A DRAWING EDUCATION PROGRAMME FOCUSING ON ENHANCING ABSTRACTION ABILITY

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ABSTRACT

This study considers the 'three sub-abilities' that constitute the abstraction ability and focuses on drawing as an education for acquiring them. Focusing on the similarity between the process of drawing and the semiotic triangle, elucidating their relationship with the sub-abilities that constitute the abstraction ability, it devises a drawing education programme that focuses on 'observing' rather than 'drawing'. The drawing education programme formulated is implemented on 177 students, and the result is determined using tests that enable objective evaluation to prove the effectiveness of the program in helping students acquire the 'three sub-abilities' that constitute the abstraction ability.

The educational programme proposed in this research, which focuses on the universality of the effects of learning drawing, as well as the quantitative criteria for evaluating it, will contribute to familiarize practical education in the field of art to the general public.

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1 INTRODUCTION

The term 'design', once recognised as having a narrow meaning of 'styling', is now attracting attention from many quarters as a useful concept for increasing socio-economic value, as typified by 'design thinking', and the field of 'design management' in particular has attracted a lot of attention in recent years. Abstraction ability is one of the key competencies considered necessary for practising design management. This study considers the 'competency' that constitute abstraction ability and focuses on drawing as an education for acquiring it. This research aims to clarify the relationship between the process of drawing and the 'ability' required for abstraction ability, and to devise and implement a drawing education programme that focuses on 'observing' rather than 'drawing', to effectively acquire the ability. The output obtained from the drawing education programme is then evaluated using a quantitative method that does not rely on subjective perspectives such as how well it is done, to prove the effectiveness of drawing education in the acquisition of abstraction ability.

2 DRAWING AND SEMIOTIC TRIANGLE

2.1 What is drawing?

Drawing, in this paper, represents the act of sketching objects mostly with pen or charcoal, and is distinguished from a finished work (i.e. tableau) carefully drawn with oil or other media.

Drawing is often seen as a matter of good or bad 'drawing' technique, but ability to observe is just as important as the ability to draw. This ability of observation should be exercised not only on the motif, but also on the drawing you are making and the perceptions you gain from looking at the motif. In other words, there are three objects of observation in drawing: the motif in front of you, an image in your mind and your own drawing. The motif refers to the object for drawing, while the image refers to a structure that is reproduced in your mind based on the perceptions gained from observing the motif. Figure 1 describes the relationship between these three objects of observation in the form of a triangular diagram superimposed on the drawing process.
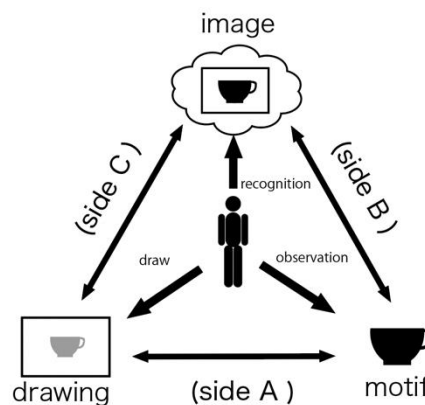

Figure 1. Model of drawing process

(**Side A**) Corresponds to the observation and comparison of the motif and the drawing.
To start a drawing, the first step is to observe the white paper and motif placed in front of you, and to think about where on the drawing paper and in what size the drawing should be done. Everything takes place on the drawing paper, so it is necessary to get the idea of the relationship between the size of the motif and the drawing paper before making detailed observations of the motif. Also, the motif must always be compared with your creation throughout the drawing.
(**Side B**) Corresponds to the observation and comparison of the motif and the image.
As it is not possible to express the motif in a drawing by just looking at it, it must be converted into an image based on your own memories and experiences in order to recognise and express it in a picture.

It is also at this stage when you develop a strategy for drawing, and it is necessary to observe not only the motif but also your own experiences and memories.

(Side C) Corresponds to the observation and comparison of image and drawing.

It is to start drawing on the drawing paper based on the image. The drawing is observed and compared with their own image as you draw, and keep revising the drawing so that it comes closer to the image. Thus, drawing can be said to confirm the accuracy of the transformation into an image and the degree of discrepancy between the drawing and the image by directly comparing the drawing and the motif.

2.2 Semiotic triangle

In the semiotic triangle of *The Meaning of Meaning* by Ogden and Richards (1923), the human thought process is considered as a kind of symbolic action, which is expressed in terms of three relationships: the symbol, the referent to which it substitutes, and the thought or reference that grasps the relationship between the two.

Let us consider these items and their relationship as well as where the elements in drawing mentioned earlier correspond to these items. A motif in front of you, an image you recognise from seeing it, and a drawing that expresses the image, all represent the same thing (motif), but since 'drawing' represents an object with a picture as well as the word for 'motif', the relationship between the two can be translated as 'symbol' and 'referent', while 'image' applies to 'thought' since it grasps and symbolises them.

Thus, if we view the act of drawing in terms of the tripartite relationship between motif, image and drawing, we can see that it corresponds extremely well to the semiotic triangle, as Figure 2 shows.
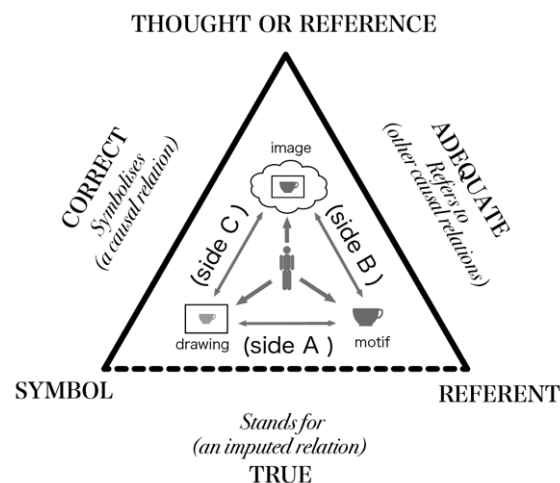
Figure 2. Overlaying semiotic triangle on the model of drawing process

(Side A) Stands for (an imputed relation)

This represents an attributional relationship between symbol and object, but there is no direct link between the two.

The same applies to drawing: it is not possible to trace or transfer the motif directly onto paper, so once you have an image in your mind, you have to express it on paper using drawing materials. The drawing and the motif can be compared physically, but the process of creation takes place through perception; therefore, it is common to the relationship of semiotics, where there is no direct relationship between symbol and referent. Therefore, Side A can be interpreted as observing and comparing two real objects that are not directly related to each other.

(Side B) Refers to (other causal relations)

This refers to the multiple causal relationships between the indicated object and the thought. What and how an object is imagined depends on the social background and experiences of the person who sees it, and the same applies to drawing, and this factor has a lot to do with the fact that even with the same motif, differences in memory due to the thoughts and experiences of the person conducting the drawing can appear as individuality that goes beyond good or bad expression. You mutually observe the relationship between your memories and the motifs in front of you and define the direction of the

drawing to be made. Therefore, it can be said that Side B is about observing and comparing real things and the memories associated with them.

(Side C) Symbolises (a causal relation)

This is the symbolic causality between symbol and thought, in that each thought object becomes its own interpretation and represents a specific symbol. In drawing, the motif is not directly compared to the drawing, but the drawing is compared to the motif through its own image and the causal relationship is stronger for the image than for the motif. Therefore, Side C can be interpreted as observing and comparing an image that exists in your mind with a real object.

3 ABSTRACTION ABILITY

3.1 What is abstraction ability?

'Abstraction ability' refers to 'the ability to abstract things', and 'abstraction' has been discussed in a variety of fields, including philosophy, natural language, mathematics, computer science, art and cognitive science. Saitta and Zucker (2013) develop a general theory of detailed and rigorous 'abstraction' using formal systems. This section introduces discussions in the fields of computer science. In the field of computer science, Kramer (2007) states that there are two aspects of abstraction. One is "the process of formulating general concepts by abstracting common properties of concrete instances", and "a general concept formed by extracting common features from specific examples". Let us call it as *insight* ability, in the sense of extracting the essence of things.

The other is "the act of withdrawing or removing something" and "the act or process of leaving out of consideration one or more properties of a complex object so as to attend to others". Let us call it as *removal* ability in the sense of leaving out the superfluous. It can be said that insight refers to the act of extracting common properties between several objects, while removal refers to the act of discarding certain aspects of an object.

In order to discuss abstraction in design management, it would be necessary to have a *bird's-eye view* of the subject as a whole prior to insight and abstraction. Thus, before abstraction, it is necessary to determine the Scope of Interest (SOI) and set the system boundaries. For these reasons, the three abilities - bird's-eye view, insight and removal, shall be considered as sub-abilities of abstraction ability in this study.

3.2 Abstraction ability, the process of drawing and semiotics triangle

Next, the correspondence of the above-mentioned three sub-abilities of abstraction ability is discussed with the relationship between the process of drawing and the semiotic triangle. These relationships are shown in Figure 3.
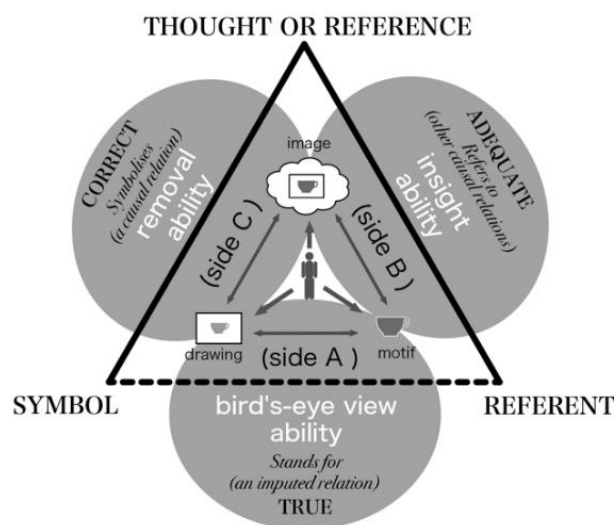

Figure 3. 3 capabilities corresponding to drawing process and semiotic triangle

(Side A) Observe and compare between objects that are real but not directly related.

As the entire drawing paper, including the margins, is the work and scope of your responsibility, observation should be directed not only to the content of the motif, but also to its relationship to its surroundings and to the paper drawn. While drawing, they constantly judge how close or not close the drawing they are making and the motif they are observing are to the intended finished form of expression and update their observations from time to time. The ability to support this observation including the background from a detached perspective, can be considered as the bird's-eye view.

(Side B) Observe and compare real things and memories connected to them.

In this context, the differences in the thoughts and perceptions of each person who draws are differences in interpretation, and in order to understand not only the surface irregularities of a motif but also how it is constructed, it is necessary to understand not only the visual information but also how it is perceived in comparison with one's own experience. Biased observation based on assumptions and preconceptions cannot capture the essence of the motif but requires observation of both the motif itself and one's own memory-based perceptions, and comparison of these to discover the essence of the object. These cannot be done without insight ability.

(Side C) Observe and compare images that exist in the mind with what is real.

The expression made possible by the act of drawing with black pencil lines on white paper is extremely limited when compared to the complexity of the real motif. Therefore, it is necessary to prioritise and organise the information obtained through observation and reflect it in the output without waste, so that the motifs are separate from the actual situation in which they exist and can be naturally established in the drawing without discrepancies. To discern the essential elements and points in a drawing that are difficult to change later, such as larger structure of a motif and balance, without being distracted by the visible and prominent elements on the surface of the motif, removal ability is necessary.

The discussion above shows there is a correlation between the thought for comparing the targets and those three abilities that compose abstraction. Thus, it can be said that learning drawing is a way of developing three abilities, which leads to acquire abstraction ability.

Figure 4 summarises the correspondence between drawing, semiotics, the three abilities and each side.

	Drawing	Semiotics	Abstraction ability
side A	Observation and comparison of motifs and drawings	Stands for (an imputed relation)	bird's-eye view ability
side B	Observation and comparison of motifs and images	Refers to (other causal relations)	insight ability
side C	Observation and comparison of images and drawings	Symbolizes (a causal relations)	removal ability

Figure 4. List of drawing, semiotics and abstraction ability.

4 DRAWING EDUCATION PROGRAMME

4.1 Outline of drawing education programme

Drawing education today tends to specialise in developing drawing skills as part of art and design education. Representation techniques are essential to verify their observation skill. The art of representation is essential to ascertain the presence of the ability to see and its level. However, we have devised and implemented a drawing education programme that is not biased towards drawing skills, but is focused on cultivating the observation ability, with the aim of acquiring the three abilities: insight, removal and bird's-eye view.

The details of the programme are the same as those for art and design drawing education: the students observe the motifs to be drawn, and express them on B4 size drawing paper using pencils of five levels of hardness (2B to 2H) and shading. The motifs should be selected from natural objects such as

vegetables and fruit, and of a size that fits within the size of the drawing paper, specifically, bell peppers, bananas, etc.

The course is conducted over three 90-minute days, each day concentrating on one of the three sub-abilities of abstraction ability.

Day 1: Bird's eye view sub-ability

In order to get a feel for what is to come, the participants are first given 60 minutes to draw a motif in pencil without any guidance, after which they are given a lecture on the bird's-eye view ability and put into practice.

The students are presented with various compositional variations of how the motif fits into the picture plane and how it should be inserted, and the intention and effect of each is explained to develop their awareness of composition. By letting them to think not only about the motifs but also about the margins, they develop an awareness of the entire drawing paper. Specifically by drawing a frame in the drawing paper, the margins, which until now have only been recognised as surplus paper, become the background of the motif and they become responsible for their own work.

Day 2: Insight sub-ability

Observation of the motif itself will be explained in terms of shape, weight, size and texture, and how to be aware of each of these. Specifically, a checklist of shape, weight, size and texture corresponding to the motif is provided, so that participants can break down the observation to each point of view and record it in order to be aware of how they feel and interpret the motif. By being conscious and aware of each of these, they can learn what to look for and how to see it. The methods of expression corresponding to each of these will also be presented.

Day 3: Removal sub-ability

Learns how to organise and prioritise information obtained from observations. To understand this effectively, the participants are given a set amount of time to draw, starting with three minutes, then shortening the time to 90, 60, 30, 15 and 10 seconds, and finally trying to recreate the motif in a very short time of three seconds, and considering what choices can be made to recreate the motif in the limited time. In this case, one type of pencil is used and the motif is the same.

The participants then have 60 minutes to draw the motifs, being aware of what they have learnt during the three days. At the end of each day, the drawings of all participants are lined up in front, so that everyone can have an opportunity to look at their own drawings objectively. This gives an opportunity to learn about other people's thoughts and perspectives.

4.2 Evaluation methods

In order to measure the improvement of the three drawing sub-abilities through the drawing education, the authors are considering three tests corresponding to each sub-abilities. In this paper, we will focus on insight ability and explain what test we applied.

The authors applied the mental rotation test, which is already established as a method. Figure 5 shows an example of a mental rotation test, where two objects must be selected from the right-hand side that are the same as the object on the left-hand side.
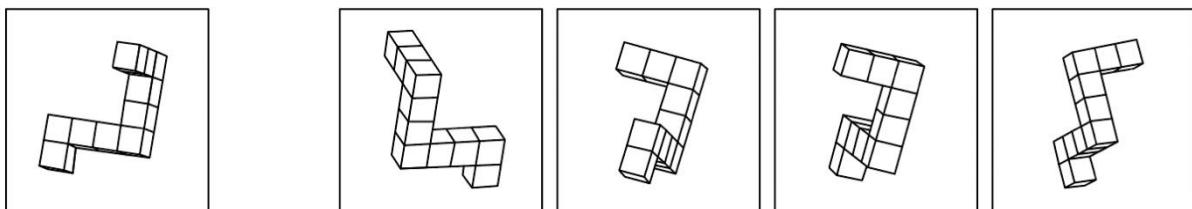

Figure 5. An example of mental rotation tests

The test follows the method used by Peters, M. et al. (1995) in which pairs of objects created by combining ten cubic blocks in three dimensions are shown to be judged whether they are the same object (Mental Rotation Test) the participants are asked to answer two sets of 12 questions, 24 questions in total, within a certain period of time. The same test was conducted both before and after the drawing program.

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The test requires the ability to transform, organise and reconstruct in the mind the information obtained from the observation of the object. Therefore, we believe this method in which examinees constantly imaging what it "would be" rather than just looking at the surface of an object is suitable for evaluating insight ability, which rates competency to deeply observe an object and infer invisible parts of it to perceive the essence of things.

4.3 Result

The drawing programme was conducted on 177 students from the Faculty of Business Administration who had not been given any specialised education in art or design, and mental rotation tests were conducted both before and after the programme. The 177 participants were given a pre-implementation test, a three-day drawing programme and a post-implementation test, each of which took place simultaneously in the same large lecture room, with a week's time between them. The mental rotation test was conducted according to the method specified by the producers. Valid data were available for 135 out of 177 participants. The invalid data are from students who have not completed the whole programme or have not taken either the pre- or post-test.

The average, median and mode of the test after the drawing education programme increased by 3.93 points, 5 points and 5 points respectively, compared to the pre-test. Five of the students whose scores had increased by more than 10 points were selected and interviewed to find out what factors they could think of that might have contributed to the increase in scores. As a result, they noted that they "became capable of seeing the whole object more easily" and "focused on finishing the whole task instead of trying to get everything perfectly right" which means they became aware of the points to look at by breaking down their observations by perspective and being aware of how they interpreted them that are linked to the drawing education program to develop insight mentioned earlier. Figure 6 compares test results.
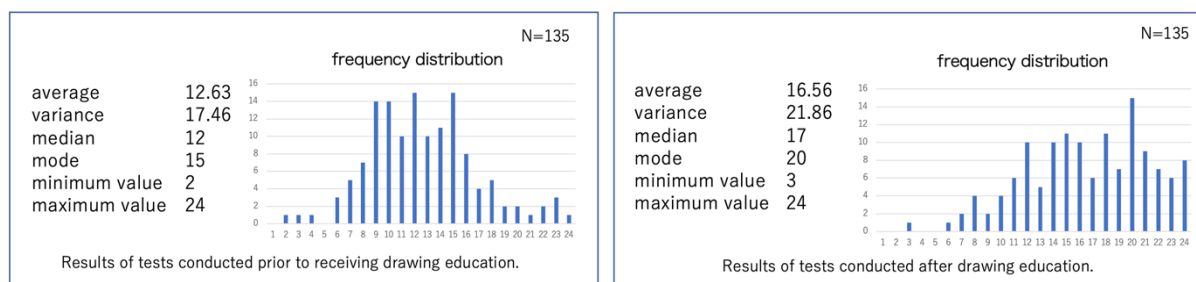

Figure 6. Comparison of test results

5   CONCLUSIONS

In this paper, the authors showed that drawing is effective in acquiring the abstraction ability necessary for practising design management. And the abstraction ability can be decomposed into three sub-abilities, insight ability, removal ability and bird's eye view ability. The evaluation how insight abilities was enhanced by our drawing education programme was also carried out using Mental Rotation Test that enable objective assessment.

The result of the test revealed that the devised drawing education programme is effective in developing one of the three sub-abilities, insight ability.

In the future, we plan to verify how much difference there is between groups who have given the drawing education programme and those who have not, and to examine the effectiveness of a test to measure the other two sub-abilities of abstraction ability, other than insight ability.

Although it is effective for people who are not involved in art and design to actually draw and create things in order to learn the thinking and processes of designers, the significance of practising it will be limited if the educational programme is biased towards expressive methods and techniques. Moreover, if the evaluation methods are subjective and sensory, it is difficult to judge the results. Therefore, in order to develop drawing education, which is regarded as a field of painting and art, in a wide range of fields, it is essential to have an educational programme that focuses on the universality of the effects of learning drawing and a quantitative and reproducible evaluation method. The drawing

education programme devised by this research and its quantitative criteria will contribute to make practical education in the field of art widely known to the public.

ACKNOWLEDGMENTS

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