CHERYL AKNER-KOLER

# THREE-DIMENSIONAL VISUAL ANALYSIS

DEPARTMENT OF INDUSTRIAL DESIGN
UNIVERSITY COLLEGE OF ARTS, CRAFTS AND DESIGN

INSTITUTIONEN FÖR INDUSTRIDESIGN
KONSTFACK

To  Gunnar, Corina and Malcolm

**Correspondence**

I hope this book is constructively criticized with respect for Rowena Reed´s intentions and that suggestions for improvement will come my way.

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## Contents

Background - Rowena Reed
Acknowledgements

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References and Suggested Reading

"It is not exactly the presence of a thing but rather the absence of it that becomes the cause and impulse for creative motivation"

Alexander Archipenko

# INTRODUCTION

This book aims to strengthen an understanding of the sculptural possibilities of form and space through developing a visual language and structure that recognizes and gives priority to 3-dimensional visual perception. It is written so as to apply to both the active process of shaping 3-D form and space and analyzing any existing visual situation.

## Foundation

The  foundation of this language is derived from the inspiring courses conducted by professor Rowena Reed at Pratt Institute in New York City and also in private Soho classes. Rowena Reed´s method of visual analysis taught her students to "think with their eyes" and to translate an inner vision into concrete experiences.
Her challenging way of teaching combined creative exploration with an analytical search for the "Principles of visual relationships".
The last pages of this book are dedicated to summarizing her background, philosophy and educational vision. Moreover, in order to gain a historical perspective, a map is included that outlines the relevant art movements in the beginning of this century and some of the major events in the early work of Rowena Reed and her husband Alexander Kostellow. As illustrated in this map, the Russian constructivist movement is the point of origin for the artistic tendencies and formal language developed by Reed and Kostellow.

## Teaching in Sweden

Under the leadership of Professor Lars Lallerstedt at the Department of Industrial Design (ID) at the University College of Arts Crafts and Design (Konstfack) in Stockholm Sweden, I have been given great opportunities to further develop and document this visual study program. The  visual problems taken on by the first and second year Industrial Design students provide the substance of this book. Using clay and paper models the students creatively question the "established terminology" and develop solutions which strengthen and / or add new concepts to the program. Regrettably, this interactive exchange of ideas with the ID students as they strive to bring visual thoughts into the 3-dimensional world could not be communicated within the scope of this book.

Although this book is written in English, most of my teaching has been in Swedish and therefore many ideas have been discovered and discussed in the Swedish language. This culturally imposed struggle with translating the visual language into Swedish and then using both English and Swedish to further develop the terminology has proven to be a very vitalizing process. To constantly re-examine the concept vailed by a term has made me keenly aware of the shortcomings of both languages. This inherent problem in communication has helped me see the need to create strong "visual images" of each form and space concept logically connected within an overall framework.

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**Framework**

Through working and teaching within this constructivistic tradition  I have felt the need to document and organize this visual 3-dimensional (3-D) terminology into a comprehensive framework which demonstrates the strength of visual analysis. The following four sections (I - IV) constitute the backbone of my teaching as well as outline the content of this book:

      I.   Elements and their properties
      II.  Movements and forces
      III. Relationships
      IV. Organization

Within this framework there are several underlying principles that are central for this 3-dimensional visual approach: 1) recognizing an interdependence between form, movement and space; 2) visualizing the inner movement and structure of form; 3) prioritizing asymmetry; 4) deconstructing a composition in a logical sequence from inner structure $\rightarrow$ movement $\rightarrow$ volume $\rightarrow$ plane $\rightarrow$ line $\rightarrow$ point; 5) perceiving 3-D compositions from a number of different views in order to grasp their all-aroundness.

**Intent**

My intent with writing this book is to prepare the reader for a dialogue with the 3-dimensional world. I believe that deeper concern for our 3-D visual reality may be awakened through learning to discern form and spacial qualities in our environment. It is my hope that the methodology outlined in the pages of this book will give a starting point for discerning the different levels of complexity inherent in each visual situation and that general principles can be made <u>concrete</u> through each individual work. The concepts presented here can all be greatly expanded upon since each visual solution/ situtation in itself is unique and demonst rates specific relationships which challenge abstract definitions.

I have tried to emphasize volume, inner movement, depth, space and all-aroundness as much as possible in order to stress 3-D thinking. However, there is no way to simulate these qualites in 2-D illustrations and photos. As a result the characteristics of the outer configuration of the positve forms overide the less tangible, spacial and volumetric qualities. Issues such as light-shadow, color, texture, transparency-nontransparancy, which are an intrinsic part of creating and experiencing form and space, have not been brought up here because of the

limits of this documentational media and time. I hope to devote energy in the future to prepare and develope  effective ways of documenting experiments which focus on these issues.

**Methods of Documentation**

This book is written on a Macintosh LC computer using Pagemaker® layout program. All photographic images show 3-D models made by ID students at Konstfack. The models have been photographed by a Canon ION digital camera and mounted into the computer using Macvision® software. The low resolution of the digital photographs was considered acceptable within the limits of the budget at the onset of the project in 1990.
Some of the illustrations are created through Superpaint® program while others are derived from an Intergraph® CAD (computer aided design)-system and then scanned into the computer. The CAD-technology made it possible to recreate some of the student´s geometrically derived 3-D models through a solid geometry computer program. This technique allowed us to deconstruct these models into their elemental parts.
The original material has been printed through a Hewlett-Packard Laserjet 4M printer.

# ELEMENTS and
# their PROPERTIES

**FOUR BASIC VISUAL ELEMENTS**
of Form and Space

VOLUME
PLANE
LINE
POINT

POSITIVE and  NEGATIVE ELEMENTS

**DIMENSIONS OF ELEMENTS**

HEIGHT
WIDTH
DEPTH

**PROPORTIONS**

INHERENT PROPORTIONS
GENERAL PROPORTIONS

**3-D PRIMARY GEOMETRIC FORMS**

CURVED
STRAIGHT

This chapter on Elements and their properties deals with defining the basic visual elements and their elemental parts, dimensions and proportions. For the sake of simplicity, the cube and rectangular volume are used to exemplify principles and ideas in this chapter. The concepts here, however, apply to the entire spectrum of forms from geometric to organic and from positive to negative.

The primary geometric forms are described at the end of this chapter. The basic visual structure defined through these primary forms provides an important visual reference for the proceeding chapters.

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## FOUR  BASIC  VISUAL  ELEMENTS

The four basic elements: volume, plane, line & point are illustrated in figure 1 below.
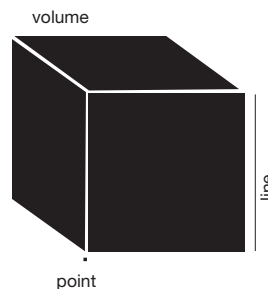
volume

line

point

Fig. 1

Any 3-dimensional visual situation can be broken down into its different elements to gain an understanding of what the whole is made up of. The four basic elements are introduced in relation to the 3-D volume. Deconstructing  the volume into its elemental parts stresses the importance of thinking 3-dimensionally even when working with 2-D or 1-D elements and, thus, focus on the 3-dimensional origin of visual elements.

Volume is a 3-dimensional element expressing height, width and depth. The boundaries of the volume are defined by surfaces. The properties of the inner mass is reflected in the movement and shape of the surfaces. These surfaces can be divided by hard transitions creating the boundaries of the planes. The boundaries/edges represent the lines of the volume and the corners on the volume are the points.

Plane is defined as an elemental part of a volume. When the surfaces on a volume have clearly defined edges so you can discern its shape and contours, a plane is delineated. Plane has lines and points as its elemental parts. A plane can also exist independantly in space and is a 2-dimensional element expressing width and length.

Line is used to delineate the shape of a plane and the hard transitions between surfaces as they form the edges on a volume. Line has points as its elemental parts. An independant line in space articulates 1-dimension expressing length.

Point is an elemental part of a line. It can be visualized as the start and end of a linear element and the corner points of a volume. Point has no elemental parts and no dimensional movement, yet it expresses position.
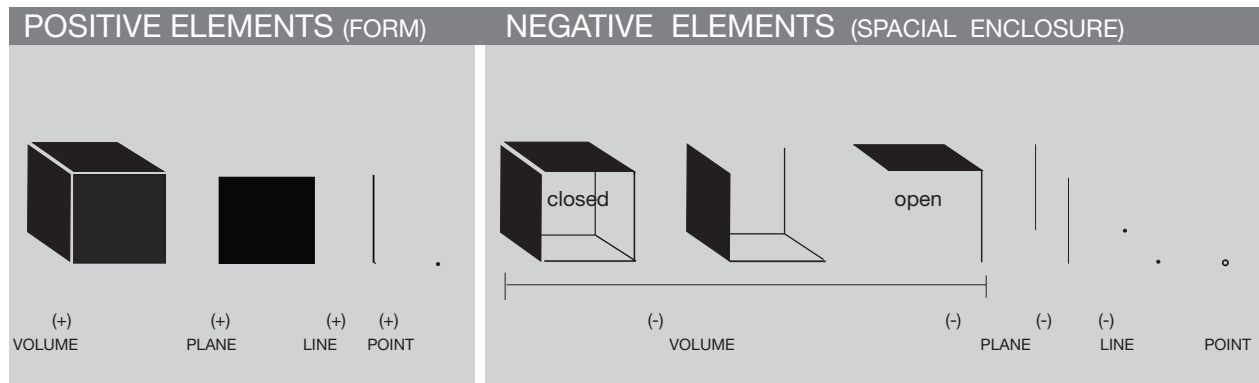
POSITIVE ELEMENTS (FORM)        NEGATIVE ELEMENTS (SPACIAL ENCLOSURE)

closed          open

(+)          (+)          (+)     (+)          (-)                    (-)          (-)     (-)
VOLUME       PLANE        LINE    POINT        VOLUME                 PLANE        LINE    POINT

Fig. 2a                                                                                          Fig. 2b

The definition of the elements: volume, plane, line, and point on the opposite page applies to tangible form (positive elements), yet the basic visual elements can also include spacial enclosures (negative elements).

Positive (+) and negative (-) elements (Fig. 2a-b) are similar in that they can both be described as visual components with more or less defined boundaries. A positive element - form - can not be perceived unless it exists in a spacial context, just as a negative element - spacial enclosure - can not exist without form to define its boundaries. The interaction between space and form represents a duality inherent in 3-dimensional visual analysis. It is what makes the visual world both concrete and abstract at the same time.

Spacial enclosures can be considered basic visual elements of 3-dimensions if the positive elements limiting a space define a clearly recog-niz-able shape. Negative elements are defined within the space between any of the positive elements: the surfaces on volumes or independent planes, lines and points in space. The description of the different positive elements can also be applied to the negative elements, yet perceived spacially. The elemental parts of spacial enclosures are, however, more varied than the positive elements. The sequence of (-) volumes in figure 2b illustrates this variation: the first volume is a closed volume using five planes to define its boundaries, the second is partially open, using three planes and the

third is a open volume outlined by one plane and one line.

The limits of spacial enclosures are dependent on the strength of spacial articulation of the sur-rounding positive forms. This involves perceiving movements and forces (see chapter II) and rela-tionships (see chapter III) that are expressed from positive elements into space. Spacial elements can therefore be interpreted differently depending on the view-point of observation and the spacial awareness and experience of the observers. The concept of negative elements is more difficult to comprehend and perceive than positive elements because we are trained to see and discern objects rather than the space between them.

## DIMENSIONS OF ELEMENTS

(applied to positive elements)

**3-D volume**

height

depth

width

**2-D plane**
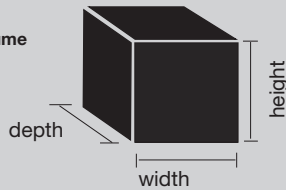
height

width

**1-D line**

length

**0-D point**  . position

The above mapping of the dimensions of elements also apply to negative (-) elements.

Fig. 3

There are a number of different terms that are used when referring to the dimensions of elements: length, height, width, breadth, depth, thickness etc. Some of these terms imply a spacial orientation. Height implies a vertical direction in space starting from the base of an element and moving to the top.  Width and breadth imply movement from side to side. Depth means the direction backwards or inwards. Thickness and length have no spacial correlation. Thickness is usually the smallest  measurement of an element, whereas  length refers to how long an element is and implies measurement. The less dimensions an element occupies, the less correlated the terms are to specific spacial orientation.

A **volume** has 3-dimensions:
    Height   =   1-D
    Width     =   2-D
    Depth     =   3-D

The limits of the first and second dimension. There is an inherent problem in defining 1-  and 2-dimensional elements as independent elements in space, because of the added thickness of the material the element  is made up of.

In theory, the concept of independent 2-D planes having only length and width can not exist in a 3-D world. Yet, they are part of our visual vocabulary used to describe a figure whose predominant visual qualities expresses 2-D. The definitions have been abstracted in order to use the idea of plane, line and point in a 3-dimensional visual context. When referring to planes in space you disregard the thickness of the material that  the plane is made of, as implying an articulation of the third dimension. Thickness of a plane is seen as a visual detail subordinate to the two predominant dimensions of a plane. A similar explanation is applied to line and point.

A  **plane** has  2-dimensions:
    Length or Height  = 2-D
    Length or Width   = 2-D

A  **line** has 1-dimension:
    Length = 1-D

A **point** has 0-dimensions:
    Position  = 0-D

8

## INHERENT PROPORTIONS

Inherent proportions involve the direct correlation of one elemental part to another. For example, the measurements of the length and width of a plane determine the exact length of the lines which border it. If the proportions of the plane are changed, then the length of the lines will be altered in correspondence to the plane.

A cube uses the elemental parts (Fig. 4): planes, lines and points to limit its total mass and to delineate and punctuate the transitions between surfaces. All the six square planes on the cube are identical in size and all the lines on the planes are therefore the same length.

Geometric forms are strictly bound by the laws of geometry. Figure 5 shows that the change of the width of plane 1 directly affects the proportions of three other planes including their edges (lines) as well as the relative inherent proportions of the entire volume. The concept of inherent proportions also applies to organic form, however, the elemental parts are not as interdependant as geometric forms. It is possible to change the shape of a plane on one side of an organic volume and not affect the proportions of the entire volume.

cube with 6 planes        plane with 4 lines

line with 2 points

Fig. 4

Fig. 5

2
3
4
a
b
h
g
c
d
f
e
plane 1
width

Four planes (1-4) and all the 8 horizontal lines (a-h) change in order to correlate with the change of width in plane 1. The vertical lines do not change.

Theses two remaining planes are unchanged

rectangular volume

+        =

The inherent proportions of the original cube are altered, changing the cube to a rectangular volume.

9
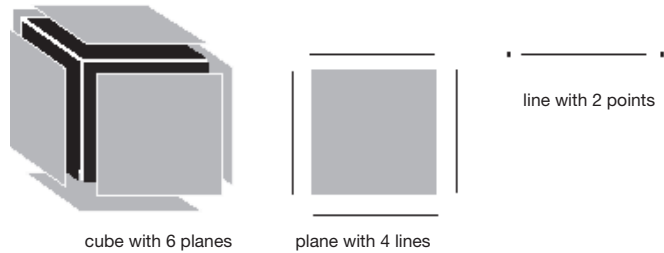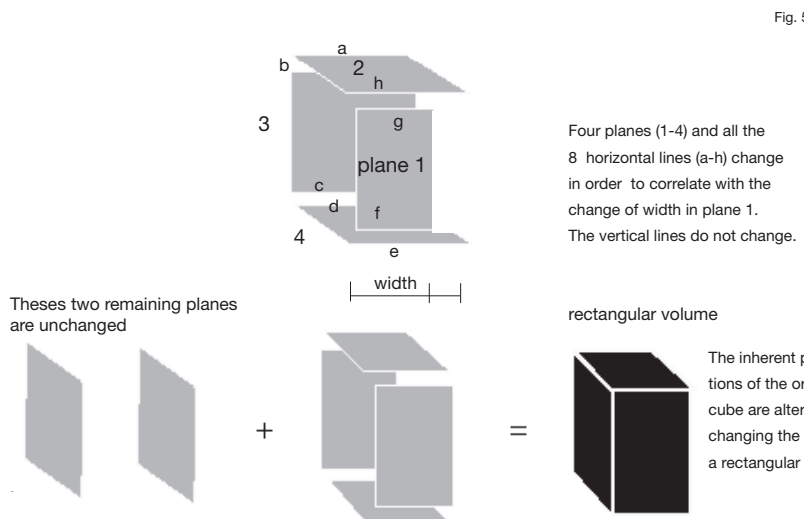
## GENERAL  PROPORTIONS

The concept of General Proportions sum-
marizes the essential proportional features
of an element rather than gives an exact
elemental description. The three primary
proportions a form can assume involves the
following features

Extensional  -  expresses length.
         A line illustrates the most extreme
         expression of extension.

Superficial  -  expresses flatness.
         A square plane is the most extreme
         example of superficial proportions.

Massive  -  expresses volume.
         A cube is the most extreme example
         of massive proportions having no
         extensional or superficial qualities.

Extentional

E/S

M/E

E/S/M

Superficial

Massive

S/M
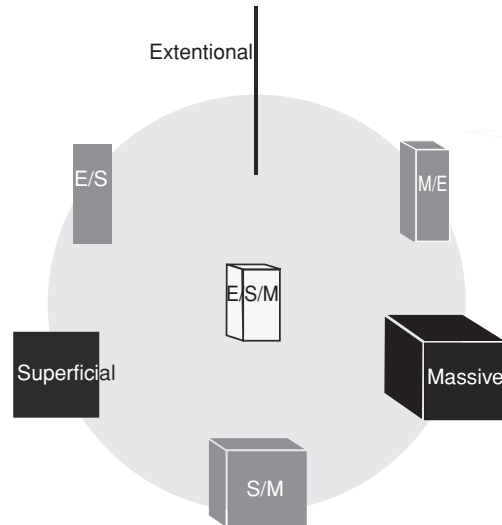
Fig. 6

**General Proportions Circle**

The primary proportions (shown in black in figure 6) are extensional, superficial and massive. Three
secondary proportions (shown in grey in figure 6) combine 50% of two primary proportions: extension-
al / superficial (E/S), superficial / massive (S/M) and massive / extensional (M/E). The middle volume
(shown in white) is a combination of all three primary proportions: extensional, superficial and massive
(E/S/M).

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## GENERAL PROPORTIONS,  SPACIAL ENCLOSURE,  JOINTS applied to 3 rectangular vol.

To see the complete visual make-up of the 3-D elements and their properties is a spacial- as well as a form-experience. It is of equal importance to be aware of the variation of proportions of each solid volume as the model turns, as well as the fluctuating spacial proportions between the volumes.

By seeing the model from different views visual information can be obtained to judge the dimensions and general proportions of each volume.

The study model of "Three Rectangular Volumes" in space shown from three different view-points in figures 8-10 is the first exercise in this visual program. It applies the visual structure and vocabulary introduced in this chapter as well as some of the principles in chapters 2-4.

GENERAL PROPORTIONS

This model of three volumes clearly expresses three different general proportions.



c
extensional
b
massive
a
superficial
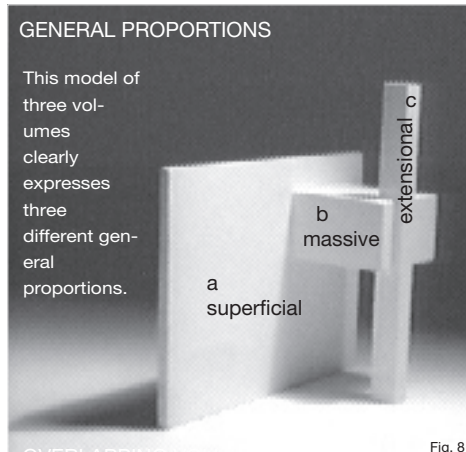
Fig. 8
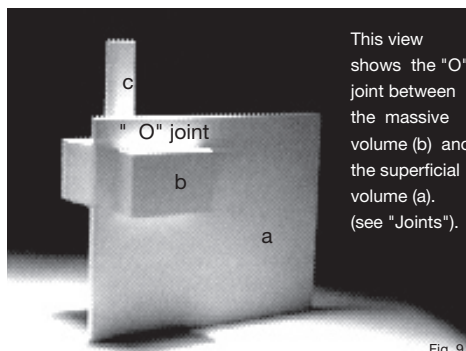
This view shows the "O" joint between the massive volume (b) and the superficial volume (a). (see "Joints").



c
" O" joint
b
a

Fig. 9

In figure 10 the horizontal extension of each positive (a, b, c) and negative (d) volume is marked by a line (black or white) in order to illustrate the contrast in measurement between the planes on the different positive and negative volumes from this view. Throughout the entire composition there is as little repetition of measurement as possible.



a
b
d
spacial enclosure
c
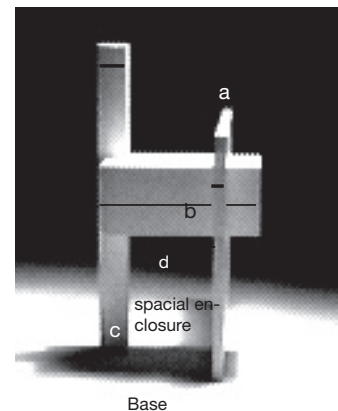
Base

Fig. 10

The distance between the voumes (c) and (a) and between the base and (b) defines the boundariesof the spacial enclosure (d) (Fig. 10).

11

## PRIMARY GEOMETRIC VOLUMES – CURVED

The three families of curved primary geometric volumes are:

**Ellipsoid sphere**
**Cylinder**
**Cone**

The basic curved primary geometrirc volumes are illustrated on the first horizonal row in figure 13 (dark grey background). These three massive volumes all have equal parameters for height and diameter. The other volumes in the same figure show how primary volumes can vary in *general proportions*: massive-extentional-superficial. Geomteric planes can be derived from all these primary geometric volumes by cutting them in three sections oriented horizontally, veritcally and in depth (FIg. 11). Figure 12 summaries the varioius geometric planes resulting from these three sesctions. The planes derived from the ellipsoid family are circules/ellipses, planes from the cylindrical family are circles/ellipes and squares/rectangles and planes form the conical family are circles/ellipses and triangles.

Three sections of the volumes:



Fig.11

| GEOMETRIC PLANES | | |
|---|---|---|
| Circle-ellips | Squre/Rectangle | Triangle |



Fig. 12
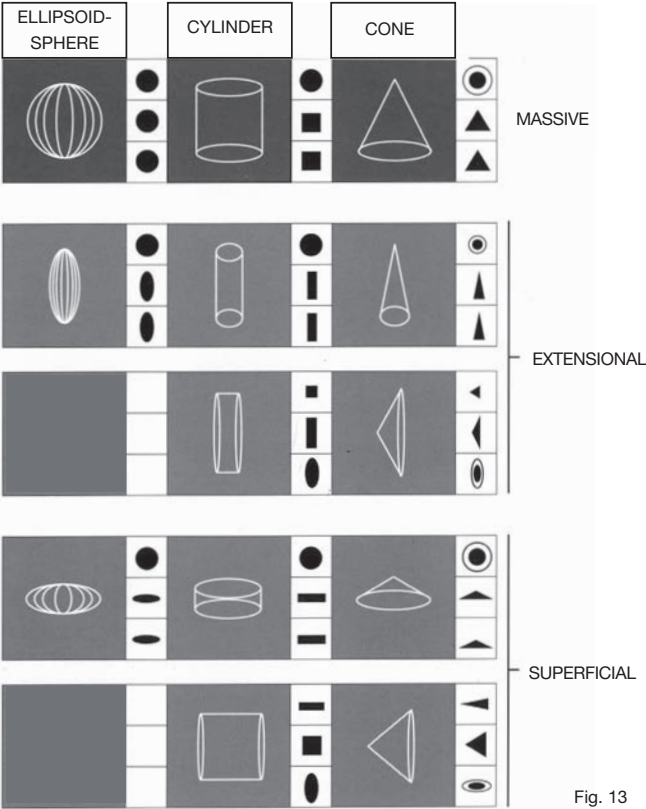


Fig. 13

## PRIMARY GEOMETRIC VOLUMES – STRAIGHT
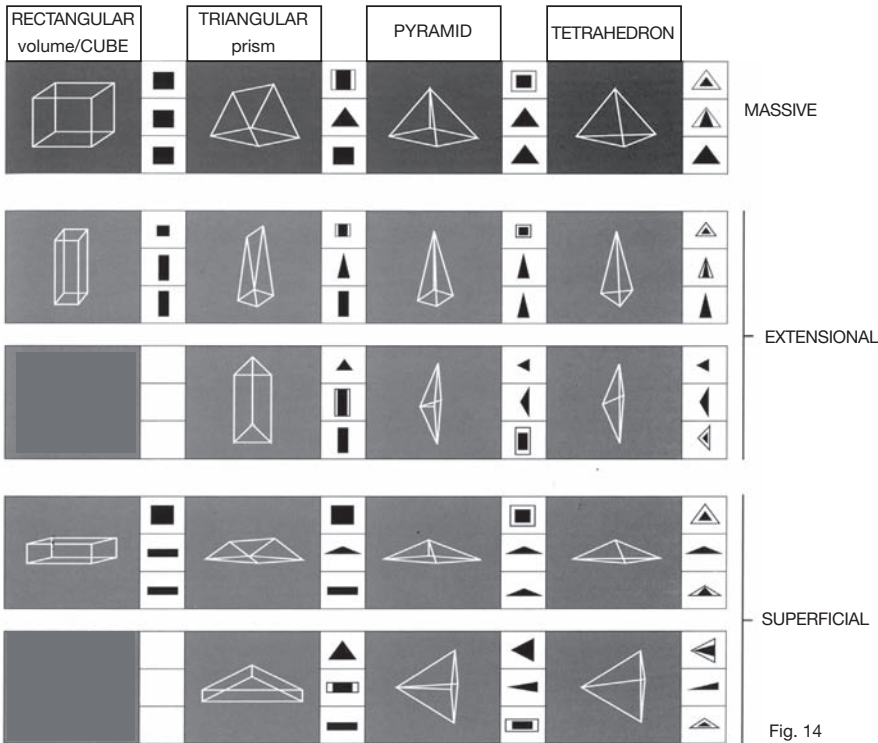
The four families of straight primary geometric volumes are:

**Rectangular volumes/cube**
**Trinagular prism**
**Pyramid**
**Tetrahydron**

The basic straight primary geomtric volumes are illustrated on the frist horizontal row in figure 14 (dark grey background).
The first four massive volumes all have equal parameters for height and base.
The other volumes in the same figure show how these primary volumes can vary in general proportions: massive- extensional -surperficial. These volumes havealso ben cut horizontally, vertically and in depth as illustrated in figure 11.



| RECTANGULAR volume/CUBE | TRIANGULAR prism | PYRAMID | TETRAHEDRON |

MASSIVE

EXTENSIONAL

SUPERFICIAL

Fig. 14

The planes derived from the rectangular volumes family are squares/ rectanlgles, planes form the triangular prism family and the pyramid family are triangles and squares/rectangles and planes from the tetrahedron family are regular or irregular trinalges. Figure 15 summaries the cut plnaes from figure 14.

| GEOMETRIC PLANES | |
|---|---|
| Squre/ Rectangle | Triangle |

Fig. 15

13

## Description of 7  PRIMARY GEOMETRIC  FORM  FAMILIES

### ELLIPSOID / SPHERE

A sphere is classified within the  ellipsoid geometric family, yet it has special conditions which governs its structure. The sphere is visually the simplest form because it is perfectly symmetrical from all views. The single continuous surface that covers the volume is a double curved surface which is at an equal distance from the center creating circular contours and no articulated axes.

Ellipsoids, like the sphere, are defined by one continuous  double curved surface, but the distance from the center gradually changes through elliptical  curvatures. An ellipsoid can change its proportions along one, two or three axes, but the sphere can only change in size.

### CYLINDER

A circular cylinder is symmetrical around the rotational axis and from top to bottom. The elemental parts are a simple curved surface and two flat circular surfaces that are parallel to each other. The simple curved surface meets the two flat planes at a right angle and outlines their circular edges.

The cylinder can change its general proportions through extension or contraction along  its  rotational axis. It can also alter its  proportions by changing the neutrally  (circular) simple curved surface to an accented elliptically curved surface. The outline of the two base surfaces then change from circular to elliptical.

### CONE

The circular cone is a very dynamic volume because of the diagonal contour of the form due to the changing diameter of the curved surface. The elemental parts of a cone include one simple curved surface that wraps around the volume, one flat surface with a circular contour and one vertex point. The movement of the curved surface creates the circular edge on the flat base. At the top of the volume where the curved surface comes together at a single point  the vertex is created.

The simplest way to change the proportions of a cone is to extend it along its primary, rotational axis. However other proportional variations that vary the width or depth, requires that the curved surface follows an elliptical curve and that the base plane of the cone changes to an elliptical  plane.

## RECTANGULAR volume / CUBE

A cube is defined by the same properties as a rectangular volume, however, it has special conditions governing its proportions. The cube is visually the simplest straight geometric volume, because its elemental parts are all identical and the composition of the elements involve right angles and parallel relationships. The 6 flat elemental planes of the cube are all squares of equal size, which fixes the inherent proportions and allows no variation in width, depth or height. The only changes that can occur are in scale. A rectangular volume is constructed of 6 flat rectangular or square planes in right angled relationships to the bordering planes. There are three sets of parallel planes which have an inherent proportional relationship to each other. Variations of the proportions of a rectangular volume can occur along all three axes.

## TRIANGULAR prism

A triangular prism is similar to a cylinder in that it is symmetrical between the two parallel triangular planes and out from the primary axis. The elemental parts include three rectangular or square planes and two parallel triangular planes. The three rectangular or square planes are at an acute or obtuse angled relationship to each other. The degree of the angle between the rectangular planes defines the shape of the two triangular planes. Changing the general proportions of a triangular prism by varying the distance between the triangular end planes involves no structural changes in the angles between the elements. However, changing proportions that vary the length of the sides of the base triangles introduces new angular relationships between the sides of the triangles and the rectangular surfaces.

## PYRAMID

A pyramid has similar features as the cone, such as the diagonal contour of the form and the vertex point at the top. The elemental parts of a pyramid are four planes with triangular outlines and a fifth plane which is square or rectangular. The triangular planes meet at a vertex at the top and form the sides of the pyramid. The square or rectangular plane form the base. The straight pyramid with the tip of the pyramid in line with the center of a the base implies that the opposing triangular planes are identical. Proportional changes are determined by the rectangular proportions of the base and the height of the vertex.

## TETRAHEDRON

The tetrahedron is the simplest 3-D closed volume that can be constructed of flat planes, just as the triangle is the simplest 2-D plane made of straight lines. The tetrahedron is also the most structurally stable form of all the primary geometric forms, yet visually it emphasizes the dynamic edges and the opposing movement between the pointed corners of the form. The equilateral tetrahedron is made of four identical equilateral triangular flat planes and has structural similarities with the cube. Proportional changes are made by varying the angular relationship between bordering surfaces which directly changes the degree of each angle on the triangle as well as the length of the sides of the triangular planes.

16

# MOVEMENTS and FORCES

AXIS

PRIMARY
SECONDARY
TERTIARY

AXIAL MOVEMENT

INNER
CONTINUAL
DIRECTIONAL

FORCES

STRENGTH
SCOPE
ANGLE

CURVES

CURVE CHART
NEUTRAL
ACCENTED

DIRECTIONAL FORCES

APPLICATION

The first step in analyzing a concrete 3-D composition is to perceive the inner-  and spacial activity of the elements. These "activities" en-compass the combined effect of movements and forces. The movement of an axis and the forces that act upon it, can only be indirectly perceived through the visual clues from positive forms. It requires a kind of "x-ray vision" which visualizes the paths of visual energy that interacts with the pro-portions and shapes of the elemental parts.

The nature of sculptural experiences are rooted in the perception of the energy and inner structureof a  form or composition. The general path of move-ment through major proportions of the positive and negative elements governs the surface/plane activ-ity. The transitions between surfaces in turn control the position, shape and sharpness of the edges (lines) as surfaces come together on the form. The positon of corners/points are the last visual details of sculptural articulation.

## AXIS

## AXIAL MOVEMENT

The general definition of an axis is an imaginary line within an element which is the fundamental structure that all elemental parts refer to (Fig. 16).
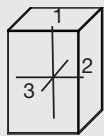


1  PRIMARY

2  SECONDARY

3  TERTIARY

Fig. 16

THREE AXES

1.  Primary axis  - the central structural line in an element which expresses the major movement of the form. It is also often the longest axis within the form.

2.  Secondary axis  - lies in oppositional an-gle to the primary axis and gives a structural line that represents the movement outward from the primary axis. It is often the second longest axis within the form.

3.  Tertiary axis  -  the structural movement that is subordinate to the primary and secon-dary axes. It is the shortest axis and usually expresses less movement then the other two.

The movement of an axis can only be indirectly perceived through the visual clues from positive forms. It requires a kind of "x-ray vision" in the mind´s eye which visualizes the paths on inner activities that interacts with the proportions and shapes of the elemental parts.

INNER AXIAL MOVEMENT is the motion expressed WITHIN the form (Fig. 17), through the length of the primary axis. The movement can range from a simple straight axis to a compound curved axis.

The contour edges of

the plane respond



primary axis
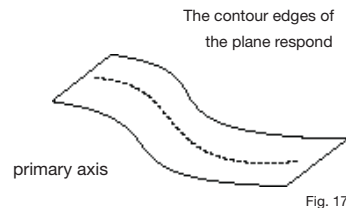
Fig. 17

The axial movement also continues BEYOND the form / spacial enclosure. This CONTINUAL AXIAL MOVEMENT activates the space that follows in line

directly after the axial movement of the form (Fig. 18). The continual visual movement of the ele-ments strengthen the articulation of a dimension in space as well as allows for potential relationships to arise between forms across space.
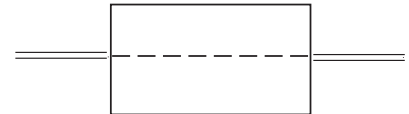


Fig. 18

DIRECTIONAL MOVEMENT is the general direction in which the whole form moves.



The triangle´s directional movement is upwards.

A rectangle has no specific directional movement along its primary axis, but it can gain direction



?                        ?
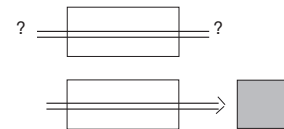
Fig. 19

## FORCES and CURVES

Elements with straight axes have a uniform inner movement that is often reflected in outer symmetrical shape and restricted spacial activity. Forces can be introduced to increase visual complexity both within and beyond an element.

A force(s) can induce structural asymmetry which is expressed in bending or curving the inner axis of a form and some of its elemental parts. Forces themselves can not be seen, but may be perceived by how they affect positive forms. The energy from the force is absorbed by the positive element and then projected outward through the form and into space. The force-induced changes in form are the results of the power the force has over the integrity and strength of the elements.

Forces encompass the following features:

STRENGTH
weak          strong
SCOPE
focused      spread
ANGLE TO AXIS

Fig. 20

STRAIGHT      BENT      CURVED

force
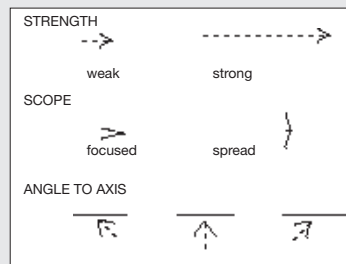
force          axial movement
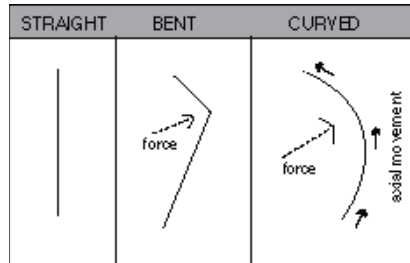
Fig. 21

An axis can express three general conditions:

A straight axis (Fig. 21a) involves a 1-dimensional movement, without any forces acting upon it.

A bent axis (Fig. 21b) incorporates two activities from different dimensions: the movement of the axis and the force that abruptly changes the course of the axial movement creating a sharp bent angle.

A curved axis (Fig. 21c) can express two or more activites from different dimensions: the axial movement and the force(s) that gradually change the course of the axis.

**Curves**
A curve is a smooth and continual change in direction (Fig. 22 and curve chart on p. 20).

The three ex. of curved planes /surfaces in figure 22 illustrate the correlation between the axial movement & the shape of the edges/transitions of each surface.

The original rectangular plane is changed to a simple curved plane. The two curved edges (x and y) express the same curve as the curve of the axis (z). The two end- edges remain straight.
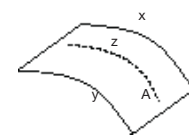
(A) simple curve = mono-force

This view of a merged volume (p. 39) shows a twisted plane (B). The two curved edges (x and y) and the primary axis (z) are similar, yet each express a slightly different curve. The two end-edges remain straight.
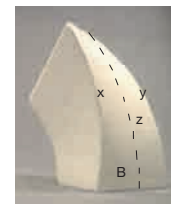
(B) twisted curve = bi-force

The compound curved surface (C) curves in all 3 dimensions. The edge (x) and transitional surfaces (y) all express different curves that respond to axis (z) as well as the movement of the surrounding surfaces.
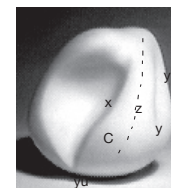
(C) compound curve = multi-force

Fig. 22

## CURVE CHART

The chart in figure 25 shows examples of a variety of different curves. The purpose of this chart is to offer a selection of curves which illustrate subtle differences in how the curve expands, due to the strength, scope and angle of each force(s) (see Fig. 20). The shape of a curve can assume two general features: neutral  or accented (Fig. 23-24). Three of the curves on the chart are neutral: circular segment, spriral and reverse (even) and the remaining curves are accented.

NEUTRAL:
The curve has the same radius throughout  the entire curvature.
A  segment of a circle is neutral.

neutral

Fig. 23

accent

Fig. 24
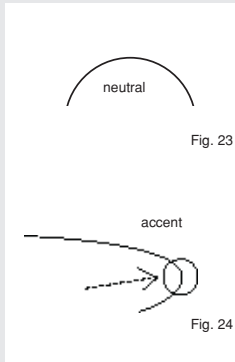
ACCENTED:
The degree of curvature changes throughout the curve. The accent  is the most expanded area of the curve.



Circular segment

Reverse (Even)

Elliptical segment

Reverse (Uneven)

Spiral

Trajectory

Supporting

Parabola

Hyperbola

Resting

Fig. 25

20
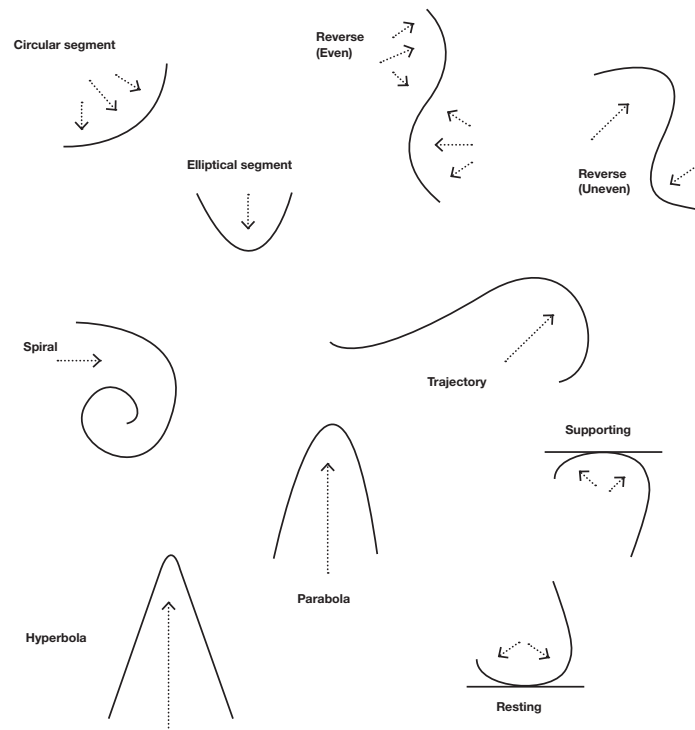
## DIRECTIONAL FORCES                    Application of axes, curves, accents and directional forces

The DIRECTIONAL FORCE  is the energy channelled out from the accent through the form and into space. The directional forces radiate from both the convex and concave sides of the accented area (Fig. 26).
The specific shape of the curvature controls the path of the directional force. The concave side of the curve has a more focused  force than the convex side, since the force is more enclosed as it moves out from the accent. On the convex side, however, it is more



concave

directional forces

convex
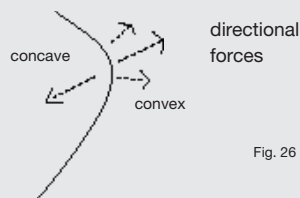
Fig. 26

Directional forces add visual activity to the composition that can compete with the inner axial movement of the elements. The organization of the elements should include coordinating the axial  movement and posi-ton with the directional forces. The concept of balance (see chapter IV) relies greatly on how the directional forces work to complement the other movements and structures within the composition.



top

fragment 1      a      side
fragment 2

bottom

Fig. 27

The original ellipsoid in figure 27 has a circular contour as seen from the top or bottom and an elliptical profile around the sides.

Figures 28 and 29 are fragments of the divided ellipsoid (see chapter III).
Figure 28 (fragment 1) shows the straight silhou-ette of one of the simple curved dividing sur-faces through the ellipsoid and also the accented surface on the outer contour of the ellipsoid.
The movement of the axis is a compromise between the straight silhouette and the accented surface.



accent from ellipsoid

straight silhouette

axis

fragment 1

Fig. 28



neutral curved contour

D.F.

a      b

D.F.

accent from the divided surface
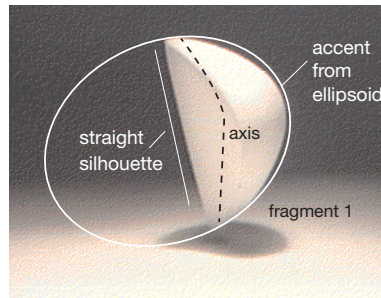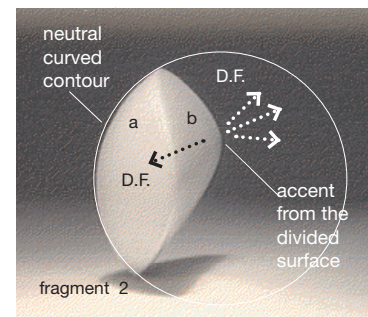
fragment  2

Fig. 29

The curved surface (a) in figure 29 (fragment 2) shows a neutral curve that comes from the circular contour of the ellipsoid. Surface (b) is a simple curved surface that divides the ellipsoid.
Directional forces radiate from the accent on surface (b) through the form and out into space.

# ▐▌▌ RELATIONSHIPS

ORDER

DOMINANT
SUBDOMINANT
SUBORDINATE

AXIAL RELATIONSHIPS

COMPARATIVE RELATIONSHIPS

JOINED FORMS

INTERSECTIONAL FORMS

TRANSITIONAL FORMS

DIVIDE
ADAPT
MERGE
DISTORT

FORCES in RELATIONSHIPS

TENSIONAL
ORGANIC

EVOLUTION of FORM

Relationships are created between the properties of the elements (chapter I) and their movements and forces (chapter II). These interrelationships create a network of visual connections that make up the overall visual statement. Each relationship, no matter how subtle, becomes an important compositional link so that even the smallest detail can influence the originality and quality of the entire visual image.

This chapter on relationships also includes ideas of how to combine and reshape geometric forms based on principles of division, adaption, distortion etc. These ideas are presented under their own section called "Transitional forms". Following this section is an introduction to structural principles and interrelationships of forces concerning organic forms. A chart over the different geometrically derived forms and organically shaped forms is  presented at the end of this chapter. The theme of this chart is to illustrate an "Evolution of Form" from geometric to organic. The sequence of "evolution" shows two different 3-D models that exemplify two ends of a spectrum at each stage.

# ORDER

The features that determine the hierarchy of order in compositions are:

Dominant -
      character - strongest
      size - largest
      interesting position
      spacial articulation
      structural importance
      influence over other parts

Subdominant -
      character - strong
      size - smaller than Dominant
      interesting position
      spacial articulation
      structural importance
      influenced by Dominant

Subordinate -
      character - complementary to
      dominant and subdominant
      size - smallest
      spacial articulation
      dependent on the dominant
       and subdominant

Details -

The idea of hierarchy of order is implicit when working within an asymmetrical organization. Since the principles of asymmetry prioritize contrasting properties and non-repetition, there will always be elements and qualities that dominate and others that are subordinate (Fig. 30)

A method for deciding which visual qualities/forms are more important than others is to first cover up or "think away" one quality/form at a time (Fig. 31-33) and ask the following questions:
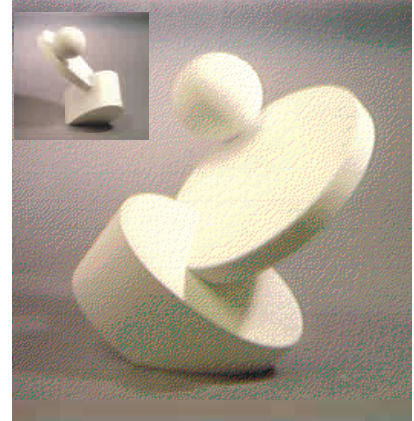


Fig. 30



Fig. 31
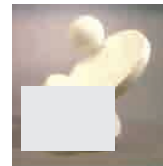


Fig. 32

Which form seems to give the entire composition its identity? Which is the most visible from all views and is perhaps largest? This is the dominant. Which one has a clear and vital interrelationship with the dominant, yet has a less interesting shape and is smaller? This is the subdominant. Which is dependent on the dominant and subdominant  forms, yet is smaller in size and is a complementary form? This is the subordinate.

## ORDER cont.

The idea that something dominates over an-other can be relative to the view of observation. At some viewpoint a subordinate form can gain more visual attention because it is closer to the observer or partially overlaps a more dominant form as in figures 34a and 34b.



Fig.34a                              Fig.34b

However, certain features and forms will  be remembered as having overall dominance. This accumulated allround impression, which our visual memory and 3-D experiences are built on, gives the basis for judgement of the work and a sense of order can be interpreted.

### GROUPING

Each level of the hierarchy can be represented by a single positive (Fig. 30) or negative element (Fig. 36) or by a group of elements. Grouping ele-ments or features together involves recognizing similarities,e.g.: shape, movement, position, size, proportion, color



a

b
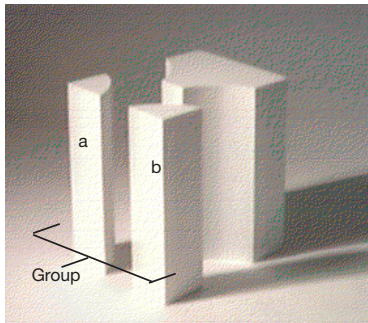
Group

Fig. 35

Figure 35 shows that the forms a & b are iden-tical in shape, movement  and proportion (but not orientation). Together they form a group which has a subdominant roll in the composition. The rela-tionship between grouped elements/features can occur in a specific area or across the entire com-position. The shared qualities that define a group must have visual strengths that  overrides other form/space interruptions.

Negative elements  are also recognized when determining the hierarchy of order. This model has a clearly outlined spacial enclosure (x)

x
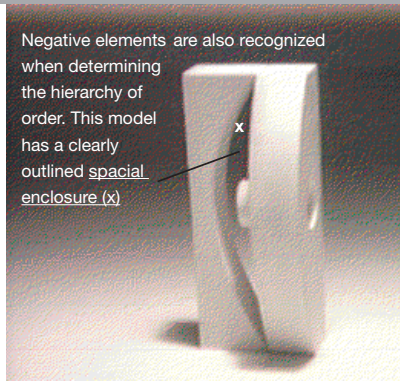


Fig. 36

The idea of order is easy to understand when it comes to the example above and on the prior page, since each form is a separate unit. When analyzing a complex object that is highly differenti-ated and does not easily brake down into separate units, it is more difficult to specify what the visual order is. None the less, it is important to seek a visual hierarchy to gain an awareness as to which features are essential in communicating the visual message.

Throughout the development of a composition, experimental studies can be undertaken to see if the message can be made stronger. The non- es-sential features can therefore be reshaped in order to reinforce the major idea.

## AXIAL RELATIONSHIPS

Since the axes represent the individual visual structure within each element, then axial relationships created within and between elements reveal the essential framework of the composition.  Some basic axial relationships are:

Oppositional Relationships  - The axial movement of one element lies in an opposite dimension to another. The forms pull away from each other, moving out in different dimensions and are considered independent visual compontents. Figure 37 shows oppositional  relationships: adjacent  and across space.

Parallel Relationships  - The axial movement of one element runs parallel to that of another. Figure 38 shows parallel relationships: adjacent  and across space. Figure 35 on the prior page shows a parallel axial relationship across space between (a) & (b) which also forms a group.

Continual Relationships  - The axial movement of one element flows directly into another. Figure 39 shows two continual relationships: adjacent  and across space.

OPPOSITIONAL RELATIONSHIPS

adjacent                    across space
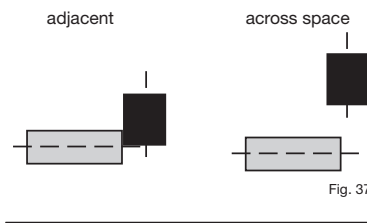
Fig. 37

PARALLEL RELATIONSHIPS

adjacent                    across space
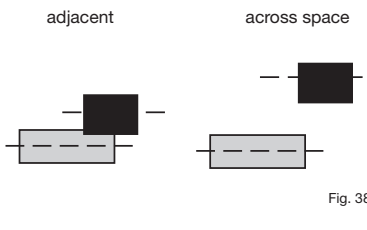
Fig. 38

CONTINUAL RELATIONSHIPS

adjacent                    across space
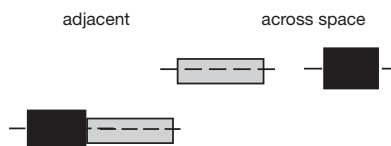
Fig. 39

**Gesture**
A gesture is a special condition for curved elements in a continual relationship. It deals with guiding the axial movement of forms so they gradually group
together to make a continual complex movement.

Fig. 40

The change in position, direction and distance between each line in figure 40 depends on the shape and strength of the continual movement
(see page 18) from one to the next.
If the gesture involes 3-D volumes, then the proportions and outer shape should complement each other so that some of the contours of the forms continue from one to another.

## COMPARATIVE RELATIONSHIPS

The visual information concerning elements and their movements and forces can be subjected to comparative relationships; to examine in order to note the similarities or differences.
The figures 41-42 give exampes of some comparative relationships.

In figure 41a, a black circular plane and a black rectangular plane are compared to each other and to the surrounding outlining frame. Together they visually activate the space within the frame. The circle is lifted slightly from the bottom line of the frame activating the space underneath. The rectangle and the circle express contrasting comparative relationships between the roundness of the circle and the straightness of the rectangle.

The frame itself has a primary vertical movement, which reinforces the vertical movement of the black rectangle. The solitary circle in figure 41b looses some of its contextual identity since it is isolated from other elements. Its roundness is no longer compared to the long rectangular qualities of the other plane and without the frame its position and scale seems vague.

Fig. 41a

Fig.41b



negative part

right an-gled corner

curved sur-face

negative part
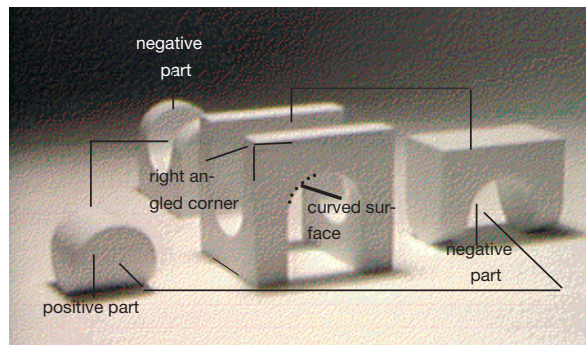
positive part

Fig. 42

Figure 42 shows a cube divided by a simple neutral curved surface that cuts through the cube in two opposing directions.This model demonstrates several comparative relationships, e.g. between the negative and positive parts, between the curved surface and the straight edge / right angled corners.

## JOINED FORMS                                    Three basic joints

Joining elements together provides a structural quality between the elements.The relative proportions and the 3-D orientation of each volume determines the type of joint, i.e. orientation in the vertical, horizontal and depth dimension, as shown in figure 43.

vertical dimension        horizontal dimension

front view:

depth dimension

top view:
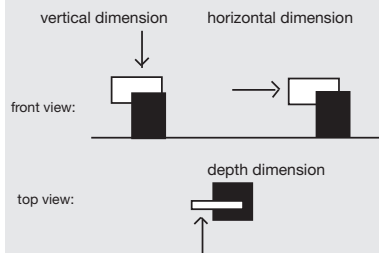
Fig. 43

There are three basic joints that can oc-cur between rectangular volumes in a static organisation (see chapter IV):
"L"  = 2-sided,  "U"  = 3-sided,  "O"  = 4-sided

1 L        1 U 3      1 O 3
  2          2          2

4

The above three joints can be made as PARTIAL or COMPLETE joints as illustrated in figure 44.



Partial

Complete

Active
Passive
Active
Passive

Partial

Complete

Active
Passive
Active
Passive

Complete
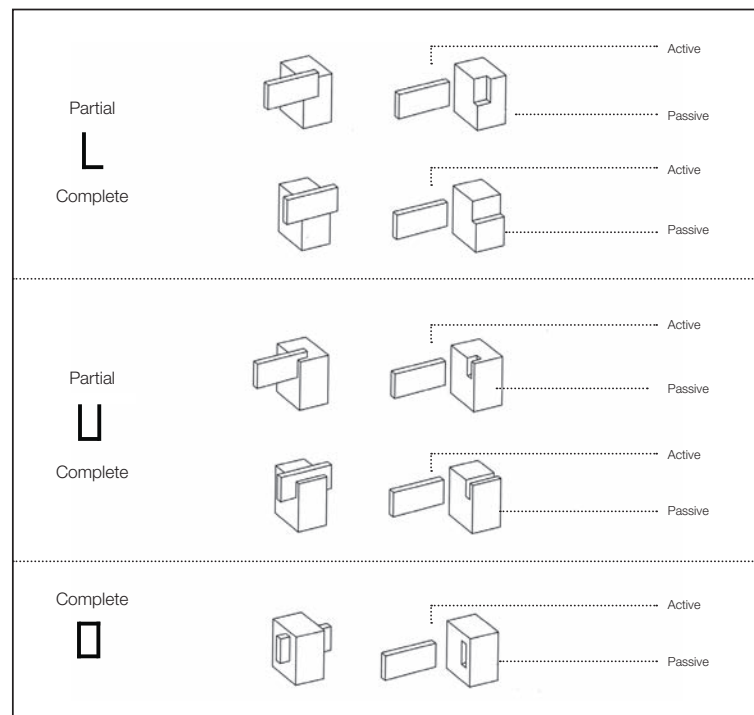
Active
Passive

ACTIVE and PASSIVE: When forms are joined together there is usually an active form, that retains its entire volume and a passive  form that is cut to make the joint.

Fig. 44

28

## JOINED  FORMS  applied to ellipsoid and two cylinders

The composition in figures 45 - 46 is made up of an ellipsoid and two cylinders. The two joints applied here are both complete "U" joints.

The following features are **added** to the volumes due to the joints:

*  elliptical curved lines around the joints
*  induced axial movement through the flat cylinder between the two joints
_____

The following features are **subtracted** from the volumes due to the joints:

*  the elliptical cylinder (active) cuts into the flat circular cylinder (passive) - joint 1 .
*  the flat cylinder (active) cuts into the ellipsoid (passive) - joint 2

Since the volumes intersect each other at dynamic angles the two joints are asymmetrical.

elliptical
cylinder

circular cyl-
inder

ellipsoid

Fig. 45

active

passive

elliptical
curved
line around
the "U" joint

Fig. 46b

joint 1

accent

axis

accent

joint 2

ellipsoid

From the accent of joint 2 an axial movement is in-duced through the surface of the flat cylinder upward toward joint 1.

Fig. 46a

accent

active

elliptical
curved lines
around the
"U" joint

passive

Fig. 46c

Figure 45 and 46a show the same model from two different views. Figure 46b and 46c show a close-up picture of the two joints visible in 46a.

In joint 2 (Fig. 46c) the passive el-lipsoid is joined to the "active" flat cylinder on "three sides" creating a "U"-joint. A section of the "pas-sive" ellipsoid is cut away to con-struct the joint. The elliptical hard edges introduced through joint 2 adds strong details to the compo-sition.

## JOINED  FORMS  - three rectangular volumes

Joining volumes together so that all three or more volumes intersect each other builds a compound joint. The three geometric rectangular volumes in figure 47 have op-positional relationships to each other  that lock the volumes into place. There are two different types of joints applied here, "O" and "U", illustrated in figure 48. The new parameters introduced through the joints create asymmetrical qualities on the volumes. The orientation of the joints subdivide the rectangular volumes and intro-duces new edges.

**Analysis of a compound joint**
The brake-down of the compound joined volumes illustrates three joints (Fig. 48):
The first is a complete "U"- joint showing the massive volume deeply joined on three sides within the superficial volume; the second is an "O"-joint where the extensional volume moves completely through the massive volume; the third is another complete "U"-joint showing the extensional volume cutting down the superficial volume.



COMPOUND JOINT:

all 3 volumes interlock with each other.

Fig. 47
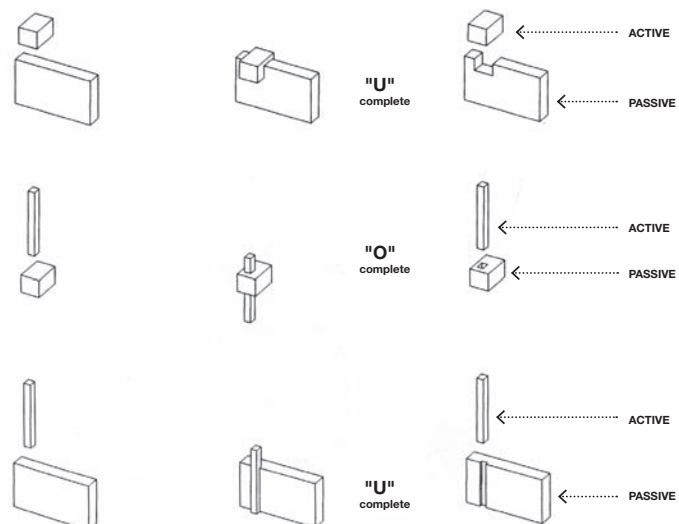
Fig. 48

## INTERSECTIONAL FORMS



Fig. 49

### INTERSECTIONAL FORMS



COMPOUND                    CORE

Fig. 50a                        Fig. 50b
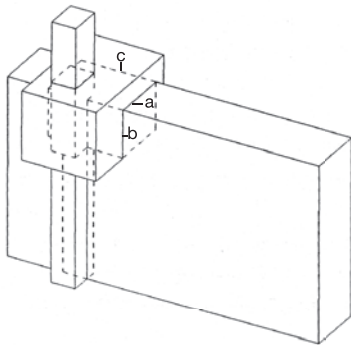
**COMPOUND JOINED VOLUMES**

The composition of 3 rectangular volumes in figure 49 is the same as the composition in figure 47.

The intersectional forms delineated within this compound joint are a composite of 3 rectangular volumes. The visible hard lines (a) and (b) at the joints in figure 49 define two contours/edges of the compound intersectional form. The dotted lines in figure 49 also indicate the contours of the compound intersectional form that are either hidden within the joint or can not be seen from this view.

Figure 50a shows the compound intersectional form with the edges (a) and (b) indicated as in figure 49. The dotted line (c) in both figure 49 and 50a marks one of the hidden contours within the form. Figure 50b shows the core intersectional form, which is also marked by dotted lines in figure 50a.
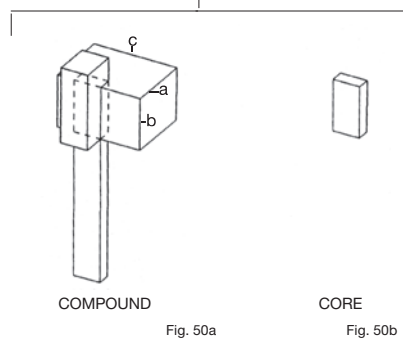
The sequence of intersectional forms are:

COMPOUND INTERSECTIONAL FORM requires at least three volumes that intersect each other and create an interlocking joint. A compound form encompasses the entire differentiated form that is confined within the limits of the shared joints.

CORE INTERSECTIONAL FORM is the minimum common body within the intersectional forms which is shared by each of the joined forms.

The concept of intersectional forms is by definition restricted to the joints between basic geometric volumes. The surfaces that "cut out" the intersectional forms are therefore completely geometrical.

None of these cut-surfaces on the intersectional forms can be seen on the exterior of the joined volumes. The intersectional forms therefore must be derived indirectly from the different inherent proportions and structure of each of the volumes. The hard lines at the joints between the volumes define some of the contours/edges of the inter-sectional forms (see Fig. 49-50). Yet, to visualize the proportions and contours of the compound intersectional form(s) takes a great deal of concentration, because the properties of the joined geometric volumes influence your visual interpretation of the intersectional form.

## JOINED  and  INTERSECTIONAL FORMS applied to sphere, cylinder and cone

Figures 51 and 52 show joined, curved geometric volumes. The joints are basic, two-volume joints (which are less complex then the prior compound joints illustrated in figure 47 - 49).

Figure 51 applies a complete "U"-joint
Figure 52a applies a complete "O"-joint.

INTERSECTIONAL FORMS
As explained on page 31, intersectional forms  are geometrically derived. The surfaces that cover the intersectional forms are therefore totally geometric in character. Due to the specific properties of curved geometric forms and the dynamic position of the two joined volumes, the intersectional forms have asymmetrical qualities. The edges of the intersectional forms are delineated by how the contours of the two volumes match up with each other. Since there are only two volumes involved in the joint, there is no compound  intersectional  form, only a core intersectional form from each joint. These examples of core intersectional forms in figure 51 and 52b-c have a visual simplicity that is akin to the original forms. They express aspects of basic geometric logic, yet, encompass asymmetry and dynamics.

The two joined volumes in figure 51 are illustrated with different values of gray to separate the volumes from each other and to easily identify the origin of the cutting surfaces that define the intersectional form. The cylinder is light gray and the sphere is dark. Correlating these gray surfaces to the core form shows that the spherical surface (dark gray) defines the top surface and the cylindrical mantle surface (light gray) defines the bottom surface.
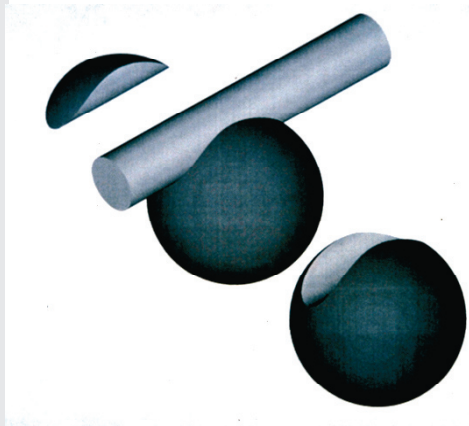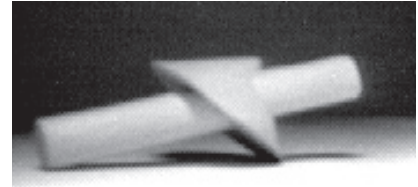


Fig. 52a

Another example of two joined curved volumes is shown in figure 52a. The composition is that of a cylinder piercing through a cone; the corresponding intersectional form is shown in figure 52b.
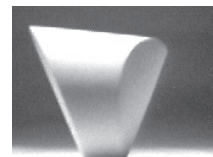


Fig. 52b

Figure 52c shows an intersectional core form derived from a joint between a cone and a sphere.



Fig. 52c



Fig. 51

32
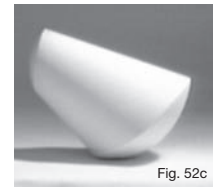
# TRANSITIONAL FORMS

This separate section on transitional forms within chapter III describes how geometric volumes can be altered through introducing new form relationships between elemental parts, forms or forces. The concepts divide, adapt, merge and distort (presented in the following pages) are grouped together under the heading transitional forms. By using primary geometric volumes as a starting point for development, new features which deviate from geometry can evolve.

The form exercises based on the above concepts are developed to explore transitional properties and are conducted under visually controlled conditions which help to isolate the specifc qualities in question. It is the resulting variation in shape that is the focus of interest in this section as well as finding ways to communicate the new "transitional properties" that arise.

The method used to structure the transitional properties that each solution embodies, is to set up a bipolar spectrum that marks out two extreme qualities. As an example, divided forms (p. 34) are related to each other in a specrum from accordance (features that are similar to the original form) to discordance (features that are different from the original form).  Some of the transitional form concepts were easier to analyze by this spectral method than others. Nevertheless, there is a great deal of visual experience to be won in the process of defining the general theme for the spectrum as well as the extreme situation that exemplify each spectral end.

33

# DIVIDE

To **DIVIDE** means to cut through a geo-
metric form creating two or more parts. The
 relationship of parts to the whole and the
direct correlation between shared cut
surfaces  gives an inherent logic and visual
order to divided forms.
The 3-D movement of the dividing surface(s)
and its orientation through the form can
introduce unique qualities to the parts that
can be similar or different to the original
form. The shape and size of these parts are
confined within the properties and
proportions of the original geometric form.
The visual analysis here deals with the
similarities and differences between the
properties of the original geometric form
and:

- the dividing surface(s)
- the inherent proportions and shape
of the parts
- the overall  organization of the parts

When the above features are similar to the
original form they are in **accordance.**
When the above features are different from
the original form they are in **discordance.**

a          b          c          d          e          f

straight surface                                                                    compound curved surface

SPECTRUM

**ACCORDANCE**
Features that
are similar to the
original volume.

Fig. 53
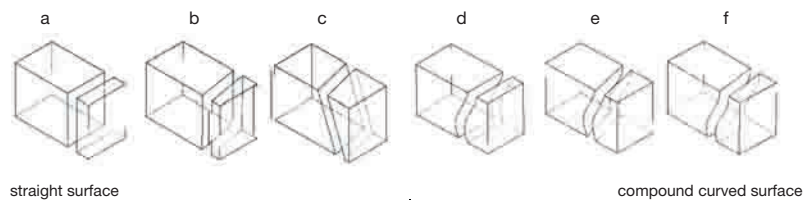
**DISCORDANCE**
Features that
differ from the orig-
inal volume.

The sequence illustrated in figure 53 of divided
rectangular volumes, is based on the movement
and orientation of the dividing surface. The divid-
ing surface gradually changes from straight to
compound curved and from a vertical to diagonal/
curved orientation. The first volume to the left has
been cut into two parts by a straight surface mov-
ing perpendicular through the volume (a). The new
cut planes/surfaces that appear on the two parts
are identical to each other and to the end planes
on the original volume. These two planes are there-
fore  both in total accordance. Progressing through
the sequence from left to right, the straight surface
first changes orientation. By tipping  the surface at
a diagonal, angled in one dimension, the two cut
planes retain a rectangular shape (b).

The next change in orientation is tilting the plane
dynamically backwards, angling the plane in two
dimensions (c). None of the corners are right an-
gled and thus, the cut planes have become rhom-
boids. Since all these planes are flat with straight
edges they are more or less in
accor-dance with the planes on the original
volume. The next step in the sequence is that the
surface movement changes from flat to simple
curved (d).  This curved movement introduces
features that are not derived from the original
rectangular volume.  The curved cutting surface
becomes morecomplex changing from mono-axial
(simple curved) to tri-axial curved as it moves
to the right. The last three divided volumes (d-f)
express varying degrees of discordance.

34

## DIVIDED  FORMS  applied to sphere

Figures 54 - 57 show the division and reassemblance of a sphere. The organizational concept for this model is bsed on 3 flat dividing surfaces that cut through the sphere. The cuts are made in a specific sequence (Fig. 55)) which are followed by shifting or rotating the parts on the dividing surfaces.

Fig. 54

Slidiing this part on the common cut planes creates a crescent shaped plane.

Fig. 56

The following features are in **Accordance;** similar to the original form:

*  circular contour on the flat cut planes
*  crescent shaped planes
*  retaining the spherical-like quality in the overall gestalt
*  sliding and/or rotating the parts on the cut planes
_____

The following  features are in **Discordance;** different from the original form:

*  flatness of the dividing surface
*  straight lines and sharp corners that appear at the intersection of two cutting surfaces

The  contrasting sharp corners and straight lines shown here are mostly hidden within the composition.

crescent shaped plane

The spherical like qualtiy of the original form is retained.

Fig. 55

Fig. 57

## ADAPT

To **ADAPT** means to fit one geometric form up against or around another geometric form without subtracting or reducing either of the forms. In the process of adaptation one form is defined as stable (unchanged) and the other, the compliant  (pliable or changed).
The compliant  form is reshaped at the area of contact to comply with the properties of the stable form. The edges of the adapted (compliant) form are hard so that there is a clear border line between the forms.
The visual analysis here starts with examining the:

- orientation of the forms to each other
- elemental parts of the compliant
form to find a starting point for adaption

There should be a sense of control over the adapted area on the compliant  form so that it seems consciously manipulated to fit the stable form, instead of forced or deformed.

Figure 58 defines the two extremes within the spectrum for adaption, e.g. **assimilate**: to adjust the compliant form so as to encompass the stable form and **dissimilate**: to disengage or segregate the compliant form from the stable form.

a                                                                                 b



circular cone and
circular cylinder

elliptical cylinder and
cube

SPECTRUM

**ASSIMILATE**
involved in complying to
the stable form.

Fig. 58

**DISSIMILATE**
uninvolved  in complying to
the stable form.
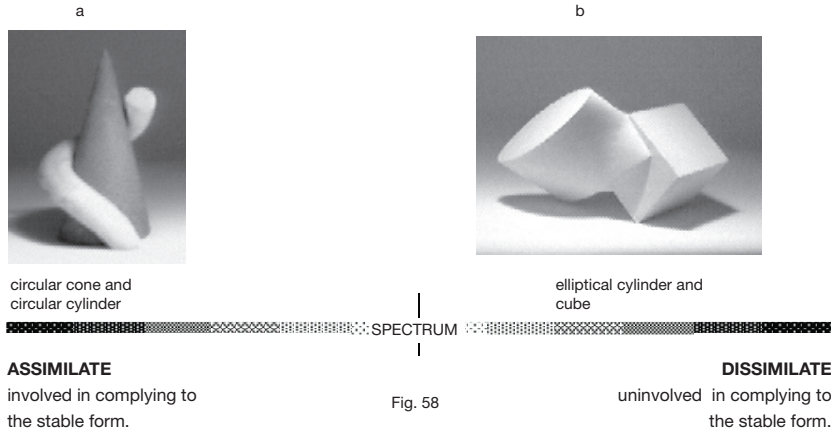
The method of adapting the compliant form to the stable form can be separated into two types: To manipulate the entire compliant form around the stable form (a) or to make an incision in the compliant form at the edges of the elemental parts of the volume or in a "visually logical" area (b).

Adaption of one form to another involves developing features that are similar to joined  forms (p. 28-30). Joined forms have a defined border

between the forms at the joined area, just as the compliant form retains a distinct border as it adapts to the stable form. Joined forms express passive and active qualities within the joint, which can be compared to the compliant and stable qualities of adapted forms. The adaption of the compliant form also expresses control-led distortion based on the shape of the stable geometric form.

36

## ADAPTED   FORMS  applied to cube and elliptical cylinder

Figures 59a-c show different views of an elliptical cylinder adapted to a cube. The elliptical cylinder is compliant  and the cube is stable. The sharp edges and corners of the cube have cut through one of the flat elliptical surfaces and the simple curved mantle surface. The volume of the cylinder has been adapted to the shape of the cube by creating distorted corners (Fig 59b) on the cylindrical volume.

The flat elliptical surface is cut and pushed outwards inducing a slightly curved surface which stretches the elliptical

straight edge

flat elliptical surface

Fig. 59a

accent of the elliptical cylinder

distorted corner

Fig. 59b

cut hard edges

non-geometric double curved surfaces

top cylinder
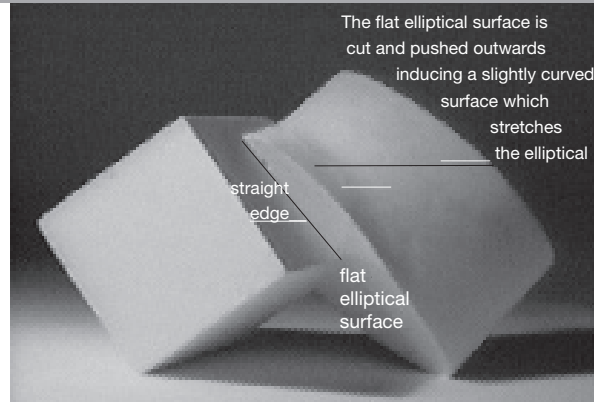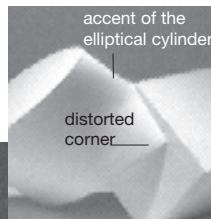
mantle surface

Fig. 59c

The organization of the two volumes is dynamic (see chapter IV) and the adaption involves one of the accented areas of the elliptical cylinder (Fig. 59a-c) and four hard edges of the cube.
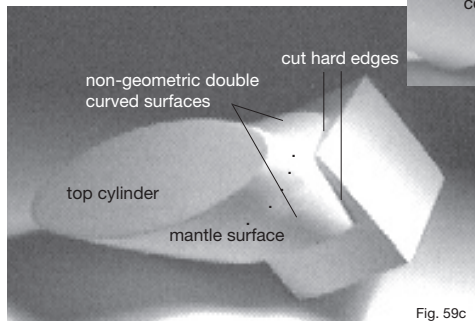
The simple curved mantle surface is divided and pressed outward to partially encompass the massive body of the cube. Two hard edges are introduced on the mantle surface as well as two non-geometric double curved surfaces (Fig. 59b-c).

The following features are **Assimilated;** involved in complying to the stable form:

*  four straight edges on elliptical cylinder induced by the cube
*  non-geometric double curved and simple curved surfaces
*  the outer elliptical edge stretches to accommodate for the cube
*  distorted corners introduced on the cylinder
*  asymmetrical qualities on the original symmetrical cylinder

_____

The following features are **Dissimilated;** uninvolved in complying to the stable form:

*  more than half of the elliptical cylinder is unchanged
*  main straight axis in the cylinder is intact
*  the top elliptical surface retained its original geometric properties
*   the shape of the cube is easily discernible

## MERGE

To **MERGE** means to blend two or more geometric forms into a combined figure. Merging of forms can occur gradually throughout the entire composition or abruptly within an isolated area where the two forms come together.
The overall figure can appear to unite or to separate the orignal forms depending on:

- orientation, movement & relationship of the axes of the original forms toward each other

- variation in properties, size and elemental parts between forms

- how gradual or abrupt the transition between surfaces are

Figure 60 defines the two extremes within the spectrum of merging forms: **Converge** involves unifying forms as well as creating transitional surfaces that gradually change from the properties of one form into the properties of anorther. **Diverge** involves separating forms as well as creating transitional surfaces that abruptly change from one form to another.

a          b          c          d



rectangular volume +          sphere +          pyramid +          elliptical cone +
triangular prism          triangular prism          circular cone          tetrahedron

SPECTRUM
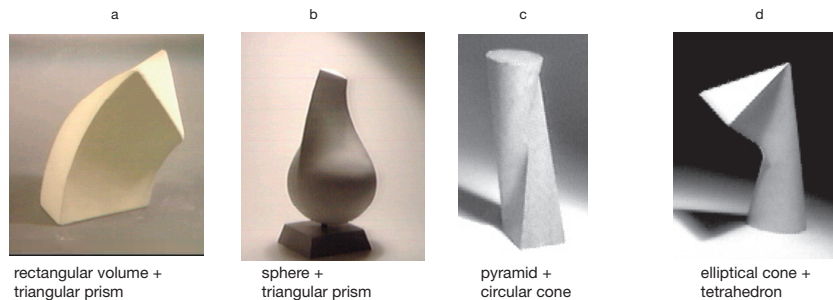
**CONVERGE**
Features that express unity between forms. The transitions are gradual.

Fig. 60

**DIVERGE**
Features that express separation between forms. The transitions are abrupt .

Figure 61 shows a sequence of four forms from converge to diverge. The order is determined in reference to the transitional surfaces and how gradual or abrupt these surfaces merge the forms together. If the sequence was based on showing unity - separation, then form (b) would change places with form (c) since the overall proportion and contour of form (c) expresses a more unified merged form.

Figure  61 shows a merged forms that express some visual properties of a joined forms. Surface(x) on the triangular prism is not a transitional surface but rather a surface that cut into the ellipsoid. This shows an exemple of how the different form stages overlapp with each other.



x
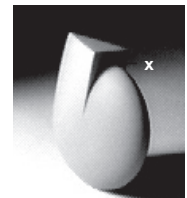
Fig. 61

## MERGED FORMS applied to triangular prism and rectangular volume

Figures 62a-e show different views of a merged rectangular volume with a triangular prism. The original forms had similar size and proportions. The two forms were originally placed at a dynamic angle to each other. To compensate for the changes from a rectangular volume to a triangular surface, one of the edges of a rectangular surface must be reduced to a point (Fig. 62a).


triangle

Fig. 62d


rectangle

Fig. 62e

The only two surfaces that are unchanged from the original geometric forms are the triangular surface shown in figure 62d and the rectangular base shown in figure 62e.



Fig. 62c

The rectangular surfaces on the sides of the volume stretches and curves to adjust to the transformation.
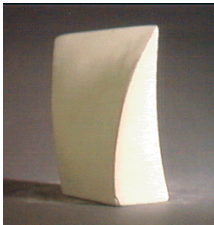


Fig. 62b

The original rectangular volume curves through its surfaces and inner axis to meet the edges of the dynamically oriented equilateral triangle.
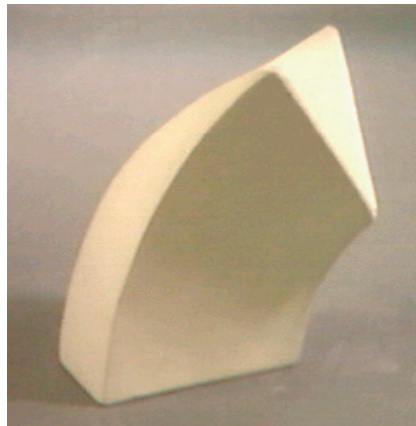


Fig. 62a

The following features
**Converge;** unity between forms gradual transitions

*  The two original forms are totally united with each other
*  The main straight axial movement in both volumes have merged together and express a single curved axis
*  All of the surfaces parallel to the main axis of the original forms have merged together and transformed from straight to curved
*  One of the 4-sided surfaces on the rectangular volume has been transformed into a 3-sided surface
_____

The following features
**Diverge;** separation between forms abrupt transitions

*  The top triangular surface from the triangular prism is unchanged
*   The bottom rectangular surface from the rectangular volume is unchanged

39

## DISTORT

To **DISTORT** means to expose a geometric form to a force(s) affecting its inner structure and elemental parts.The act of distorting can be a direct result of forces that affect the qualities and inherent properties of the material in which the forms are made, e.g. throwing a block of clay against the wall. Another way is to interpret how a force should affect a form under controlled conditions, given a defined material. This method of distorting is on a more abstract level since the materials used to make the model can differ from the intended material. Some different direct, physical forces are: twist, squeeze, roll, pull, push, bend, hit, erode, etc. Examples of interpreted forces are: optical distortion, implosion, explosion etc.

Figure 63 shows different ways of distorting geometric forms within a spectrum. The position of each form within the spectrum shown here is relative and not absolute.
On the one end of the spectrum is **conform**, the form expands the inner mass which stretches the surfaces. Conform also means that force(s) work with the properties of the elemental parts and the inner structure of the original form. On the other end is **deform**, the form contracts and the force(s) work against the properties of the elemental parts and the inner structure of the original form.

a                               b                               c



twisted cylinder            imploded tetrahedron              bent & imploded cylinder

SPECTRUM

**CONFORM**
Features that expand  the form and work with the structure of the form.

Fig. 63

**DEFORM**
Features that contract the form and work against the structure of the form.
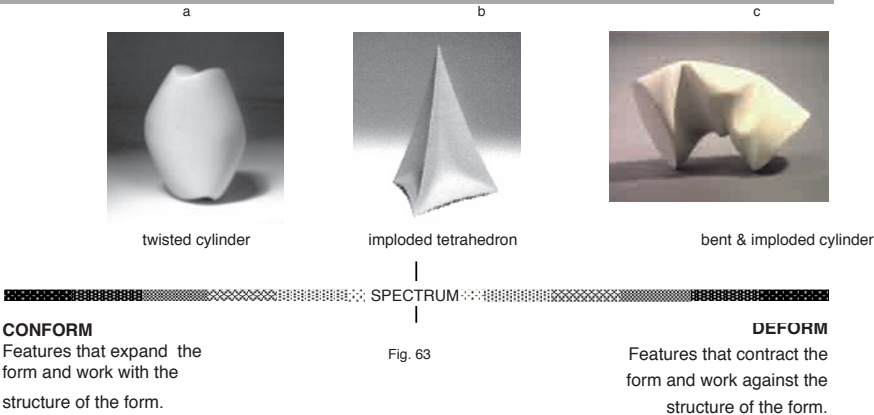
The way the force(s) work with or against the structure of a geometric form depends upon the:

type

movement

magnitude

orientation

of the forces in relationship to the shape and structure of the form

The position of the above selected forms within the spectrum (Fig. 63 a-c) is based on expansion and contraction. The properties of the surfaces on all the forms have been more or less changed as well as the edges and contours.

Distorted forms often express tensional relationships between expanded and contracted areas. The visual changes that occur on distorted geometric forms are often of an organic nature, i.e. transitional surfaces, expansion and contraction, convexities and concavities etc. (see Chapter IV).

## DISTORTED  FORMS applied to circular cylinder

By taking hold of the two ends of the original  cylinder and twisting the form around its own axis (Fig. 64) the simple curved surfaces of the original form change to double curved surfaces with two strong asymmetrical accented areas (b and c in Fig. 65). This axial twist work with the structure of the original form. A tensional relationship between these two accents (Fig. 65) expands the form diagonally and changes the movement in the mass of the original cylinder. The grip used to hold the cylinder squeezed the circular ends and created oval, simple-curved surfaces (a in Fig. 64).



The form expands between the two accents

b

c

Fig. 65

The following features **Conform;**
expand and work with the original form:
*  The mass and mantel surfaces expand outward
*  Twisting the cylinder around the primary axis
*  The hard edges of the original circular ends of the cylinder are retained as they change to oval
*  The more or less straight silhouette as seen in figure 66

The following  features **Deform;**
contract and work against the original form:
*  Introducing double-curved surfaces with asymmetrical accents
*  The end-surfaces contract inward and are simple-curved with oval contours
*   The tensional relationship occurs through the mass, changing the movement of the axes within the form



a

TWIST

oval accent

Fig. 64

The overall proportion, structure and movement have expanded and the form no longer retains strict geometricproperties, yet a geometric heritage can be deciphered.

Figure 66 shows a straighter silhouette due to the more simple curved quality of the surface at the oval accents of the form.

oval accents

Fig. 66

The original form was a circular cylinder.

circular cylinder
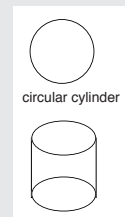
Fig. 67

## FORCES IN RELATIONSHIPS

Forces express visual activity within and beyond the positive and negative elements. As mentioned in chapter II, forces are not visible in themselves, however, their paths can be discerned and controlled through the shapes of the positive forms in the composition. The visible embodiment of a force can be seen at the accent of curved surfaces or at angled corners within and at the edges of volumes.

TENSIONAL RELATIONSHIPS
deals with the energy that
 radiates from directional forces
(Fig. 68).

The two illustrations below in
(Fig. 69a-b) show two examples of tensional relationships. In figure 69a the directional forces on the concave side of the two curved lines channel their energy out from the accent towards each other.

Fig. 68



Fig. 69a                    Fig. 69b

In figure 69b the force from the convex side of one curve relates to the force from the concave side of the other curve.



a

b
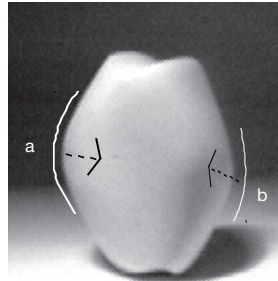
Fig. 70

The distorted cylinder in figure 70 shows a tensional relationship through the mass. An inner energy and tension is embraced between the two accented areas, (a) and (b). The arrows represent the directional forces that channel this interaction. The tensional relationship moves at a diagonal through the form.

.

In figure 71 the rectangular volume is distorted (see p.40) through expanding inner forces. The accented compound curve at the top interacts with the front and with part of the underside of the volume. The axial movement of the form runs horizontally through the longest proportion and is affected by the organic (see p. 43) inner activity of the forces in tensional relationships.



compound curve

axis

front curve

underside  curve

Fig. 71

42
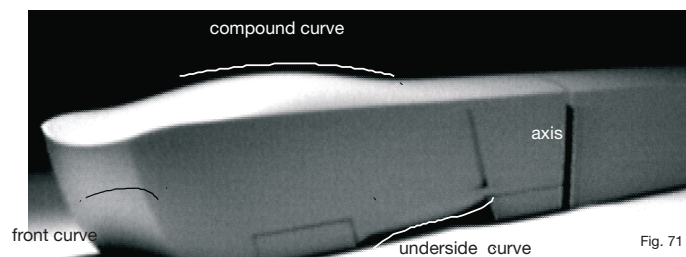
## ORGANIC  FORMS

A general definition of organic is to have properties associated with living organisms. The approach in this handbook for describing organic form is to find links from the organic world to the geometric world. Unlike geometric forms, which have a clearly defined mathematical structure that dictates and restricts the properties of the elemental parts, abstract organic forms are in general "amorphous". However, the simplest organic form = the egg, and the simplest geometric form = the sphere/ellipsoid have a great deal in common (Fig. 72).

Organic concepts presented here do not involve the mapping of shapes and forms from nature, but rather aims to find abstract general principles of growth and diminishment. The interaction between movements and forces is the most essential concept in organic form. Through these subtle inner activities organic forms express expansion and contraction. The visual elemental parts of organic forms are curved surfaces that are either convex or concave with varying degrees of transitions between the surfaces.

**Convexity:** growth and expansion
**Concavity**: diminishment and contraction
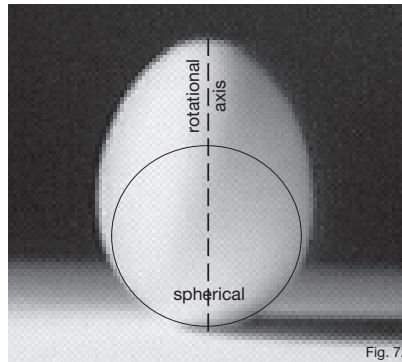


Fig. 72

EGG - total convexity

All eggs exhibit total convexity and can be regarded as the visual evolutionary link between geometric and organic forms. Perfectly spherical eggs, such as fish eggs, are during certain stages of development identical with the geometric sphere. This implies that the geometric and the organic form world may be considered to have a "visual ancestral origin".
Eggs can also resemble different members in the ellipsoid family (chapter I). The classic hen´s egg is similar to an ellipsoid, however, it is asymmetrical from top to bottom. The bottom curvature in figure 72 takes on the shape of a sphere which slowly transforms to different degrees of elliptical curvature as it moves upwards.

The hen´s egg has rotational symmetry around its primary axis. This rotational symmetry is exemplified through the circular section of a plane that cuts at right angles to the primary axis. The  different sections mapped out below illustrate the similarities and differences between a hen´s egg (Fig. 73a) and a geometric ellipsoid (Fig. 73b). The dark circle on the inside of the egg sections is the yolk. Since the yolk is perfectly sphereical any flat section through it results in circles of different sizes.
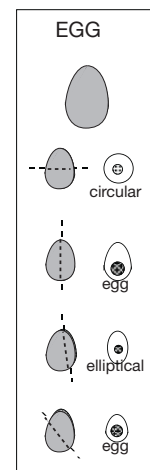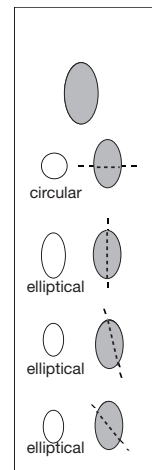


Fig. 73a        Fig. 73b

## CONVEXITY and CONCAVITY

The neutral curved line below in figure 74 gives a simple illustration of convexity and concavity. The curved line implies that convexity and concavity are the direct opposite of each other, where the convexity is the outside and the concavity is the inside of the same curve.

convex        concave

Fig. 74

convexity - form pushing outwards
concavity - space pushing inwards

3-D convexities and concavities are expressed as organically shaped positive and negative volumes and are much more complicated than a curved line. There is no direct match between the inner and outer shapes of convexities and concavities on volumes due to how the entire mass of the form interacts with the forces.



c
a
central
concav-
b
e
soft
transition
d
convex sur-
face
f
hard
transition
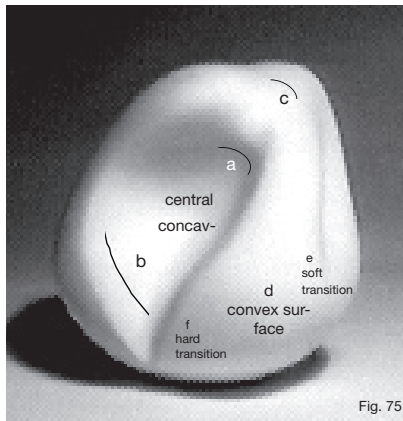
Fig. 75

Hard transition (f) separate the convex surface from the central concavity, whereas soft transition (e) blends the convex with the concave surfaces.

The organic form shown from four different views in figures 75 - 78 express various shapes of convexity and concavity. The organic features are non-geometric and therefore each convexity and concavity is made up of a number of different surfaces that define the limits of the positive or negative volumes (see "central concavity" in figure 75). Tensional relationships across the enclosed space of the central concavity can be seen between the accents (a) & (b). Tensional relationships between accent (a) within the concavity and through the form to accent (c) on the convexity can also be noted. The transitions between the active surfaces on the convexity and concavity are important visual expressions of the form. In figure 75 the convex surface (d) has a harder transitional edge on one side and a soft transitional surface on the other side.

These three different views of the above sculpture show various qualities of convexities and concavities.



g
h
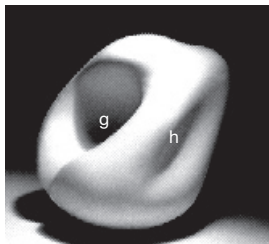
Fig. 76
deep concavities (g) & (h)



i
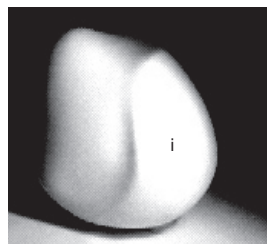
Fig. 77
broad expanding convexity (i)



j
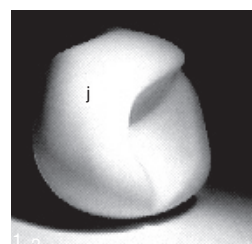
Fig. 78
complex curved convexity (j)

## CONCAVITY and CONVEXITY

The sculpture in figures 79a-e is made up of concavities and convexities and is similar to the model on the prior page, however, the concavity  has a more dominant roll in the composition.

The larger and deeper the concavity pushes its way into the mass, the more it influences the inner structure and thereby develops a visual dominance. The positive volume is diminished  while the negative concave volume grows. The model illustrated here is built around a piercing concavity, which is the most extreme example of concavities. A piercing concavity can be compared to a tunnel. The two openings of the tunnel allow light to move through the form and an integration of convex and concave surfaces from one side to another. The openings as well as the inner "tunnel" are composed of a vast number of oval/organic surfaces and contours that blend and intertwine with each other.

Figure 80 shows a simplified example of this blend of contours as they progress from one opening through the tunnel to the other opening.
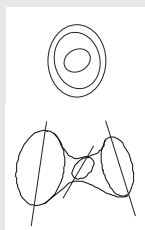
front view Fig. 80
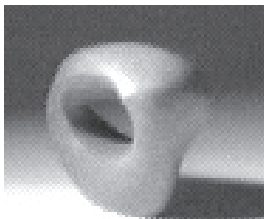

Fig. 79a

These five views of the same model show the diversity of oval and organic shaped surfaces defining this compound concavo-convex form. In figures 79b-d the opening and the piercing concavity  are illustrated by drawings.


Fig. 79e

The directional movement of the ovular opening is angled to the vertical in figure 79d.
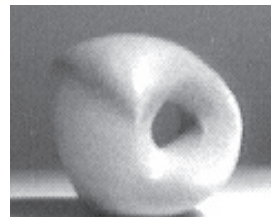
The piercing concavity moves in depth through the organic form in figure 79b.
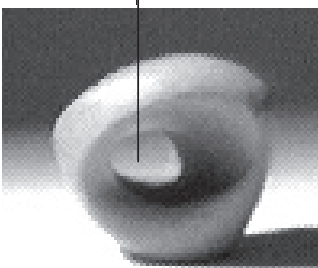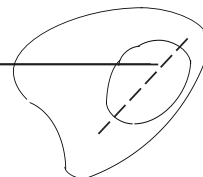

Fig. 79d

Only a part of the piercing concavity can be seen in figure 79c.


Fig. 79b


Fig. 79c

45
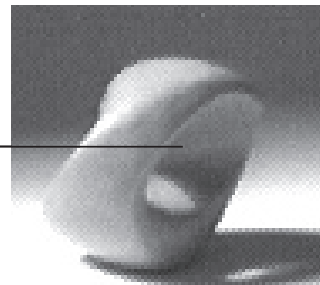
## EVOLUTION of FORM from GEOMETRIC to ORGANIC  FORMS                The gradual stages of form "evolution"

The "evolutionary" progression of form begins with the outline of the structure of primary geometric forms. Each stage progresses from this geometric base to a higher level of visual complexity. The sequence illustrated in figure 81 depicts seven stages of evolutionary development where each stage has its own bipolar spectrum (e.g. the divided spectrum ranges from accordance and

discordance) as defined earlier in this chapter. The figure shows one example from each side of each spectrum.

The first stage of evolution, shown at the far left in figure 81, begins with joining primary  geometric forms together. Demarcated within the joints are intersectional  forms which are completely defined by geometric surfaces, yet allow for asymmetry.

The four following stages, i.e. divided, adapted, merged and distorted can be considered transitional forms  because they progressively introduce transitional properties of non-geometric and /or organic nature and link geometric forms with "amorphous" organic forms. The last stage in development is organic , which emphasizes non-symmetrical convexo-concave features and is defined as having no initial geometric structure.

"U"-JOINT                          CORE                ACCORDANCE

JOIN                          INTERSECTION                DIVIDE

"0"-JOINT                          CORE                DISCORDANCE

Fig. 81

46
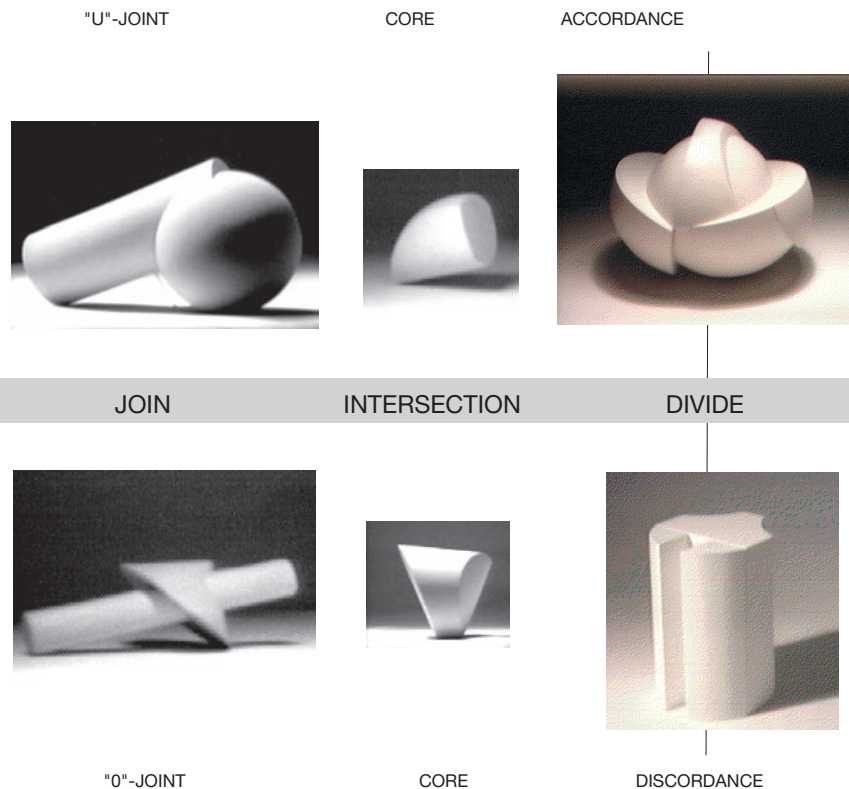
does not show <u>all</u> the different phases form can undergo. The aim is to find logical links that connects and overlaps one form spectrum with another.

ASSIMILATE            CONVERGE            CONFORM            CONVEXO-CONCAVE



ADAPT            MERGE            DISTORT            ORGANIC



DISSIMILATE            DIVERGE            DEFORM            CONCAVO-CONVEX

Fig. 81

47
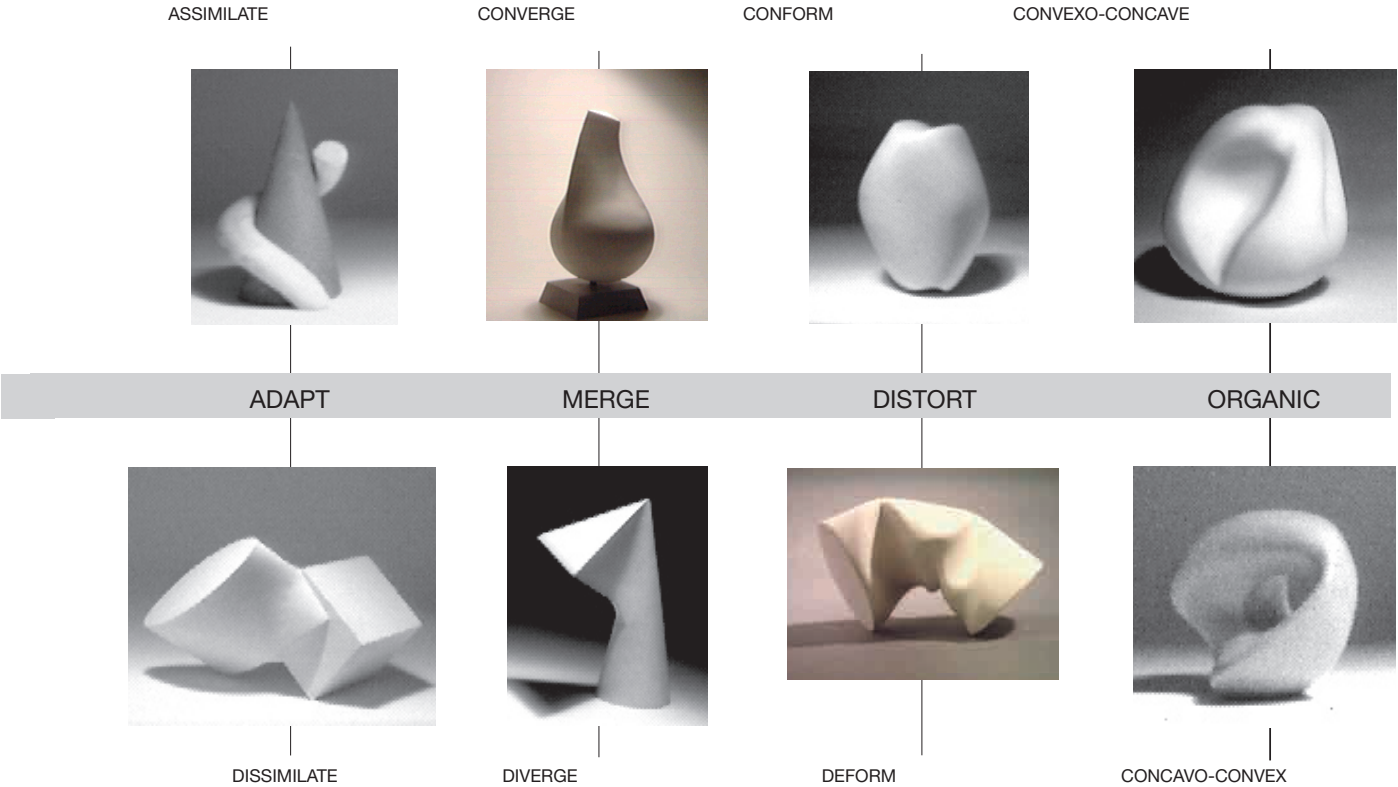
# IV ORGANIZATION

## 3-D SPACIAL MATRIX

VERTICAL
HORIZONTAL
DEPTH

## ORGANIZATIONAL FRAMEWORK

STATIC
DYNAMIC
ORGANIC

## SYMMETRY and ASYMMETRY

## BALANCE

STRUCTURAL
VISUAL

## ORIENTATION

DIRECTION
POSITION
TIP

## OVERALL PROPORTION

In this section on organization ideas and principles will be presented that pertain to pure visual compositional structure for 3-D asymmetry.
An organization can be seen as a "master plan" that maps out the routes and interactions between all visual aspects of the composition (i.e. elements, movements & forces and relationships). An organization can also be seen as the "accumulated structure" that each element can give to the total expression of the work. In other words, there is a direct correlation between the visual integrity of the individual elements and the overall organization.

The message that is meant to be communicated through the overall "gestalt" has strong bearing on the organization and character of the work. However, the scope of this handbook is to focus on the concrete descriptive visual information that can be observed more or less independent of the interpretation of the work. It may seem counter-productive to isolate form  from content, since the goal in any visual work is to synthesize these two worlds. Yet, developing the ability to abstract the 3-D visual structure that is inherent in anything that exists in our 3-D world, adds objective view-points to the creative process of "shaping" new ideas.

## 3-D  SPACIAL  MATRIX

The 3-D spacial matrix (Fig. 82) constitutes the fundamental context in which visual components interact. The three different dimensions of the matrix are: vertical, horizontal and depth, which give the basic reference of orientation for all positive and nega-tive elements and their inner structure and spacial activity.

1:st dimension is vertical
         moves - up / down

2:nd dimension is horizontal
         moves - side / side

3:rd dimension is depth
         moves - front / back

To determine the orientation of an object within a 3-D matrix requires an active participation from the observer. Visual information must be gathered from different view points, at different distances. 3-D spacial perception demands a stereoscopic vision, i.e. to observe with both eyes, as well as a high level of concentration because the different views must be fused together to give an integrated spacial interpretation. In comparison, the orientation of an element on a 2-D picture plane can be determined with one eye closed and from one fixed view.

**Depth perception**
All three dimensions,vertical, horizontal and depth are implicit in the 3-D matrix, however, the third dimension, depth, is the key to experiencing space. The depth dimension embodies a 3-dimen-sional quality in itself, unlike the 2-D more grafic representation of vertical and horizontal. A vertical dimension can be defined without relating it to the other dimensions; it is parallel to the the plumb line that is governed by the laws of gravity. The horizontal dimension does not need to be defined in relation to the vertical or depth dimensions; it is parallel to the horizon. We are extremely sensitive to any deviation from the vertical and horizontal dimensions, which at times can be a source of irritation (like a picture hanging askew).



vertical

horizontal **2**

**1**

**3**
depth
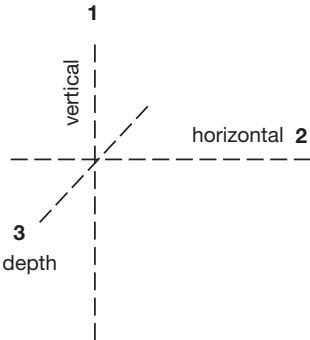
Fig. 82

However, we are not as conscious of the phenomenon of depth despite its fundamental roll in the 3-D world. Our perception of depth is nevertheless an inborn function that is integrated together with the other two dimensions within our sense of balance (E.J. Gibson).

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## ORGANIZATIONAL FRAMEWORKS

The three organizational frameworks are:

static    -    the elements are aligned with
               the 3-D spacial matrix.

dynamic  -   the elements are angled to
               the 3-D spacial matrix.

organic  -   the elements are curved
               within the 3-D spacial matrix.

The above frameworks outline three distinct ways to organize elements in space (Fig. 83a-c). The static framework organizes the elements parallel to the 3-dimensions and is therefore the most rigid framework. In the dynamic and organic frameworks there are an infinite number of degrees of angles and curvatures that deviate from the vertical, horizontal and depth dimension. The position of each element is defined in reference to the 3-dimensions. The organizational framework should correlate to the shape and character of the elements as well as  their interrelationships applied within the framework. This correlation implies a logical hierarchy from the smallest detail to the overall composition.
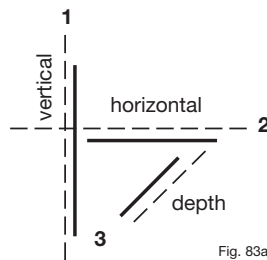


Fig. 83a

STATIC - Three straight lines parallel with the vertical, horizontal and depth dimensions, respectively.
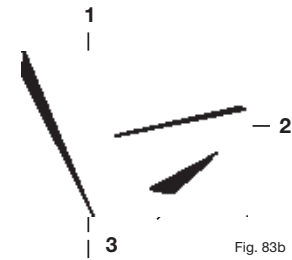


Fig. 83b

DYNAMIC - Three uneven triangles are placed at an angle to the verti- cal, horizontal and depth dimension, respectively. The diagonal properties of these triangular planes are reinforced and strengthened within a dynamic framwork.

ORGANIC - Three curved lines curve to the vertical, horizontal and depth dimensions, respectively. An element with an inner axial curvature is a pre- requisite for the organic framework.



Fig. 83c

51
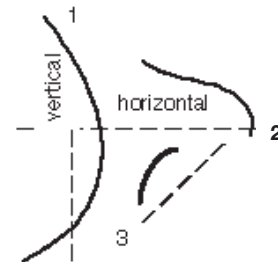
# SYMMETRY  -  ASYMMETRY

The concepts of symmetry and asymmetry apply either to the organization of elements in a composition and / or to the internal structure of a single form.

SYMMETRY
Strives to maintain regularity and creates an equilibrium through repetition and the cancellation of movements and forces by identical opposing elements and forces.
A sphere is the only perfectly symmetrical form since it is identical from all views.
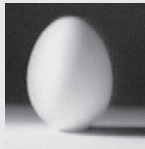


Fig. 84

An  egg has bilateral symmetry, i.e. identical qualities on both sides of a vertical dividing line, however, the composition is asymmetrical from top to bottom.

ASYMMETRY
Strives to maintain diversity and aims to counterbalance elements, movements and forces so as to compensate for opposing strengths and weaknesses, yet does not lead to repetition.

a                                          b                                          c



composition based on two         composition based on         composition based on
circular cylinders               elliptical cylinder          twisted curved plane

SPECTRUM

SYMMETRY                                                                        ASYMMETRY
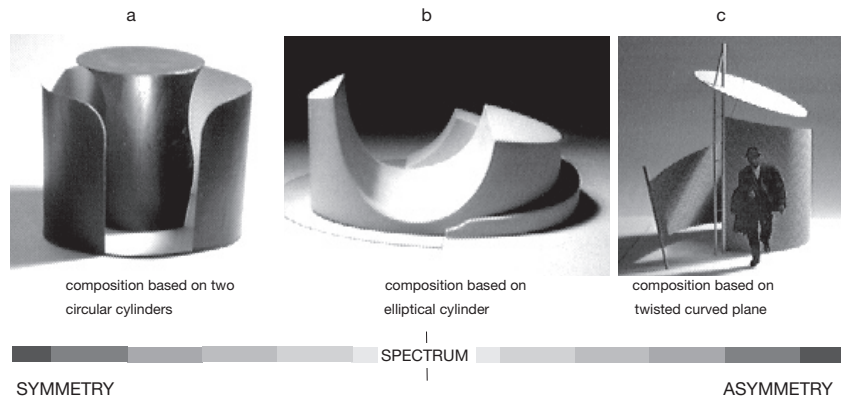
Fig. 85

Symmetry and asymmetry can also be seen as two extreme poles within a spectrum. A composition can involve a combination of symmetrical and asymmetrical qualities. Figure 85a-c shows three different compositions that exemplify the symmetry / asymmetry spectrum.
The visual method presented throughout this book emphasizes asymmetry in order to create visual challenges from each view with respect to the 3-D visual statement.

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## BALANCE

Balance involves the interaction between the properties of the elements and their movements /forces so as to establish an equilibrium or counterbalance throughout the composition. Balance can be thought of in terms of:

**Structural balance** - deals with the physical ability of a composition to "stand on its own". The distribution of weight  and the combined strucutral features such as joints, supportive elements, strenghth of transitional areas between forms etc. determine the structural balance of the compositon.

**Visual balance** - deals with perceptual dynamics of the composition, taking into account the visual potential of both positive and negative elements. The first step is to visualize an equilibrium or counterbalance between the axial movements and the visual forces within and beyond the elements. To develope such an "all- around mental image" of how the movements and forces interact within a 3-D spacial context is a very abstract experience. It is, however, the "scaffolding" on which elemental properties and relationships are built and therefore is essential for perceiving or developing visual balance. The next step it to see how the proportions of the elements are distributed within the composition and how they are correlated to the specific configuration the composition takes on from different views.

Surface qualities and visual contrasts, such as sharp edges or silhuettes, usually dominate visual perception. If these more superficial stimuli are strongly integrated with the activity of movement and forces within and beyond the elements then a clear 3-dimensional visual balance can be developed (Fig. 86).
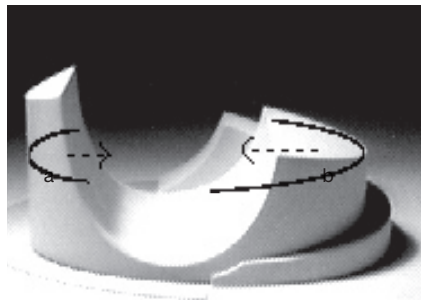
Fig. 86

The tensional relationship between accents (a) and (b) in figure 86 counterbalance directional forces. Figure 87 illustrates the tensional relationships in figure 86.

accent      a                              b      accent

Fig. 87

dynamic framework

counter-balance of axes
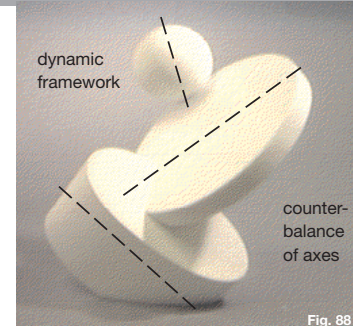
Fig. 88

**Symmetry / asymmetry and frameworks**
The perception of visual balance must take into account whether the composition is based on symmetry or asymmetry . The organizational framework, i.e. static, dynamic or organic, also set the conditions for visual balance. Figure 88 shows three curved geometric volumes in an asymmetrical, dynamic framework.

The concept of balance is constantly challenged within the visual field. The tolerance for accepting asymmetrical balance varies from person to person, since the perception of balance has to do with relating the proportions and activities within a composition to how we sense equilibrium within our body and our previous visual experiences.

## ORIENTATION

Orientation specifies the location of each element in relation to the spacial matrix. Figure 89 illustrates the terms used in orienting the elements, i.e.
direction, position and tip /rotation

direction - the general movement of the primary axis in reference to the 3-dimensions of space, e.g. angled to the vertical.

position - to shift the position of the element up or down along the defined directional movement.

tip / rotation - to turn the element around its primary axis.

DIRECTION          POSITION          TIP / ROTATION

Fig. 89

DIRECTION

ROTATION

POSITION
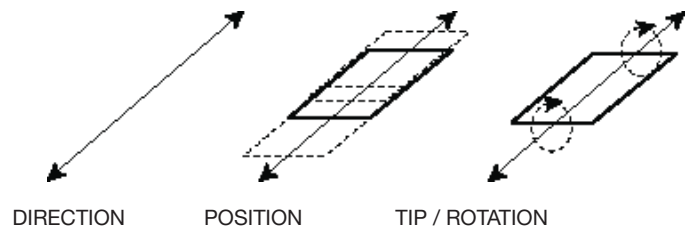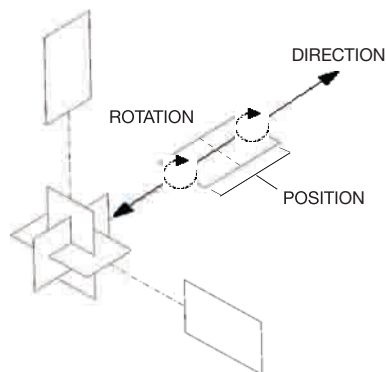
Figure 90 shows how the above terms of orientation are applied. The direction of the plane moves parallel to the depth dimension and is rotated 90 degrees.

Fig. 90

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## ORIENTATION of PLANES in a STATIC FRAMEWORK

The first structural features to be considered within the organizational framework is the orientation of the primary axis of each element. In figure 92 the three rectangular planes are organized so that the primary axis of one plane moves vertically (a), another plane moves horizontally (b) and the third plane moves in depth (c).

In figure 93 a 90 degree rotation of each plane around its primary axis has been performed (a – a´, b - b´, c - c´). This rotation is meant to illustrate the six different possible orientations of planes within a static framework. Since there are only three different dimensions, the primary axis of two planes must share the same dimension, i.e. the primary axis of (a) and (a´) share the vertical dimension, (b) and (b´) share the horizontal dimension and (c) and (c´) share the dimension of depth.
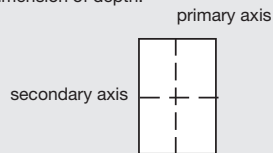

Fig. 91

The principle difference in each of these pair of planes is that the secondary axis of the two planes move in an opposing dimension (Fig. 91).
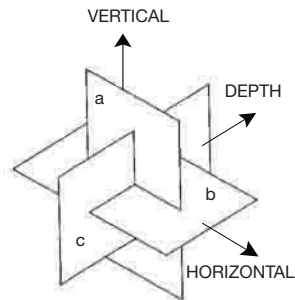

Fig. 92
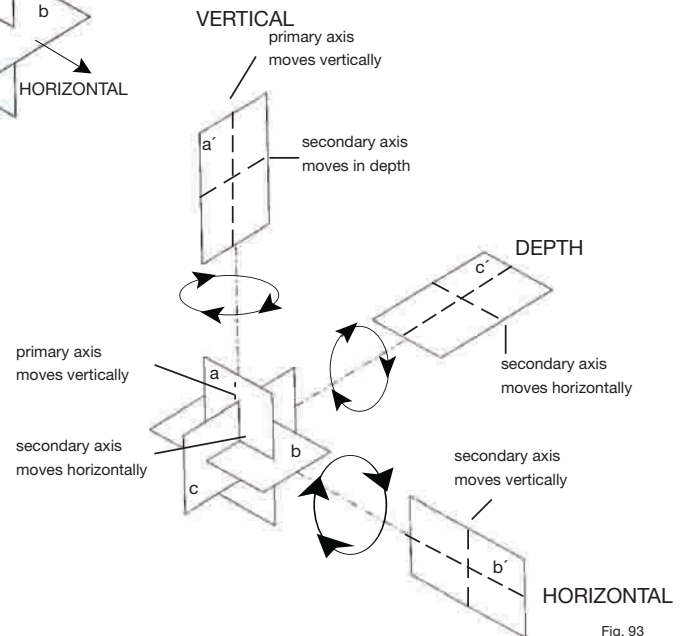

Fig. 93

## SPACIAL MATRIX, FRAMEWORK and ORIENTATION          applied to six planes

This model in figure 94a-b applies some of the terms presented in all four chap-ters.The following features are incorporated in this model:

*  A static organizational framework governs the position of the positive and negative elements.
*  The entire composition is asymmetrical.
*  The spacial enclosures (x), (y) and (z) are open negative volumes.
*  Due to the compatibility between the rectangular shape of the planes and the static organizational framework, the shape of the spacial enclosures are also rectangular and of contrasting proportions.
*  The inherent proportions of the planes and the spacial enclosures are all different from each other.
*  There is a hierarchy of order of the planes, which is dependant on an in-ner relationship of comparative size and proportion, position and role in creating spacial qualities. Plane A appears to have a dominant role, plane D a subdominant  and plane B a subordinate role in relation to A and D.



Fig. 94a

The purpose of this exercise is to define at least 3 different spacial enclosures within an asymmetrical static organization of planes. The positive and negative elements (see chapter I, p. 7) all have varied propor-tions and spacial orientation. Each element moves as 3-dimensionally as possible within the spacial matrix.

The spacial enclosures marked  (x), (y) and (z) in figure 94a-b are open from at least three sides and are therefore all open nega-tive volmes.



Fig. 94b

All 6 planes in the model can be seen in both figure 94a and b, however, in figure 94b the vertical plane D overlaps plane C and F which visually interrupts the surfaces C and F which changes the visual proportions.

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A

v1

h2

A.

B

h1        d2

B.

C

v2      d1

C.

D

v1

d2

D.

E

v2

E.      h1

F

d1

h2

F.

Fig. 95

The orientation of the movement of the promary and secondary axes of each plane is described below:

A:    primary axis is vertical and secondary axis is horizontal.

B:    primary axis is horizontal and secondary axis is in depth.

C:    primary axis is in depth and secondary axis is vertical.

D:    primary axis is vertical and secondary axis is in depth.

E:    primary axis is horizontal and secondary axis is vertical.

F:    primary axis is in depth and secondary axis is horizontal.

Figure 95 maps out the direction, position and rotation of each of the six planes (A-F).The dotted lines on the planes mark the primary axis = 1 and secondary axis = 2 as well as the dimensional direction of the two axes; vertical = v, horizontal = h, depth = d. As an example, plane A shows that the primary axis moves vertically (v1) and the secondary axis moves horizontally (h2).

## OVERALL  PROPORTION

The **overall proportion** has to do with the entire shape of the composition and sum- marizes the proportions of the positive and negative elements. A way to perceive the overall proportion is to observe the composition "out of focus" (e.g. by squinting). This allows the details and the sharp silhouette to fade as you see the object from all sides so that the entire composition is generalized into pure movements and proportions.

Figure 96 shows three curved geometric forms joined together in a dynamic framework. The gray-shaded surface in figure 98 is meant to illustrate the overall proportions of the model in fig 96. The illustration can not represent the 3-D volu- metric qualities of the overall proportion, but it does show that the main directional movement is angled to the ver- tical dimension and that the compostion is asymmetrical.

A comparision of the principally different ways of seeing form and space is shown in figure 97 and 98. Figure 97 zooms in on details within the model while figure 98 "shadows" these superficial qualities.
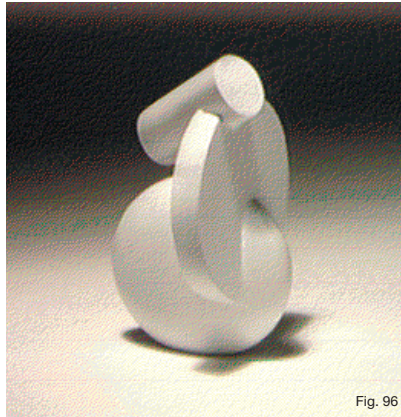

Fig. 96


Fig. 98

**OVERALL PROPORTION**


accent

elliptical curved lines around the "U"-joint
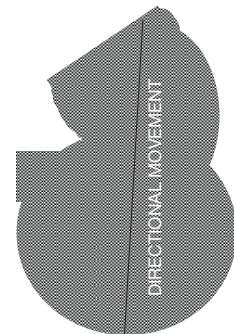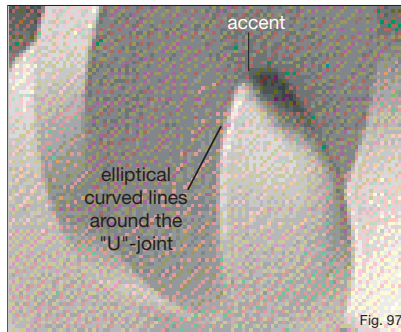
Fig. 97

The **"U"- joint**  in figure 97 illustrates how the lines around the joint are shaped in comparison to the overall proportins in figure 97 (a more com- plete joint analysis can be found on page 29).

## BACKGROUND
### Rowena Reed

Professor Rowena Reed was a sculptor and teacher, who was born at the turn of this centruy. She belonged to the generation of artists that took on the challenges of introducing the principles of the modern movement into art and design education in America. Through her close working relationship with her husband, painter Alexander Kostellow, she colllaborated in the development of a logically structured  foundation for the visual arts. Together Reed and Kostellow worked out a visual foundation program that introduced the different levels of visual complexity through concrete experiences in 2-D and 3-D mediums. The terminology was consistent throughout the program and reinforced at each level. The exercises were intended for artists as well as designers, since the ideas explored in the foundation courses were "meant to apply to all forms of visual expression" (2).

Alexander Kostellow outlined the first stages of this visual program through his teaching positions in the painting departments at Kansas City Art Institute in  Missouri and at Carnegie Institute in Pittsburgh, Pennsylvania. He began to formulate "definitions for the elements of visual experience and to identify the principles underlying the organization of these elements into significant form." (2). The program was established at Pratt Institute in NYC

1936 as the "foundation program" for all first year students in  the Art and Design Departments. Rowena Reed had responsibility for developing and teaching the 3-D courses. When Reed was invited to Pratt, together with Alexander Kostellow, she joined the teaching staff that established one of the first Industrial Design (ID) Departments in the USA. She brought her background and working methods as a sculptor into the education of an industrial designer and used her more intuitive visual approach and 3D-teaching methods with the structured visual foundation. The Industrial Design Department, under the leadership of Kostellow, integrated the foundation program into its own curriculum. Rowena Reed was therefore able to develop and teach advanced studies of form and space at the ID department, as well as lead and/or collaborate in practical/functional design projects that applied the visual foundation.

After the early death of Alexander Kostellow in l954, Rowena Reed continued to teach for more than thirty years and developed new directions within the visual program. Her devotion to explore the fundamental issues of 3-dimensional visual  phenomena assured that her comments and criticism were unaffected of trends and "isms" that superficially shape the art and design world.

### Reed´s teaching methods

Rowena Reed´s 3-dimensional sensitivities were intimately linked with her ability to abstractly analyze and discern visual complexity. Reed´s method of teaching encouraged a creative process that gave her students freedom of expression and ensured 3-D visual thinking. Through a spontaneous confrontation with 3-D sketching, a variety of visual expressions would begin to take form. The power, identity and idiosyncrasies of each sketch could potentially contribute to the final "visual statement", either directly or indirectly. The development of a gestalt / image progressed through different phases that interwove this spontaneous method with an analytical approach which involved determining the inner structure and abstract organization of a composition.

The source of inspiration for Rowena Reed´s dynamic sketching process presumably stems from her experiences with German - American painter Hans Hofman. Hofman´s painting and teaching methods "initiated the transformation of abstract art from the invention of images, drawn before they were coloured, to their creation in the process, or action, of painting" (3). Rowena Reed brought that abstract spontaneity from painting into developmental methods of sculptural work without reducing 3-dimensional complexity. She was very

clear about distinguishing between the 2-D vision and tools of a painter and those of sculptor. Students were usually discouraged from working out ideas in a 2-D media in her courses, because line, surface quality, shading, color and fixed view- points were stressed when working 2-dimensionally. In contrast, working solely in a 3-D media, emphasis is placed on volume, space, depth and all-roundness, which is vital in communicating sculptural experiences.

Toward the last part of her teaching career, Reed became involved in architectural problems and art installations where spacial articulation was imperative. She worked out ways to explore static, dynamic and organic space where expansion of the "total negative volume" was a central concept. These space studies were a further development of her understanding of convexity and concavity which the Russian - American sculptor Alexander Archipenko initially introduced to Reed.

Archipenko was Reed´s most important link to the modern development within the sculptural arts. The controversial ideas of shaping space as a "tangible" element as well as the constructivistic attitude that

Archipenko fostered through his teaching helped to build the platform on which Rowena Reed founded her teaching. The following citations of Alexander Archipenko (1) gives insight into his view of convexities/concavities and the creative process:

"It is evident that in sculpture each point of the surface would have meaning and be related to millions of other points of the surface. Likewise, relief and concave are reciprocally integrated. It is exactly as in music; each note has its psychological significance while it is related to every other note and pause in the composition".

Alexander Archipenko was considered one of the first truly modern sculptors of the 20th century (5). His classic training gave him the technical working methods of a traditional sculptor and his inner artistic vision freed him from the conservative bonds with materials and representational imagery. Archipenko left Russia around the onset of the revolution and was therefore not engulfed in the Russian constructivist movement. His unique 3-dimensional organic methodology was based on abstraction of the figure and did not share the dogmatic geometric grounds nor the social/ political connections to art.

**Previous documentation**

Neither Rowena Reed nor Alexander Kostellow documented their educational program or the theoretical framework that structured their visual vocabulary and principles. Many of the concepts Alexander Kostellow integrated into the comprehensive visual structure came from contemporary artists that were active in New York City in the beginning of this century, many of which had emigrated to the US from Europe.

There is little documentation by others concerning Reed´s or Kostellow´s methods of teaching and educational material within the visual field. Arthur Pulos writes about Alexander Kostellow´s roll in establishing educational requirements for industrial design programs as well as heading committies that worked to strengthen the profile for the industrial design profession. These issues demanded all Kostellow´s time outside of the Department.
Research is needed to trace the individual artists that Alexander Kostellow studied and worked with, who influenced and supported him during the initial phase in creating an objective base for the visual arts and design as well as Kostellow´s and Reed´s step by step development of their principles of visual relationships.

The structure I have attempted to document in this book is therefore my interpretation and further development of Rowena Reed´s 3-D foundation.

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## HISTORICAL CHART

The chart on the this page is derived from the chart "Art streams of the 20s" in John Willett´s book "The new sobriety - art and politics in the Weimar Period 1917-33". This chart has been adapted to put Reed and Kostellow in a historical context and points to some schools / movements that share a common source of inspiration.

The dark grey blocks mark the initial events of Reed´s and Kostellow´s development. The light grey blocks outline the movements and schools that contributed to establishing the bases of artistic expression that stem from the visual arts themselves and the creative process.

Alexander Kostellow 1896 - 1954
Rowena Reed-Kostellow 1900 - 1988

## ACKNOWLEDGEMENTS

# INDEX

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For references regarding the background of professor
Rowena Reed,

Development of the curriculum at the Department of Industrial Design (ID) at the University College of Arts, Crafts and Design in Stockholm has been carried out during a three year project. The purpose has been to produce teaching materials for our own educational program within the Department, but also for exchange with other design schools in Sweden where similar curriculum developmental projects are under way. The focus has been on the following areas:

**Designmetodik** (Design Methodology), Vilda idéer och djuplodande analys; om designmetodikens grunder, belyser hur designarbetet planeras och genomförs i sina olika faser där funktionsanalys utgör en central del av arbetsgången hos en designer.

**Three-Dimensional Visual Analysis** (Form- och Rums-studier), shows how form may be created, influenced and perceived in a structured manner. These visual studies constitute a link between fine and applied arts by developing a "form grammar" which supports both application and education.

**Modellbyggnadsteknik** (Model Making), introducerar material och tekniker för modellfram-ställning i olika am-bitionsnivåer. Skilda materials förutsättningar och begräns-ningar samt bearbetningsmetoder presenteras med råd och anvisningar om hur ett gott resultat ska uppnås och misstag undvikas.

Industrial Design is a young education with a great need for curriculum development. The future intention with this se-ries of books is that other subjects will be added as the basic teaching program progresses.

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