AN ANALYSIS OF FACTORS WHICH WILL DETERMINE
THE APPLICATION OF DESIGN TO
INDUSTRIAL ARTS PROJECTS

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CHAPTER I

INTRODUCTION

This thesis is a study in a particular phase of industrial arts education—that of industrial arts design. It presents an analysis of design in the industrial arts program for the purpose of education for esthetic appreciation.

When one surveys the purposes of the industrial arts program he finds such objectives as those listed by Engelhardt and Overn for practical arts education. These are as follows:

1. To give meaning to the hand-work and art of the pupils.
2. To provide in free periods reading and construction materials for those of varying degrees of ability.
3. To develop an importance of all human occupations.
4. To develop participation in home activities.
5. To develop the ability to construct, manipulate, and repair devices, tools, machinery, and materials used in the home.
6. To induce pupils who avoid academic studies to think in terms of practical jobs.
7. To give prevocational experiences.
8. To develop an understanding of relations between needs and wants, and between spending and earning.
9. To develop appreciations of beauty, design, and craftsmanship.
10. To develop a social attitude toward work both in and out of the home.

It is toward the objective of developing appreciations of beauty and design that the teaching of industrial arts students to recognize and produce good design is directed.

Much of the Industrial Arts program deals with student activity in making objects or projects in shopwork. The teacher has a good opportunity to aid the student in creating and recognizing artistic value in these projects. In fact, since design is seldom taught as a subject itself in the industrial arts programs of high schools, the project-making activity is the logical place to work in the aspects of design training.

In any educational work it is important to analyze and organize materials and subject matter in light of the particular situation in which they are needed. This is the purpose of this study. The problem deals with an analysis of the field of design and of projects used in the industrial arts program to determine how good design can be secured in these projects made in the shop.

Aims and Aspects of the Problem

The material in this study is organized and presented toward the standpoint of use by teachers of industrial arts in the high schools. A survey of one hundred and sixty-five high school industrial arts teachers in regard to their college training for the teaching profession was made by Joe Harold Farmer. In this survey, college courses that teachers indicated a need for were ascertained. In a list of twenty-two courses, the expressed need for further training in design
ranked sixth. This may be taken to signify that teachers recognize fully the opportunity and need for design in relation to their teaching of project work in industrial arts.

The analysis of the field of design is made from presentations by generally accepted authorities in design and art. No attempt is made to validate the theories as to the nature of good design, since this would properly come in a philosophical treatment of aesthetics. The psychological and sociological processes that are involved in regard to styles of design are not discussed. The study is limited to dealing with principles and fundamentals used to produce artistic results down through the ages.

The projects considered are those of wood and metal made in shopwork classes. This limitation is made in view of the fact that woodwork and metalwork are the most commonly taught courses in high school industrial arts programs. Although other courses may offer possibilities for use of design, it is felt that best treatment can be given in this study to design of projects specifically of woodwork and metalwork.

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2J. H. Farmer, "To Determine Whether or not the Colleges of Texas are Preparing Their Students to Teach Effectively in the High Schools of Texas," (Unpublished Master's Thesis; North Texas State Teachers College, Denton, Texas, 1939), p. 54.

3Ibid., pp. 24-27.
Related Studies

Studies in design in relation to industrial arts somewhat related to this study are here mentioned. One such study by Ralph M. Coleman deals with design in relation to ornamental iron. The object of this study is determining a satisfactory course of ornamental iron for high schools in light of home needs, student interests, and good design. The design factor is that of judgment of projects according to generally accepted standards of design.

Another somewhat related study is that made by Jack J. Lamb in regard to the use of art metalwork in junior high schools. Mr. Lamb's work deals with project activity in art metalwork and an analysis of materials and tool processes used in such work.

Other work in this field have been reported in professional literature. In the Industrial Education Magazine, Vol. 40, May 1938, H. B. Roysher presents an article entitled "Training Industrial Designers." This article deals with a study of factors influencing use of design principles in modern industrial design, and limitations of design in industry. The

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study also includes the use of design in industrial arts programs as related to the use of design in industrial production with consequent implications as to the training of industrial arts teachers in regard to design.

"An Industrial Design Thesis" in Design, Vol. 40, December 1936, is a report of a study made by students at the College of Fine Arts, Carnegie Institute of Technology, in regard to specific design problems. This study deals with actual work in the creative designing of given projects.

K. L. Van Doren, in "Designing for Appearance," Design, Vol. 37, March, 1936, gives a study of design principles and their application. This study deals with the application of design to articles produced in industry similar to those used for projects in industrial arts programs.

Sources of Data

Data in this study were secured from professional literature. Most of this literature was in the form of books on pure design, design in art, industrial design, and specific phases of industrial design concerned with woodwork and metalwork. Also articles from professional magazines provided sources of data. The designs of projects made in high school shops were secured by personal visitation of the writer and from teachers in the field.

An appreciable amount of literature may be found in the field of design, but for the most part it deals with pure or
abstract design, methods of creative design in the fine arts, or design in the mass production schemes of industry. The data from this literature, particularly that from the field of pure design, are organized in this study from the standpoint of project activity in the industrial arts program. The project activity requires consideration of factors that limit and determine design possibilities.
CHAPTER II

ANALYSIS OF PURE DESIGN

Definition of Design

Design means order and arrangement. An easily understood definition is that given by Isabel P. Snelgrove, who says that, "A design is an orderly arrangement of lines, shapes, and colors." ¹ This simple statement, for all practical purposes, seems to convey sufficient meaning for the term design. More deeply and abstractly, design may be construed to mean order in human feeling and thought.² The activities by which that feeling or that thought is expressed usually deal with materials that possess lines, shapes, and colors. The field of pure design encompasses all works of art or compositions that have esthetic implications. One may properly speak of the design of a painting, the design of a building, the design of a piece of furniture, or the design of a piece of fabric—or, in fact, the design of anything that results from arrangement of materials and their elements. Thus in the study of any of the arts and crafts, pure design is the basis of esthetic significance. Design covers the arrangement of details according to a plan in regard to

structure, outline, decoration, implied movement, or any other elements of composition.

Designing implies the use of lines, shapes, and colors. Here are named the most important elements or essentials of design which are to be discussed in the following paragraphs.

Essentials of Design

The essentials of design are line, form or shape, color, light, and space.3

Line

A line, mathematically speaking, is the intersection of two planes. In a design, lines still mean the same, but their visible representations are the framework of the design. Lines indicate directions, and define boundaries of forms or shapes. In a piece of craft work, one part of the material fitting against another forms a line, as in the case of one piece of wood fastened to another. This line is an object of visual perception and reveals much of the nature of the design. Lines may show as decorative outlines of shapes and areas, or the shapes and areas may have no visible outlines except where one color ends and another begins. In all cases, the lines are there, influencing and determining the qualities of the design.4

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3 Allen Tucker, Design and the Idea, p. 34.
4 Snelgrove, op. cit., p. 1.
Form or Shape

Form is the area or portion marked off by lines. The term mass may also be used with the same meaning as form or shape. Form is the existence of an object, or parts of an object. In the area or body of a design one sees form against form, or form adjacent to form. Form may be simply one area or portion of color against another area of color. In any case the entire body of the design is made up of forms or shapes, having various proportions and relationships to each other and to the whole design.\(^5\)

Color

Color is the surface vibration of light which makes form visible. One could not see form without color. The lightness or darkness of a color is termed "value", light colors having high value and dark colors low value. The name of a color is called the "hue", such is red, green, or blue. The "intensity" of a color refers to the strength or weakness of the color.\(^6\) The effect of light produced by any particular material that shows a color is called the "tone". This term is referred to very often in design. Difference of tone may be produced by changes of lightness or darkness of colors, by shadows caused by adjoining parts, by light reflected brightly from some certain spot, or by difference

\(^5\)Ibid., p. 1.

\(^6\)Elizabeth Burris-Meyer, Color and Design in the Decorative Arts, p. 29.
of texture or surface treatment of the material itself. The
whole completed design may be spoken of as having a certain
tonal quality, just as the parts are described as having
tonal relationships.

Light

Light reveals form, line, space, and color. Light, as
an essential of design means more than something which makes
it possible for one to see. Light is introduced into the
design to aid visibility of the design. The use of light
gives contrasting hues and a variety of values which affect
the tonal quality of the design.\(^7\)

Space

Space, as an essential of design, is the medium in which
form, line, color, and light exist.\(^8\) Space is an important
factor in determining the relationships of other essentials
in composition. Space in relation to design may be the cubic
content of the object to be designed (volume), the size of
the layout, or the area of materials used.

The Use of the Essentials of Design

These essentials are always present in a design. They
may exist to a greater or less degree, but they are still
the materials that make up a design project, whether it be

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\(^7\)Ibid., p. 336.

\(^8\)Ibid., p. 336.
merely an abstract representation or an actual object made for a definite use.

In Figure 1 is shown a design commonly termed an abstract design. Here one sees the essentials of the design as mere representations made with pencil or pen. The lines are the divisions of the different portions or forms, the color or tone of the forms differentiate them from each other, the light introduced reveals the whole design itself and affects the tonal quality, and the space is the size of the layout and its component parts.

Fig. 1.—Abstract representation of a design

Fig. 2.—Design of an object made from actual materials.
In Figure 2 is shown a drawing of a piece of furniture as an example of a design made with actual materials. In this case the lines are the joining of pieces of materials; the forms or masses are the pieces of wood that, together, make the object; the color is that of the wood itself and its surface treatment; the light produces highlights and shadows that affect the tonal quality or appearance; the space of the design is the volume of the total mass.

Here, in these illustrations, one sees the use of design essentials and the consequent importance of them in the finished product. It is the use and arrangement of these elements that produce designs. It is the use and arrangement of these elements that are governed by the principles of design in the production of an object which has esthetic value. These principles are to be discussed in the paragraphs following.

Principles of Design

In any discussion or analysis of design, probably the most important phase is that dealing with the principles of design. They are usually termed fundamental principles of design or composition. In all the literature on design surveyed in this study, whether in connection with painting, decorative art, industrial arts, or industrial design, the same principles are discussed and regarded as basic to creation or improvement of design. In regard to design and design principles, Burris-Meyer says:
Primarily, a design is the arrangement of details according to a plan. The arrangement may be any object—a dress, a picture, a piece of furniture, a porcelain, a textile, a piece of jewelry, a book, or a window display of merchandise—and while these articles would seem to be far apart in purpose, there are certain basic principles which are necessary to the success of them all.9

This statement is clearly indicative of the use of principles of design. They have been used down through the ages as guides to producing artistic results. According to William H. Varnum, the modern significance of these principles is just as important today as in the time of the Egyptians.10 Quoting from Varnum:

Whether we consider ancient, period, or modern design, there are age old principles which must control massing and spacing.11

Principles of design are used to test the artistic worth of objects planned. A design may be judged poor because of lack of conformity to the fundamental principles of design, or good because it embodies these principles.

The following presentation of principles of design is an organization of principles discussed by various generally accepted authorities in the field of art, pure design, industrial arts design, and industrial design. Although there was no particular uniformity in the presentations of these authors, the principles to be given in this study were treated

9Ibid., p. 320.
11Ibid., p. 49.
by each as being fundamental principles in regard to order and arrangement in light of resulting esthetic value.

The listing of these principles is not an attempt to rank them in order of their relative importance. Since they are so essentially related in the design as a whole, it would be difficult to determine the value of each one separately.

The Principle of Proportion

Since a design is made up of different forms, or parts, these parts have a proportional relationship to each other, and to the design as a whole. In other words, one part is so large or so small in proportion to related parts. In design, three phases of the subject of proportion suggest themselves—the proportions of the containing space or volume, the proportional relationship between the parts of the design and their containing shape, and the proportional relationship between the parts of the composition itself.\textsuperscript{12}

The real meaning of the principle of proportion seems to be that whether or not a design is successful or pleasing depends upon good proportion of its parts. Here is the question of what is good proportion. One may say that the ability to form or judge good proportions is some sort of natural artistic talent. This may be true to some extent, but the most pleasing proportions of line or space in the average person's perception have been fairly well basically established.

\textsuperscript{12}Burris-Moyer, \textit{op. cit.}, p. 375.
The theories of good proportion are based on the fact that the human mind rejects monotony, and welcomes variety and subtlity. Variety means a succession or mixture of different things. Subtlity means delicately adjusted and refined relationships. Another factor in proportion is interest. A line or space that is readily divided into equal parts by the eye lacks interest. Beauty of proportion, then, depends upon a relationship that provides variety, subtlity, and interest. It is true that an experienced eye may be successful in measuring good proportions, but there are some rules for securing good proportions that are fairly well established. For instance, a square area is usually rejected as monotonous because the sides are the same length. A rectangle is of more pleasing proportions, but if the rectangle is simply made of two squares put together, it is again rejected because the relationship is easily solved by the eye.

Good proportions of line.—Probably one of the most successful proportional relationships of lines is that generally credited as having been brought into prominence by Kepler. This is that the most pleasing division of a line is that made so that the short part possesses the same proportion to long part that the long part does to the whole line (shown at A in figure 3). This division gives subtlity

13 Varnum, op. cit., p. 40.

and variety, and even a variation of the proportions to a certain extent will give good relationship.

In regard to the proportion of lines Varnum says:

A rule-of-thumb method of checking subtlety is to divide the length of the lesser line into that of the greater. If the quotient is a whole number, as $300 \div 75 = 4$, the relationship is pretty sure to be unsatisfactory. A quotient of 1.61 is one of the very best ratios we have. If the quotient is near a whole number as 3.02 or 1.98, the proportionate relationship is characterless and indefinite and lacks decision, while incommensurate quotients are to be preferred to commensurate figures.\(^\text{15}\)

Thus, one can see that the matter of good proportion is fairly definite after all. Figure 3 shows some proportionate relationships of lines. At A is shown the division already mentioned where the shorter line has the same proportion to the longer line as the longer line has to the line made by the combination of the two. At B is shown a poor relationship because the eye readily detects the fact that the longer line is just two times as long as the short one. At C is shown a good proportional relationship according to the rule given by Varnum.

\[ \text{Fig. 3.--Proportionate relationship of lines} \]

\(^{15}\) Varnum, op. cit., p. 40.
Good proportions of areas.—The discussion of the proportions of lines may seem a little unrelated because lines are seldom ever judged by themselves. The lines, however, mark off areas in the design, and proportionate relations of the areas run much in the same way as those of lines. Already it has been stated that the square area is considered of little value because of its static quality, although a square area may be used sometimes to reduce the dynamic qualities of a design.

Probably the most generally accepted good proportions for areas are those worked out by Jay Hambidge as being the most pleasing of all shapes. Hambidge is given credit by many authors as having discovered these proportions in a systematic and intensive study of design and esthetics. 16 Space will be given here to a discussion of the proportions and illustration of the construction of a few of the best rectangular shapes.

16 Reference is made to Hambidge's work by these specific authors:

Burris-Meyer, op. cit., p. 322.

Varnum, op. cit., p. 44.

Fig. 4. -- Good proportions of areas
At A is shown what is commonly called a "Root Two Rectangle." In constructing this shape, the diagonal of an original square is used as the length of the rectangle, and the side of the square used at the height. At B, the rectangle is made by first constructing a root two rectangle and drawing its diagonal. This diagonal is used for the length of the rectangle, and the height is the same as that of the original rectangle. This is usually called a "Root Three Rectangle." At C is shown a "Root Five Rectangle," made by putting two squares together to form the original rectangle, and then drawing the diagonal. The diagonal is used as the length of the rectangle. At D is shown what is called the "Golden Oblong." The credit for the discovery of this rectangle as a very pleasing shape is given by Van Doren to Leonardo da Vinci.\(^\text{17}\) This is produced by bisecting a square, drawing the diagonal of half the square, and producing this along the bottom line to form the length of the rectangle.

Good proportion in volume.—Good proportion in volume may be based upon good proportion of areas, since enclosing areas determine the volume. In Figure 5 are shown good proportions of volume made by the combinations of well proportioned rectangles.

Fig. 5.—Proportions of volumes

In this illustration a pictorial type of drawing is used. The proportions are drawn true to scale by an isometric foreshortening device.

The good proportions of lines, areas, and volumes discussed above are used as the basis for creating good designs or judging them as to their artistic and esthetic value. The principle of proportion deals with the fact that beauty, satisfaction, or artistic worth of a design depends upon the most pleasing proportions of its parts.

The Principle of Balance

In regard to balance Poore says: "The most important demand of design."\(^{18}\)

One can readily agree with this statement. If an attempt were made to list the principles of design in order of their importance, the principle of balance would

\(^{18}\) Poore, op. cit., p. 47.
probably top the list. As for a definition of balance,
Varnum is quoted:

Balance means holding of all parts of the design
together in equilibrium. "Is the design top-heavy? Is it
one-sided? Is it unstable?"—All, usually queries
regarding balance.  

To be a little more specific, balance means the equal
distribution of weight on each side of a central point or
axis. Almost anyone, whether he is trained in the fine
qualities of design or not can readily detect when an object
is unbalanced. Little peace can be had in the perception of
something with distorted balance. A perfectly balanced
pattern will give a feeling of ease and rest. Thus an ap-
preciation of the pleasure accompanying this phase of beauty
is successfully accomplished.

In relation to balance, the designer usually considers
three phases: balance of weights or masses, balance of
movement or thrusts, and balance of tone and color.

Balance of masses.—The two types of balance of masses
are symmetrical balance or formal balance, and asymmetrical
or informal balance. Formal balance is the most readily
perceived. It means that the masses on each side of a volume
are equal in size and space; in other words, symmetrical.
Asymmetrical or informal balance means that the masses on
each side are not the same, but are placed to form an

19Varnum, op. cit., p. 60.
equilibrium on the central axis. Probably the illustrations given in Figure 6 explain the matter of formal and informal balance better than words.

![Diagram A and B](image)

Fig. 6.--Formal and informal balance

At A is shown a case of two equal masses on each side of the center space. At B the masses are unequal on each side, but they still give a sense of balance around an imaginary axis which the eye seeks for and detects.

In securing balance, one of the most important things is the number of divisions of the mass of a design or object. Van Doren gives a series of illustrations that show clearly the best number of divisions to give balance. The simplest is shown by use of dots. One dot placed by itself, of course, does not present much of a problem of balance. Designs and objects of utility, however, usually have more than one part. If two dots are placed side by side, the eye moves from one

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to the other and a sense of unease results. If three dots are placed in a row, the eye centers on the middle dot and the outside ones appear as balanced parts. Thus three divisions seem the best. If four dots are placed in a row, the same situation as with only two results. If five are used, balance again results. It begins to appear that an uneven number of divisions makes better balance; that is, at least, in the case of equal and adjacent divisions. Seven divisions are practically all that the human mind can generally grasp in one unit.

Mass divisions are usually in the form of rectangles, or enclosing rectangles. Thus we can illustrate balance of spaces in rectangles.

\[ \text{Fig. 7.--Illustration of balance of spaces} \]

In figure 7, at A is shown a division making two equal spaces. Although the middle line is really the axis for balance, it seems to be a dividing line ready to separate the two spaces. At B is shown a rectangle with three divisions, giving better balance. At C is shown still better balance by increasing the size of the middle space. These
are very simple graphic illustrations, but they show fundamentally the best divisions to be made of space and masses.

**Balance of movement.**—Movement is something new in this discussion. Implied movement or dynamic quality are probably better terms to express it, but not quite so simple. Movement in design means simply the impression of direction given by the general shape, or more usually by the lines of an object. The eye follows lines in the dominant direction or thrust of their pattern. Balance of movement then means the effect of movement and counter movement. They do not necessarily have to neutralize each other and give a static impression; in fact, a dominant movement in one direction may be desired. In any case, there must be counter movement to give a peaceful effect. Too much directional leading of the eye gives a genuine sense of instability and causes a distortion of the appearance of general outline and masses.

![Fig. 6.—Illustration of balance of line movement](image)

Again, simple illustrations are used to show balance of implied movement. Thrusts and counter-thrusts are
completely balanced in A, producing a somewhat static area. Counter thrusts in B do not neutralize the dominant upward movement, but balance it to give a sense of security. A more dynamic and interesting form results.

Balance of tone and color.—Balance of tone goes hand in hand with balance of spaces. Different tones give different appearance of spaces as to size. Spaces that appear perfectly balanced may not appear so when the tones of the areas are changed. Different kinds of materials that have contrasting surface tones will need adjustment for balance. A different surface treatment of some space will probably require a change of size to maintain balance.

The Principle of Rhythm

Rhythm means changes of sensation in regard to the perception of arrangement of line and masses. It means a regularity of changes in a regularity of measures, with the effect of movement on our minds. Notice that this movement is not merely movement of the eye but movement of the attention from one part to another. A design is more pleasing and satisfying when a repetition or arrangement of parts causes the attention to move smoothly from one to the other. It has by now become apparent that monotony is the greatest enemy of good design. Rhythm introduces variety and thus defeats monotony. To use another simple illustration, the balanced

21Ross, op. cit., p. 2.
arrangement of spaces shown in Figure 7C may have the center portion changed slightly to introduce rhythm and make the design more interesting. This treatment is shown in Figure 9, with A as the simple arrangement, well balanced but lacking in variety, and B showing a more interesting pattern.

Fig. 9.--Illustrations of changes of line and space to give variety and rhythm.

Although the changes and repetition that create rhythm are productive of implied movement, the design is not necessarily made unstable. As has already been stated, balance is the principle of composition which holds the forces of movement to a proper degree of interest.

The Principle of Harmony

To produce the most esthetic satisfaction a design must be made up of parts that have elements in common. This is the meaning of the principle of harmony. Harmony implies that all elements entering into any design are in accord.\(^\text{22}\) If parts have a correspondence or likeness, they are in harmony. The principle of harmony is an all-embracing

\(^{22}\)Namie Russell Mutz, *Learning to See*, p. 4.
principle. It refers to lines, shapes, sizes, areas, masses, and colors. Probably the most readily seen illustration of harmony is in the use of spaces which have the same proportions as related spaces, although they may be of a different size. The spaces involved may have the same enclosing proportions as the enclosing proportions of the containing space of the design.

The term "Harmonious Relationship" is used very often. It signifies something to be desired and infers the existence of beauty. In connection with design it has the same meaning. The quality of a design depends very much upon the harmony of its parts.

The Principle of Unity

Unity, of course, implies oneness, or the fact that something seems to be complete. In the artistic sense, it means the assembling and organizing of different parts or elements into a beautiful ensemble or whole.23 A design must have a completeness of appearance that gives the general idea of its purpose. Wherever unity is recognized, the organization of means to an end is found. Unity requires balance and rhythm. These are important factors in securing unity, but are not quite the whole of it. The organization of parts must effect a purpose. Whether or not a design conforms to the principle of unity may not be quite so readily

recognized as in the case of conformity to good proportion or balance. But, nevertheless, one always judges a design as to its unity in considering its worth. It is probably, whether realized or not, the first thing perceived in an object. To be of good design, an object must appear as a unit, well-organized for a purpose.

**Design of Lines**

Lines in the design have already been discussed. The use of lines is governed by principles of composition. As essentials of arrangement and order they play their part in producing aesthetic value. A complete analysis of design, however, should give a little more about line design than the treatment of lines as essentials. One hears the expression "An eye for lines." Basically this means an eye that is good in judging and appreciating the effects of lines in relation to a whole design. The importance of the rest of the arrangement is subordinated somewhat when a functional form shows prominent lines. The design of curved lines would probably be a better title for this topic of discussion. Many objects because of their form or function show curves in their outlines, or curves in their parts. Some curves are regarded as artistic and some are not. In all artistic curves, variety is the keynote. A constant change of curvature from one end to the other is desired. Curves are usually termed artistic because of their suggestion. The "curve of force" is often spoken of. This curve gives a sense of strength and support,
and is particularly effective on supporting members of objects. It has infinite variations, but always retains the same characteristics—showing linear movement or growth, promoted by a change of curvature of a long flat curve terminating in a short vigorous curve.\textsuperscript{24} A representation of this curve is shown at A, Figure 10.

\begin{figure}[h]
\centering
\includegraphics[width=0.5\textwidth]{fig10.png}
\caption{Artistic and unartistic curves}
\end{figure}

Another artistic curve used much in design is the so-called "Line of Beauty", or the Ionic Volute. This is a curve terminating in a spiral, the movement of which is based on geometric progression. A reverse curve with one portion larger than the other is shown at B, figure 10. This curve is sometimes called the "Line of Grace."\textsuperscript{25} Good proportion in this curve usually demands that the smaller curve bear ratios of from one to five to one to seven to the larger curve. That is, the lengths along the curves from the break

\textsuperscript{24}Ibid., p. 110.

\textsuperscript{25}K. Gordon, \textit{Esthetics}, p. 170.
of the reverse should bear these proportions. Reverse curves having the two portions the same size, or nearly the same size, are monotonous, and show little artistic value. Such a line is shown at C, Figure 10. Curves that are parts of circular arcs are usually regarded as of little value, especially in larger forms.

**Combinations of Colors**

The proper combinations of color are essential in securing good design. This use of color was mentioned in the discussion of the principles of harmony and balance. Further explanation is given here in regard to color with rules concerning the best arrangements and combinations. Harmony of color combinations is given generally in three divisions: complementary harmonies, monochromatic or dominant harmonies, and analogous harmonies.

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![Color chart](fig11)
In figure 11 is shown a color chart as usually given by authors in connection with color harmonies. The colors are grouped in a circle producing an opposite for each. White is considered as all colors combined, and black the absence of color. Gray is commonly termed as a "neutral."

When opposite colors, across the color wheel, of equal value, area, and intensity are combined, a complimentary harmony results.\(^{26}\) The dominant or monochromatic harmonies are produced by variations within a single hue. A low value of any hue may be combined with a high value of any hue, or a low intensity of any hue with a high intensity of the same hue. The other combinations producing analogous hues are made by combining any hue with the hue that immediately follows or precedes it on the scale. The color combinations which are considered to match well are given in the following list.\(^{27}\)

Red - white, yellow brown, orange.
Orange - white, red, brown.
Green - white, yellow, red, blue, brown, black.
Blue - white, black.
Purple - white, red, blue, black.
Gray - all colors including white.

As to the balance of areas of colors, the general rule

\(^{26}\) De Garmo and Winslow, op. cit., p. 97.

\(^{27}\) The authority for these color combinations is credited to Paul Frankl by Varnum, op. cit., p. 142.
is that the higher intensity and higher value should occupy
the lesser area and the lower intensity and lower value should
occupy the greater area.26

**Types of Design**

In this analysis of design, two types will be discussed.
These two types will cover the use of design to be treated.
They will be termed as structural and decorative.

Structural design, of course, refers to the structure
of an object itself. As here used it means the arrangement
of the fundamental elements, members, or parts. Decorative
design refers to contour enrichment and surface enrichment.
The two types are found together. The structure is designed
and then given decorative enrichment to a greater or less
degree.

Decorative design in regard to contour enrichment means
the design of the main outline or the outlines of parts of
an object. When the members have been arranged according
to the desired plan, and material has been reduced until it
does not exceed what is necessary for function and quality
of masses, artistic quality may be promoted by further re-
finement of contour and outline. This may be effected by
curves or penetrations.

Decorative design in regard to surface enrichment means
additional treatment of surfaces of materials. The type of

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26 De Garmo and Winslow, *op. cit.*, p. 95.
materials of course largely determines the nature of the surface decoration. Decorative design on surfaces usually involves the representation of forms regarded as being artistic. It may involve purely the representation of lines and shapes in an abstract pattern, or the portrayal of existing forms or experiences. The decorative design of surfaces is governed by the same principles as other design; the arrangements are only in two dimensions instead of the three dimensions involved in structural design of masses, since only the surface is treated. The term decoration is sometimes construed to mean design itself. It is, however, only a phase of design.

**Style**

This study is no place for a discussion of the sociological and psychological processes that are involved in regard to styles and their effects on man's thoughts, actions, emotions, and values. A thorough discussion of design should, however, include something about style. In artistic creations probably more than anything else, prevailing styles influence the use of design. At different periods of history, different styles have prevailed, and during each period objects were up-to-date if they possessed the characteristics of the style at that time.

In regard to style, Varnum says:
Change is the life of style. Moreover, style is an external expression of the inner spirit of a given time. Thus into our form-and-mass structure must be designed a freshness, directness, and stability, a freedom from the past traditions which are considered wholly out of touch with this, the machine age. The machine must be considered, not as a vehicle of production, but as a mass creative production; and thus machine construction actually becomes the expression of the inner spirit of our present life, making the designer the master of the machine, not its slave. This is an experimental age; and, in spirit of this age, designers constantly are experimenting with new forms, and materials out of which styles originate.

Thus we get from such an able treatment of style the idea that is behind what we call "Modern" style. This style will probably change and become obsolete, as others have down through the ages. But while styles change, the same principles of style determine beauty and aesthetic value. New styles are merely new ways of using design essentials to give certain characteristics of the style. What are the characteristics of modern style? They can best be shown by an illustration in contrast with old forms.

![Illustration of two tables: A and B]

Fig. 12.—Contrast between features of old and new forms

28 Varnum, op. cit., pp. 60-82.
At A in Figure 12 is shown the main characteristics of old forms in furniture. They are, mainly, the copious use of curves in outline, broken lines, appendages, softly rounded mouldings, and a covering of surface decoration. At B are shown characteristic details of modern forms. They are long unbroken lines of contour, emphasis on flat planes, penetrations into the mass, long continuous lines of mass division, bolder treatment of molding, and plain treatment of surfaces to enhance the natural beauty of the material. Surface decoration, when used at all, is usually in the form of veins to make lines, or small precise cuts spaced to give impressions of lines. With these characteristics, objects of modern styles are readily recognized.

At times, passing fads make fashionable the re-creation of past styles or at least a modern treatment of them. This is particularly true of the so-called "period styles" of furniture. Space can not be given here to a discussion of the characteristics of these various styles. Reference can be made, however, to books which illustrate the identifying elements and give good treatment of period styles. These are as follows:

1. Rogers, J. C., Modern English Furniture, New York, Charles Scribners and Sons, 1930.


**Design and Function**

Function in relation to design means simply this: is the object designed suitably to perform its intended purpose? This suitability involves size, strength, form, use, and materials. In regard to suitability, Burris-Meyer says:

> Undoubtedly, the first consideration when studying the elements of a design is the suitability of the material of which the article is made to the purpose for which the article is intended.\(^\text{30}\)

And in regard to function and decoration the same author says:

> The decoration of all design, which is so often an essential to its beauty, must also be suitable to the purpose for which the design is intended. The suitability or utility of a design is concerned in the first place with the material of the design and second with color and line. Good design is consistent with the nature of the materials used.\(^\text{31}\)

Although the first part of this discussion dealt entirely with the aspects of pure design, it is felt that some mention should be made of the importance of function in the use of design. The above quoted statements indicate clearly the importance of intended purpose of function of objects.


\(^{31}\)Ibid., p. 323.
The field of industrial design has come into existence almost in the past decade. It covers the work of designing products of industry. To begin with, mass production was made possible by the machine, and vast quantities of articles were turned out in assembly-line order. Production at low cost was the first aim, and little attention was paid to design. After all, how could a machine-made object ever be artistic? But industry soon woke up to the fact that in competitive selling, eye appeal was important. Consequently the industrial designer was born. He worked over the articles, keeping inside the limits imposed by the materials and machine tools that made them, and came out with more attractive pieces of merchandise. Since industry has developed so greatly, a profession has been made of industrial designing. Here is what Robert M. Cooper has to say on the subject:

Industrial design is no longer a chimera, an artistic daub, a starry-eyed bugaboo sponsored by long-haired artists. It is a calling that requires hard work, a long training, expert knowledge of the drawing board, creative ability that is founded on common sense, a fertile imagination that knows its boundaries, a familiarity with engineering principles, a memory for architectural axioms, and a mastery of the hard laws of production costs, systems of manufacturing, and merchandising. Modern industrial design is rooted in the soil of reality and flourishes under the guidance of men who are designers by training, choice and vocation.32

Summary

Design is order and arrangement of lines, shapes, colors, and spaces according to a plan. Good design is obtained when arrangement or composition follows fundamental principles of design. Using these principles one can set up general criteria for evaluating or judging designs as to their artistic and esthetic quality. The designs may be purely abstract representations used for decoration or actual objects made for use. They may be evaluated in regard to proportion, balance, rhythm, harmony, unity, value of line, quality of color, characteristics of style, and functional purpose.

A design should have good proportionate relationships as to lines, areas, and masses. Good proportions are relations of parts in ratios that the eye does not readily detect or solve. The best divisions of lines are those that give the same ratios between the shorter parts and the longer parts as the longer portions have to the whole length. Best proportions of areas are those whose length and width have the ratios of one to three, two to three, three to five, five to eight, seven to ten, or some similar ratio that does not cause the eye to divide it readily into equal parts. Monotonous ratios of areas such as one to one, and one to two should be definitely avoided. Other ratios such as one to one and one-sixth are weak and lacking in variety. Best proportions in total mass or volume are obtained when the enclosing areas have the good proportionate ratios just given. Good proportions of objects
with curved contours may be determined by securing best ratios of enclosing rectangular and volume shapes.

A good design must have visual balance. It should give a definite sense of stability. Weights on each side of the central axis should appear equal. The balance may be obtained through symmetrical or like-sided planning where equal weights or masses are equal distances from the center, or by asymmetrical arrangement in which unequal sides are placed at unequal distances from the line of axis. In this case the lesser mass or weight should be the greater distance from the center to give visual balance through suggestion of leverage. Lines or general shapes may be arranged to give a sense of movement in some direction, but this movement should be balanced by suggested counter movement in the opposite direction to give a peaceful interest. Tonal relations and colors should also appear balanced. Large areas of light tones balance small areas of dark tones.

A design should have rhythmic changes or repetitions of shapes to give variety and interest. Rhythm is obtained by regular changes of shapes which give a sense of movement. This rhythmic movement should, of course, be well balanced by regularly repeated intervals or divisions.

A design should have harmony of parts. Harmony is secured through likeness. If the major mass or volume is rectangular, the parts harmonize if they are also rectangular and have the same proportions. Dominant shapes and proportions should recur throughout the design to give harmony.
A good design gives the appearance of being unified, or its parts well integrated into a unit for a specific purpose. Its artistic value depends to a large extent on its unity.

In designs of objects that have curved contours or in decorative designs where curves are predominant, good proportion of curves is necessary for beauty. Curves should have variety and subtlety induced by long curves terminating in short curves, by changing arcs of curvature, and by reverses. Best proportions of curved lines are generally the odd-number ratios of the parts. The short curve should bear a ratio of one to three, one to five, one to seven etc., to the long curve. Reverse curves of the same length and curvature are monotonous and uninteresting.

Different colors used in a design should harmonize in their relationship. Harmony of colors can be secured by the well established rules of complimentary, dominant, and analogous schemes given in the paragraph dealing with color combinations.

To give the highest degree of artistic pleasure, designs of objects should possess the characteristics of prevailing styles. Modern styles are characterized by long unbroken lines of contour, emphasis on flat planes, penetrations into the mass, long continuous lines of divisions, plain treatment of surfaces, and very little surface decoration. Designs, in general, are to be desired that possess these characteristics. Esthetic significance, however, gives styles of
past generations qualities that make them valuable. This is particularly true of the period styles of furniture, which fads often make popular. Designs that possess definite characteristics of these styles are quite all right when used in appropriate surroundings.

As to function, a design is good that is planned for the greatest degree of service and use. The design of an object should be definitely in accordance with its intended purpose, and in keeping with the materials and methods of construction.
CHAPTER III

ANALYSIS OF INDUSTRIAL ARTS PROJECTS

The projects in this discussion will be confined to those made of wood and metal. These two are by no means the complete range of materials used in industrial arts programs. They are, however, the most commonly used. Woodworking and metalworking are usually the main courses of industrial arts in which projects are made for use that involve design as an important factor. Design is an important factor in ceramics, printing, leather craft, bookbinding, and, in fact any of the other fields of industrial arts. To attempt to discuss design in these various fields would, however, require too much space and time for this study. Since the majority of industrial arts teachers in junior and senior high schools are concerned primarily with woodwork and metalwork, this study is confined to the use of design in these fields which are limited by the school situation.

Aims or Objectives for the Making of Projects

Specific aims or objectives for the making of projects may be listed as follows:

1. Knowledge of and use of common materials of industry.
2. Use of certain tools.
3. Skill in the performances of operations necessary to construct objects.
4. Skill in planning and working according to plans.

5. Satisfaction of practical needs and interests of students.


These aims or objectives are not to be confused with the general educational aims of the industrial arts program given in Chapter I. They are specific aims in regard to why a project is made. The making of projects is considered as educational activity directed toward the aims in Chapter I just mentioned. The listing above was not made in order of importance. There may be many and varied other specific aims in project making, depending upon the particular school situation, but they will fall under the general aims given above.

Factors in Woodwork

Nature of wood.—Wood is probably the widest used material in industry. The average person is in contact with and uses wood products daily in so many ways that it would be hard to sum them up. It is light and has strength enough to serve countless purposes in objects of utility. Its natural color and tone are pleasing enough to make it useful for various ornamental purposes. It is a stiff, fibrous material, and does not bend easily.\(^1\) It cannot be hammered or mashed into shape; it must be cut and fitted. Pieces cut

\(^1\)Herman Hjorth, *Principles of Woodworking*, pp. 223-233.
the way the grain runs possess the most strength in a situation of lateral strain, since the fibers that make up the grain in most woods have a ready tendency to split or separate when pressure sets up a situation of cleavage. They also break if excessive force causes sharp bends. Wood is not particularly adapted to curved forms, especially long curves that weaken it. Wood used in school shops usually comes in the form of rough stock of all sizes, finished stock of specific sizes, veneers which are thin pieces of large size, and plywood which has been manufactured by gluing several thin layers together with the grain running in opposite directions. Common fastenings for wood are nails, screws, dowels, and glue.

Since wood is comparatively soft, it is easily scarred or scratched, and must be worked with care. It is clean to work with and offers great opportunities for the development of pride in fine craftsmanship.

Tools used in woodworking.--Practically all the tools used in woodwork are cutting tools. No need is felt here to take up the different tools or their specific uses. The thing to be brought out is that the use of tools and skill in their use is very important in the industrial arts program. Since industrial arts aims at contributing largely to vocational efficiency, practice must be given in operations that involve use of tools. After all, the skilled trades involve the making of something that requires the skillful use of tools. Aside from the vocational aim, industrial arts
deals with the use of common tools used by almost everyone in the upkeep of the home.

The industrial arts teachers must, then, have projects made that will offer the best possibilities for the students to become acquainted with and skillful in the use of the most common tools.

Possibilities of decoration.--Decoration of wood, aside from the painting and staining of surfaces, is confined by the material to contour enrichment and surface treatment by cuts or tool markings. Surface treatment is mainly in the form of carving. Representations of forms or conventionalized motifs are cut into the surface. Although wood carving is usually considered in a separate field from structural woodwork, the exercise of this craft in school shops goes well with projects that, because of their use, may be decorated to produce something with more than average artistic implications.

Types of projects generally made.--The types of wood projects generally made in junior and senior high school shops may be divided into three classes. The first class includes those made for purely ornamental purposes, and those—namely, pieces of furniture—used in the home either as parts of suites, or as odd or occasional pieces for some specific purpose. These are the projects that have the most possibilities for artistic appreciation. Those of the second class include those of more value purely as to function, such as work tables, work benches, tool boxes, etc. The
third class covers projects strictly of a utilitarian value, such as those made to serve for rough home or farm furnishings. These projects are usually built because they offer good possibilities for experience in carpentry and can be readily used or sold by the student.

Factors in Metalwork

Nature of material.—Metals generally used in industrial arts work are the more common metals used in industry. They are the hard metals such as cast iron, wrought iron, steel, and their alloys, and the softer metals such as copper, brass, bronze, tin, lead, aluminum, and german silver. The harder metals are used in making objects the use of which requires great strength and lasting qualities. Steel may be hardened to an extreme degree needed in cutting tools. The softer metals, some of which are called semi-precious, are used in making objects to serve countless purposes, from the strictly ornamental to those requiring weather-proof and abuse-proof treatment. Metal can be hammered or beaten into shape. It can be fastened together by welding and soldering processes, or by bolts, brads, or rivets. Holes may be punched by force. These are the general characteristics of metal, although each metal has particular qualities that limit its characteristics.

Tools used in metalworking.—Tools generally used in school shops for metalworking are those used for cutting and

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punching, bending, welding and soldering, grinding, hammering, polishing, and filing. The same can be said in regard to the choice of metal projects that offer possibilities to develop skill with tools as was said of woodwork projects.

Possibilities of decoration.—In the phase of metalwork commonly termed "Art Metalwork," there are many possibilities of decoration. In working on projects of utilitarian value, there are not so many. Art metalwork usually is the use of the softer or semi-precious metals in making objects mainly for the sake of their appearance and beauty. Surface decoration is usually effected by planishing, etching, engraving, hammering, forming, marking with impression tools, coloring by acid or heat treatment, or mere polishing of the natural surface. Ornamental iron which is usually treated differently from art metal work, also offers possibilities for decoration purely for an artistic purpose. Decoration in ornamental iron is effected chiefly by hammering, addition of decorative forms, filing, twisting, and coloring by heat treatment. Objects made for strictly utilitarian purposes, such as tools, have practically no possibilities of much surface decoration since it would interfere with their use.

Types of projects generally made.—The same classification of types used in woodwork projects fits the metalwork projects fairly well. In the first class are mainly the objects solely for ornamental purposes and those with artistic implications serving some special use such as bowls, vases, lampstands, candlesticks, letter openers, trays, etc. Most ornamental
iron comes in this class. Metal is used very little in shops for the purpose of making furniture, especially larger pieces of furniture. Although metal furniture is now being made extensively in industry, the proper equipment for such work is usually out of the limits of junior and senior high school shops. The second class largely includes tools, tool boxes, etc. The third class is made up of rough work for strictly functional purposes, mainly sheet metal projects and machine parts.

The Problem of the Industrial Arts Teacher in Regard to Design

By this analysis of industrial arts projects, one can see the problem of the teacher of woodwork or metalwork in relation to design. His bit toward helping the student in developing appreciation of and ability to create good design is only one of the things he has to do. Projects must be made that show the limits and possibilities of materials. Projects must be made that involve the best combinations of uses of tools. Projects must be made that involve most and best practice of construction operations. The needs and interest of the student should be taken into consideration in determining what projects shall be made. Since the average high school student has had little training himself in design of projects, it is largely up to the teacher to keep up this phase of the work in the way of checking projects for design possibilities and instructing and helping the students work them out. The student left to copy or work out his own design
without the esthetic implication being pointed out to him loses a chance of receiving much benefit from this phase of industrial arts.

As the field of design in industry grows, and the public is made more aware of good design in everyday life, the industrial arts program must keep pace or lose value. Objects for use made in school shops will naturally be compared with those turned out in industry. The making of projects which do not compare favorably, although the workmanship be good and the skills and knowledge learned be useful, will not have the greatest possible value as a meaningful experience. The extra time and effort spent in securing good design will be well spent for both teacher and pupil.

The problem of the industrial arts teacher in relation to design, then, is to take the projects that best serve toward the other aims and objectives and aid and direct the student in planning and making them so as to secure conformity to theories of good design and thereby possess beauty and artistic value.

Summary

This analysis of projects covers only woodwork and metalwork because they are the most commonly used materials in high school industrial arts shops. Project selection for class work is determined by teaching objectives such as skill in work operations and use of tools, satisfaction of practical needs and interests of the student, knowledge and use of common materials of industry, skill in planning and working
according to plans, and the development of aesthetic appreciations.

Tools used in woodwork are practically all cutting tools. Wood cannot be hammered or wrought to shape. It must be cut and jointed. Decoration of wood is usually in the form of decorative cuts such as flutes, beads, veins, and carved representations of designs. Metal is a quite different material. It can be hammered, forged, bent sharply, and welded or soldered at joints. Decoration is usually in the form of etching, engraving, forming, planishing, chasing, etc.

The types of projects generally made in high schools are those used for purely ornamental purposes and those used in the home as furnishings. Furniture, in separate pieces, and in suites make up a large part of high school woodwork projects. Other types are those for utility and less ornament and those of rough carpentry. Types of metalwork projects include those of ornamental nature made from the semi-precious metals and wrought iron, tools, and objects of utility—mostly sheet-metal.

The problem of the industrial arts teacher in relation to design is to check projects that fit the shop program best for possibilities of design improvement.

Some of the more commonly used high school shop projects are shown in Table 1. In this study, drawings of projects that had been actually made in industrial arts shops were secured from sixteen different schools. From these drawings, designs of seventeen different projects were chosen for the
illustrations of design evaluation in Chapter V. These projects do not represent the complete range of objects made in the shops. They were chosen because of the possibilities offered for illustration of work in design and because they were by far the most commonly used projects in the school shops surveyed. All of the schools offered woodwork courses and six had metalwork courses. Table 1 shows the frequency of use of projects selected in different schools.

TABLE 1

FREQUENCY OF USE OF SELECTED PROJECTS IN DIFFERENT SCHOOLS

<table>
<thead>
<tr>
<th>Name of Project</th>
<th>No. of schools in which projects were made</th>
</tr>
</thead>
<tbody>
<tr>
<td>Night tables</td>
<td>9</td>
</tr>
<tr>
<td>End tables</td>
<td>5</td>
</tr>
<tr>
<td>Footstools</td>
<td>15</td>
</tr>
<tr>
<td>Bedside stands</td>
<td>7</td>
</tr>
<tr>
<td>Combination radio and</td>
<td></td>
</tr>
<tr>
<td>magazine stands</td>
<td>11</td>
</tr>
<tr>
<td>Magazine racks</td>
<td>12</td>
</tr>
<tr>
<td>Tie racks</td>
<td>16</td>
</tr>
<tr>
<td>Clock shelves</td>
<td>11</td>
</tr>
<tr>
<td>Whatnot shelves</td>
<td>12</td>
</tr>
<tr>
<td>Lampstands</td>
<td>6</td>
</tr>
<tr>
<td>Book ends</td>
<td>16</td>
</tr>
<tr>
<td>Candlesticks</td>
<td>6</td>
</tr>
<tr>
<td>Letter knives (metal)</td>
<td>6</td>
</tr>
<tr>
<td>Book ends (metal)</td>
<td>6</td>
</tr>
<tr>
<td>Tinner's hammers (metal)</td>
<td>3</td>
</tr>
<tr>
<td>Rivet sets (metal)</td>
<td>3</td>
</tr>
</tbody>
</table>
CHAPTER IV

THE APPLICATION OF DESIGN TO PROJECTS

Here are given methods or devices to be used in securing good design in projects. They deal with the planning and arrangement of materials in projects to secure the best artistic results according to the principles of design given in Chapter II. They result from consideration of factors of project making and construction that limit possibilities of design. They deal with the design materials and essentials that woodwork and metalwork projects present. These devices are general answers to the question of how projects can be made to have more esthetic and artistic value. They are not offered as magic formulas, but as general rules or methods that can be interpreted for the demands of particular projects.

In wood projects, especially pieces of furniture and other objects of utility, particular attention should be given to structural design of masses and spaces. The characteristics of wood permit mostly structures of straight pieces fastened together. This lessens the possibility of extensive contour enrichment and makes the quality of the design rest upon the well proportioned, well balanced, and harmonizing spaces and masses. If care is exercised in planning the fundamental mass and space divisions, the object will be pleasing without so much contour enrichment or surface decoration.
Since a mass of equal sides is usually considered static and lacking in variety, masses and lines of an object should be arranged so as to give an impression of movement or thrust in a certain direction. As function demands, this may be in a horizontal relationship or a vertical relationship. It should however be one or the other, in preference to a generally square sided mass.

The lines in or on an object should produce the same general shapes as those of the contour or outline. This is necessary to give harmony of spaces and proportions. The lines may be structural divisions or joints, or lines for decorative purposes. Apparent distortion results to a greater or less degree when lines are at variance. Curved lines that form major spaces inside rectangular shapes appear out of place and inharmonious. The same is true of angular lines in connection with curved outlines. Lines at variance with the outlines or at changing angles produce a visual unrest. Best effects are produced when lines carry out the same directions as the outlines.

In most projects parts are placed in functional divisions. This may be seen readily in the case of a knee-hole desk where the center space divides the outside portions. Similar divisions of spaces are made by the shelves of a book case, the supporting legs of a footstool, and the lateral cross-pieces of tables that prevent spreading of the legs. Care should be taken in arranging these units to keep the appearance of the whole object unified. Divisions that do not show
the connecting effect of some common member or line are likely to give the impression of just being stuck on, whether they are connected rigidly or not. Planning should include some visible continuous part or line to tie the divisions together.

Where function makes use of three major vertical divisions of masses or spaces, best visual results are usually secured by making the central division the larger in proportion to the other two. This aids greatly in securing balance, rhythm, and variety. Such an arrangement may be followed successfully even on flat surfaces, where for the sake of variety, lines or penetrations are used to make major divisions of space.

Where two vertical divisions of an object are used they should generally be the same in size and alike in shape and form. However, function sometimes demands that one of the divisions be larger. In this case the apparent weight of the larger should be planned to balance that of the smaller. This can be accomplished by making the tonal effect of the larger portion the lighter of the two, having distinct visible support under the side away from the smaller mass, or by leaving out spaces in the larger division that are not necessary.

Formal balance is best adapted to industrial arts projects. Most of the projects are comparatively small and complete objects or units. While asymmetrical or informal balance produces variety that has pleasing artistic results,
it is better adapted to larger structures, and requires more
skill than the average industrial arts student, who has had
little training in design, possesses. It requires more time
in planning, and since it has already been shown that the
industrial arts program must cover several other phases,
time spent on any one thing is an important factor. Also
the projects generally made are well fitted for construction
of like-sided parts which balance around a central part or
line of axis. This can readily be seen in such objects as
desks, library tables, typewriter tables, book ends, metal
lampstands, radio cabinets, and semi-novelties such as
hanging shelves, wall brackets, etc. The function and
methods of construction of these objects make the simplest
and stoutest arrangement that of like sidedness. Formal
balance of parts is just as productive of beauty as informal
or asymmetrical arrangement. The beginner can grasp the
significance of the principle of balance better when he puts
something on one side to balance the same on the other.

When function, use, or construction requires two dis-
tinct horizontal divisions of an object or its mass, either
the upper or the lower should be the larger. This prevents
the monotony of two like-sized spaces and the effect that
the object appears as two parts, one stacked on the other.

In the case of three horizontal divisions the best mass
spacing is usually that of making the central portion the
larger in its vertical dimension, and the top and bottom
portions proportional in height. This may be varied in case some particular use of the lower portion requires that it be the higher. In such a situation the best effect is usually secured by having the middle portion slightly less in height than the lower and the upper slightly less than the middle. This gives a pyramidal or graduated effect very conducive to visual balance.

Supporting members such as legs or bases should be planned to carry out the general movement and emphasize continuity of lines.

Functional parts of objects such as handles or knobs should give the appearance of paralleling the major movement or thrust of the whole object, or as divisions in the opposite dimension. Many times knobs, drawer pulls, or even rows of screw heads may be lined up sufficiently enough to give a divisional effect to an otherwise plain mass.

When curved lines are used in wood projects they should be only a slight decorative enrichment or a functional requirement, and should have a minor part in the design as a whole. Curves cut too deeply weaken the structure. When some piece of an object, particularly the supporting parts, are cut to a curve for outline enrichment, the curve should never be cut into the grain so that the smallest part of the piece is made to weaken for the purpose that the whole part is intended.
Curves can be used to an advantage in contour enrichment of metal because the nature of the material readily permits bends. Care should be taken, however, to plan the curves so as not to destroy the effectiveness of masses and spaces by having them so complex as to cause centering of attention on the curves alone. This is to be considered more in projects made of metal that are for some use than those of purely ornamental purposes, where the beauty of the lines may be the only value of the object. Curves may be used to a great advantage at the terminal points of metal members, where they give a lengthening effect and prevent a chopped-off look. These terminal curves may be nothing more than a rounding of the material itself, but particularly in the case of wire, rod, or strap metal the member itself may be bent.

Small curves and rounded corners may be used to a distinct advantage in wood as well as in metal to soften the effect of square angles. It is best, however, if these curves be small enough in proportion to the object as a whole so that they do not detract from the major character of the mass and line pattern. For instance, if curves are used in the corners of a rectangular shape they should not be large enough to give the impression that the rectangle has been altered into another shape. The purpose should be to soften the angle made by straight lines at corners. Such curves are usually called transition curves. Top and outside corners of objects may also be rounded or cut to a curve to soften the transition of contrasting lines, and for the
functional purpose of protection of edges while in use, since the rounded edge will not become dented so readily. In any case, however, best use of curves does not detract from the major line pattern of the mass.

In the case of objects with completely curved contours, as projects in wood turning, and particularly bowls, vases, etc., formed from metal, the breaks of curves should line up to form what may be horizontal divisions of mass. This is illustrated in the case of a bowl whose contour is made up of curves that make the middle wider than the bottom or top. A line at the widest part should be treated as a horizontal space division. The divisions of such masses should be planned as was suggested in the treatment of vertical divisions of masses already given. The same is true in the case of turned objects such as candlesticks, where the contours are made up of a series of curves.

On an object that has a curved outline with several breaks and changes, continuity of line is the important thing. Small straight lines and reverses may be used, but the whole contour or outline of the mass should give an impression of free-flowing continuity.

Some one space or part of an object should be made the dominant part of the design, with the other parts subordinate to it. This aids greatly in securing unity. In many objects this dominant part of interest may be one of the mass divisions—usually the central one. On small objects whose
greatest value is that of decoration, the dominant interest may be a space of the decorative design or color. Objects with divisions that are equal in interest value are lacking in artistic quality compared to designs having dominant and subordinant interests.

General shape impressions should be repeated throughout the design. If opposing shapes are introduced they should be subordinated to the general characteristic shapes. If the major mass of the object shows angular shapes, these should be repeated in the decorative scheme. The same is true of rounded or curved shapes. If angles be introduced in designs having curve characteristics, they should only serve to break monotony in use of repeated general shapes. The same is true of the introduction of curves into designs having general angular characteristics.

Quite often projects of ornamental nature having symbols of clubs, fraternities, organizations, etc. are made in school shops. The symbolic shape that is the motif of the design is, of course, the important thing. Wherever possible they should, however, be conventionalized or shaped to give best conformity to principles of design. In shapes having irregular contours as in the case of shields, and plaques, or having geometric shapes such as diamonds, triangles, or polygons or equal sides, the important thing is to secure good proportion. This is probably best done by checking enclosing rectangular shapes for possibilities of interesting
ratios. Monograms used in decoration should be designed as much as possible in the general proportions of enclosing or supporting shapes.

In wood projects, straight cuts such as chamfers on corners can be used to advantage in contour enrichment. The chamfer, which is a forty-five degree angle cut across a corner, can be readily cut with a plane, and does not require skill that is out of range of capabilities of average shop students. Chamfers should, however, be used only on objects which have general angular characteristics. They should never be large enough to detract from the general square shape of the corners they are made on. The angular cuts are merely for a transitional softening or functional purposes.

Surface cuts such as flutes, veins, and beads can be successfully used to enrich areas on wood projects. Such cuts, when viewed as a part of a design, are primarily lines, and good arrangement depends upon their use as lines. Lines should always mean something. They should mark off or divide areas. Lines used for the sake of surface enrichment should always have a definite ending place, and not stop abruptly in spaces. Line patterns are quite effective in modern styles of design. They should be kept in an interesting and balanced arrangement. Lines chased and engraved in metal are subject to the same considerations given to lines on wood surfaces.
In the use of colors on projects, best use is that of selecting one color as a dominant interest and using harmonizing colors subordinately. Equal areas of color do not provide the interest of a dominant area and lesser harmonizing areas. Often, accent of a design is brought about by small areas of bright or strong intensity of color in contrast to larger areas of light tonal value. Small bands of bright color are particularly effective in modern design.

Different tonal values of areas brought about by surface treatment of materials are valuable to interesting design. This surface treatment of metal is usually in the form of planishing or etching. The making of the surface irregular by the hammering or acid action causes it to reflect light differently from the plain areas and produces a darker tone. Difference in tone value of the dominant and subordinate areas of a design are particularly desirable.

In wood projects, particularly those to be used as pieces of furniture, best color effects are secured when tonal values approximating the natural color of wood are obtained in the finishing. Stains of medium value should be used, since excessively light or dark stains detract from the esthetic significance of the natural color characteristics of particular kinds of wood. This consideration applies to the so-called "clear finish" obtained by use of stains, shellac, varnish, lacquer or wax. Small objects used largely for ornamental purposes, of course, may have their beauty
enhanced by use of paints or enamels that give bright colors and cover the surface of the wood completely.

In combinations of woods of different natural colors, one kind of wood should be used for the major portion of the design, and the other used only as a very subordinate contrast. The use of small areas of dark wood with large areas of light wood produces a very pleasing contrast. The same is true of small light areas used with large dark areas. In any case there should be a definite contrast between the tones, since areas of more nearly equal tone value are lacking in interesting contrast. Where light woods are used for objects, functional parts such as knobs, handles, and drawer pulls, and parts forming the bases provide an excellent opportunity for the use of dark contrasting wood. This serves not only to increase beauty but has a functional value in that the darker tone does not show so readily the marks of handling. Inlaid or glued-in bands of contrastingly colored wood work in well to produce characteristics of up-to-date styles.

In the case of shop projects made for a decidedly useful value, best design deals with the fundamental mass and shape of the object. A well constructed object with masses well-balanced, well-proportioned, and harmonizing, needs little decoration to fit in well with present-day use. Over decoration should always be guarded against. The enrichment of contours and surfaces may serve well to give students practice
in use of tools, but an over-decorated object is distinctly lacking in value. This does not exclude decorative enrichment completely, but emphasizes the quality and service of plainly finished objects with well adjusted mass relationships.

Where decoration is used, particularly on objects decidedly for ornamental use, decorative surface treatment should give the appearance of being a definite part of the object, and not that of something having been superficially added. Where abstract or geometric designs are used, the general shape characteristics of the entire object should be carried out in the decorative design. The area of the surface design should have a proportionate relationship to the enclosing outlines. Where bands or borders are used they should have a consistent forward or onward movement. Margins should never be large enough to detract interest from the enclosed design and should have a good proportionate ratio of size to the area of the design.

Decided effort should be made to secure conformity of projects to prevailing style. Adherence to old-type projects hinders the progress of the industrial arts program. Some projects made in the shop because of their small size and ornamental usage have a certain value when they represent antique or period styles. In the cases of such projects authenticity of representation of some old form is the thing to be desired. The esthetic value lies in the well arranged
identifying elements of a particular style. For the most part, however, projects should be selected that maintain style levels with industrially produced articles.

Shop projects for use in the home should be planned as much as possible to harmonize well with the home furnishings of the student. The industrial arts teacher should definitely consider this in aiding the students to select projects. In more advanced woodwork classes where several pieces of furniture are made, training in unit planning of room furnishing should be given. Projects with no particular identifying characteristics of style that appear as odd, out-of-place objects in surrounding furnishings have little artistic value and should be avoided.

All projects made in the shop should be considered for possibilities of design improvement. Some because of their intended use and material seem to offer little chance for artistic improvement, but most projects give a definite opportunity for the use of good design.
CHAPTER V

ILLUSTRATIONS OF DESIGN EVALUATION

To illustrate the use and evaluation of design in industrial arts projects, a series of plates showing drawings of actual projects are presented in this chapter. The purpose of the plates is to show projects lacking in qualities of good design in contrast with the same projects having much better arrangement. Each plate shows a project having relatively small value in regard to design and the same project with a different arrangement of shapes and details to embody the characteristics of good design. The designs shown are the ones secured from high school industrial arts classes discussed at the end of Chapter III and listed in Table 1.

In the case of relatively poor and good designs secured of the same project, these are shown together on the same plate. For the purpose of illustration, however, some of the plates show the drawing of an actual project lacking in good design in contrast with a drawing made by the writer suggesting better arrangement to secure good design. Considerations and points of evaluations of the designs shown are made in light of the analysis of design already given.
The summary of Chapter II gives the general criteria for evaluating the designs. In addition to judging the projects according to the principles of good design, the more subtle characteristics peculiar to each object in relation to its making, material, and use are discussed in the explanations given with each plate.

The suggested good designs given in these illustrations are not presented as being the best projects for use in shop programs. The purpose of the illustrations is to show factors of the use of design and design evaluation in selection of projects.

For the purpose of best representing the objects in these illustrations, a pictorial type of drawing is used. Dimensions are drawn to scale with an isometric foreshortening device to give a more accurate visual appearance.

All the designs shown have been considered carefully as to soundness of construction in accordance with the material and intended use. The same tool processes are involved in making the project of poor design and the same project of good design. The illustrations show the better arrangement of lines, shapes, masses, colors, and particular characteristic details to produce good design within the limiting factors of the project situation.
Plate No. 1

This plate shows designs of a very widely used project in high school shop programs. Either object will serve the purpose of holding books in place, but as to value of design there is a decided contrast. In considering these designs, the design A is lacking in qualities of artistic value, while the object shown as design B shows a conformity to design principles that makes a more pleasing object.

In evaluating these designs, the matter of proportion may be considered first. Although the vertical part of the first object does not have a square shape, it can readily be seen that a straight-sided enclosing area would be a square. This gives the static, blocky appearance that shows neither as a vertical nor horizontal mass. The proportion of the object of Figure 2 is readily seen to be rectangular. Although it cannot be checked by glance as to the exact ratio, the shape has a complete appearance that the eye does not readily divide into equal parts.

The three outline curves of the first object join each other in a way to give the impression of three equal divisions of mass, and the sameness of size causes a monotony of movement. Probably the most inharmonious element of this design is the decorative portion. The enclosing lines of the decorative area are decidedly out of keeping with the major outline characteristics. The monogram letter has instability and confusing motion.
In the design of the second object, the curves used to soften the contour are small and do not detract greatly from the general rectangular shape of the mass. Lines are continued from the curves of the major portion downward to give the effect of mass division. The central portion is the larger and with the added effect of the decorative area becomes the dominant interest of the design. The outline of the decorative area follows nicely the outline form of the major portion, and the monogram letter quite in keeping with the shape character of the whole object.

Plate No. 2

Here is an example of planning to produce a better design for a simple piece of furniture. Design A shows relatively inferior designing to that of Design B. The most noticeable lack of good design is the unstable appearance of the legs caused by the large tapers on the bottom. Although the construction of this table may be quite strong, it does not have the appearance of solidness that the other table has with its legs straight to the floor and the added shelf bracing the legs. The tapers on the legs were probably cut to give an impression of lightness. This has been accomplished in the second project by making the supporting members slightly less in size and rounding the outside corners.

The table shown in Design A is lacking in good proportion to the one in Design B. The height is greater than the width giving a vertical rectangular shape, but the top is square,
making all four sides of the mass the same width. This is not as pleasing as the result in the second design where the type is a rectangle of good proportion, giving a variety in appearance of the front and sides of the mass. If some functional use made it best for the first table to be square, then the equal dimensions would be the best to use, but since the use as an occasional night table placed at the side of a bed would scarcely make any difference as to the few inches required to give a rectangular shape, the proportions giving variety of spaces make the second design decidedly much better.

although the projection of the top in the first design is not a particularly bad feature, the flush top of the second, with slightly rounded corners, shows a much better treatment. The evenly fitted top adds to the neatness and finish. Attention has been given in the second design to the drawer pull, changing it from the turned round knob that appears merely as a standard utility detail to a shape definitely in accordance with and a part of the major mass. The lower shelf may also be pointed out as a functional improvement over the first design, since it can readily be used to hold extra articles such as books or magazines.

The softly rounded corners, the harmonizing drawer pulls, and the straight lines of the legs give Design B a neatness and trimness of appearance that give definitely a more artistic quality than the first design possesses.
PLATE NO. 3 - WHATNOT SHELVES

DESIGN A

DESIGN B
Plate No. 3

In considering these two what-not shelves, Design B is by far the best appearing object. Design A shows a lack of proper planning as to the curved outlines of the supporting side pieces. The contour curves of these pieces are very monotonous because of the continuous rolling effect of the parts which lack definite directional movement. The bulbous appearance at the middle is not conducive to good visual balance. The continuance of the side pieces up past the back portion detract from the unity of the complete object. The straight line of the front panel is at variance to the curve of the side piece to which it is fastened. This extension of the curved side out from the front gives a rather weak appearance. Design B shows a rather extravagant use of curves for contour lines. It seems that they were made with very little planning. Design B, on the other hand, shows a much finer adjustment as to contour details. In the first place, the mass shows a general angular shape in keeping with its function. It is made to hold objects slanting outward so that they will be readily accessible for selection. The side pieces have straight contours up along the front, giving a vertical upward movement. The top corners are neatly rounded with graceful curves of good proportions. The curve at the top of the sides is a long curve terminating in a short curve that provides an interesting transition. The very small straight breaks add variety to the curves and
keep the major straight line impression. The smaller transition curves at the bottom of the sides are similar to the curves at the top. The back portion gives a strong supporting appearance, with very slightly rounded corners for smoothness.

Design B shows clearly a finer adjustment of details to produce a better design.

Plate No. 4

Of these two designs, Design A can be considered as inferior in good appearance to Design B. The first thing apparent in Design A is the completely round compass curves of the supporting pieces. These curves, going abruptly outward, give a heavy, blocky appearance. The sharp angular cuts give a harshness of appearance in addition to the abruptness of the curves. The combinations of large angles and large curves are not very harmonizing. The blocky appearance of the ends makes the enclosing space proportions seem rather square and uninteresting.

Design B can be considered as the best design. The slight narrowing of the ends toward the top provide an appearance of lightness. The curves are more graceful and subtle, and detract little from the general shape of the ends; in fact they carry out a very slight upward thrust. These curves enrich the contour and give a definite supporting appearance. Since the lines of the end pieces provide a slight upward movement, the proportion appears better adjusted.
In general appearance, Design B seems much better as to form and shape.

Plate No. 5

In comparing these two designs, the contrast of decorative patterns is the most apparent. Even though the outline of Design A makes it inferior in appearance to Design B, it is the use of poor arrangement as to decorative elements that make it a rather poor design.

These metal book ends provide readily for added surface decoration because of their ornamental use. The decorative design of the first, however, is overdone. The pointing of the angular portions to the round center gives a rather bizarre effect. Lack of harmony of shapes is the outstanding fault of this design. The circle in the center is out of keeping with the rectangular outline, and the angles give too many directional movements. Although the element of radiation sometimes produces a pleasing effect in decorative patterns, the radiation in this design is much too strong and harsh.

Going back to a consideration of the outline of Design A, the sharp corners at the top give a rather abrupt start to the curve. The top curve detracts somewhat from the complete shape appearance.

Design B shows a much simpler and richer treatment both as to outline and decoration. The rectangular shape has good
PLATE NO. 6—BEDSIDE STANDS

DESIGN A

DESIGN B
proportions, and the rounded corners give a finished appearance. The chief element of the decoration is the etched surface area that provides a contrasting tone to the marginal outline. This central tone is easily the dominant interest of the design and gives a quiet, pleasing appearance. Design B shows a well controlled use of decorative elements.

Plate No. 6

These two bedside stands show distinct modern styling. The long straight lines, sweeping curves, and plain surfaces show a quite modern treatment. One, however, shows an arrangement that is much more artistic than that of the other. Design B is the one that can readily be selected as having a finer appearance.

The curves on the ends of the shelves of Design A are so large that they give unbalanced movement. The horizontal thrust is too strong in one direction. The line of the bottom of the top drawer is just far enough above the line of the middle shelf to give a disconnected effect. Another note of distraction is that of the arrangement and spacing of the drawer and door handles. The rather short door handles placed apart break up the interest of the solid mass, and appear rather weak in comparison with the other elongated forms.

The base of Design A is too massive. The important thing about the stand should be the functional space. A base appearing so massive is quite unnecessary. It detracts from the dominant interest of the functional part.
The top shelf is left off in Design B, giving a better visual balance, and providing rhythm of movement. The dominant thrust of this design is also horizontal toward the right, but much better balanced than that of Design A. The smaller curves on the corners of the shelves lessen the sweeping line notion. The top drawer is made slightly larger so that the bottom lines up with the shelf. The base of this object has been reduced in height and appears quite unobtrusive.

Vertical thrust to balance horizontal thrust is obtained by making the door handles long and placing them in a vertical position. The length of the drawer pull evens up with the lines of the door handles. The dark, contrasting tones of the handles, drawer pulls and base give accent to the surface areas.

Plate No. 7

Here is a contrast of styles. Design A represents old forms and Design B represents modern arrangement. Design A shows fairly good design although the square shoulders at the top provide a harsh note. Design B is also good design according to conformity with design principles. Style, here is the most important thing to consider, and Design B is probably the best choice for an up-to-date piece of furniture. The surrounding furnishings would of course have something to do with the selection. Design A might go well with room
PLATE NO. 8—MAGAZINE RACKS

DESIGN A

DESIGN B
furnishings that possess characteristics of old forms. Design B, of course would go well with modern furnishings.

Design A shows jointed construction, with legs to give solidness and stability of appearance. The tapers on the legs relieve some of the weight of the mass. The square-cut shoulders below the upholstering are a bad feature. It has a rather rustic appearance.

Design B shows glued-up solid construction of the end pieces and small decorative vein cuts to accent the general shape. The appearance of this footstool is one of unity and good proportion.

Design B would probably be considered the best choice of the two in most cases because of its distinct modern styling.

Plate No. 8

The magazine rack is another very commonly made high school shop project. Here are two designs for magazine racks that well illustrate the difference between good and poor design. Design B is readily seen to be the best design.

Design A shows rather poor planning as to contour curves and definite mass outlines. The three almost equal curves at the top of the side pieces make a rather indefinite shape. The inward curves at the bottom give an unstable appearance. The pointed, upward curve in the middle of the bottom also adds to the unbalanced appearance. The long curve across the top of the center piece is uninteresting, accented by the
half-moon shape of the hand hold. The curved contours seem to have been cut so as to prevent the existence of any straight lines. The resulting effect is weakness of design.

Design B shows much better arrangement. In the first place, the straight lines of the sides give a definite shape to the mass. The curves at the bottom are arranged to give a suggestion of support with very small straight breaks to accent the curves. The tops of the sides are cut to graceful contours with a definite center portion to provide better balance. The center partition also has a nice, simple treatment with rounded corners. Design B appears much better balanced than Design A although the dimensions are practically the same. The fact that Design B has a more definite shape makes it by far the best design.

Plate No. 9

Here is an illustration of what can be done in the way of designing simple objects for better appearance. Such objects as tinner's hammers do not offer many possibilities for design improvement. If almost any object, however, is considered carefully, improvements in its appearance can be made.

In tools such as shown in this plate, the greatest value is that of being made to do the best job. If appearance can be improved without impairing the function of the object, however, the value is increased. In the case of the two tinner's hammers shown, both will probably do the intended
PLATE NO. 10 - RIVET SETS

DESIGN A

DESIGN B
job equally well. The angular shape on one end is for setting seams, and the straight end for hammering. On the face of the hammer head the angles across the corners lessen possibilities of chipping or of cutting the metal being hammered. The small matter of difference in treatment of the beveled corners produces a distinct difference in the appearance of the hammers.

Design A shows the best looking hammer. The tapered cuts on Design B give a note of variance to the square shaped mass. The eye follows the angles of the tapers to produce opposing movement of lines. On design A, the straight chamfer terminating in a small curved surface gives a general straight line movement. The short curves at the beginning of the chamfer give a slight break in the smooth plain surfaces and provide a degree of interest.

Plate No. 10

Considerations of these designs are much the same as those of Plate No. 9. Either of the two will probably serve the intended purpose, but one is better appearing and therefore has more value as a tool.

Of these two rivet sets, Design B is the best appearing tool. Probably one of the reasons that it is the best design is that it shows an effort has been made to give it a better appearing shape. The tool shown in Design A gives evidence as having only been shaped enough to make it suitable to work with, and no definite effort made to give it distinctive form.
PLATE NO. II—TIE RACKS

DESIGN A

DESIGN B
Design A has a rather blocky, crude appearance. It still looks like the rough block of tool steel it was made from. The extra long shape in proportion to the width and thickness gives little chance for interesting proportions. The rounded corners on the hammering end add to the unfinished look.

Design B shows that the shaping has been planned to produce a definite form. The smooth curves show well the characteristics of the steel from which the tool is made. The hammering end is made smaller to give accent to the working end. The bevels on the corners of the face and hammering end vary the shape of the curves and give a finished appearance.

Plate No. 11

These tie racks are objects which provide opportunity for simple decoration. The decorative patterns are worked on the surface with wood carving tools. The added decoration, since it does not interfere with use, enriches the object and gives practice in finer craftsmanship.

Design A, however, is not nearly so good as Design B. The long, weak curves that form the top outlines are monotonous and detract from visual balance. The carved area enclosing the monogram, does give to some extent a dominant interest, but its shape is inharmonious with the general shape of the object. The strong semi-circular curve is at variance with the long, shallow curve of the top. The treatment of the ends with the slight inward curves provides a
rather pointed appearance to the top outside corners. This lessens the stability of the design, since the eye follows the outward movement of lines.

Needless to say, the functional part of the tie rack of Design A has received rather poor treatment as to the shape of the supports and the protruding ends of the rod.

As an object of artistic value, Design B is far superior. The area to be decorated has been extended upward from the functional part by well-balanced and well-proportioned curves. The supporting graceful curves on the sides soften the strong effect of the circular shape at the top. The dominant interest of this design is the decorative area. This area follows the contour outline of the object and is arranged for variety and interest. The shape of the rack is in keeping with the form of the bottom of the object and adds to the appearance of the design.

Probably the most outstanding feature of Design B is the well planned formal balance of outlines.

Plate No. 12

Of these two designs, Design A will have to be judged as being less artistic than Design B. Design A is a good example of too much contour enrichment.

The supporting pieces of these shelves have general triangular forms. This form is best for function since the shelf must be supported out from the wall with as little space as possible being taken up by the downward pieces. Curving
PLATE NO. 12-CLOCK SHELVES

DESIGN A

DESIGN B
the contour is quite the natural treatment for these supporting pieces. The curves of Design A are, however, much too extravagant. The direction changes too many times and the straight break at the middle shows a lack of continuity. The upper and lower curves have reverse parts that are practically the same size, giving an uninteresting ratio. Such a copious use of curves is also out of keeping with the nature of wood. The material may not have been weakened seriously by these cuts, but the suggestion of weakness detracts from the design.

Where the contour curving of Design A has been overdone, the curve of Design B has been left plain and simple. In fact, it can be said that the curves of the supporting members of Design B still lack some adjustment to produce the best results. The shapes of this design are, however, very much better than those of Design A. The artistic value lies in the continuous supporting curve with an interesting growth and proportion. Also, the width of the shelf of Design B has been slightly narrowed to give better balance and shape.

Plate No. 13

Here again are shown two objects of definitely modern style. These turned lamp bases go well with characteristicly new furnishings. It is hard to say which of these designs is the best. The difference lies in very subtle qualities. By all rules of good design, the lamp base shown as Design B should be the best. But does it look better? Design A has almost as good appearance as Design B.
The selection of the best design here requires a careful analysis of design factors, and even after all points are considered, there is little difference in the visual appearance.

Design B has an even number of mass divisions, with each the same size. This is not conducive of good design, but here the arrangement is not so discordant. The thing most detracting from Design A is the depth of the division cuts. This slight excessive depth gives a lack of connection and unity.

Design B has an odd number of mass divisions, with graduated sizes from bottom to top. This is to give better balance and variety. The division cuts are not quite so deep, providing a more unified appearance.

In a choice of one of these lamp bases, Design B would probably be considered the best because it does have essential factors of good design, although there is very little difference of appearance in the two objects.

Plate No. 14

Here is an illustration of what happens when an object is made to show decidedly new form, but has inharmonious characteristics of old forms retained. Design A shows this very clearly. The bold treatment of lines and spaces is weakened by the curved contours on the base portions and by the heavy effect of the moulding on the top corners.
Design A is decidedly inferior to Design B. Not only are the odd, curved legs out of harmony with the general treatment of lines, but the space divisions made by the front of the shelves have a poor arrangement. The horizontal shelf in the left portion of the object has an abrupt ending adjacent to the center of a space of the right portion. This gives a disconnection that breaks up the interest of the space arrangement. The extension of the right end up even with the top of the left portion does not quite give good balance.

In Design B, more careful attention has been given to space arrangement. The lower space of the left portion has been increased so that the top shelves of both portions line up. This space arrangement has a dynamic, rhythmic appearance. The height of the base has been decreased and this portion made solid in keeping with the straight lines of the general mass. The contrasting tone of the base also provides accent to the design. The height of the right end piece has been decreased below that of the left top, giving better balance and a rhythmic change of shapes.

The mouldings have been retained on the outside top corners for a functional purpose. They serve readily as extensions to grasp when moving the object. The one on the left end also provides support for objects placed on the top.
Plate No. 15

Design B is considered the best of these two objects. The tapered legs of the end table shown as design A are too heavy at the top. The taper running the whole length gives a rather spread-out appearance. The top of the table appears somewhat thin and out of keeping with the heavy mass of the legs. The most discordant factor is, however, that of the curves on the bottom cross pieces. The general shape of the table is angular, and those curves only give distracting shapes. The general appearance of Design A is that of very plain unplanned details with an incongruous effect of poorly proportioned curves on the bottom members.

In design B, decorative cuts have been made in keeping with the general angular shape. These cuts are mostly chamfers on corners. The chamfer on the corners of the top give a finished look. The same is true of the legs with very small angle cuts on the corners. The straight legs give an even vertical thrust, and the small taper on the bottoms give an appearance of lightness. The end table of Design B has much better balance than that of Design A. Design B has by far a neater and a more carefully planned appearance.
Plate No. 16

Here are two wood turning projects with contrasting designs. These candlesticks are used almost solely for ornamental purposes. Their value is largely that of the antique. They are representative of forms used for many years on similar objects. The artistic quality of such objects lies in beautiful lines and rounded surfaces.

Of these two designs, Design B is by far the best. It has three distinct major divisions of mass—the base, the body outlined by long continuous graceful curves, and the top which is shaped to hold the candle. The body, or central portion, is the larger and dominant portion of the mass. The proportion and shape of the outline curves of the central portion give a very pleasing appearance. The smaller curves on the top are similar in shape to long ones of the middle portion. Beauty of line is the most important factor in the design.

Design A shows a distinct lack of artistic curves. The mass is broken up into too many different shapes. The vertical mass is divided up into four parts that are nearly the same size. The straight lines forming the lower middle portion are inharmonious to the rest of the curves. Most of the curves of the outlines are of rather poor proportion. The bulbous effect of the top gives an unbalanced appearance.

The overuse of divisions and breaks gives Design A a rather bizarre and ugly appearance.
Plate No. 17

Because of their small size and use these copper letter knives may be given enriched contour and surface treatment to make them more ornamental. Design A is the relatively poor design and Design B the best.

The outline curves of the handle of the knife shown as Design A make a rather uninteresting shape. The three almost equal curves at the top give a lack of directional line movement. The division between the handle and blade has a very weak appearance, with the mass being cut rather deeply and the outline showing two equal curves side by side. The most readily noticeable defect of the design, however, is the poorly shaped decorative area. This area is an asymmetrical form in an otherwise perfectly symmetrical shape. To much eye motion and unrest is caused by this crudely shaped etched area.

Design B shows a much better shape. The top corners of the handles are rounded for softness but the generally straight lines show a definite shape. The chased lines near the outer edges of the handle set off a dominant central portion. The interest of this portion is enhanced by the darker tonal area of the decorative pattern that is shaped in accordance with the outline.

The blade of Design B is also better shaped. The very small breaks beneath the handle accent the general straight lines. These straight lines and the angular shaped point
Give a suggestion of sharpness, making the knife appear more useful for its intended purpose.

Design B in contrast to Design A illustrates what can be done by a little careful planning within a limited project situation to make an object that possesses the most artistic value.
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