ILLUSTRATED DRAWING OF CUBIC FORMS

(A PEDAGOGICAL ESSAY ABOUT THE BEGINNINGS OF DRAWING OF CUBIC FORMS)

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Summary

As, parallel to an increase in requirements concerning visual education the time that may be allotted to teaching diminishes continually, the contradiction is tried to be alleviated by methodological development. The paper covers the schedule of drawing lessons, makes concrete suggestions for the introduction of novel visual means and pedagogical methods and analyses the pedagogical importance of the multi-step individual correction. The illustrations may form a starting point for a methodological study-aid to be elaborated in detail, in the future.

First-year architect and engineer students, but also secondary school students visiting university preparatory courses have their first introduction to free-hand drawing at the Department of Drawing and Composition.

Many of them are confronted for the first time here with drawing an object that had been set. It is with astonishment for them to hear, at the very beginning, that their former positive knowledge concerning a cube is regarded here as an erroneous remembrance.

Human sight developed in the course of subsistence, in the service of recognition. Children are drawing the "view" bigger than reality because they believe the cube to be better recognizable in this way. It is an old truth that "conceptual" sight is not identical with "drawing" sight.

The main aim of the initial period is to rectify erroneous conditionings.

At the threshold of teaching drawing one is faced with the problem of heterogeneous preliminary education, the many new experiences manifesting themselves at once and the little time available.

What makes the situation so very bad is that there is an unabridged gap between spatial (stereoscopic) culture and elementary graphic-descriptive knowledge in the curriculum of elementary and secondary schools.

Why should an architect be able to draw?

A structured environment-formation establishes the rational framework of our everyday needs. We are of the opinion that the computer will never be able to substitute the "free" hand led by creative fantasy!

To explain the necessity of free-hand drawing it is sufficient to show a photograph and the drawing made from it, from an identical angle. The dif-

ference jumps to the eye: only drawing is able to emphasize what is essential and omit the superfluous. A good architect must have a better than average talent for drawing. The free-hand sketching done by an architect is a higher order human capacity and we believe it should never be left to a computer.

Knowledge can be made fuller but through improving skill.

To be able to achieve suitable results more efficient methods have to be applied because of today's shortness of time.

The basis of visual education is to unfold instinctive drawing activity. It is our task to "teach seeing" and to make drawing after nature well liked.

A knowledge of drawing is present in every newborn baby in the form of a genetic code. Still, it will learn to draw through ontogenesis, viz. individual development. Erroneous conditioning of education and environment divert the child from the route of development. The compulsion is missing that makes it express in drawing. (The language expressed in drawing came into being because of such compulsion.) And though the parallel to the language certainly is rather inappropriate it is still worthwhile to have a look at language studying as, there too (except for the mother language that we learn for 5—6 years intensively and without noticing it), persistence, diligence and real interest is needed to achieve success as Kató LOMB puts it in her book: "Talking of languages, it occurs to me".

Also motivation, interest is needed. To arouse interest is an important preparatory activity also in teaching drawing. A special possibility is given in this regard by the summer drawing camp following the second university year and by optional subjects.

Due to an unevenness in preliminary teaching a comprehensive preparatory system is needed.

The informative work prior to enrollment should be widened in this sense: TV and newspapers, a walk through the university, trial lesson, publications, collection of patterns.

But why do we want students to draw cubes on the very threshold of organized free-hand drawing teaching ?

This is a question our students are expecting to be answered and rightly so. Beginners need the traditional 80 cm edge length 10×10 mm angle-iron frame, welded, yellow shell-cubes.

By asking to draw this very simple model the realization of a number of basic relations, learning discipline in drawing and, maybe, a conditioning of a certain drawing-order is the aim. We also teach "observation": what to look at, how to look at, some rules of perspective theory (horizon, vanishing points, foreshortening, convergence), but also some technical tricks (measuring, proportionment, use of drawing board and -pencil).

At the very beginning an infinitely simplified framework, stripped from its solid faces is chosen as the object of patient observation that the basic rela-

tions to be imparted should be demonstrated easily. The ancient 3-dimensions are embodied in the cube.

What had been learned as related to the cube can be applied later, in any drawing-task to be realized after nature. Let us look for instance at the trick of horizontal direction introjection of the corners, when clarifying the nearness-relations of the corners. In this case the foremost cube edge serves as vertical scale. Introjection is carried out first with the upper edge of the drawing board. Later on also nomographic lines drawn with the free hand are satisfactory. When the students gained some practice, the pencils are but moved in the air and finally these kinds of controls are done by sight. What we want to achieve when drawing the shell-body is a certain conditioning of skills, later on the student will relate-control subconsciously when drawing not a "nude" cube but some complicated setting.

Let us call to mind Dürer's plane-disintegration technique that the Cubists re-discovered. He disintegrated spatial forms into geometrical ones in the course of two-dimensional planar projection as triangles, squares, circles . . . and cubes, cones, pyramids, cylinders, spheres. In the course of cube drawing, through observatory stages we also arrive at the recognition of — apparent — plane figures appearing in the lanes of the shells and/or the complementary forms that can be "written" into the circle.

All the above form part of control or even maybe of composition — sketching — constructing, until we finally arrive at the first, acceptable cube through conscious conditioning.

The curriculum follows the principle: from the simple to the complex. This can be clearly seen in the first year curriculum: following the cube and lines of cubes, complex settings (cubes, prisms, shells and/or compact bodies) and later bodies of rotation follow. It should be noted, by the way, that absurd errors (viz. not drawing the planes well) will show up excellently on a line of cubes.

Let us now have a look at the requisites.

In each drawing room the useful, harmonizing wire and/or "solid" basic figure form (designed in identical modules) is found, that proved its worth in traditional free-hand drawing teaching. There are also further requisites: coloured sheets of squares, reflectors, hangings, plasters of Paris, etc.

The sheets of squares are used for a regular distribution of planes. With the help of relations between the elements of set-up, they can be well demonstrated.

A square net drawn on the walls, the floor can do much to make measuring and self-control easy. Sketching in the opposite plane would become clear with the aid of the horizontal dividing line on the wall. This kind of aid is already available, due to the old tiles that cover the wall of the passages and the same kind of graduation could be used in drawing rooms, too.

Using as model an adjustable edge big cube could also be a suitable demonstrative means. The errors occurring on the drawing sheets could be proven on the scale. This, sometimes achieves surprising effects. We may only state that the ball rolls off the sheet . . . the floor spins up . . . the side is dented . . . etc.

Further useful auxiliary means are: reflectors, mirrors, curtains. A part of these are already available. Also adjustable plane big plane mirrors could be used installed on roller stands for the purpose of control and adjustment-multiplication.

Curtains may serve to cover the shell (transition towards solid bodies).

A rapid camera (polaroid) may also come in useful.

For a similar role, but a less expensive method small glass sheets are used on which the sights are copied with the aid of a liner pen. The sheet serves as optics, looks at the object as if through a glass window. The method is mostly used in case of students from abroad and serves, especially in the beginning to get over illustration specificities far from European notions. The method helps clarify the concept of proportion between the distorted images of cover and bottom, convergence, proportion of lateral faces. This, however, is a teaching means suitable for extreme cases when it is not worthwhile to draw into the drawings.

The means of the present is the rarely used writing projector. It is suitable to introduce flow-diagrams drawn on site continuously with china ink on a plexisheet.

Contrary to black board drawing it has the advantage that the sheets can be kept. Its importance is that students do not get prepared pictures, but a solution that is built in before their eyes and, as they see the process itself it can be better believed.

The future belongs to Video. Its use may make the introduction of the very best methods generally possible. On the one hand it could demonstrate the samples drawn by the very best students in a wide circle and on the other, by on site "live" utilization, everybody's work could be recorded-projected-played back. The method is widely used in the field of sport, games. It is a highly useful "mirror"-system as everybody is always interested in his own image.

A daily necessity would be a so-called work-edition connected to individual subjects. Its structure could be something like the series of figures shown in the paper, with many pictograms, as far as possible without any text (keeping students from abroad in mind) it would be a footing for the given sphere of subjects.

When planning the time schedule of drawing lessons the following may be taken into consideration:

— the rhythm of correction
— individual and joint work
— the principle of individual and multi-step correction.

During a drawing lesson that lasts 2 hours I find that in a group of 20, about 4—5 minutes time is allotted to each student. In case of a completely faulty drawing that is by no means sufficient for correction. According to the following calculation a total of $20 \times 4 = 80$ minutes are needed for the contentual part of a "multi-step correction for one person".

By the multi-step term we mean that in the mentioned 4 minutes it is possible that there are part-corrections several times. Let us assume that there is one minute available for the right start (placement on the drawing sheet, big masses, foreground — background, horizon, floor-line) later when the students are already up to a certain level follows the main part of correction concerning the individual — three minutes — and finally, in the last "course" we may again find time to attend the students needs, discussing detail problems, technical tricks.

The correction is efficient and concerns the individual if it does not stop at general criticism given at the student's back but the teacher sits down in the student's place looks at the sight from his aspect what he and only from this spot can see. This, however, does not necessarily mean a direct drawing into the drawing, though the majority of the students has nothing against direct correction. The possibility is given to draw the neighbours together, to jointly correct students of similar capability who made identical errors, together.

The time schedule of a lesson is the following:

1. Introduction of the subject matter, explanation of the adjustment, sketching the aim;
2. Explanation of the method, introduction of basic errors;
3. Introduction of the technique — means, passing along sample drawings, models.

The role of individual, multi-step correction is highly important at the beginning. Each student should have "his own professor", he feels that here and now somebody occupies himself with him. We know that immediate teacher-student relationship has great importance in efficient teaching.

There are many who do not even know the terms used in criticism. What, e.g. is meant by distorted image caused by projection ? Especially in case of students from abroad or those from the country is it of special importance to illustrate our words immediately.

How lucky that the language of drawing is international and pictograms are unanimous !

Thus when criticising the proportions of distortions the actual sight is measured — shown — corrected.

But it should be kept in mind that the actual task should not be drawn instead of the students: it is not wise to shoot the game instead of the gunman !

Prior to the first, individual correction it is wise to leave some time, until the student gets to a certain point, this is possible within 15 minutes, or so.

It can be avoided in the first minutes already that the student get stuck.

Examination of the drawing board from the vanishing points is suitable to control convergences. A drawing looked at from behind and from the top shows the state of verticals. Control of the forms that can be written into — written around gives a factual judgement within the shortest possible time.

The subject matter of the first lesson is sitting down, fixing the drawing sheet, searching for the suitable view points, the type of pencil, its sharpening . . . and here also the dangers of rotating the drawing board should be explained. When starting to draw everybody should select his own view point that nobody's head or shoulder should get into his field.

As an example I measured and recorded not long ago the time schedule reflected on a student in a cube-drawing double-lesson:

5 minutes — loss while sitting down, setting up,
5 minutes — preparation of the subject matter, setting up, motivation
5 minutes — explanation of principles (on the drawing board), starting "push"
15 minutes — free drawing
15 minutes — the first correction of the student and his environment (correction of proportion between distorted images of cover and bottom, to let make a scale on the nearest vertical edge, insisting on comparing certain points by horizontal projections, introduction to the use of the upper edge of the drawing board as projection edge),
20 minutes — free drawing (while the teacher looks at the others),
15 minutes — second correction sitting on the seat of the student, complete re-drawing if necessary, factual evaluation, giving "made to measure" home tasks on basis of typical weaknesses, practising the formerly learned. The length of this stage depends on the number of students and their capability,
20 minutes — free drawing
15 minutes — last correction, not so much in drawing rather in words. If the drawing is finished, detail-tasks are given to develop missing skill: e.g. spacing net of sides, floor-calibration, ranking the cubes, drawing in small cubes, drawing parallels, etc;
5 minutes — joint evaluation, comparison, answers to questions.

This makes 100 minutes. As double lesson is $2 \times 45 = 90$ minutes and, as in practice we start work at 15 minutes past the hour and working is possible till the next full hour we have a max. of 105 minutes.

As can be seen a more detailed correction depends, of course, from the number of students and it thus affects each student at a different stage of the drawing process. There are such whose drawing is corrected in the first half hour,

others' only at the end of the double lesson. Walking around all the time, making remarks, encouraging has the function of avoiding getting completely stuck and finding out the optimum order of correcting. Apart from certain "fire extinguishing" cases I walk along the rows according to spontaneous seating. In this way I reach everyone and also those occupied with drawing hear when I am approaching them. In this way stress can be diminished, the rhythm gets more even.

It can be observed that it is practically in the second and third free-drawing phase ($2 \times 20 = 40$ minutes) when others can be corrected. If about 15 minutes detailed correction should be reckoned with here too, then the group could not be made up of more than 4—5 students. However, in reality each tutor has 15—20 students . . . The table was prepared, by the way, considering the weakest pupils (in a small group).

It follows that but a third or quarter of the time may be reckoned for one student during a normal lesson in the "detailed, individual" correction phase: 4—5 minutes instead of a quarter of an hour!

Still, every practicing teacher knows how difficult it is to identify oneself with a (already spoilt) student drawing, to draw into it. The student, of course, will immediately feel if the correction is not right or it is the teacher who made a mistake: students are excellent critics!

Because of the high dispersion in the capabilities of the students everyday practice forces a superficial correction. It would be expedient to half the number of students in a group, that in the ideal case no more than 10 persons should pertain to one teacher. In this way the intensity of teaching may be doubled at an unchanged number of lessons.

For a better rhythm of common and individual work phases it is worthwhile if the student tears himself away from his drawing, from time to time. Detaching himself from his drawing board he may recognize the mistakes he made, may even get rid of them.

Some physical movement may be brought about between the rows by ourself, asking, for instance, one of the students — perhaps just the one where we noticed problems — to draw in the vertical edge-quartering division of the exhibited shell-cube with chalk, etc.

Drawing is more than just copying an object. In vain does the student draw the sight if he does not understand the relations contained.

How to make the student understand these relations? Let him go there, walk around the object, touch it! In this way the relations of the line and the plane can be made understood. Also different optics can be used (coloured filter papers, coloured parts of the objects and environmental elements), as the observation scans different object layers. This is a method to teach succession, discipline in drawing. In this way a step-by-step processing of the object, the background, the basic plane is possible, all of them separately. Convincing can

be to project the drawing error into real sight. There are many people who do not feel what a few centimetres error on the drawing board means ! As the students in question are studying to be architects teaching scale in the course of free-hand drawing lessons is not at all superfluous as the few centimetres error on the drawing board may be several metres in reality. This can be illustrated on the movable edge cube.

Working up in drawing is not manufacture but thinking. Teaching drawing is first of all occupied with teaching the mode of seeing things. Seeing, observing, conscious composing, the analysing process of problem-solving is our teaching task in the starting phase.

There are certain common validity remarks, where technical tricks should be made known, e.g. "To construct a picture cutting a sighting slot from cardboard can be used." Or a few words about how to use a pencil, the technique of it: "Above the erroneous part first a new, suitable net of lines should be drawn and only then should the now disturbing lines be erased." Not even the erroneous line is superfluous: let us assume it to be the scaffolding of the building. It is easier to draw on a surface where the rubber was not yet at work. Thus, in case of superfluous lines much less remains (the lines connecting corners or the old corner) and, in case of shaded drawing the old line can be incorporated in the order of shading.

Students are sometimes more grateful for small tricks than when shown the real, great relations.

As a Hungarian writer Margit Kaffka put it: "To create a rule from experience is an inborn human talent as eating, sleeping or loving !" One should never be angry because of mistakes ! Our own bad experience may be a carrier force, too.

"One should never get hold and not let go the steering wheel" viz. the rules. But it is also not right to be afraid of mistakes. For professional "error-erasing" lots of patience is needed.

The "grid method" may help to draw and control symmetries, angles of declivity, meaning that some kind of division (e.g. fence bar, hand rail, but also Dürer's wire net division viewingframe) is used between the eye and the object. The division, however, should be symmetrical. The patch-inclination of viewfields turning up on two sides of a vertical (+ width) gives a good feeling of character, in my drawing the angle with the vertical . . .

"What we permit the child to discover itself, will stay for life" — as said Piaget the French psychologist.

But I must also emphasize the importance of sketching. Let us make a series of rapid sketches when, e.g. the observation-fixing of a square sheet placed on the floor is the aim, to show how the position of corners changes projected to the basic line. While sketching a lot can be imparted to beginners if we make them concentrate on concrete detail-tasks.

Very often the students are trying their best to master more complex tasks, in vain though as basic knowledge is missing. Thus, for instance, when several ellipses should be constructed while the student is not even able to draw in perspective the needed squares around it.

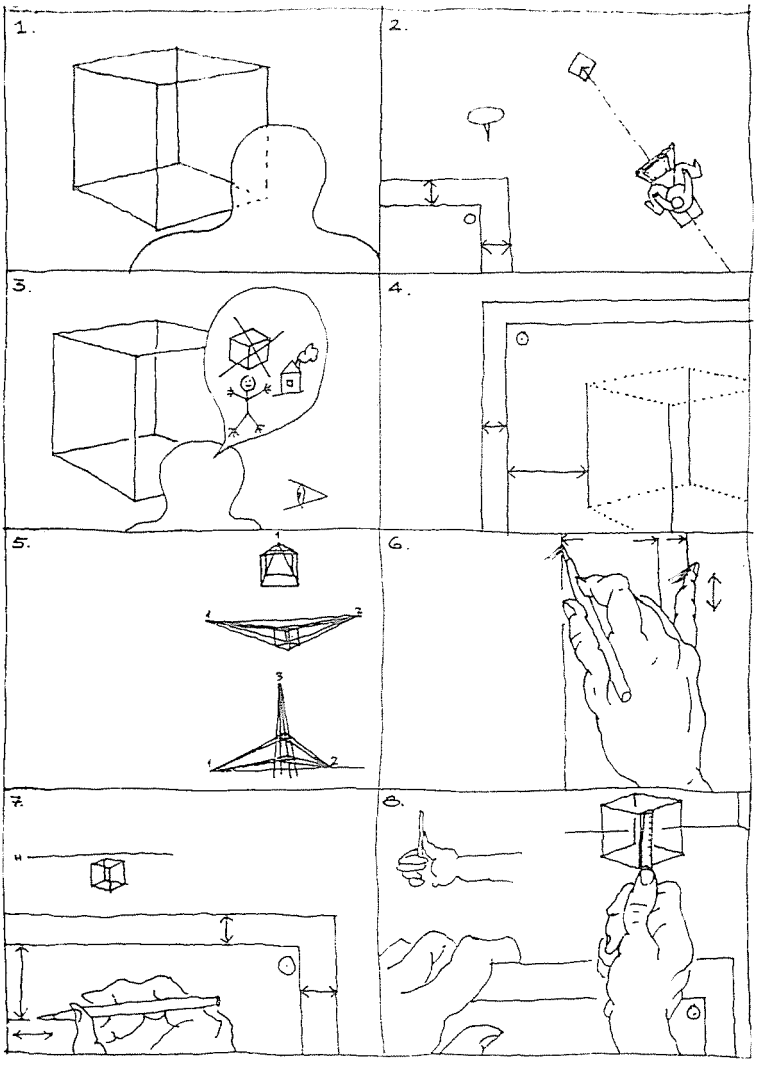
In such a case one should take the trouble to revive knowledge back to the squares placed into the floor level.

According to many people the starting point for the cube is to draw the basic square, we, however, suggest to find the vertical planes first. As to drawing the basic square: this phase may even be quantified by placing the edge of the drawing board at a nearby "corner". This will be the horizontal, to which the angles of inclination of the starting edges may be measured. Then, with a rigid neck we take a good look and mark the projected cornerpoints, the horizontal projection of sides with our pencil on the board. Following this the sections can be related to each other with a mm accuracy. Later on even rule of thumb will suffice.

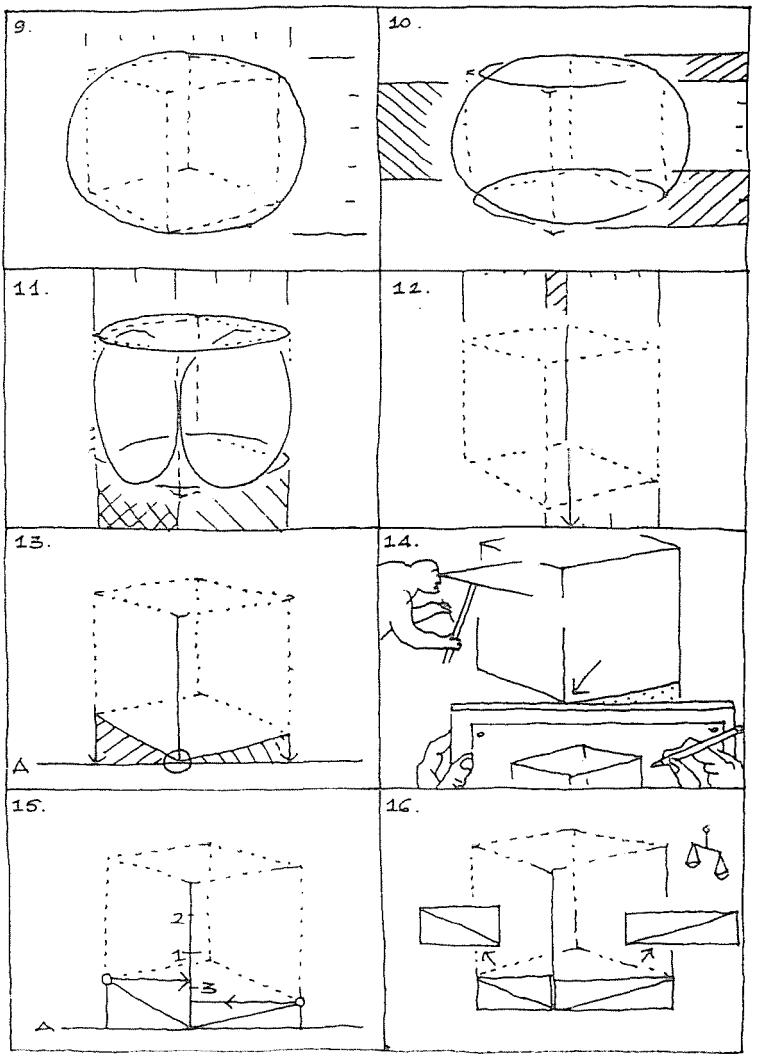
The right angle side height necessary for the tangent should be measured by eye and pencil, the student should assess but one measurement.

In the following I shall try to summarize by illustrations what is mostly emphasized during the first lessons:

1. Selecting the view-point. The student has to sit in a way that the sight should not even be covered in part by those sitting in front of him. The vertical-horizontal edges should, if possible, not be too near each other.
2. Use of drawing pins. Fixing the drawing-paper. The longitudinal axis of the trestle board should point towards the centre of gravity of set-up.
3. The student should draw what he sees. Former prejudices should be made to forget.
4. The verticals should be parallel with the vertical sides of the drawing board — drawing paper. This should be measured from time to time. (see also Figure 32.)
5. Three types of perspective are possible: sitting in front of the cube there is one vanishing point if sitting in a general position there are two. Verticals are never distorted.
   The third case: with a tower-like building we will have three vanishing points but here then even the verticals converge.
6. Vertical drawing: the small finger, leaning on the edge of the drawing board slides parallel. Leaning our hand on the small finger can be useful against "carving".
7. For horizontal drawing we should use the upper edge of the drawing board. Placing it at the given point of the sight it cuts the foot of the angle to be measured.



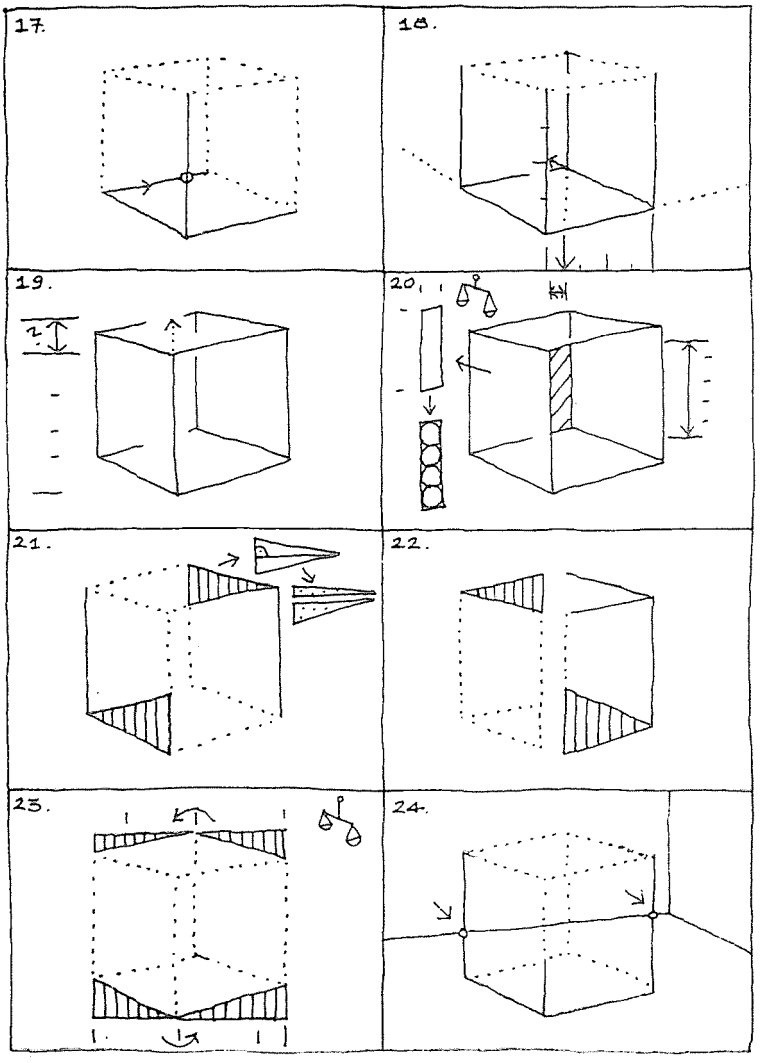
8. In the beginning let us use the pencil to measure major relations, the arm should be stretched, the thumb is the slide.
9. Placing the sight on the drawing paper. Let us find the most simple framing form. Let us leave some air — fore and side field — around the picture.
10. Relating the measure of view: horizontal projection of the corners on a vertical scale.
11. Proportion of sides: vertical projection of corners on a horizontal scale.
12. An important detail-data: the position of the back — the fourth —



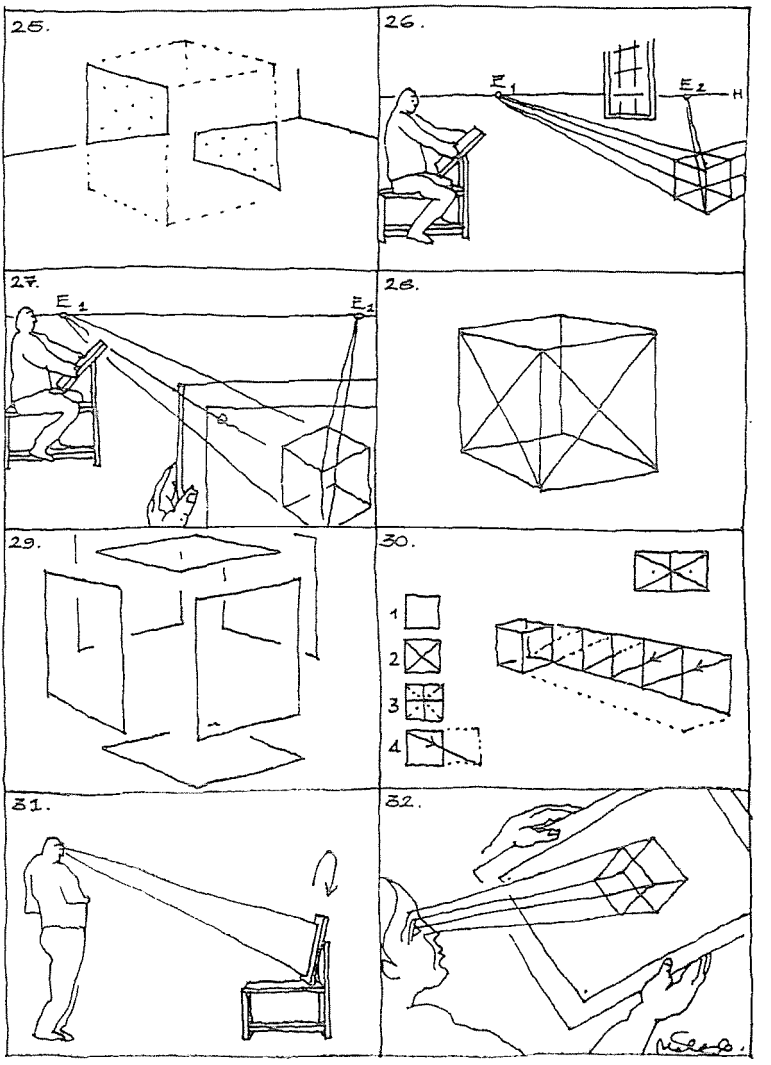
vertical edge which will also be projected on a horizontal scale. Let us relate the apparent plane figure width between the near and far vertical edges to its height.

13—14. The apparent "steepness" of the floor-edges starting from the nearest bottom corner is the tangent of the foot angles. The hatched complementary triangles are observed.

15. Measuring of the former angle-relations: the height of the external corners is projected with the horizontal of the drawing board on the scale of the nearest vertical edge. The figures indicate the order of edge division (quartering).



16. Examining the proportions of foot angles, positive and negative triangles. The vertical projection of the corner pertaining to the side with the shorter projection is bigger than that of the corner with the longer horizontal projection.
17—18. Examining the intersection of the rear lying (horizontal) edge on the vertical scale.
19. Control of the view of the upper sheet: lengthening the vertical scale with a design line.
20. Examining the proportions of plane forms that can be written within



the shell-intervals, for instance how many circles or squares can be drawn into the shaded part ?

21—22. Examination of the form of part-triangles; by drawing in the line of height a resolution into two rectangular triangles.

23. Examining the plane figures complementing the sight.

24. The relation of main environmental features to our set-up, e.g. the segment of floor-wall.

25. Incising the background into the contours of the object. Further detail-plane figures will evolve.

26. Determining the horizon-eye plane of our environment (projecting the wall-window-board-coating division).
27. Two vanishing points very seldom fall on the drawing board. It is possible, however, to look for a vanishing point that is near to us e.g. that of the diagonals.
    Parallel edges converge and meet at a vanishing point on the horizon. This aspect makes our two-dimensional drawing a spatial one.
28. By drawing the blade diagonals the fact that the lateral surface is a square shows up.
29. And finally, the sides of the cube are controlled one by one to see if they seem to be squares ? Here an abstraction from the other lines is necessary. Therefore construction lines should be left but very faintly.
30. The diagonal method: if the nearest cube seems all right, the other ones can be exposed. The small line of figures shows how to make a square from a square in perspective. The median point has been connected with the opposite corner and in this way the lengthened line cuts out the new corner point on the lateral elongation. For the construction let us use a small sight-sketch: what is to be connected with what ?
31. From time to time the student should get up and look at the drawing from a distance, with a fresh eye.
32. Let us control "convergence" also from the direction of the vanishing point. Holding the drawing board flat let us cock our eye, in this way errors "jump to the eye". Uncertainties of the verticals come to the fore when holding the drawing upside down. To avoid the error of "seeing in" a mirror or the method of looking through the drawing paper should be applied.

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