SOMMAIRE

KINESTHETIC STIMULATION AS A METHOD FOR IMPROVED DRAWING-SKILL ACQUISITION

Louise Pelland

Dans le but d'éveiller la sensibilité des étudiants, quelques artistes du début du siècle, tels Kimon Nicolaïdes et Johannes Itten (Bauhaus), employèrent une stimulation kinesthésique. Utilisant une technique similaire, l'auteur découvrit dans son enseignement, que les étudiants produisirent de meilleurs dessins. Des psychologues étudiant le domaine de la perception, ont découvert, il y a déjà quelques années, l'importance du toucher agissant comme complément à la perception visuelle. Malgré cela aucune recherche ne fût poursuivie dans le domaine de l'éducation artistique, afin de déterminer si le toucher est d'une importance dans le dessin. Cette thèse démontre l'hypothèse que les sujets se servant d'une stimulation kinesthésique (toucher) ainsi qu'une information visuelle acquièrent une meilleure habilité de dessin que ceux n'utilisant l'information visuelle. Nous avons fait des expériences avec quarante sujets variant des âges de treize à seize ans. L'objet d'observation utilisé, fût une moitié d'artichaut. Six artistes professionnels ont servi de juges afin de placer les dessins dans un ordre de un à vingt. Les résultats démontrèrent que les dessins de ceux qui avaient "toucher" étaient meilleurs à ceux qui ne "touchèrent" pas, et ce, à un niveau très significatif. Le Wilcoxon Rank-Sum Test fût utilisé pour cette analyse statistique.

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CHAPTER I

INTRODUCTION

1.1 Definition of the Problem and Terminology

The eye and the hand are the father and mother of artistic activity.

- Rudolf Arnheim

If one plays slightly with the words in the above quotation, one can get the following interpretation: visual and tactile perception are essential for the growth and development of artistic activity.

Is touch an important factor in the ability to render the essence of an object or model through drawing? How necessary is it for visual perception? These are important questions not previously answered in art education research (Itten, Nicolaides, Kennedy).

Consider a typical drawing class today. In such a drawing class, a model or object is usually placed in the middle of a room with an appropriate lighting. The class begins with drawing exercises and quick sketches, followed by a more exhaustive observation. Students try to reproduce carefully what they see. The movement, the shape, volume, the modulations of the light, etc. The teacher walks around giving his or her comments to each student. A drawing class is three hours long and demands a certain concentration from the students. It is usually calm and silent.

A very different approach, however, was followed in the Bauhaus during the 1920's where the painter, Johannes Itten, helped his students

to get more actively involved in their work by introducing the use of the senses, such as touch, to stimulate and enrich the students' perceptual experience. The classes would begin with physical exercises to loosen up and relax the body and mind followed by drawing exercises based on the subject of the day. The exercises focused the students on sensations or feelings which they had to render graphically.

The resulting sketches were usually done very quickly with large gestural movements in order to help the student not to intellectualize about the sensation, but rather to feel it emotionally. In short, it was an appeal to spontaneity, something that Itten was fond of doing. If they had to do a study on texture, he asked them to find anything with textural interest. In the class, Itten had them touch and feel the texture before representing it on paper. Itten reinforced perceptual experience with tactile and kinesthetic experience as well.

The author, during several years of teaching, noticed that students were dissatisfied with their results after having worked very hard to realistically represent an object or model. One of the problems was that they did not seem to know how to take their time to properly observe the model or object. Another problem was that the students were often inhibited, particularly with a live model.

In an effort to involve the students in experiences that would open their perception, uninhibit them and facilitate the understanding of the subject matter, the author, having not yet discovered Itten, introduced kinesthetic body movement and stimulation by touch. In addition to obtaining the desired effects, described above, the author noticed that the drawings seemed better. This is the background that

led to the formulation of the central hypothesis of the thesis that touch and kinesthesis might improve drawing skills.

Before describing related research on this topic, some terminology will be defined. By visual observation, is meant the observation of colour, shape, volume, texture and rhythm, acquired through sight. Kinesthetic observation, is the observation of volume, rhythm, texture and shape, through muscular sensations, such as touch. Drawing skill is defined as the ability to transpose to a graphic medium a representation of an object that captures the object's essential properties such as intensity, modulations of lines and texture, to yield an overall harmonious rendition of the object along with a certain realism.

1.2 Related Research

The painter Johannes Itten (1964) who taught at the Bauhaus during the 1920's and later in his own school, developed a pedagogy based on all the senses. "Educate the sense of touch, increase its sensitivity and perceptivity" (p. 52) is how Itten described his method of teaching art.

Itten developed a teaching method based on feeling rather than intellect to reach artistic experience. According to Eberhard Roters (1969):

> Itten's first aim was to set people free from their inhibitions, to loosen them up. Only then would they be receptive to art education as such. He therefore began the lessons with physical training sessions. The limbering up exercises were intended to make students aware of their own bodies and the movements through which their hands projected the form of a picture onto a surface. His search was for the inner landscape or "inscape" not for a penetrating analysis of the outside world. (p. 51)

Studying texture he would have his students touch a variety of materials to experience and discover the character of the materials. It

had not only to be seen, but also felt.

Similarly, the artist and pedagogue, Kimon Nicolaïdes (1969) emphasizes that "the right way to draw has nothing to do with artifice or technique, with aesthetics or conception" (Introduction).

> Learning to draw is really a matter of learning to see -- to see correctly -- and that means a good deal more than merely looking with the eyes. Because pictures are made to be seen, too much emphasis (and too much dependence) is apt to be placed upon seeing. Actually we see through the eyes rather than with them. It is necessary to test everything you see with what you can discover through the other senses, and their accumulate experience. If you attempt to rely on the eyes alone, they can sometimes actually mislead you. (pp. 5-6)

Nicolaïdes reaches Itten's pedagogy in a different manner, though they both base their teachings on the primary use of the senses. The difference remains in the fact that Nicolaïdes uses the senses indirectly (particularly touch which he qualifies by stating that "our understanding of what we see is based to a large extent on touch) through the memory sensation of these experiences. He tells his students to draw an object or model by imagining that their pencil was touching the 'contour' of the object or model. It appears that Nicolaïdes never went as far as to instruct his students to actually touch the objects themselves rather than just imagining that they were touching them. As for Itten, he uses the senses directly in the class as a working tool. He also emphasizes more on kinesthetic aspect, using the whole body.

But what do the psychologists and researchers in art education think? Is there really a link between visual and kinesthetic or touch perception?

Lowenfeld (1945) discovered in a study for visual and haptical aptitudes the existence of two distinct creative types, based upon two

unlike reactions toward the world of experience __' the haptical and the visual __'.

According to Lowenfeld, an extreme haptical type of individual is a normal sighted person who uses his eyes only when he is compelled to do so; otherwise he reacts as would a blind person who is entirely dependent upon touch and kinesthesis. An extreme visually minded person, on the other hand, is one who is entirely lost in the dark, and who depends completely on his visual experiences of the outside world. Most persons fall between these two extreme types. He adds "visually minded persons have a tendency to transform kinesthetic and tactile into visual experiences. Haptically minded individuals are, however, completely content with the tactile or kinesthetic modality itself" (p. 101).

Lowenfeld concluded that "one among four individuals depends upon touch and kinesthesis rather than upon vision" (p. 111). This study also demonstrated the importance of kinesthetic stimulation for some individuals and that we should be aware of this fact in the teaching of art. The muscular sensations are an important factor in the process of learning and knowing.

We know that children often have a tendency to touch and manipulate an object before drawing it, as if to tame it and get to know it better. Vernon (1970) in her book, Perception Through Experience, also notes that children assist their visual perception of shape by tactile handling. Luria (1961) found with children under five years that tactile handling was of assistance in the identification of shape. There is a theory which holds that the child draws what he knows rather

than what he sees. As Arnheim (1974) states, "much picture-making does not in fact rely on what the eyes happen to see at the moment the picture is produced."

Psychological speculation has put a good deal of stock in the sense of touch. Since the sense of sight involves essentially a two-dimensional projection onto the retina of three-dimensional 'real world' objects, psychologists reasoned that touch, with its direct three-dimensional information, would provide more accurate and objective information for perception. Arnheim concludes by saying that "it cannot be doubted that touch, from muscles, joints, and tendons, contributes enormously to our awareness of shape and space" (p. 166).

Harold Rugg (1963) emphasizes that "the act of knowing is indeed the total gesture of hands, limbs, face, torso, autonomic and central nervous systems" (p. 277). Gregory (1970) who deals a lot with perception attested that "other sensory information such as touch does influence how we see" (p. 42). Another group of researchers, White et al. (1969) whose work deals mostly with blind subjects discovered that 'skin' plays an important role in our perception. They found that skin (on the back) can act as a kind of retina. As we can see, touch, muscular sensations and senses in general do play a vital role in 'seeing'. Vision alone does not seem sufficient in itself. Tactile and visual perception are complementary. John M. Kennedy (1974) concisely describes the conclusions that are evident from the research described in this section:

> Many of the things found depicted in visual displays are not inherently visual. Space and form are not inherently visual. The geometry of edges and surrounding air — the world of corners and wires — is tactual as well as visual. (p. 150)

As can be seen from the above studies, none of the researchers investigated whether drawing methods such as those used by Itten, Nicolaïdes, etc., that use kinesthetic information are better in any sense than purely visual methods. This thesis investigates the hypothesis that subjects that use kinesthetic information as well as visual information will produce better drawings than those using only visual information.

1.3 Scope of Thesis

The process of selecting the object of study, in this case an artichoke, is described in Chapter II. This chapter also describes the selection process of the subjects (students), experiment controller, and judges. The drawing experiment is described in Section 2.2 where a photograph of the object is provided. Section 2.3 gives a description of the evaluation criteria used by the judges and the judging procedure that was followed. The original French translation of these criteria is also included (all the judges were French speaking).

The experimental results are presented in Chapter III. A brief introduction to hypothesis testing is given and the Wilcoxon Rank-Sum Test is described. This formal quantitative statistical test was applied to the analysis of the results of each judge individually as well as the total ensemble of judges. In addition, the results of some less formal, more qualitative and visual tests are given at the end of the chapter.

Finally, a discussion of the results, some conclusions, and some suggestions for further research are given in Chapter IV.

La première source d'information c'est le corps propre, la personne elle-même et c'est par la voie des sens que normalement se fait la première ceuillette d'information. Si l'on observe un fruit, il faut bien sûr le voir, le regarder, mais aussi le toucher, le soupeser, le sentir, le goûter, etc.

Aucun livre ne peut fournir des odeurs, des textures ... pourtant dans la recherche, ces donnés sont essentielles et bien des découvertes n'auraient jamais eu lieu sans cela.

– André Paré (p. 235)

CHAPTER II

EXPERIMENTAL DESIGN

2.1 The Selection Process

2.1.1 Requirements and Description

The choice of object was crucial. For the purpose of the study the object needed to have many textural qualities as well as an interesting shape and some volume. The object had to be stimulating visually as well as kinesthetically.

An artichoke — cut in half, offered all the requirements, exciting for the eye and touch. The repetitive and convergent aspect of the leaf texture, being hard and thick, provided interesting stimulations for the subjects. Moreover, the cross-sectional view of the vegetable, with it's linear streams converging to the heart, imprisoned under velvety fibers, offered a most interesting graphic design. The artichoke could be placed at different viewing angles, and could be shown open or closed.

Conclusively, the artichoke not only challenged the subjects but also provided an unusual and unique shape to work from.

2.1.2 Selection of Subjects

Two high school classes of fourth and fifth grade were selected arbitrarily. Once approval had been secured from the high school authorities and of the home class teacher, both classes were then

arbitrarily divided into four groups regardless of sex and ability, although categorized by age -- 2 groups of 15-16 year olds and 2 groups of 13-14 year olds. It was not possible to have four groups of the same age that is why we have two age groups.

2.1.3 Selection of Drawing Test Administrator and Judges

The test administrator for this experiment was an education student from the University of Montreal. Her role was to give the instructions to the students. She did not know the reasons for this research. She had to be as neutral as possible showing neither facial nor physical expressions so as to eliminate any possible bias that might arise due to a communicating personality or nonverbal inputs that might influence the subjects. In this manner the emphasis was on the 'drawing experience' itself rather than on tangential phenomena. Two groups of subjects simply listened to her voice on tape, while two other groups were given the instructions in person by the test administrator. This is to see if there is a significant difference in performance when a live test administrator is used.

Judges

As this thesis is based on the demonstration of improved drawing skills, we availed ourselves of professional artists as judges. Three of the judges were painters and three sculptors. All judges had been teachers and no judge knew about the objectives of the research. Most of the judges are in their thirties and teach at CEGEP and University. They are actively involved as artists and most of them are getting to be well known and their work has been discussed by local art critics.

2.2 The Drawing Experiment

There were four groups of students, ten students in each group. Groups A and B were comprised of 15-16 year olds. Group A was given tape recorded instructions which encouraged them to touch the artichoke and manipulate it before drawing it. Group B was told by the test administrator rather than by tape recorder to imagine what the vegetables would feel like, and then to draw them. Groups C and D were made up of 13-14 year olds, with ten students in a group. Group C was given instructions by the test administrator to touch and manipulate the artichokes before drawing them. Group D was instructed via the tape recorder to imagine what the artichoke felt like before drawing it.

Materials

- 9 x 12 white cartridge paper
- pencils: 20 of type HB
  20 of type 2B
- 10 artichokes cut in half (total 20)

To create contrast and project a clear image, the artichokes were placed on black construction paper. We proceeded with one group at a time. The students were in their usual classroom which is very spacious. There were two students per table, and each student had an artichoke placed in front of him or her at a distance of one foot. The cartridge paper and pencils were already in place.

EXPERIMENTAL DESIGN

Kind of Stimulus	Number of Subjects	Age	Treatment to Subjects
Visual tactile	10	15-16 Group A	Recorded instructions
Visual non-tactile	10	15-16 Group B	Test administrator Present
Visual non-tactile	10	13-14 Group C	Recorded instructions
Visual tactile	10	13-14 Group D	Test administrator Present

In the four groups the home class teacher introduced the test administrator, by saying: "Today this person will give you a drawing observation class" and would leave the room. The test administrator would then start the one hour lesson. While the artichokes were distributed, the students were told that this was a class in observational drawing. She did not answer questions.

First Group A

Visual and tactile/recorded instructions

After the introduction, the test administrator pressed the button

on the tape recorder, and the following instructions were given to the students via a recorded message: "Look at the object, take it in your hands. Explore it, feel the texture, the shape, the volume. Close your eyes. Take your time." — 5 minutes — "Replace the object at the same distance in the angle of your choice. Draw the object." Once the session started she withdrew to the back of the room.

Second Group B

Visual non-tactile/test administrator

The teacher introduced the test administrator who proceeded in the same way with the other groups though she placed the artichokes at different angles, open or closed, since these students did not touch the object. She then gave the following instructions: "Observe the object in front of you. Try to imagine the sensation of the object. Is it cold, warm, soft, rough? Imagine the volume. Take your time." — 5 minutes — "Draw the object." The test administrator withdrew to the back of the room.

Third Group C

Visual non-tactile/recorded instructions

Introduction by the teacher. Same procedure as in the second group, though she withdrew at the end of the room, after starting the tape recorder. Same instructions as in the second group.

Fourth Group D

Visual and tactile/test administrator

After the introduction by the teacher, the test administrator gave the same instructions as in the first group.

2.2.1 Photograph of the Chosen Object

2.3 The Judging

2.3.1 Evaluation Criteria

The criteria were originally given in French, since the six judges were French speaking (following page).

Evaluation Criteria

A - Line Characteristics

Precision, modulation and sensitivity of line. Demonstrates confidence.

B - Quality of Texture

Ability to evoke in the viewer different sensations of texture.

C - Focus of the Object

Captures the object's essential properties such as intensity, modulations of shape, texture, etc., in rendering the object with a certain realism.

D - Utilisation of Space

Attentive to the organization and composition within the space of the page.

2.3.2 Specimen

Critères d'Evaluation

A - Caractère du trait

Sensibilité de la ligne. Modulation et précision du trait. Qui reflète une assurance.

B - Qualité texturale

Abilité d'évoquer la sensation de différentes textures.

C - Observation approfondie

Meilleur rendement de l'essence même de l'objet en fonction de

la compréhension et de la familiarisation de l'objet, propulsant une extension vers le réalisme.

D - Utilisation de l'espace

Attentif à l'organisation et à la composition dans un espace donné, i.e. surface de la feuille.

Juge no. 1 groupe A-B

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20

groupe C-D

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20

2.3.3 Procedure

Each judge worked alone in a room.

1. Judges were told that they would evaluate observation drawings following the given criteria, previously outlined on page 15. We proceeded in two sequences: first, 20 drawings of the 15-16 year olds. Tactile and non-tactile, groups A and B; second, 20 drawings of the 13-14 year olds. Tactile and non-tactile, groups C and D.

2. The judges read the four criteria and their definitions. It had to be clear and understood in their minds. While they were reading in another room, the drawings were placed on a floor, or on a large table. They were numbered at the back for identification of the tactile and non-tactile drawing situation. They were mixed and had 10 of each.

3. The judges were left alone. They had to place the twenty drawings in a rank order of 1 to 20 corresponding to the criteria. There was no set time limit for the judging.

CHAPTER III

EXPERIMENTAL RESULTS

3.1 The Drawings

The drawings were done on white cartridge paper of 9 x 12 with two pencils of type HB and 2B. No erasers or rulers were provided. In Groups A-B (15-16) the drawings are labelled from 1 to 10 (touchers) and 21 to 30 (non-touchers). In Groups C-D (13-14) the drawings are labelled from 11 to 20 (touchers) and 31 to 40 (non-touchers).

All the drawings are in Appendix 4. These xerox copies render well enough the original drawings, even though we cannot always see the sensitive quality of the pencil.

Description of the Notation on the Drawings

The arrow indicates how to look at the drawing.

↑ = vertical

→ = horizontal

The letters M and N-M indicate 'manipulated' and non-manipulated'.

3.2 Results: The Judging (See Appendix 1)

3.3 Statistical Analysis

3.3.1 Hypothesis Testing

In a standard hypothesis testing problem of comparing a new treatment, procedure, or method with another established, or classical, method one chooses a sample of N subjects and divides them at random

into two groups: one group of size n receives the new treatment while the other of size m = N - n referred to as the control group, receives the standard treatment.

In this study n = m = 10 and N = 20. The judging procedure used in this study yields a ranking of the 20 subjects according to the drawings they made. If there is no effect in the new procedure, i.e. if the manipulation of the object being drawn does not provide any useful information for drawing-skill acquisition then the probability that a particular drawing receiving a rank between 1 and 10 should be the same as the probability that the rank is between 11 and 20.

Thus the null hypothesis H_o will be rejected if the ranks of the touchers differ significantly from the null distribution. The exact null distribution for values of n and m up to 20 is given in Lehmann (1975).

3.3.2 The Wilcoxon Rank-Sum Test

The appropriate statistical test for testing the above hypothesis based on ranks is the Wilcoxon Rank-Sum Test (WRST). In this section this test is described and terminology defined.

Let S_{ij} denote the rank of the ith subject among touchers (drawings) by the jth judge, i=1, 2, ..., 10, j=1, 2, ..., 6. Similarly, let R_{ij} denote the rank of the ith subject among the non-touchers by the jth judge, i=1, 2, ..., 10, j=1, 2, ... 6. Thus for example, for group A in section 3.2 page 18:

$$S_{7,3} = 10$$

and $R_2 = (R_{11,2}\ R_{12,2}\ \ldots,\ R_{20,2})$
$= (9, 18, \ldots, 12)$

In general for n 'touchers' the WRST uses the following statistic:

$$W_j = S_{1,j} + S_{2,j} + \ldots + S_{n,j} - \frac{1}{2} n (n + 1)$$
$$= \sum_{i=1}^{n} S_{i,j} - \frac{1}{2} n (n + 1)$$

for testing the hypothesis for judge $_j$. For n = 10 this reduces to:

$$W_j = \sum_{i=1}^{n} S_{i,j} - 55$$

3.3.3 Analysis of Individual Judges

The above statistics were calculated for each judge in groups A-B and C-D for the rankings in Appendix I. The results of these calculations are given in Appendix 2. In the tables, for a result to be significant at the 0.05 level (a well established acceptable level) W_j must be less than 28. x_i denotes the label number of drawing written on the actual drawings in Appendix. P signifies the probability (see Appendix 2).

3.3.4 Analysis of Ensemble of Judges

While it is interesting to perform the analysis on each judge separately, as was done in the previous section, in order to see the variability and differences among different judges, to test the hypothesis properly we must analyse the entire data simultaneously, i.e. we must find a ranking of the subjects based on evaluation information from all the judges. (see Appendix 3)

One method of doing this is to obtain a score for each subject by adding the ranks given to that subject by all the judges and subsequently ranking the subjects according to this score. Once this final ranking is obtained one can then proceed in the same manner as in the previous section.

Using previous notation, the score for subject i is given by:

$$\text{SCORE } i = \sum_{j=1}^{6} S_{i,j}$$

The subjects are then ranked according to increasing values of Score i, i = 1, 2, ..., 20.

Let S_i denote the rank of the ith subject when ranked according to SCORE values, i = 1, ..., 10, among the touchers. Let R_i denote the rank of the ith subject when ranked according to SCORE values, i = 1, ..., 10, among the non-touchers. The WRST uses the statistic:

$$W = \sum_{i=1}^{10} S_{i-55}$$

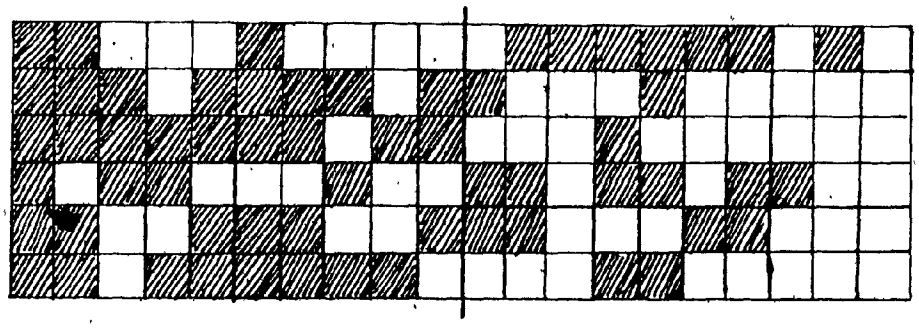
3.3.5 Visual Tests

While the two previous sections provide the scientific test of the hypothesis of this thesis and provide quantitative results in the form of significance level probabilities, it is nevertheless interesting to exhibit some visual tests. While these are not at all scientific they provide some qualitative results and a feeling for the strength of the results which may complement the significance level probability of the previous section.

Figure 1 below demonstrates the order in which the drawings were placed in the two groups by all the judges. Each row of squares represent the twenty ranked drawings by one judge from left to right. Since there were 6 judges we have 6 rows. The 'black' squares indicate that the particular drawing in that rank position came from a 'toucher'. Similarly, a 'white' square indicates that the drawing came from a 'non-toucher'.

FIGURE 1

Group A/B



Group C/D

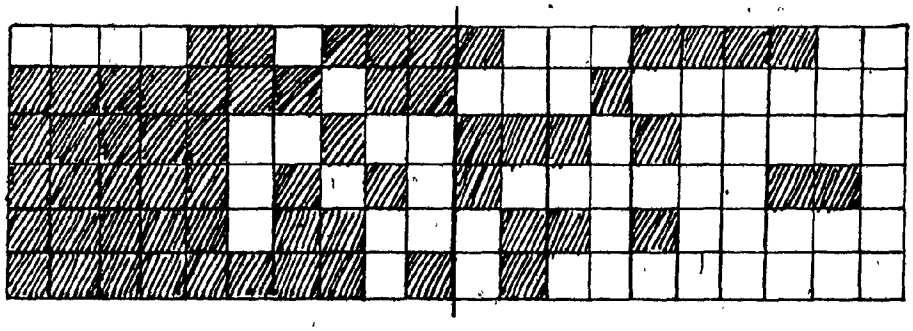
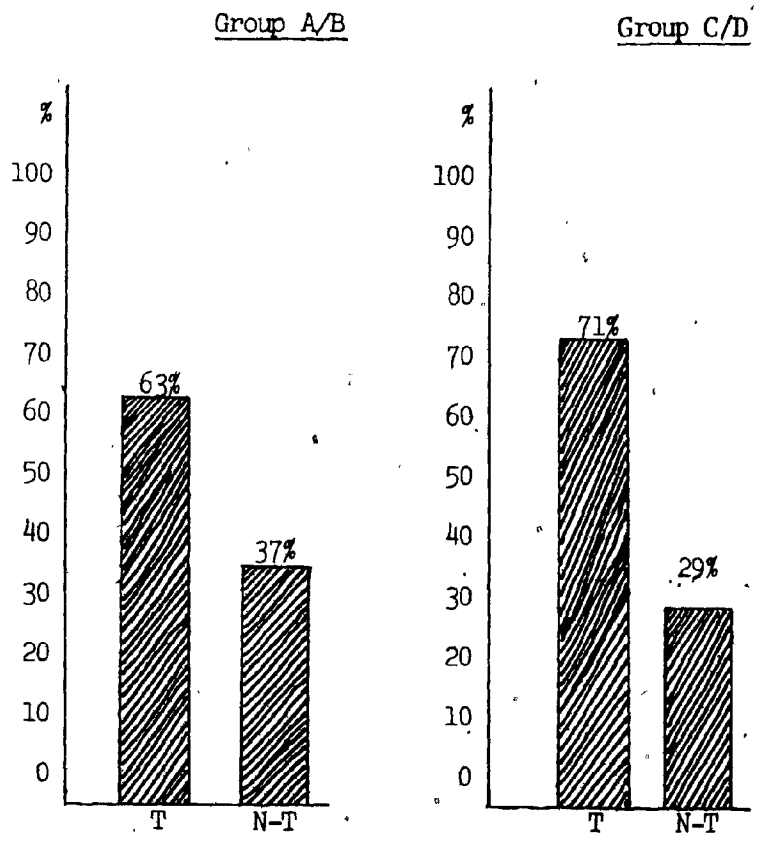


FIGURE 2

Percentage of Touching and Non-Touching Drawings Ranked in the Upper Half of the Group



T - touchers

N-T - non-touchers

CHAPTER IV

DISCUSSION AND CONCLUSION

4.1 Discussion of Results and Concluding Remarks

As we can see, the significance level of the rankings of the judges in the groups is very high -- 0.0262 for groups A-B and 0.0012 for groups C-D. This shows that the probability of the drawings being ranked in this manner by chance is very small indeed and that a difference is clearly apparent in the drawings between the 'touchers' and 'non-touchers', and that the toucher's drawings ranked consistently higher.

If we look at Figure 1 we see that one judge (judge no. 1) ranked the drawings very differently from the other judges. In fact, he seems to prefer the non-touchers. Following the judging session with judge no. 1, it became apparent during a discussion with the judge, that he was not following the criteria specified in the judging instructions and was guided more by what he called "the naïve quality," that he found in the drawings. Although the "naïve quality" is not considered as a negative criterion, "realism" here was used as a criterion to interpret the sense of the feeling of the object. Surely, it can be rendered in an abstract way depending on our reaction and feeling of the observation subject, but this comes with experience. It was also more objective to judge 'realism' than 'naïvete'. Thus it

would seem, at least according to judge no. 1, that the non-touchers produced more 'naive' drawings than the touchers. Although the above reasons may constitute grounds for discarding judge no. 1 in the analysis (in statistical terminology this judge is termed an 'outlier') even when he is included in the ensemble of judges, the results are very significant, as the results above show.

The students were not divided into homogeneous groups with respect to sex, ability and artistic level. Thus these factors contribute to variabilities among subjects. In spite of this variability, the results came out strongly. Thus there was no need to resort to more complex statistical analysis methods in order to compensate for this variability. This again strengthens the overall results. As mentioned in section 2.1.3, two groups B and D had live instructions from the test administrator which groups A and C had recorded instructions. From Figure 2, if we compare groups A and D, i.e. recorded versus live instructions among the toucher's, we see very little difference indeed, 71% versus 63%, and in fact, this difference was probably not due to a difference in age since the latter was just a difference of one year.

It is interesting to speculate on whether there is any difference between actually touching an object and merely imagining that one is touching the object. Kimon Nicolaides told his students to imagine by looking at the object or model, that, with their pencil, they were touching the observation model. In the experiment in this thesis, the subjects had the cut artichoke in front of them and were told to imagine these various 'sensations' of touching the object. Because of this control of the non-touchers, by imagining, the results show that improved

drawing-skill comes from touching rather than only imagining the touched sensations. To actually touch the object not only brings to the students perceptive information of the object, but also decontracts them and allows them to work with larger gestures, feeling more confident. This was noticed in previous classes the author gave. A serene atmosphere exists contrary to a certain tense and serious feeling in usual classes. Drawing classes should explore the senses, such as touch, to enlarge our perceptual awareness of the model, as another 'tool' to facilitate the technique acquired with more information, to release the gesture. How can we reproduce a sensation of a soft or rough texture or a volume if we haven't felt it? It demands more concentration to render these sensations if we use only visual information.

This applies also for the case of a live model in trying to capture a movement, a position, or an expression. If we have not ourselves experienced the movement, position, or expression of the model it becomes more difficult to "capture" these qualities. We tend to draw merely what we see "externally." But if we internalize the above qualities and transpose them graphically, the resulting drawing should be a much better rendition. Thus, touch and kinesthesis helps to explore this other dimension of 'insight'.

In conclusion, the analysis of the results of this thesis strongly confirms the hypothesis that touching information improves drawing-skill acquisition.

4.2 Suggestions For Further Research

Several problems remain to be investigated in this area. It would be interesting to repeat the experiment of this thesis with a

control of age, sex and ability level, and also with different objects to validate this thesis. Does touch influence drawing-skill acquisition to the same extent with children as with adults?

According to Montagu, "at all ages the female is very much more responsive to tactile stimuli than the male" (p. 183). It would be interesting to see if touch information influences drawings in the ability to render an observation model in a drawing in these divided groups of men and women.

It would also be interesting to repeat this thesis with different observations, the usual visual observation, the touching and imagining in Nicolaides' way, to see where the line is drawn, if a difference would appear distinctly or not, in the rendition of the model in the drawing.

Another suggestion would be to use the body as a source of kinesthetic information. It might be interesting to research the effects of observing and imitating a live model on drawing performance.

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APPENDIX 1

RESULTS: THE JUDGING

First group 15-16 year olds.

A. No. 1 -- 10 manipulating/visual kinesthetic

B. No. 21 -- 30 non-manipulating/visual non-kinesthetic

Juge no. 1

1	2	3	4	5	6	7	8	9	10
2	8	25	27	29	9	30	21	24	26

11	12	13	14	15	16	17	18	19	20
23	4	7	1	3	5	10	22	6	28

Juge no. 2

1	2	3	4	5	6	7	8	9	10
10	8	3	27	5	4	7	9	21	2

11	12	13	14	15	16	17	18	19	20
1	30	29	26	6	24	23	22	25	28

Juge no. 3

1	2	3	4	5	6	7	8	9	10
10	2	3	8	4	5	1	27	9	7

11	12	13	14	15	16	17	18	19	20
30	21	23	6	29	26	25	22	24	28

Juge no. 4

1	2	3	4	5	6	7	8	9	10
10	27	3	7	29	30	23	8	25	21

11	12	13	14	15	16	17	18	19	20
5	1	28	9	2	26	4	6	22	24

Juge no. 5

1	2	3	4	5	6	7	8	9	10
10	8	27	21	7	3	2	30	29	5

11	12	13	14	15	16	17	18	19	20
4	9	23	26	24	6	1	22	28	25

Juge no. 6

1	2	3	4	5	6	7	8	9	10
10	8	27	3	5	7	2	4	9	29

11	12	13	14	15	16	17	18	19	20
21	26	30	1	6	23	24	22	25	28

Second group 13-14 year olds.

D. No. 11 — 20 manipulating/visual kinesthetic

C. No. 31 — 40 non-manipulating/visual non-kinesthetic

Judge no. 1

1	2	3	4	5	6	7	8	9	10
33	31	32	35	15	14	36	16	11	12

11	12	13	14	15	16	17	18	19	20
13	39	38	34	17	19	20	18	40	37

Judge no. 2

1	2	3	4	5	6	7	8	9	10
12	11	16	15	20	17	19	33	14	13

11	12	13	14	15	16	17	18	19	20
32	31	35	18	39	36	34	37	38	40

Judge no. 3

1	2	3	4	5	6	7	8	9	10
12	14	15	13	17	35	39	20	33	36

11	12	13	14	15	16	17	18	19	20
16	11	18	34	19	38	40	32	31	37

Judge no. 4

1	2	3	4	5	6	7	8	9	10
12	16	11	14	20	31	13	36	17	33

11	12	13	14	15	16	17	18	19	20
15	35	32	37	34	38	39	19	18	40

Judge no. 5

1	2	3	4	5	6	7	8	9	10
12	13	14	17	15	39	11	20	38	36

11	12	13	14	15	16	17	18	19	20
34	18	19	31	16	33	35	40	37	32

Judge no. 6

1	2	3	4	5	6	7	8	9	10
15	12	14	13	16	11	20	17	39	18

11	12	13	14	15	16	17	18	19	20
33	19	36	38	34	40	35	32	31	37

APPENDIX 2

ANALYSIS OF INDIVIDUAL JUDGES

Group A/B

i	xi	Ri or Si
1	1	14
2	2	1
3	3	15
4	4	12
5	5	16
6	6	19
7	7	13
8	8	2
9	9	6
10	10	17
11	21	8
12	22	18
13	23	11
14	24	9
15	25	3
16	26	10
17	27	4
18	28	20
19	29	5
20	30	7

Judge no. 1

$$W_1 = \sum_{i=1}^{10} S_{i,1} - 55$$

$$= 115 - 55$$

$$= 60$$

Significance level:

NOT significant

i	xi	Si or Ri
1	1	11
2	2	10
3	3	3
4	4	6
5	5	5
6	6	15
7	7	7
8	8	2
9	9	8
10	10	1
11	21	9
12	22	18
13	23	17
14	24	16
15	25	19
16	26	14
17	27	4
18	28	20
19	29	13
20	30	12

Judge no. 2

$$W_2 = \sum_{i=1}^{10} S_{i,\ 2} - 55$$

$$= 68 - 55$$

$$= 13$$

Significance level:

$P(W_2 \leq 13) = 0.0019$

i	xi	Si or Ri
1	1	7
2	2	2
3	3	3
4	4	5
5	5	6
6	6	14
7	7	10
8	8	4
9	9	9
10	10	1
11	21	12
12	22	18
13	23	13
14	24	19
15	25	17
16	26	16
17	27	8
18	28	20
19	29	15
20	30	11

Judge no. 3

$$W_3 = \sum_{i=1}^{10} S_{i,3} - 55$$

$$= 61 - 55$$

$$= 6$$

Significance level:

$P(W_3 \leq 6) = \underline{0.0002}$

i	xi	Ri or Si
1	1	12
2	2	15
3	3	3
4	4	17
5	5	11
6	6	18
7	7	4
8	8	8
9	9	14
10	10	1
11	21	10
12	22	19
13	23	7
14	24	20
15	25	9
16	26	16
17	27	2
18	28	13
19	29	5
20	30	6

Judge no. 4

$$W_4 = \sum_{i=1}^{10} S_{i,4} - 55$$

$$= 103 - 55$$

$$= 48$$

Significance level:

$P(W_4 \leq 48) = \underline{0.4559}$

NOT Significant

i	xi	Ri or Si
1	1	17
2	2	7
3	3	6
4	4	11
5	5	10
6	6	16
7	7	5
8	8	2
9	9	12
10	10	1
11	21	4
12	22	18
13	23	13
14	24	15
15	25	20
16	26	14
17	27	3
18	28	19
19	29	9
20	30	8

Judge no. 5

$$W_5 = \sum_{i=1}^{10} S_{i,5} - 55$$

$$= 87 - 55$$

$$= 32$$

Significance level:

$P(W_5 \leq 32) = \underline{0.0952}$

While this result is not significant at the 0.05 level it is at the 0.1 level which is acceptable among some researchers.

i	xi	Ri or Si
1	1	14
2	2	7
3	3	4
4	4	8
5	5	5
6	6	15
7	7	6
8	8	2
9	9	9
10	10	1
11	21	11
12	22	18
13	23	16
14	24	17
15	25	19
16	26	12
17	27	3
18	28	20
19	29	10
20	30	13

Judge no. 6

$$W_6 = \sum_{i=1}^{10} S_{i,\,6} - 55$$

$$= 71 - 55$$

$$= 16$$

Significance level:

$P\,(W_6 \leq 16) = \underline{0.0045}$

Group C/D

i	xi	Si or Ri
1	11	9
2	12	10
3	13	11
4	14	6
5	15	5
6	16	8
7	17	15
8	18	18
9	19	16
10	20	17
11	31	2
12	32	3
13	33	1
14	34	14
15	35	4
16	36	7
17	37	20
18	38	13
19	39	12
20	40	19

Judge no. 1

$$W_1 = \sum_{i=1}^{10} S_{i,\,1} - 55$$

$$= 115 - 55$$

$$= 60$$

Not significant

i	xi	Si or Ri
1	11	2
2	12	1
3	13	10
4	14	9
5	15	4
6	16	3
7	17	6
8	18	14
9	19	7
10	20	5
11	31	12
12	32	11
13	33	8
14	34	17
15	35	13
16	36	16
17	37	18
18	38	19
19	39	15
20	40	20

Judge no. 2

$$W_2 = \sum_{i=1}^{10} S_{i,2} - 55$$

$$= 61 - 55$$

$$= 6$$

Significance level:

$P(W_2 \leq 6) = \underline{0.0002}$

i	xi	Si or Ri
1	11	12
2	12	1
3	13	4
4	14	2
5	15	3
6	16	11
7	17	5
8	18	13
9	19	15
10	20	8
11	31	19
12	32	18
13	33	9
14	34	14
15	35	6
16	36	10
17	37	20
18	38	16
19	39	7
20	40	17

Judge no. 3

$$W_3 = \sum_{i=1}^{10} S_{i,3} - 55$$

$$= 74 - 55$$

$$= 19$$

Significance level:

$P(W_3 \leq 19) = \underline{0.0093}$

i	xi	Si or Ri
1	11	3
2	12	1
3	13	7
4	14	4
5	15	11
6	16	2
7	17	9
8	18	19
9	19	18
10	20	5
11	31	6
12	32	13
13	33	10
14	34	15
15	35	12
16	36	8
17	37	14
18	38	16
19	39	17
20	40	20

Judge no. 4

$$W_4 = \sum_{i=1}^{10} S_{i,4} - 55$$

$$= 79 - 55$$

$$= 24$$

Significance level:

$P(W_4 \leq 24) = \underline{0.022}$

i	ix	Si or Ri
1	11	7
2	12	1
3	13	2
4	14	3
5	15	5
6	16	15
7	17	4
8	18	12
9	19	13
10	20	8
11	31	14
12	32	20
13	33	16
14	34	11
15	35	17
16	36	10
17	37	19
18	38	9
19	39	6
20	40	18

Judge no. 5

$$W_5 = \sum_{i=1}^{10} S_{i,5} - 55$$

$$= 70 - 55$$

$$= 15$$

Significance level:

$P(W_5 \leq 15) = \underline{0.0034}$

i	xi	Si or Ri
1	11	6
2	12	2
3	13	4
4	14	3
5	15	1
6	16	5
7	17	8
8	18	10
9	19	12
10	20	7
11	31	19
12	32	18
13	33	11
14	34	15
15	35	17
16	36	13
17	37	20
18	38	14
19	39	9
20	40	16

Judge no. 6

$$W_6 = \sum_{i=1}^{10} S_{i,6} - 55$$

$$= 58 - 55$$

$$= 3$$

Significance level:

$P(W_5 \leq 3) = \underline{0.0000}$

APPENDIX 3

ANALYSIS OF ENSEMBLE OF JUDGES

Group A/B

i	xi	Score i	Ri or Si
1	1	75	13
2	2	42	5
3	3	34	4
4	4	59	12
5	5	53	7
6	6	97	18
7	7	45	6
8	8	20	1
9	9	58	11
10	10	22	2
11	21	54	8
12	22	109	19
13	23	77	14
14	24	96	17
15	25	87	16
16	26	82	15
17	27	24	3
18	28	112	20
19	29	57	9.5
20	30	57	9.5

$$W = \sum_{i=1}^{10} S - 55$$

$$= 79 - 55$$

$$= 24$$

Significance level:

$P(W \leq 24) = \underline{0.0262}$

Group C/D

i	xi	Score i	Ri or Si
1	11	39	5
2	12	16	1
3	13	38	4
4	14	27	2
5	15	29	3
6	16	44	6
7	17	47	7
8	18	86	16.5
9	19	81	14
10	20	50	8
11	31	72	13
12	32	83	15
13	33	55	9
14	34	86	16.5
15	35	69	12
16	36	64	10
17	37	111	20
18	38	87	18
19	39	66	11
20	40	110	19

$$W = \sum_{i=1}^{10} S - 55$$

$$= 66.5 - 55$$

$$= 11.5$$

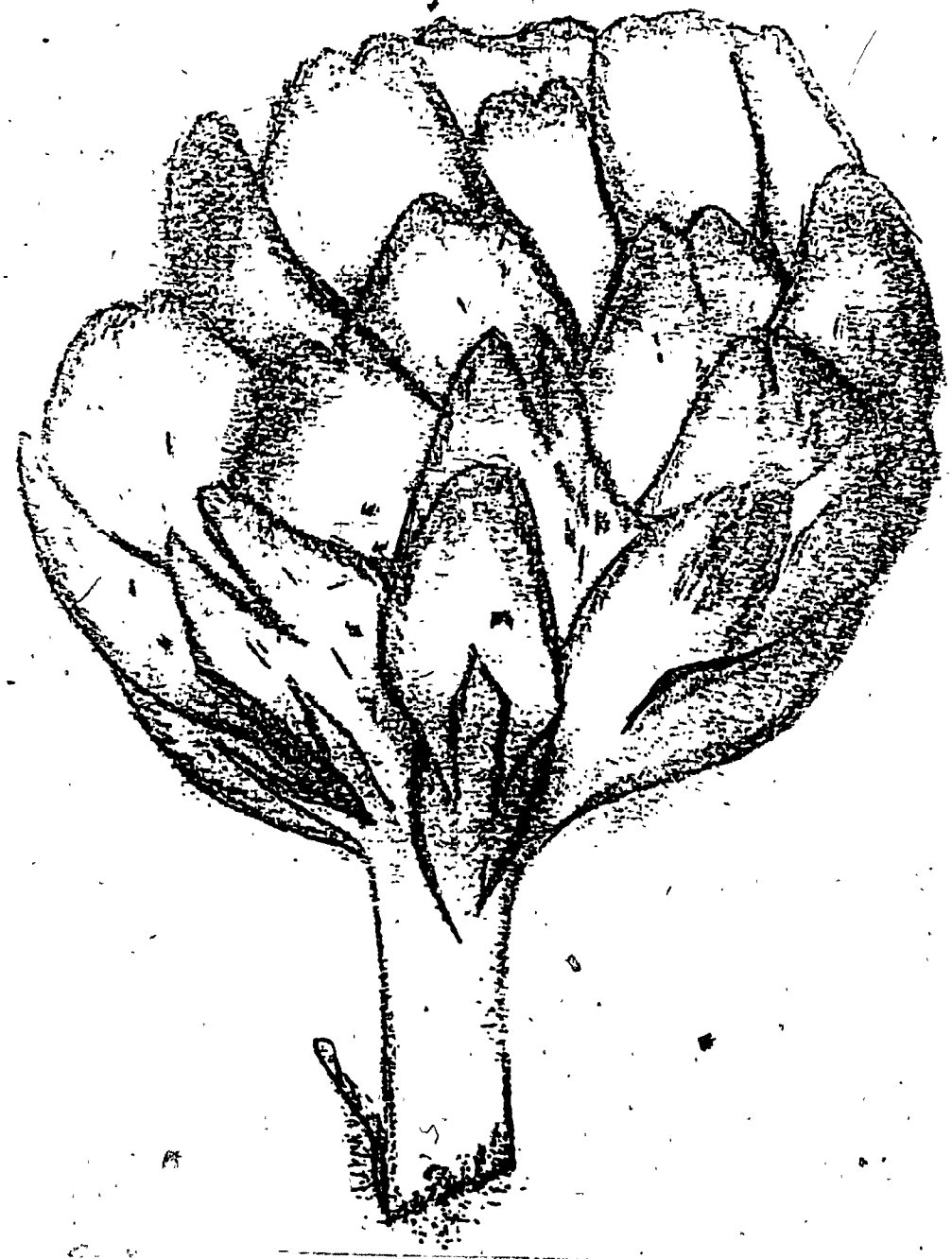
$$P\ (W \leq 11.5) = \underline{0.0012}$$

APPENDIX 4

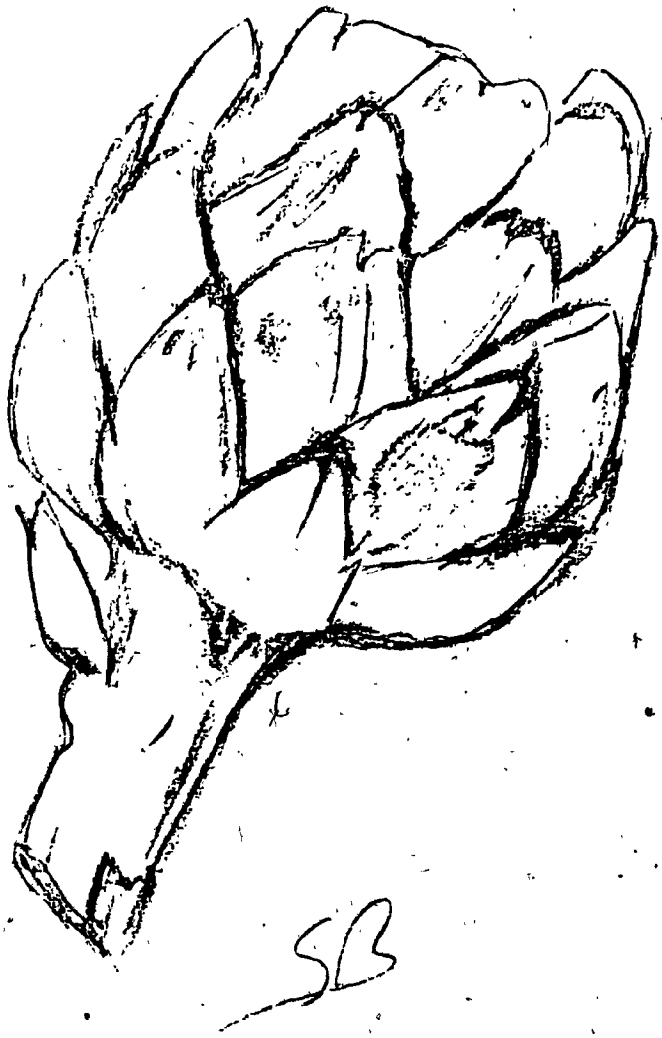
DRAWINGS

GROUP A/B

1-M-4

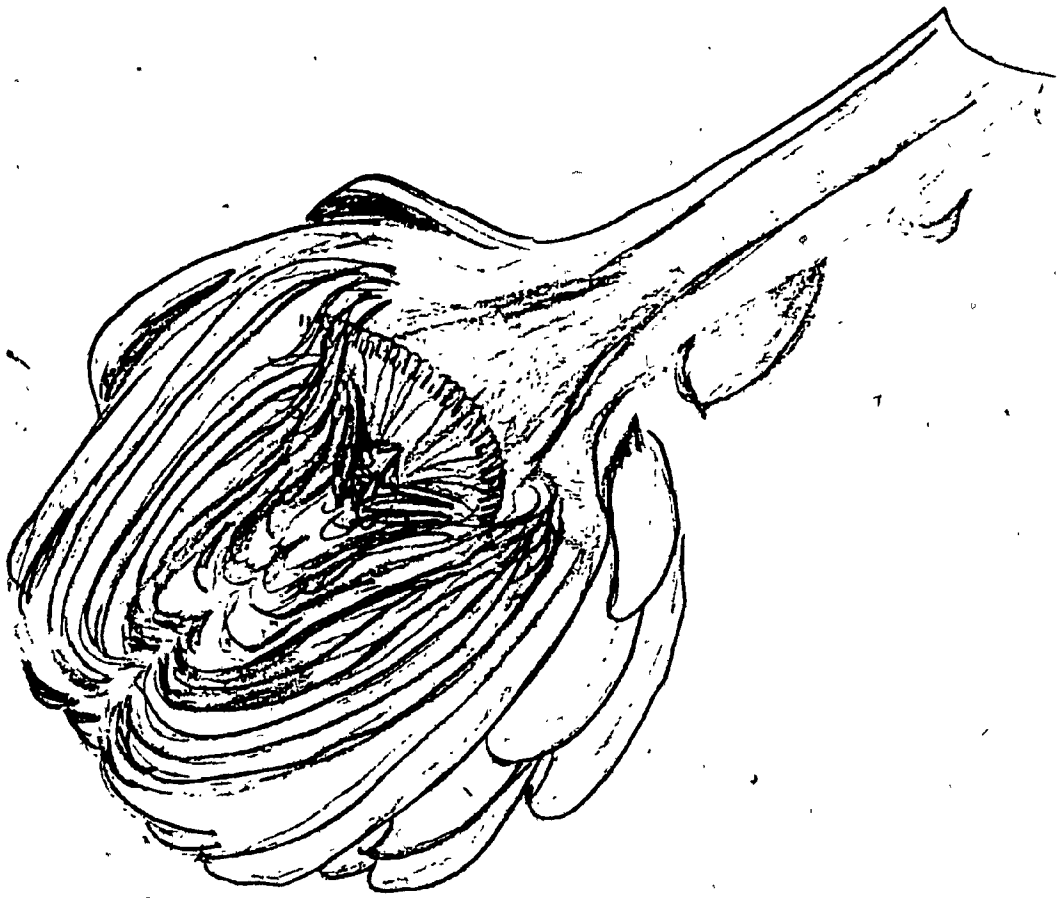


2-M-↑

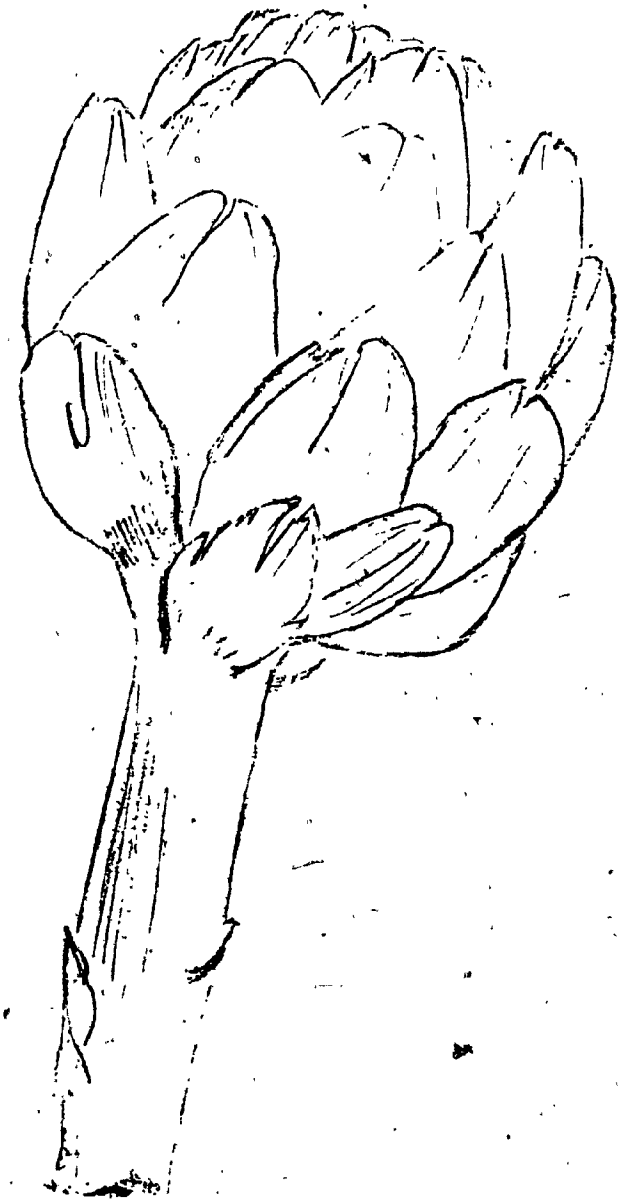


SB

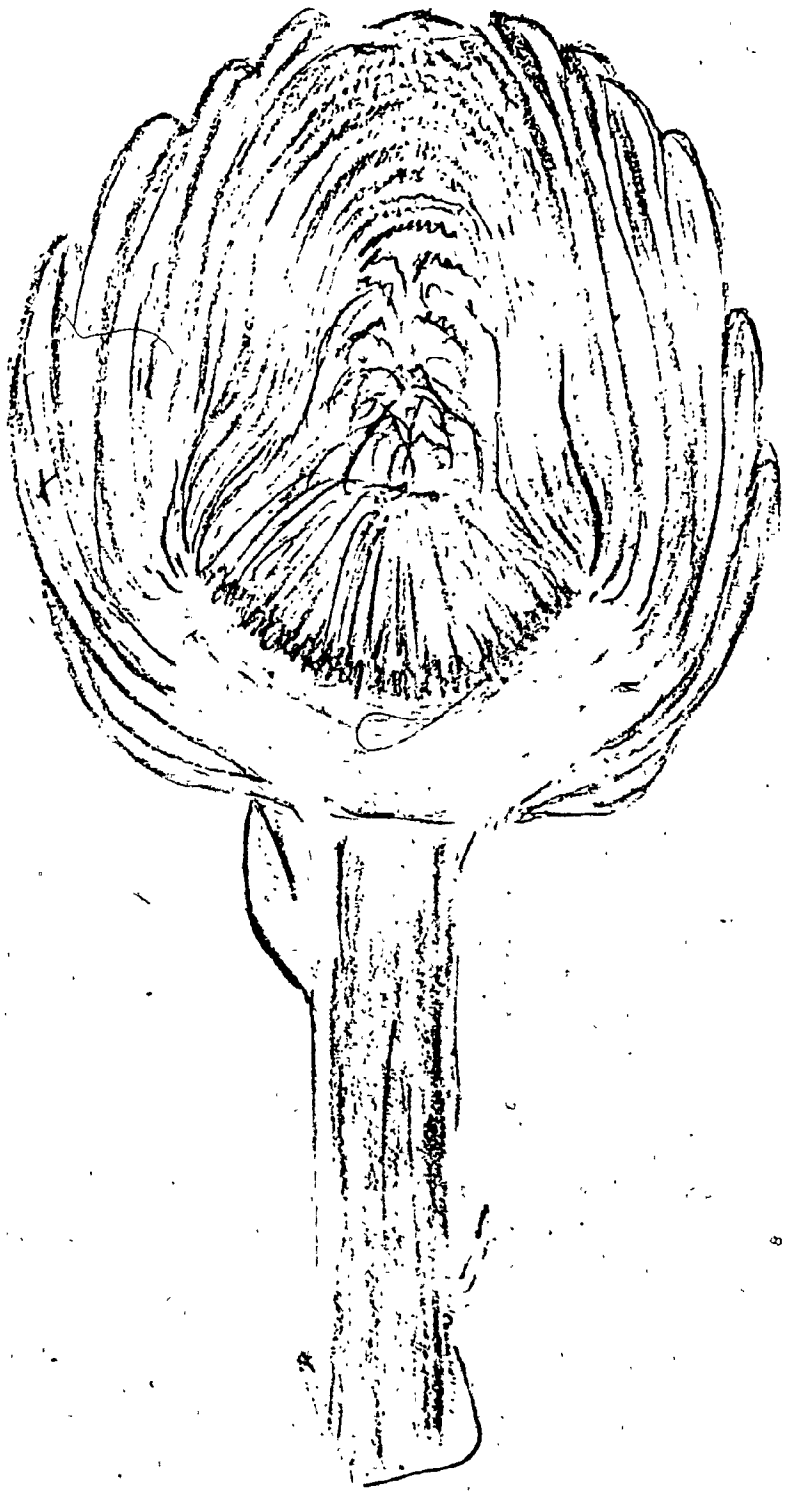
3-M-↑

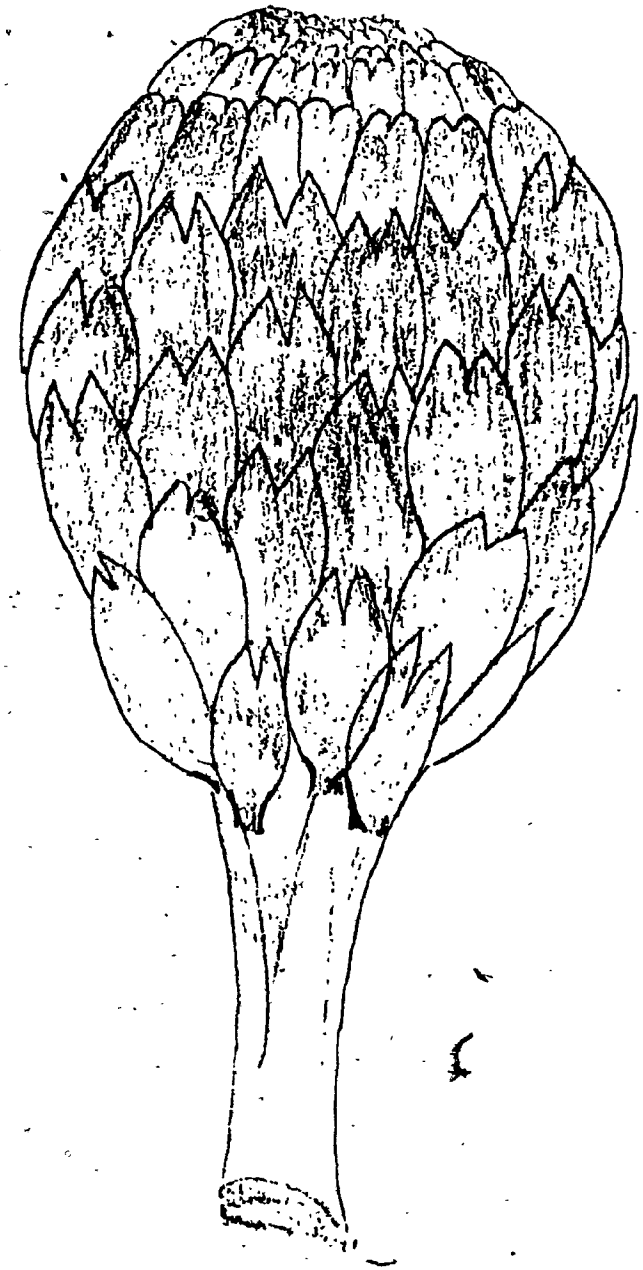


4-M-↑



5-M-↑





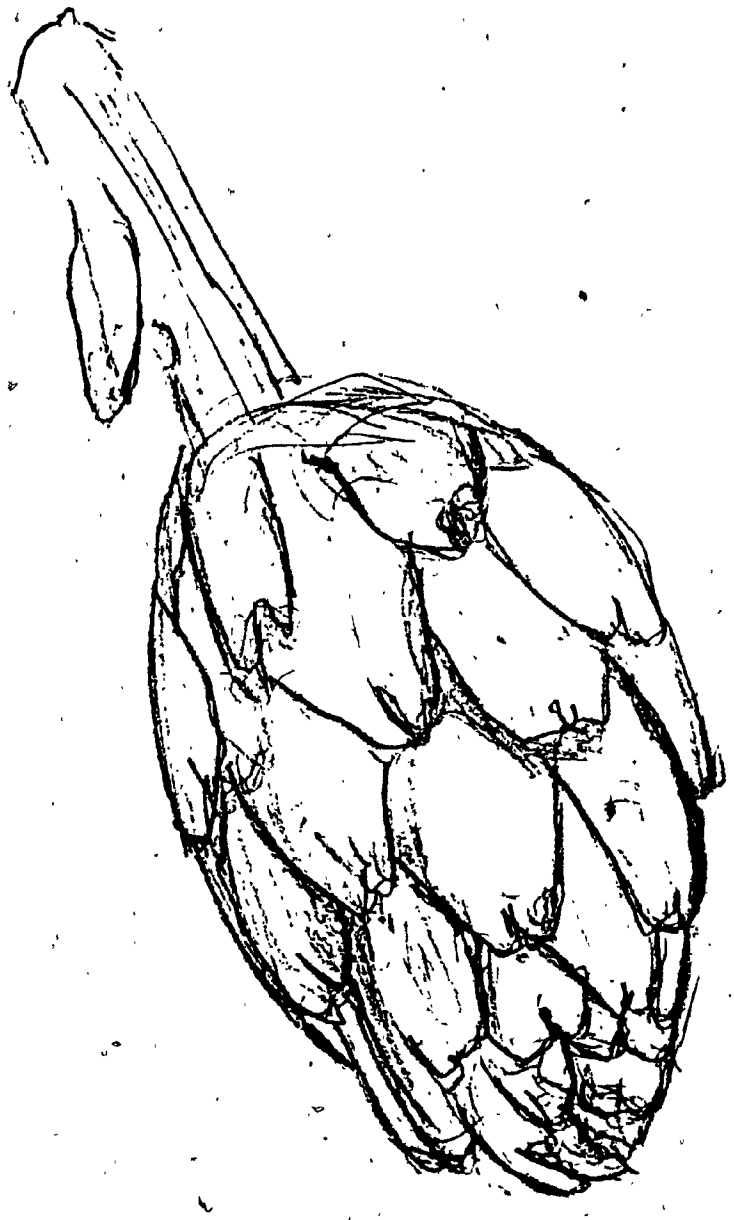
un artichaud

6.M.

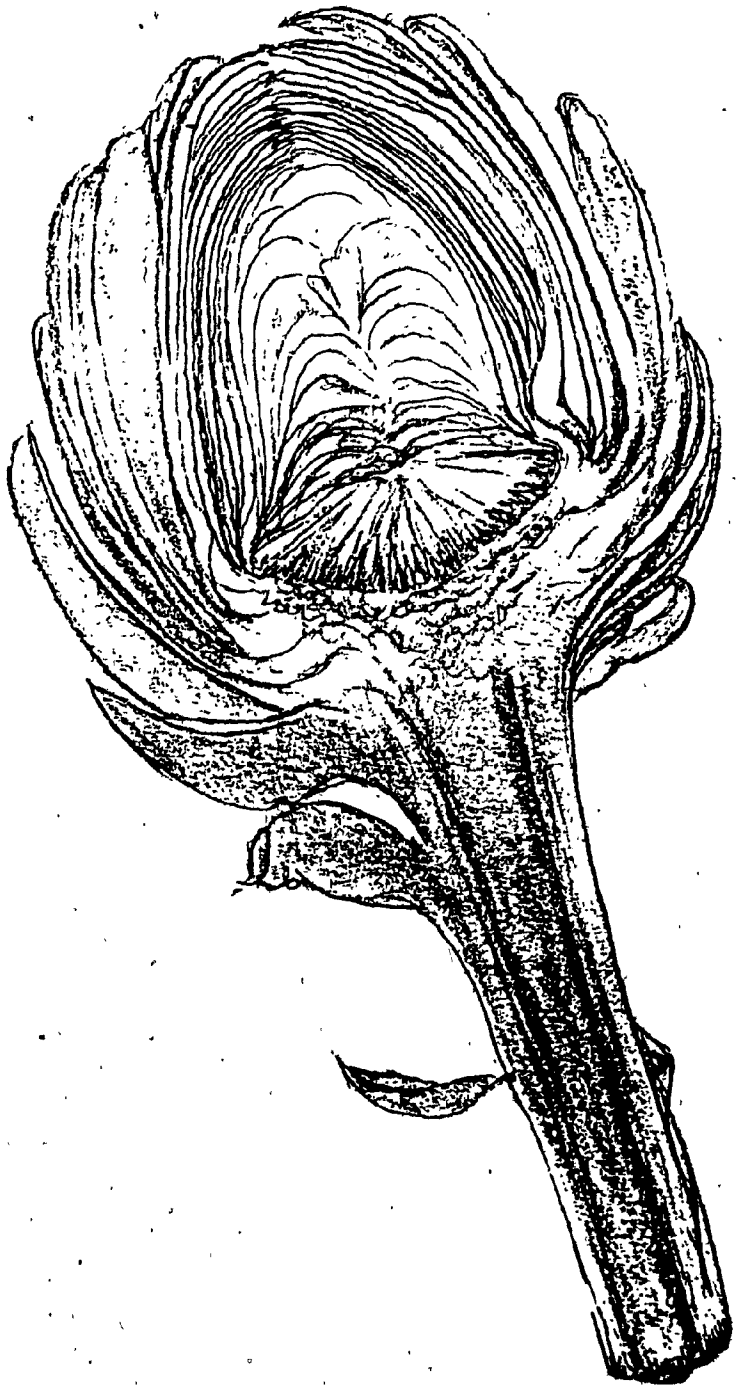
7 - M - →

8— M— →

9 - M - →



10 – M – ↑

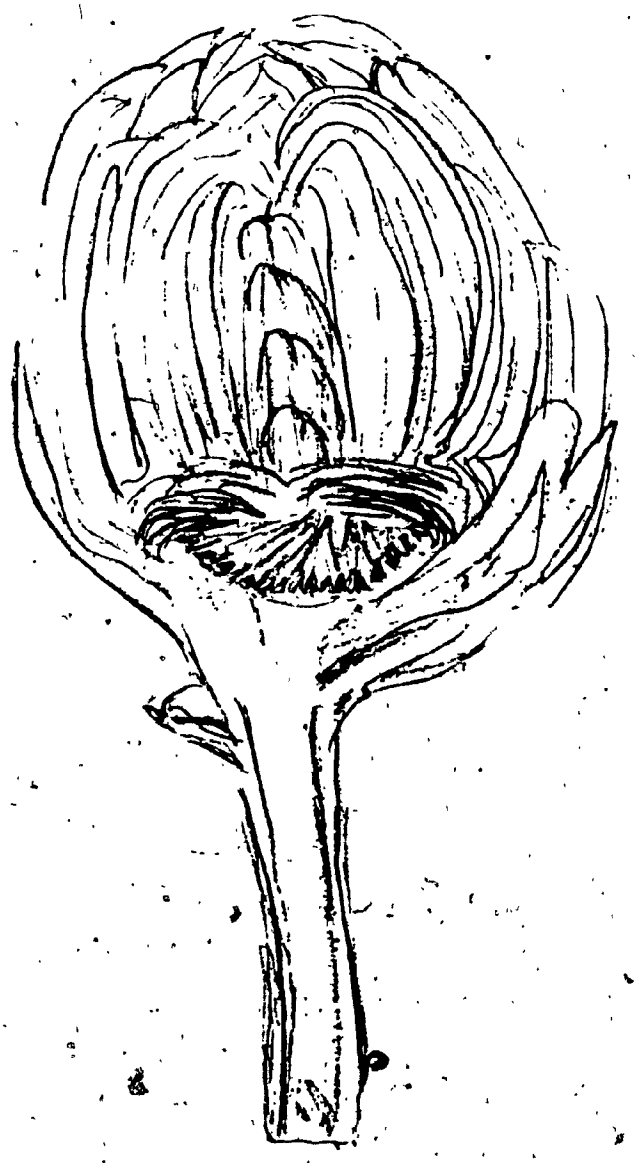


...L'ARTICHAULT "FROID"

22_N.F.M. →

23 - N.-M. →

24 N.-M. →

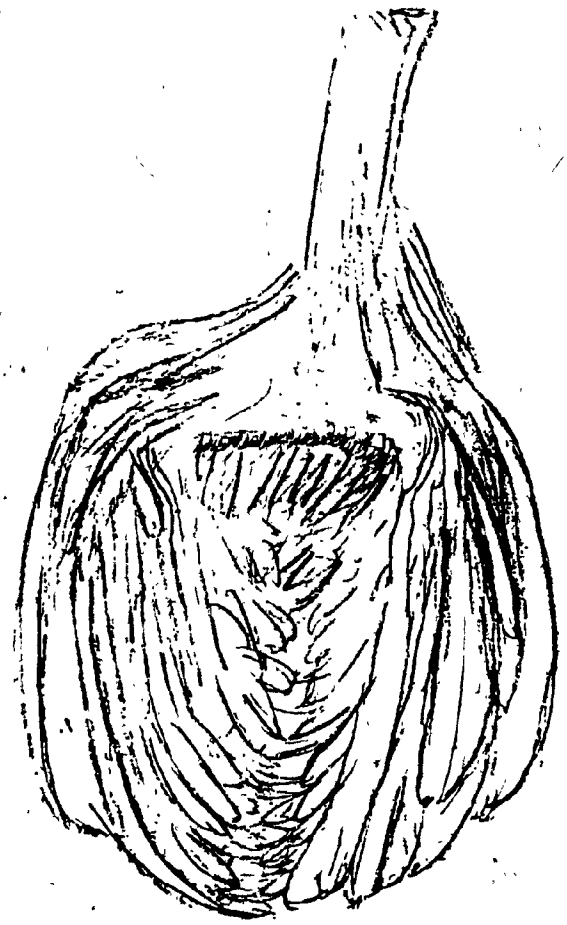


25_N.-M. →

26-N.-M.-D.

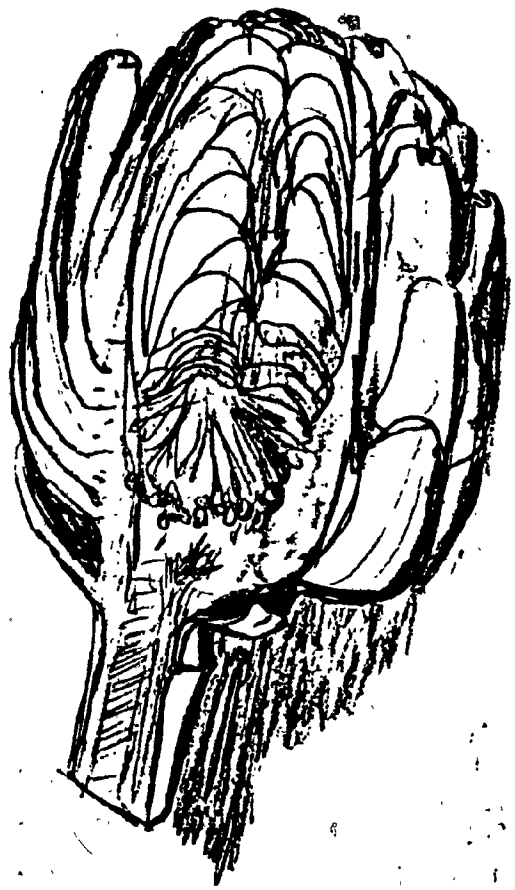
27-N.-M →

28-N.-M. →



29 - N. - M. →

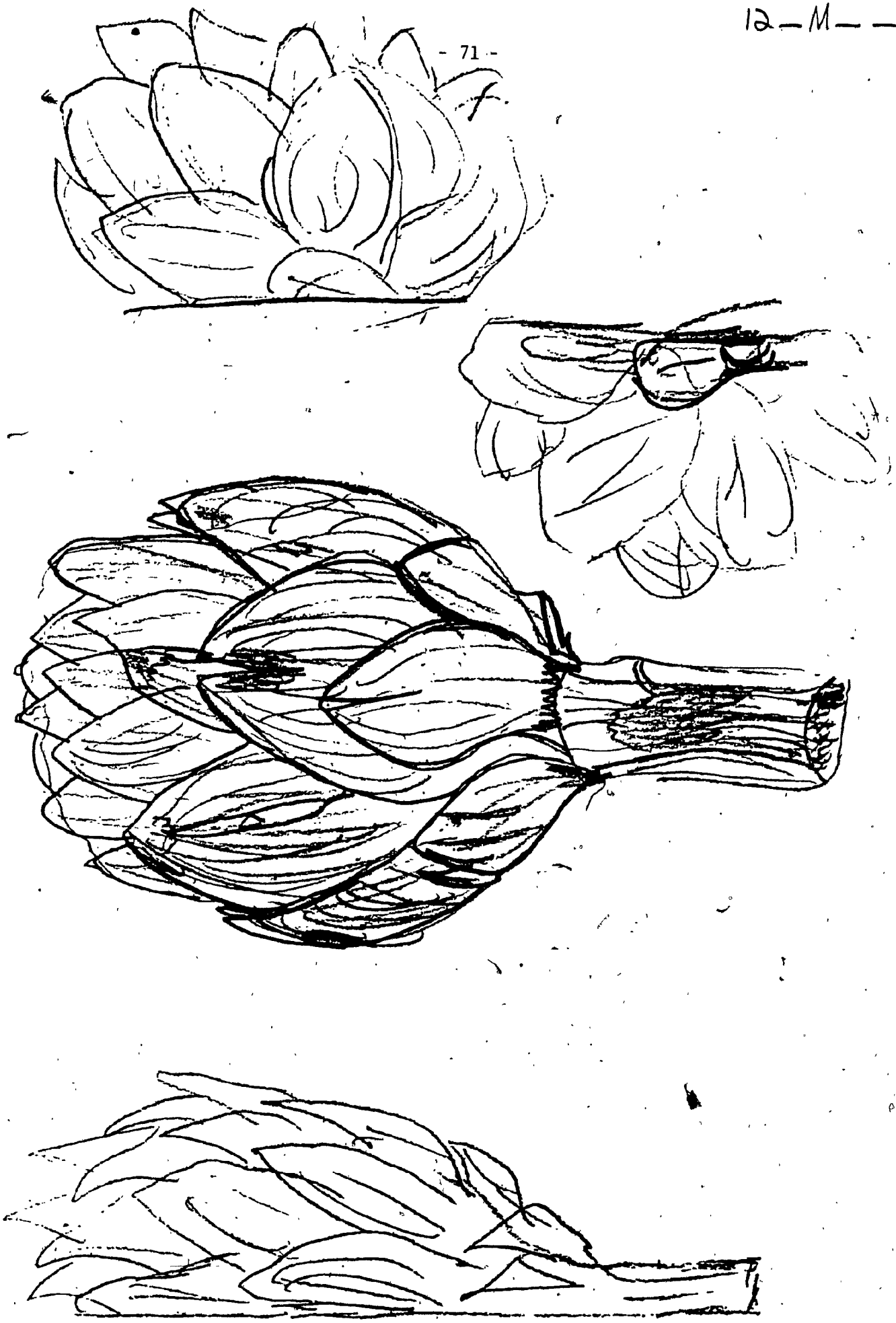
30-N.M. →



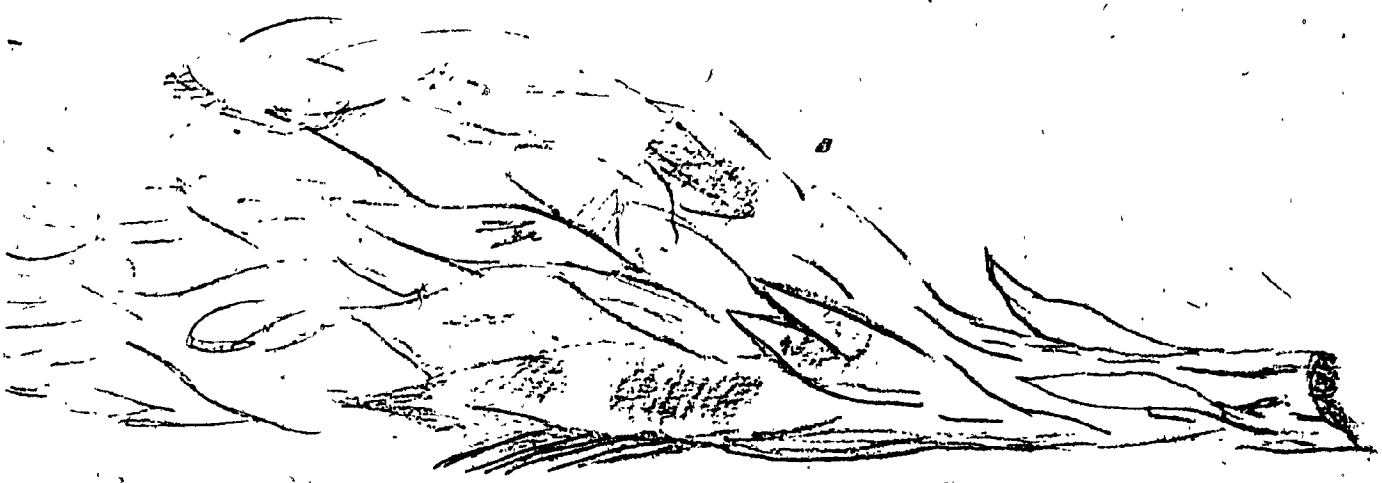
GROUP C/D

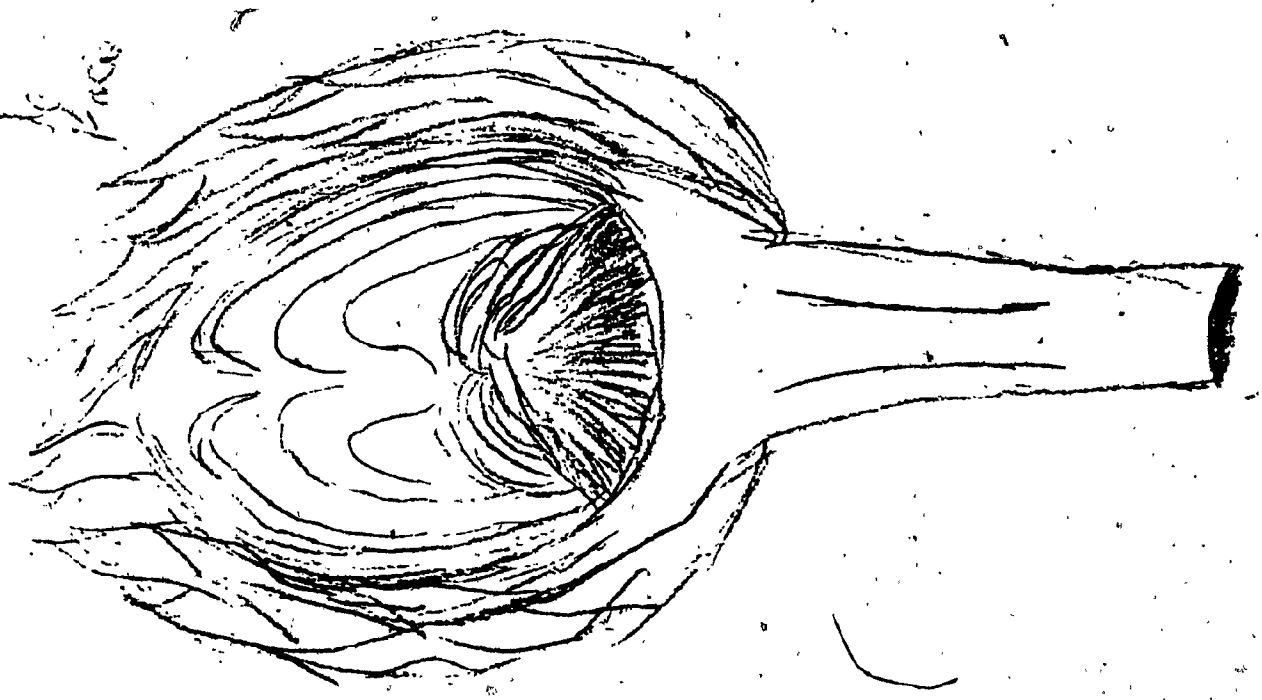
11-M-↑

12—M— →



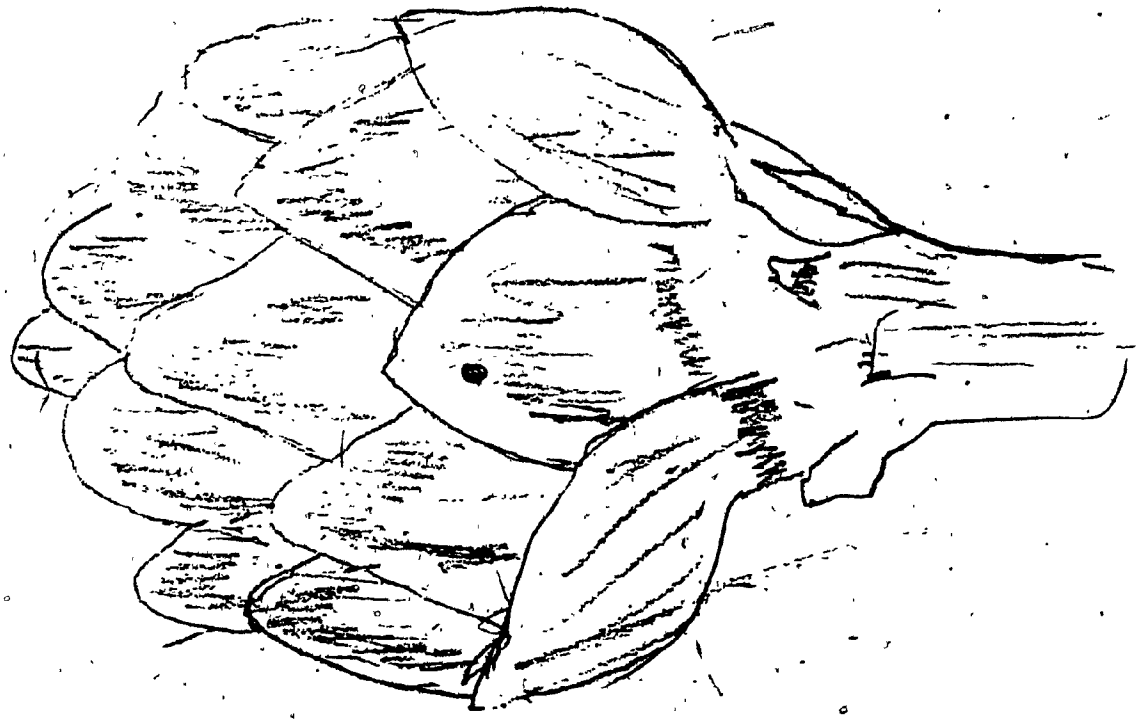
13-M-



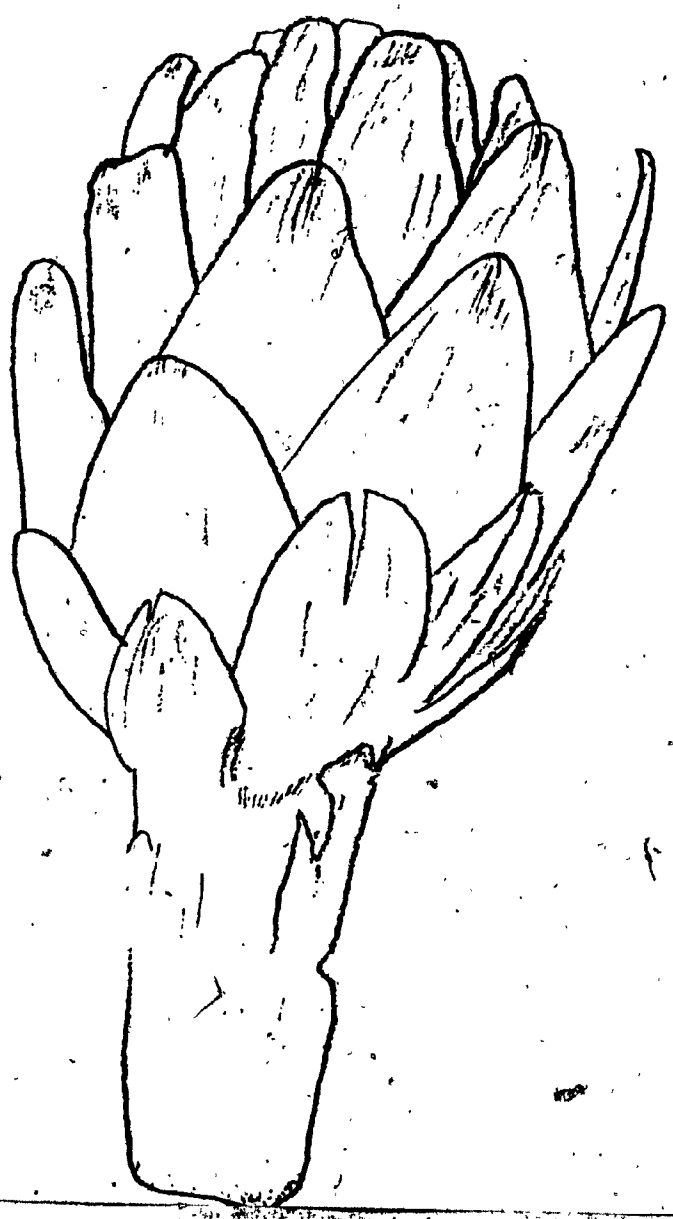


14- M - →

(artichoke)

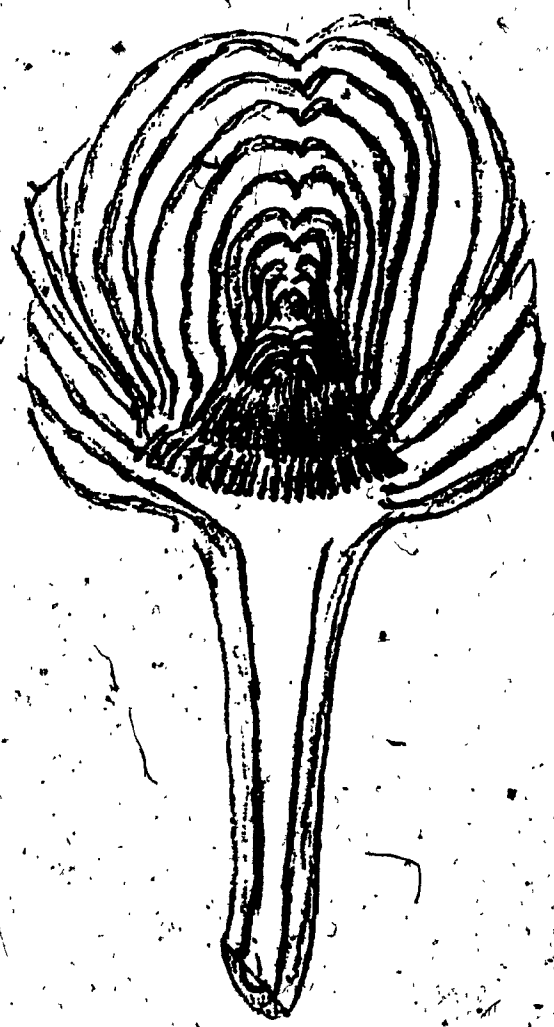


15- M- ↑

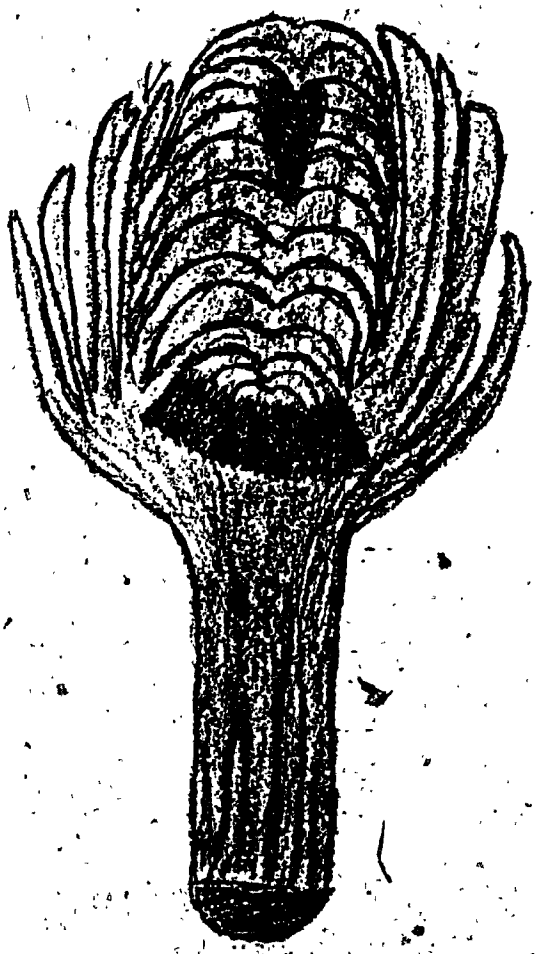


16 — M — →

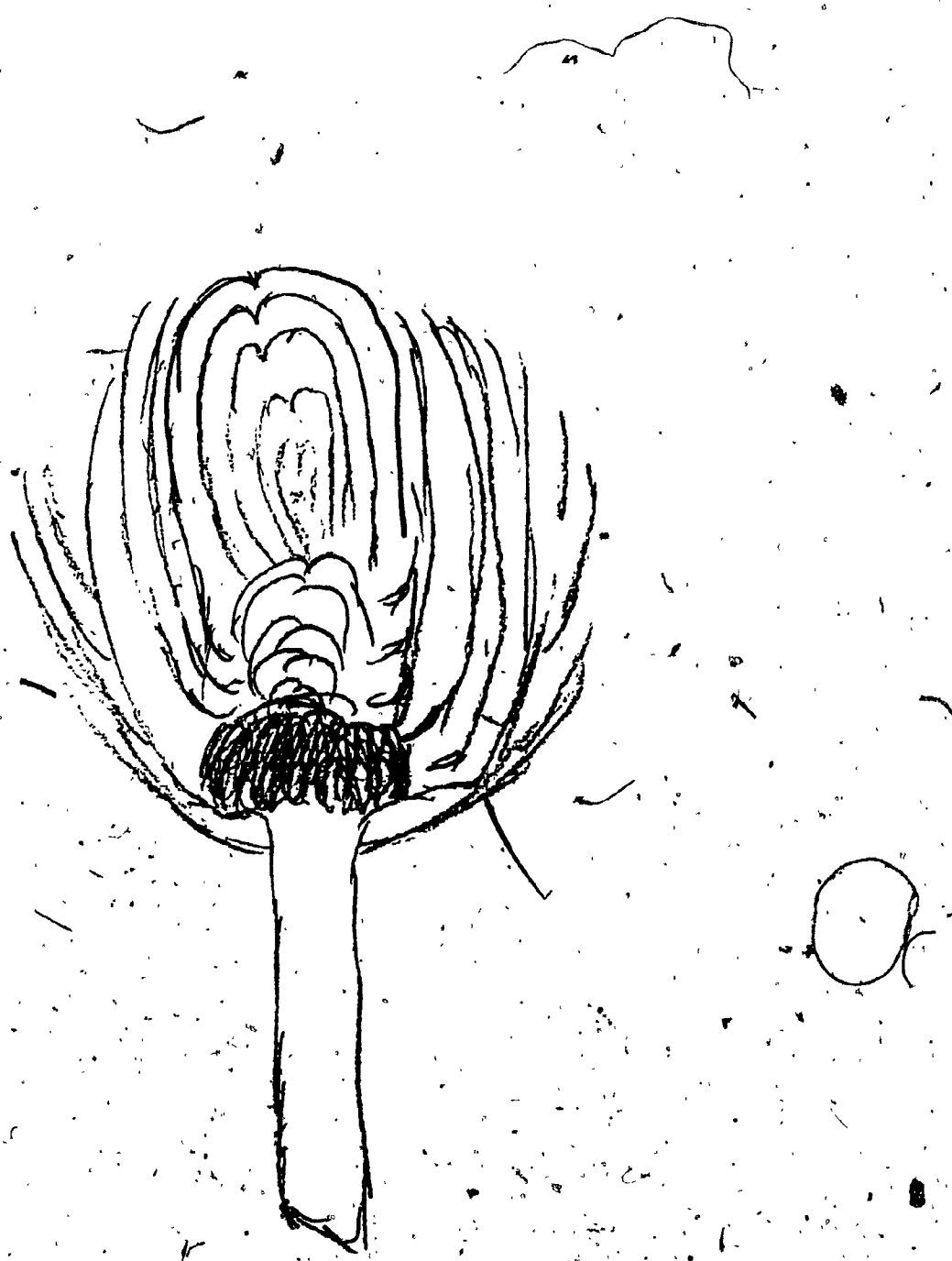
17-M-4

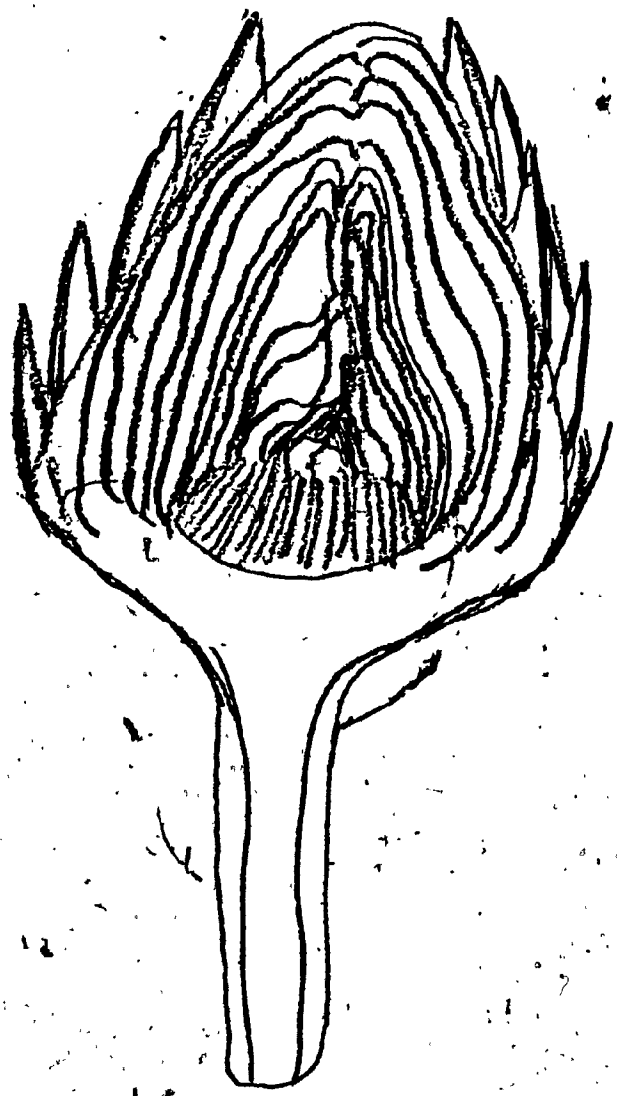


18-M-



19-M-↑



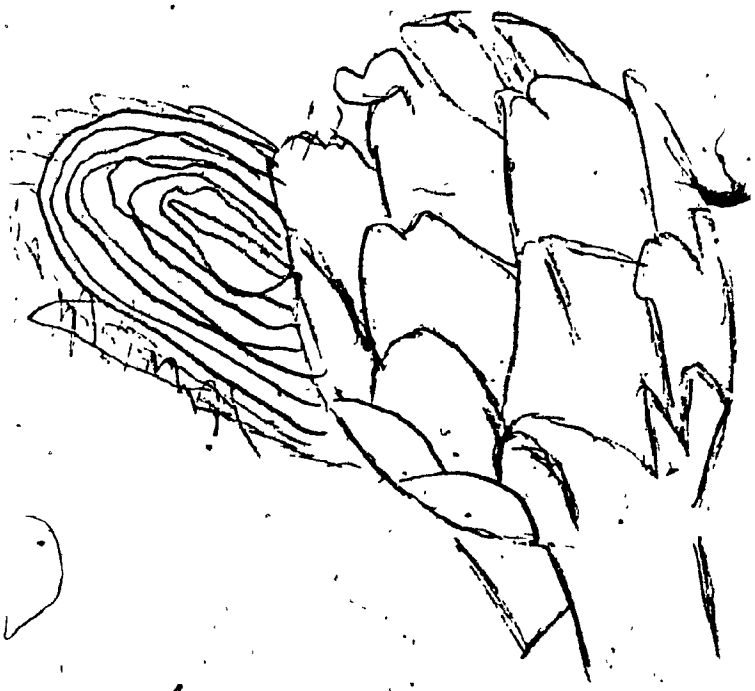


31 – N.-M. →

32-N.-M.-1

33-N.-M.

34 -N-M- →



35- N.-M- →

36 - N.-M. →

37-N-M-

38- N.-M- -