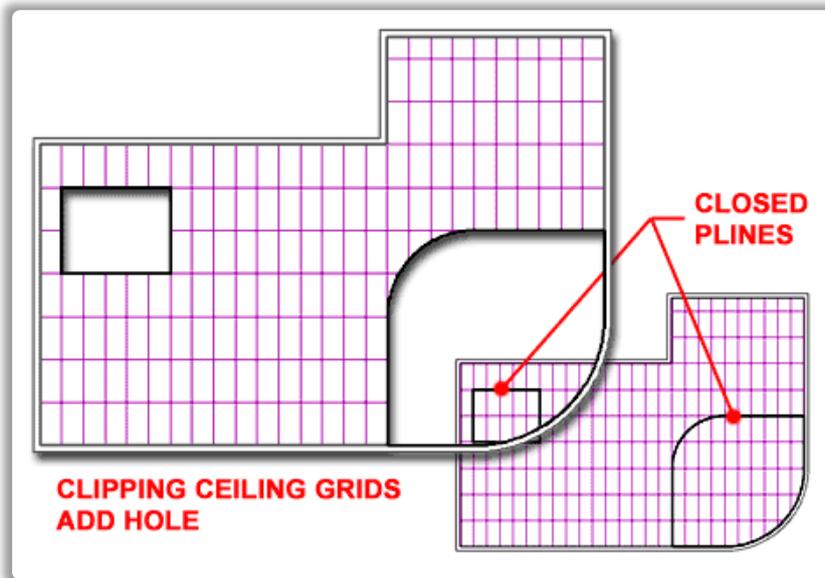
81

Figure 27: using grids in design plane of public buildings
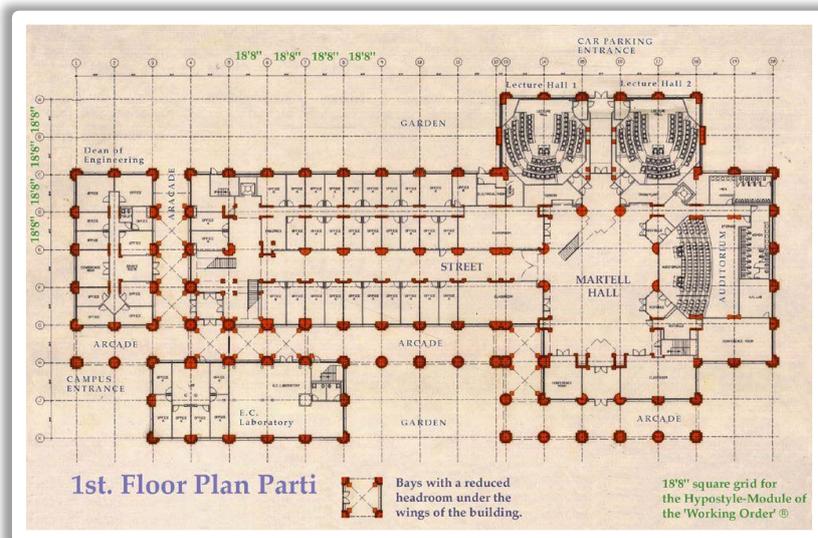

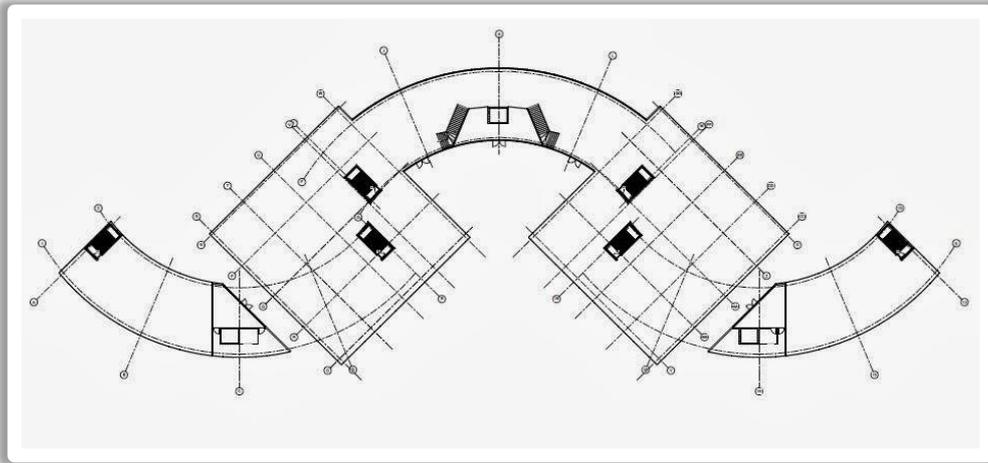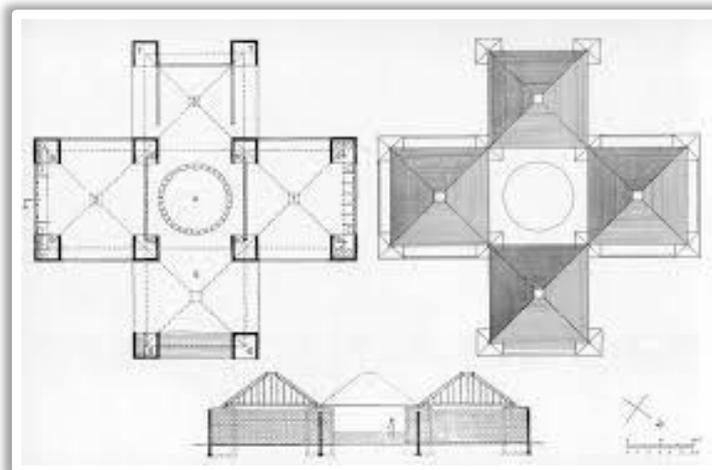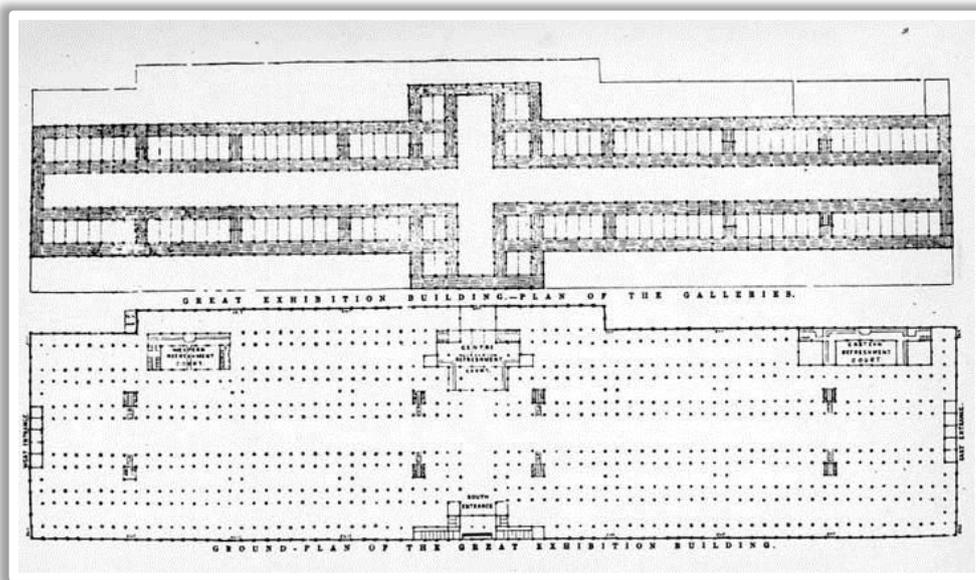**Figure 28: using grids in design ceiling plane .**

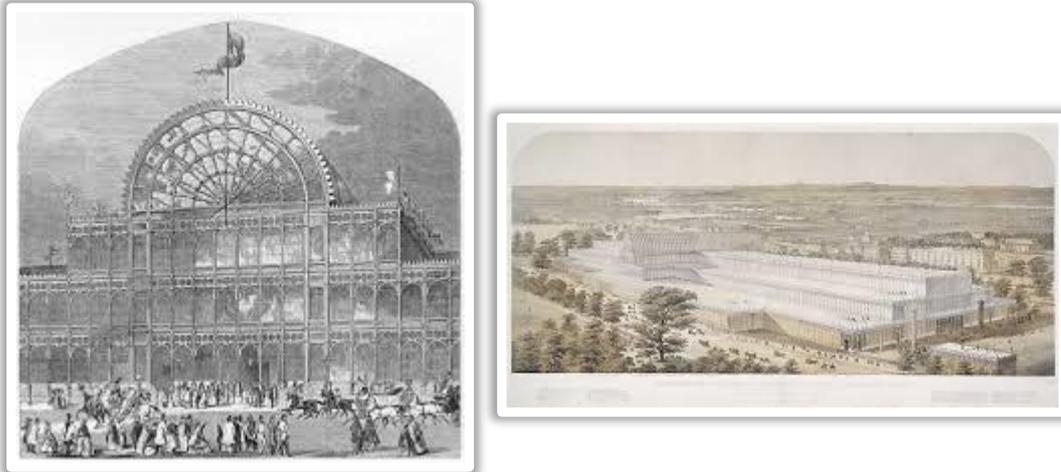**Figure 29: using grids in design ceiling plane .**

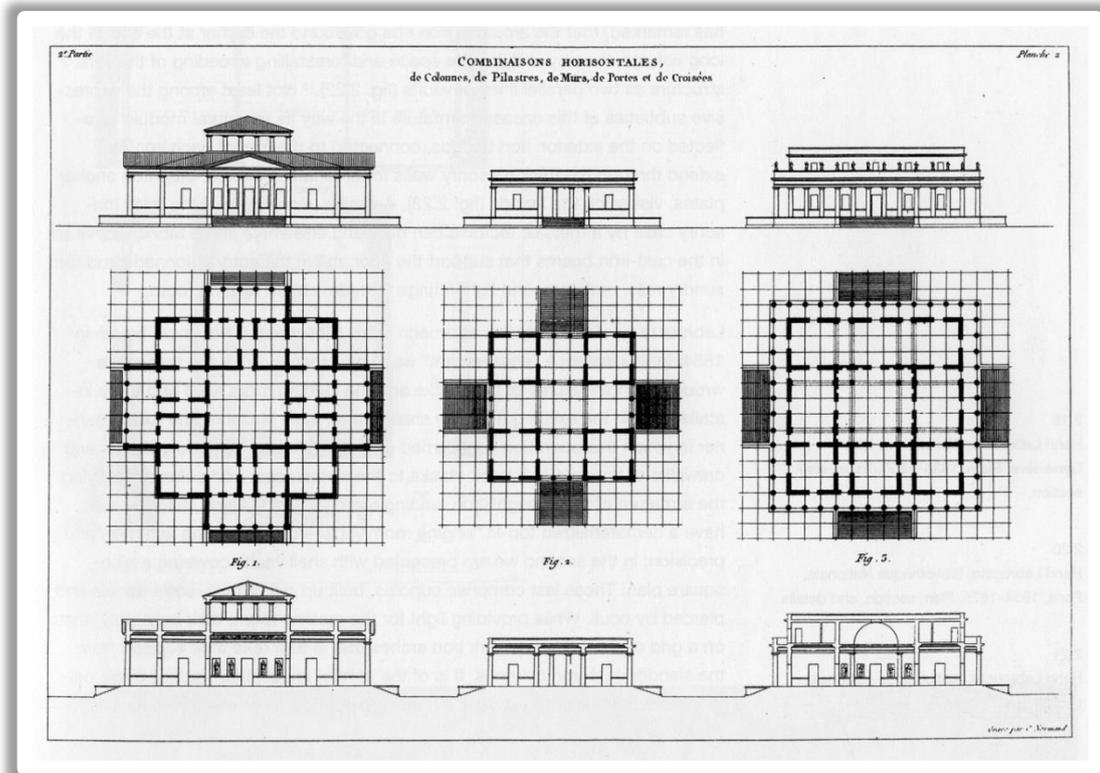**Figure 30:** using grids in Sketches of plan design .

10.2 using grids in plane and elevation of buildings .

Figure 31 using grids in design Crystal Palace .

Figure 32: photos shows using grids in designing The Crystal Palace .

Figure 33: COMIN AISONS HORISONTALFS .

11 .The research conclusion.

▪   Grids can help a designer organize the placement and dimension of building elements and spaces. By associating different grid positionings for each class of element, the designer can control relationships among elements. Some architects may not favor this method of designing —! or some may favor it for some projects but not others. It is a formal approach, in which the designer makes and records systematic placement rules. It thus places a value on explicit formulation of design rules.

Design of the configuration of grids , and specification of placement rules can become an important preliminary phase of the layout process.

▪ The advantage is that once the designer makes decisions about placement rules, the system helps organize the layout. CoDraw's Grid Manager program supports theuse of grids as a design tool . In CoDraw, grids are regular elements of the design just as any other graphical element. The Grid Manager enables the designer to first define and then work within simple positioning rules with respect to grids . Within these self-imposed constraints on element positions, a designer can freely design, exploring alternate layouts.

▪ Just as a design built from modular components doesn't have to be boring, a grid of space built from modules doesn't have to be boring either. For one you can break out of the grid. A grid is more guide than absolute rule. It's ok to move some elements off the grid to add visual interest and attract the eye to them.
There are a lot of ways to combine modules into the larger units of fields, columns, and rows. A grid of 2 columns and 2 rows has at least 4 modules and thus 4×4 or 16 possible combinations of modules to fill the space. That doesn't sound like a lot, but the more modules, the more the possibilities. An 8×8 grid would have nearly 4,100 possible combinations, a 12×12 grid over 20,000. There's plenty of flexibility in those numbers.

▪ We constrain choices with a grid. We don't eliminate them. And that's only using one grid. There's no reason you're limited to only one grid on a single canvas. Different grids can be combined to form compound grids to allow for much greater possibilities and flexibility.

▪ Grids follow the same principle of modularity . In some ways that seems obvious given the terminology modular grids. In other ways though it isn't quite as obvious that they're the same thing. However, when you think about how grids divide space and make it easier for us to make layout decisions, I think the modularity of grids falls right in line with the reusable modularity of components and design patterns . They separate concerns , by dividing the space into modular units. The characteristics of these modular units are reusable and through reuse help us more efficiently place information, Finally the structure of

▪ these units in the grid leads to greater consistency in how content is organized.

▪ Grids are generally made visible only through use, but some designers have exposed the workings of the graphic design machine to demonstrate that the grid is something not only of utility, but also of beauty. Once visible, the precision of the grid acts as evidence of design credibility, and its purity of form has a mystical draw.

▪ Grids use to help to match the best design elements arranged and make sure that our designs will translate properly to be displayed on many computer screens and mobile devices as to have a wealth of resources at our disposal to help us best choice of grid system to match the design we want.

▪ Grid system is a collection of visual elements in graphics arrange , the grid system need structure for your layout that consist in service the rules of horizontal and vertical lines which intersect and are used to arrange contents in the projects ,this will help to distribute the project elements .

▪ Grids keep your design organized as one of the chief uses for grid to keep your elements aligned and ordered , this because grids encourage alignment ,that big part of their job description actually ,by establishing a grid system , you are creating a set structure for yourself to align elements against , and in doing this you can create for yourself a neat , clean and organized design .

▪ Grids will make your job quicker as we `re always looking to get things done quicker and better , the words ( improved efficiency ) is music to many people `s ears , so this point should sound like a symphony grids can greatly speed up and improve your design time , as they can act as a guide that signals where is best to place ,position, and scale elements ,instead of randomly positioning elements until you find a decent looking composition , grid should help to guide you to ward a natural solution .

▪ Collaborating with other designers will be much easier as the designer has to work with other designers , so grids might to be the answer to relieving some of stress and frustration of miscommunication as previously mentioned ,grids help in many ways to give an underlying structure to your design and provide guide as to where certain elements of design should be placed ,therefore , if you have solid grid set up in your design and a new designers share with you ,they will (hopefully) , and be able to see how you intend to position elements .

▪ Grids will make balance as grids are consistent and when you divide your design up into a certain amount columns , you will begin with a symmetrical plan , from here ,it should be much easier to judge which side of your design occupied by design elements causing powering than other side .

▪ Grids will enhance your visual hierarchy as a common as assumption about grid based design is that using a grid means dividing each element of your design up into equally

sized blocks, which would all most completely override , by using a grid for the basis of your design , you can draw attention toward or away from certain elements by scaling them up to extend across multiple columns .

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