margarida gaspar de matos

OBSERVING CHILDREN DRAWINGS

a methodology to observe pictorial productions

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to Eduardo, Tania and Mariana

to my parents

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Three years ago, when I was examining a sample of primary school chil - dren drawings, I had to leave the room for a few minutes. When I came back my daughters and two friends were examining the drawings and bet - ting if they would guess the producers gender and grade.

After a first (angry) moment I became curious about their theories . What kind of information about the picture producer they thought they could extract from looking at their pictures?

They were right most of the times and I tried to enquire after their reasons. Answers were vague but sure:

" 4^{th} grade wouldn't draw that way " . (" which way?")
" That way! (pointing vaguely around) "
" boys wouldn't colour it that way "
" surely a girl made it "
" boys always draw fireplanes "
" girls are more careful "

There should be something about the way children solve a " draw a draw- ing " problem that could give informations about the producers.

Was it the representation strategies? or the colours? or the subject? or a combined effect? or else?

I began thinking about an observation methodology of relevant factors in children drawings. I discussed with Visual Art teachers, reviewed the

literature, enquired Primary School teachers, observed different sam - ples of children drawings.

Afterwards we tried to apply that methodology . For that purpose we collected a small sample of primary school first and fourth grades.

My children required to guess producers characteristics , reached with that new sample 89% and 85% right bets for gender, and 85% and 82% for grade; 85% by mutual agreement in what gender was concerned, and 82% in what grade was concerned; 75% and 71% of right bets in both gender and grade; 75% by mutual agreement. The reasons they gave to justify their choices will be detailed later.

We applied our methodology of observation to those drawings and some results, which must be looked into with some caution will be presented later.

PART I

1. INTRODUCTION

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PART I

1. INTRODUCTION

1.1. STATEMENT OF THE PROBLEM

" It is useless to look without seeing "
Goethe

The purpose of the research is to delineate a methodology to observe children drawings, that may allow the observer to be aware of how chil - dren solve problems presented in representing objects, actions, ideas , qualities.

We will use that methodology to observe 28 drawings made by primary school children. We intended to observe What children actually draw , and How,and then looking for similitudes and contrasts between younger and older children, boys and girls.

We avoided the question "Why?.." (the child draws that....) , that usually gives rise to some divergences between different authors , Stern (w.d.), Lowenfeldt (1965), Arnheim (1975) , Kellogg (1969) , Luquet (1927), Goodnow (1977) e.g.
Our theoretical framework will not include psychoanalytical perspectives

1.2. RELEVANCE OF THE STUDY

Psychoanalytical oriented authors consider children drawings as a pro -

jection of inner world and conflits. Other authors not following that approach, also differ in the relative importance attributed to visual processing, cognitive structures, motor control performance, envolved in drawing productions.

All those authors however seem to agree that drawing activity envolves complex processes and is much more than a question of time occupation or " complementary activity ". Can we face children pictorial productios in other terms than the aestetical qualities, or the adequacy of the pro - ducts in what concerns their similitude to the reality?

Some authors (Vygotsky in Meadows 1986; Klee in Roux 1979) referred an analogy between drawing and writing processes, considering writing as a special sort of drawind which represents language. Freeman (in Meadows op. cit.) suggests that the lack of motor control, which may be improved by praticing, leads to the same sort of errors and attempts at solutions both in writing and in drawings.

In our primary schools children are often asked to draw, mostly as a complementary activity: to illustrate a text or a school trip; or simply to keep a group of children occupied when the teacher is not available. Drawings are mostly seen in the terms of their aestetical qualities : is the drawing " pretty ", " well done " ? Sometimes children are taught how to draw something " correctly", how to colour it " properly " and with the " right " colours, by means of imitating the teacher or following his instructions.

We thought that if we could have a methodology to observe relevant factors in children drawings, this might help as a guide to increase a more rele-

vant pratice in primary school, and teachers wider interest.

The point would be how to recognize children individual problems, and how to give them cues that may help to solve representation problems , without interfering with their individual way of creating. How could teachers help pupils to improve their productions without homogenising class drawings , lowering children originality and pleasure?

For the moment we will not even try to answer those questions, that we saw discussed in Arnheim (1971), Field (1970), Eisner (1972) Dewey (1958), Green (1978) e.g.

Our methodology could help as a guide to understand the complexity of children pictorial productions.

1.3. INITIAL QUESTIONS

We will try to answer two main questions. The first one concerns the methodology to observe the drawings:

What is important to notice when observing children drawings?
(What factors? How to note them?)

We used Luquet (op. cit.), Arnheim (op. cit.) and Goodnow (op. cit.) literature references as our main source of theoretical information.

Two Visual Art teachers collaborated in the sucessive versions of an observation grid, issued from the analysis of three factors that we considered important:

How the child draws (representation stategies)

What the child draws (subject)

How the child colours (colour)

We enquired primary school children and primary school teachers for their theories about representation products and producers. We viewed several samples of primary pupils drawings, collected for other studies.

Our second main question was:

(How) do children differ in what their pictorial productions are concerned?

We used the methodology of observation in a sample of 28 children drawings, using two independent observers. Sample selection and data collection procedures will be detailed later. For the moment we will refer that this preliminary study was limited to 14 pupils from the first grade and 14 pupils from the fourth grade, half boys and half girls, in such a way that for each grade age difference would not be superior to eleven months.

Those 28 children were referred by their teachers as having an average/ good socio-economic status, an average / good academic achievement , no important emotional or medical problem. The reasons for that sampling choice will be developed later.

In those drawings we considered the differences in colour, representa - tion strategies and subject , in what gender and grade were concerned. We considered some regularities in those factors characteristics .

When presenting some results we will keep in mind that the observation

methodology, while being ellaborated having in mind children from 6 to 12 12 years old, has only been applied in a narrow population of " average" pupils, from the first and fourth grade, in a small place in the suburbs of a town, in the center of Portugal, in February 1987, under the conditions we will refer.

The results obtained are not (yet) an important extention of what has been done in the field till now. Generalisations envolve great risks. In what concerns ourselves, our results are mostly a tool for future work. We learnt a lot from our failures and sucesses and from the literature review, all our discussions and drawings observation. This was perhaps the most important consequence of the present work.

PART II

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PART II

1. LITERATURE REVIEW

1.1. PERCEIVING, PROCESSING, PRODUCING

Eisner (op. cit.) defends that only a deep study of Art and its History allows a full understanding of art effects on human experience. Indeed, analogies are often made between children art, primitive people art , or in general common situations where a person is for the first time re - quested to represent an object. (Arnheim op. cit.). In the same way some similitudes were found between some processes used by children and processes used by Art Masters in several forms of visual art productions. (Gombrich 1960, 1978; Arnheim op. cit. e.g.) (picture 1)

Different reasons were suggested by different authors in order to explain factors envolved in pictorial production.

To Meier (1939 in Eisner op. cit.) artistic ability depends on enheri- ted factors such as motor skills , perseverance, intelligence as well as on environement influences that may increase perceptual ability, creati - vity and value judgements. To Lowenfeld (1969) every child has a po tential artistic ability which can be increased or decreased due to en- vironmental influences. To McFee (in Eisner op. cit.) artistic ability depends on factors such as readiness (physical, intellectual and perce- ptual), psychological setting (is it a rewarding or a threatening ex- perience?), information processing ability (perception organization , understanding), and design skills (creative ability, ability to use

the graphic medium, design ability).

It is broadly accepted that at first children drawings are not so similar to real objects.

Arnheim (op. cit.) suggests that young children lack of technical capacity, motor control, and so they produce the easiest shapes, also easier to draw (circles, ovals,then straight lines) . This fact would not mean for itself either that their cognitive processes would identify complex shapes with simplified ones or that children were not motivated or lacked of observation skills, but simply that they represent the relevant aspects of the structure of an object, as far as their technical capacities allow .

According to other authors (Luquet op. cit. ; Piaget 1975), children would not represent what they see, but what they know about a particular object or situation. That would be the reason why they use transparencies (picture 4 A; picture 6 A, B, C, D) e.g..To Piaget this pattern reflects a general aspect of children cognitive development. Children are not able to use an overall point of reference for all units using one unit as a reference for the next , for instance they draw trees at 90 degrees to a line that stands for a pad, or they draw chimneys at 90 degrees to a line that stands for a roof. (picture 7 B)

Drawings were referred as an indicator of intellectual ability by other authors (Goodenough 1926 e.g.) but that hypothesis was strongly questionable (Kellog op. cit. ; Chabrol 1987; Medinnus, Bobitt, Hulett in Eisner op. cit. , Arnheim op. cit.)

Arnheim defends that both children and primitive people see much more than what they draw. As well as visual artists they do not intend to take

photos when they draw. An oversimplyfied drawing can fill all the re - quests, depending on their objectives. (picture 2 A; D; picture A, B,C).

For instance the circle, by which children represent a head, is not obviously representing the real shape of a head. Nevertheless this pattern was considered adequate to suit the general visual roundness, perceived as a general structural characteristic of the head (picture 1 B, C). In the same way verticality seems to be a structural characteristic of human legs (picture 3 B)and symmetry a structural characteristic of human body. (picture 2, picture 3 B).(Arnheim in Eisner op. cit.).

To Meumann (in Goodenough op. cit.) younger children lack of analytical observation, eye-hand coordination, fine movements control. That would be the reason why they draw " imperfect " objects. That lack of accuracy goes on disturbing during drawing activity since children mental images include all the (" imperfect ") objects already drawn. Meumann also referred that children do not understand tridimentional space, and think that all what exists must be seen in a drawing.

To Arnheim the point is that we all have a creative individual way of representing the objects . When we, children or not, look at the world around, we apprehend global structural characteristics of the reality, whose configuration is rather undeterminated.That is, we draw equivalents of real objects.

Equivalents learning envolve different factors that include cultural ones. (picture 2). In History of Art (Gombrich op. cit.) we will notice that what is selected as a structural characteristic and what is excluded or considered additional vary from a period to another, from a culture to another.Aesthetical judgements are in part culturally issued as well .

(Marcuse 1977; Dorfles 1974).

For a certain period and for a certain culture, equivalents learning is something we all do during the whole period of our lifes - learning that something (a shape, a pattern, a colour) can represent something else and that both can mean the same. (Goodnow op. cit.)

In the same way,colours are given by general impressions and children learn equivalents that represent the relevant characteristics of the model. The graphic mediums available also make a difference since their properties are different thus producing different representation problems and products (picture 4 A, B) (Arnheim op. cit. ; Alschule and Hattwick in Eisner op. cit.; Eisner op. cit.)

Stern (op. cit.) considers drawings as individual attempts to explore and understand the world around. Drawings would express that way children inner sensations and conflits. The subject choice and the produced patterns would have to do with the way things affect that particular child in that particular moment and context.

That is also the reason why drawings were often used as a way to investigate children personality (Koch 1958; Corman 1967; Machover 1949; Biedma 1955; Aubin w.d.) . That position was questionable to other authors (e.g Harris in Eisner op. cit. ; Chabrol op. cit.) . MacCole (1985) and Fonseca (1976) used drawings to evaluate improvements due to a therapeutical intervention (e.g.).

To Alschuler and Hattwick (in Eisner op. cit.) children use different graphic mediums according to their produtions objectives, they prefer pencils to express their ideas, to communicate them to others, to represent

objects while they prefer brush or finger painting to express their feelings. Those authors defend that only when children intend to express their ideas or to represent objects, they are concerned with others approval for their drawings .

To Luquet (op. cit.) children draw for various reasons - someone else's suggestion, something they saw, something they experienced, something that interested them. Sometimes they enjoy themselves by repeating patterns that they found sucessful or specially decorative.

To Arnheim as well as for Piaget children initially draw for the pleasure of moving a graphic medium they handle with their own body,in order to see its effects on a surface which becomes animated by those lines - the pleasure of moving and the pleasure to obtain effects by moving.

Sometimes children give a different meaning to their drawings from what they had previously in mind. This has to do, according to Luquet, to their fortuitous similarity to known objects. Objects more frequently drawn present a higher similitude to real ones since their representations are everytime revised, transformed : children frequently add new details and exclude some others considered irrelevant from then on.

Luquet defends that that is because the drawing of an object is never a mere copy, but an individual reconstruction issued from what Luquet called " internal model ". This " internal model " is the result of an individual ellaboration in which a distinction is made between important and secondary parts of an object, which can be revised every new time.

In what objects representation is concerned Luquet spoke about " internal model " where Arnheim would speak about equivalents learning, the former

stressing the cognitive reconstruction where the latter stresses the cognition relevance (structural characteristics),perceptually based.

Criteria for considering an object or part of it important or not are not clear. To Luquet sometimes it has to do with functional aspects - what is drawn is what has a function; some other times it has to do with its attractiveness, its decorative effect. Arnheim stresses the perceptual equivalence within the motor capacity available . Eisner refers perceptual aspects (both visual and intellectual) , creative aspects (creating equivalents) and production aspects that include motor capacity.

To Kellog (op. cit.) a critical aspect in children drawings is their search for order and balance, being previous attempts and solutions all the time improved by new solutions (picture 3; picture 22; picture 23; picture 24).

As far as children interest in colours is concerned, Luquet defends that if the colour of an object does not matter it is used with a decorative function and apparently can be anyone . When colour is important to the objects characterisation it is used in a realistic way (similar to the real colour of the object).

Colour can be used to draw lines, to add details, to colour a surface. Sometimes colour effect is obtained by a set of coloured lines in the interior of a surface. This effect can be intentional (Van Gogh in Ghiselin 1952; Monet in Gombrich op.cit.), or due to the lack of motor skills controlling the size and weight of the hand-arm movement e.g. Anyhow those lines tend to be perceived as a whole homogeneous surface.

1.2. CHILDREN DRAWINGS DEVELOPMENT

According both to Arnheim and Piaget, the first lines children draw do not mean to represent anything.They intend to experiment limbs movement and the satisfaction of covering a surface with lines. Lines are defined by the anathomical way arms are build and thus can move,as well as by children humour and temperament. This last aspect was largely studied specially by psychoanalytical approaches.

Circles

It is commonly agreed that the first attempts to draw lines result as curvilinear movements' graphic expression. Since we intended to focus our attention on strategies used by primary school children we will not say much about this initial period. We will only refer that Gestalt views teach us that at first children draw circles because of the simplicity of circular patterns. The circle is the easiest visual pattern, a " good " shape, symmetrical in all directions. Distant objects or objects globally perceived are seen as circular as well.

On the other hand the way limbs articulate favorises circular movements : the arm can go round commanded by shoulder movements. Afterwards elbow, wrist and fingers movements become more coordinate increasing fine movements ability.

To Arnheim the circle is the first organised shape issued from initial desorganised lines. As soon as children close those lines, transforming an unidimentional line into a bidimentional surface they find that that way they are able to represent objects.

When at first children draw circles, the shape is not yet differentiate, that is circles do not represent " roundness " but " a thing ", a contrast between the basis and the shape itself. Afterwards children develop that circle in two directions:
combining various circles in a more complex pattern
drawing straight lines that cross the initial circle, or allonged shapes from that central circle,or making concentrical circles.
By that time children are able to represent various objects from these basic structure (picture 3 - simplest units).

Straight lines - vertical / horizontal

Straight lines are visually simple although technically very difficult to make. They introduce directionality. The first direction relationship between two straight lines is the square angle, and it represents all the angular relationships since it is the easiest pattern, a symmetrical one, and the basis of our space conception.

Berman (1976 in Barnard and Freeman 1982) referred as well that vertical and horizontal lines are easier for children, who seem to show a prefe - rence for verticals, according to Freeman (in Barnard and Freeman op.cit) (picture 3 B; picture 4 B; picture 23 A,D).

In History of Art we can see archaïque representations which look rigid by the use of square angles, since obliquity was not known. As it happens nowadays with children, the use of obliquity appeared late in Art History after a period when only vertical and horizontal structures were produced. (picture 15; picture 23). Intentional obliquity is powerfuly dy - namic since it is always perceived as a deviation. Even when any shape in

a drawing seems to obey to vertical-horizontal structures, all of them are perceived as obliquous or deviations from the formers .

Obliquity

Obliquity is then used in order to obtain movement and tridimentionality effects, and repair the lack of flexibility of previous representations. The use of obliquity seems to envolve a refined visual / cognitive ellaboration since in every day life, in frequent situations envolving objects design, straight lines and square angles are quite a tradition hard to change, even when basic principles of ergonomics teach us that particular objects were to be redesigned using obliquous lines (Bonsiepe 1978 , Pevsner 1968).

That preference to vertical-horizontal structures seems to have, at least in cats, a neurological basis (Arnheim op. cit.)

" Realism "

As we have seen before, for simpler and more frequent objects, there is a time when drawings begin to show some similitude to real objects. According to Luquet (op. cit.) sometimes children make particular patterns purely by chance, which are reproduced afterwards with some additional details or transformations,in order to increase their similitude to real ones. (picture 3; picture 22; picture 23; picture 24).

Plastic artists (Klee in Gombrich op. cit. e.g.) use this process of drawing lines and patterns looking for balanced patterns,as one of the ways to create suitable shapes suggesting objects, as well as children,

except that for the formers this is an intentional exercise.

To Arnheim , as we have referred those differences between real objects and drawings occur because children do not intend to take " photos " of the objects, but to draw suitable equivalents. Secondly children must develop motor control in order to be able to direct his graphic movements, and their perceptual capacities and cognitive processes become more refined and ellaborated till they are able to perceive and understand the objects as integrated units, while being able to differentiate the elements which are the parts of those units. That way children create patterns first by means of separated elements - simple and defined shapes; afterwards quite complex patterns are built from those initial units; later they will understand the object as a unit ,frequently represented in their drawings by means of a continuous line that stands for that unit border. (picture 3).

Goodnow referred that the available space is an important factor that produces problems which depend upon the sequence of the register. That is,if children do not make a previous plan of all the units they intend to draw, then the first units drawn may determine what else can be included. After drawing two arms too close to each other (e.g.) the body had to be that thin (picture 5 A); after drawing the house and the car a person was added (picture 8 B) ; after drawing all the elements on the ground a few elements were added " in the air ", and the solution found was to put a pair of wings in all " flying" elements .

To Arnheim those space occupation problems are provoqued by what he called " local solutions " - children solve representation problems, one at a time. Besides,equivalent creation request such a big effort that chil-

dren are not able to preview solutions for the following representations, in order to relate each element to the others in a same drawing.

When children copy other people drawings, their task become much easier. It envolves at least one already solved problem: the bidimentional representation of a tridimentional object (Wong 1985; Arnheim op. cit.)

The so-called realism, that is the similitude between what is drawn and real objects has different characteristics in children and adults. For a non expert adult a drawing in order to be similar to a real object, must reproduce all the details that can be seen from one single point of reference. Size, distance and volume of the various elements must be respected. On the opposite for children each detail or element must be represented in the most characteristic way. They may draw elements unseen from a particular point of view (picture 4 A; picture 6 A, B, C, D) . They may use each element as a point of reference for the next (picture 7 A, B, C, D, E, F). They may desrespect sizes (picture 8 B). Sometimes they include the object name, or other words (picture 21; picture 14 B; picture 10 A). They may, as Piaget (op. cit.) and Bord and coll(1987) suggested anthropomorphize some elements.

According to Luquet (op. cit.), later on children begin to realise that their solutions contrast with adults' in what objects representation is concerned; photos are not similar either,they notice as well ; and then, perspective being a complex process even for intelligent adults without a graphic culture, but in the other hand children being any longer happy with their previous solutions, they frequently lose their interest and pleasure in drawing. Often they say they are not able, or that they are not gifted, or simply that they think drawing activity is boring .

1.3. REPRESENTATION STRATEGIES

1.3.1. TRIDIMENTIONALITY EFFECTS

Superposition (picture 5)

Children create their own representation processes, some of them quite complex, by which they stress the elements they think are important. To Luquet, the simplest of those processes is drawing each of the elements independently from each other, in such a way that none of those elements will hide the other, not even partially (picture 5 A, B, C, D).

Superposition solutions are not common (picture 5 E, F),actually they are almost only used by graphically mature adults.

Arnheim defines superposition as a quite frequent effect in reality which consist of hidding some units in relation to a reference point and consequently obtaining a tridimentional appearence on the space represented or defined by those units. As we can see (picture 5 E, F, G, H) when one of the elements hides a part of the other, they are both perceived as a single unit and the plastic effect is considerable.

Transparency (picture 4 A; picture 6)

Luquet defined transparency as the representation of elements that actually could not be seen from a certain point of view, unless the elements between that object and the observer were transparent, which would not be the case. Goodnow considers these X Rays drawings as the result of lack of a plan of register as we have referred.

Perceptual transparency was also used in other cultures (picture 6 E) and by plastic artists (picture 6 F) in order to represent something considered important . Plastic artists can use it as an intentional exercise in order to obtain different patterns visually suggestive.

Planification (picture 7; picture 14 A, B

Luquet defined planification as the representation of the object as projected in the ground, making a flat representation of it. Sometimes those projections are visually possible, some other times several objects (or parts of objects) are planificated according to different plans which makes the results appear as twisted, and in reality impossible to be viewed from a single point of view . (Picture 7 A, E, are unusual but possible viewings ; picture 7 C, D, F, are actually impossible viewings from any single point of view.)

Using that process children often project the most significant aspects of the objects, or the factor they want to stress (picture 14 A, B). Probabily they also tend to represent the easiest shapes (views) of the objects.

Egyptiens used that process to evidentiate the factors that better suited their representation objectives (picture 7 I). In our centuary this process is considered as producing powerful plastic effects, being thus used intentionally (in Gombrich op. cit. ; Francastel 1956) (picture 7 G, H; picture 9 A, B).

Goodnow refers that this process can be the consequence of lack of a previous plan for the whole drawing.

That combined use of different viewings from different angles of the same object was quite adopted by Cubists: as we can see (picture 7) the bull head by Picasso represent several aspects of the object which are put together visually incompatible . That planned contradition was the solution adopted to represent all the visual concepts of a bull head , addictionally creating a tension since the observers try to solve that visual contradition when looking at it.

Deformation; Gradation (picture 10 ; picture 11)

According to Arnheim we would talk about deformation when vertical and horizontal lines are no longer parallel between them, seeming to converge, cirles become allonged, straight lines become curved (picture 10).

We would talk about gradation when a perceptual quality - a shape, a texture, a colour become weak, thinner or on the opposite stronger or larger. Children learn soon that when they draw an object bigger than another, if they have similar real sizes the former seem closer. (picture 10)

Deformation and gradation are quite sophisticated processes, connected with what is usually called perspective, whose main effects are, according to Luquet, that verticals remain verticals while horizontals become obliquous, thus square angles become more open or closed (picture 13 D), circles become ellipses (picture 10 A), objects size gets smaller as they are more distant (picture 11) . Colours can change in order to give perspective effects, as well as texture characteristics.

Lateral and Axonometric projections (picture 12; picture 13)

Lateral projection is not so frequent in younger children , according to Goodenough (op. cit.), but indeed once mastered avoids some of the representation problems raised by a frontal view, being thus quite popular in children drawings (picture 12).

Axonometric projection (picture 13 E, F) is a process where three sides of the same object are represented as converging in one vertex, the sides are obliquous to the observer plan but the lines that stand for those sides border are parallel two by two, while in perspective are obliquous.

Axonometric projection was a frequent process before " Renaissance " , when perspective laws were first discovered. Nowadays is often used in archictecture (Massironi 1982). Children rarely use it (picture 13 A, B). Even when they intend to represent more than one side of an object, they use more frequently other solutions (picture 13 C, D; picture 7 C).

Perspective effects were considered the most realistic since " Renaissance ". However plastic artists feel quite limitated by their use and prefer to use them in a free, non accurate way , as did for instance van Gogh, Césanne, Gauguin. Surrealists also used to manipulate space in order to obtain different effects, by using perpective contradictions (in Gombrich op. cit. ; Matisse 1972) (picture 14 C).

Children also obtain strange effects by using perspective contraditions, only they are not intentionally manipulating space but trying to solve problems raised by its representation. (picture 14 A, B).

According to Luquet and Piaget (op. cit.) only around 9 - 10 years old children are able to use some perspective effects. Only then they would be concerned about what they see (visual realism) instead of about

what they know about the objects (intellectual realism) . As we have referred,Arnheim would rather speak about they being able to give up local solutions, since equivalents representation was now easier, Goodnow would rather speaks about better previous planning skills.

1.3.2. MOVEMENT EFFECTS

Movement suggestion is also a fundamental effect in pictorial representations. Movement becomes apparent by suggesting a single intermediate position leaving the previous and posterior positions that would describe that movement to the observer imagination, (picture 16). If that suggestion is not sucessful objects are perceived as statics (picture 16 A, picture 23 A) .

It is a well known fact from History of Art (Arnheim op. cit.) that plastic artists used to draw horses galloping in such a position that movement and tension suggestion was maximised, in spite of that being an impossible position (picture 16 E). That impossibility was only discovered with the first photographs of horses galloping (picture 16 F) . Nevertheless Kandinsky prefer the former effect considering it the best in order to produce movement suggestion.

Obliquity

Obliquity, besides its tridimentionality effects, is also a common process to suggest movement (picture 15 D, E, F, G ; picture 22 H, I)

At first children do not use obliquity intentionally , their drawings sometimes look dynamic we could say " by chance ", since some lines

drawn happen to be obliquous. That fact may happen because of lack of motor control provoquing unexpected results that sometimes suit perfectly children intentions and are thus learnt and reproduced from then on in order to obtain the same effects. Younger children use more frequently curved lines which are quite sucessful producing movement effects (picture 8 A; picture 10 B, C; picture 17 A, B, C;). That effect was well known in Barroc archictecture and often used as well by Art Masters (picture 17 D).

Deformation (picture 10)

Arnheim defends that all sort of deformations give an appearence of tension or movement in drawings. Barroc artists besides prefering curved lines also frequently deformed shapes,in order to obtain effects opposite to those used before (during " Renaissance") where classic,accurate and straight shapes gave to the representations a static appearence .

Sharp shapes suggest movement or tension as well(picture 20).

Gradation (picture 19)

Another important dynamic effect is the sequence of images where sizes or the place of the elements change (picture 19). Incomplete shapes and patterns also suggest great tension or movement because they tend to be perceived as closed, finished or continued shapes (picture 18,). Those effects are frequent in Islamic art.

Opposite colours also keep a big attraction among themselves, resulting thus in a great dynamism. Impressionists as Monet, Sisley and Renoir e.g. and a bit later Pointillists as Seurat, Signac,used frequently those effects trying to represent the reality in a visual scientific way, since it was then known opposite colours contrast had a a scientific basis in sight physiology (Goethe ;Young in Pedrosa 1982).

1.4. COLOUR

Since we referred opposite colours we would like to add a few lines about the theories of colour. We review mostly Da Vinci (in Pedrosa op. cit.), Itten (1961), Küppers (1973) and Gerritsen (1975) . Althought the later two authors seem to be more adequate to colour as conceived nowadays, with the new technologies, we will refer mostly the former authours theories, since they were more important in our visual culture and education. Being the last two authors theories quite recent they would not be able as yet to produce educational and cultural influences in the way colours are perceived, or in the way colours are used in everyday life objects.

The main differences in those theories concern the authors assumption about the basic or primary colours, and their arguments defending their positions. Mostly they have to do with a later distinction between " pigment " colours and " light " colours which the two former authors did not refer.

Where Itten theory is concerned the pure colours were blue, yellow and red ; to Da Vinci the basic colours were blue , red, yellow, green (the air, the fire, the land and the sea respectively) with those colours Da

Vinci considered, all the colours in the nature could be obtained. Gerritsen introducesa difference between " pigments " whose pure colours would be yellow, cyan and mangenta; and " lights" whose pure colours would be blue, red, green.

Black was thus considered the mixture of all the colours (for pigments) or the absence of colour (for lights), since for lights white would be the mixture of all the colours.

That difference is not so relevant in the use of colour by children which apparently has more to do with colours available (mangenta for instance only recently was available in painting sets), and colour familiarity (blue, red, yellow, green seem to be till now the most used in communication design; they are always included in colour pencils boxes e.g.). Besides when drawing and painting children always use " pigments ", except for instance when they use software which allows them to paint directely in a screen by touching it.

To Itten,pure colours and their opposite (whose mixture is black) were the pairs blue-orange, red-green, yellow-violet. Each pure colour (or primary colour) has an opposite one which is the mixture of the two remaining pure colours , thus a secondary colour.

Itten based in the scientific knowledge about sight physiology, arguments that when we look at a colour our eyes become in need for its opposite, if the opposite is not available the eye can produce it itself. For instance the effect left by a red perception is not red but green, that process being valid for all the pairs of complementary (or opposite) colours. Each colour creates a tension that only finds a balance on its opposite .

That effect is also referred by Küppers and Gerritsen although they consider different pairs of colours. As we referred plastic artists use opposite colours effects intentionally since first Impressionists noticed that contrast relationship with human eye physiology (Klee 1980 e.g.).

The pair red-green is probably the most familiar (traffic lights , in nature - green plants with red flowers, vegetables,fruits e.g.)

Gerritsen made an important distinction between visual contrast and psychological contrast of pairs of colours, and referred the complexity of colour study in what symbolism and psychological effects are concerned. We will avoid here that subject, we also reviewed (Lüscher in Küppers op. cit. ; Pedrosa op. cit.), for being beyond the scope of this work.

We will however refer the psychological effect warm / cold which apparently is psysically and physiologically issued, according to Itten. To this author the opposite colours seem to be connected with a psychological effect warm / cold, although it depends on the colours around the intensity of that effect.

The use of black and brown between two contrastable colours creates a transition border that either elliminates / reduces the contrast , as it is the case with brown; or increases the strenght of each of the two colours , elliminating its contrast by creating a new one, that time with the border itself, as it is the case with black ; as " fauvistes " often did in their paintings (Pedrosa op. cit.) e.g.

According to Itten distant objects are seen as colder (blue, green, violet) and more closer objects are seen as warmer (red, yellow, orange), opposite colours are thus sometimes used to reach a distance effect .

Children often use primary colours and their opposite (Brenot 1987)but perhaps in the same way they initially draw the simplest and more familiar shapes: primary colours are the more simple , contrast between a primary colour and its opposite is the greatest , they are also the most common in everydays life, at least nowadays.

According to Luquet, younger children tend to use all the colours available, just for the pleasure of trying their effect on a piece of paper (or elsewhere), and they do not seem initially to concerned about colours being realistic or not, which obviously do not mean that they are not influenced by colours different popularity in everydays life.

1.5. PICTURES

In the following pages we present some pictures that we believe can il - lustrate what we meant elsewhere, better than words could do.

They are all primary school children productions that we have collected for the present and other studies. Pictures sources when different from those will be indicated in the last part of our References.

1 H is an non expert adult trial we included as well, to compare with a child solution (1 D) for the same representation problem

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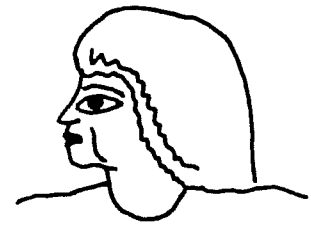

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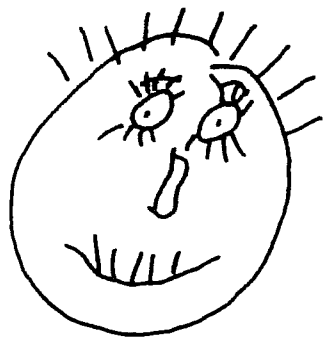

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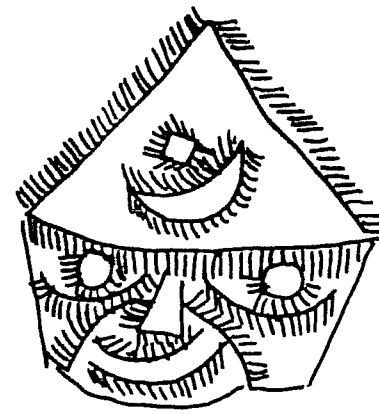

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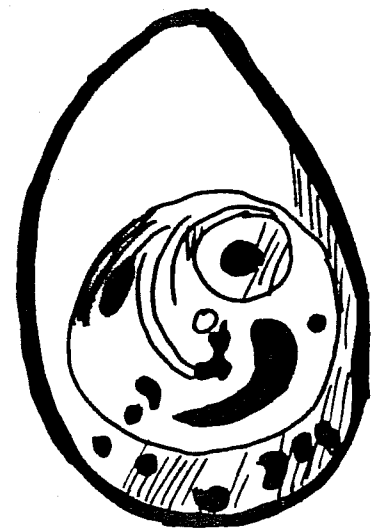

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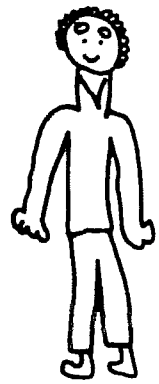

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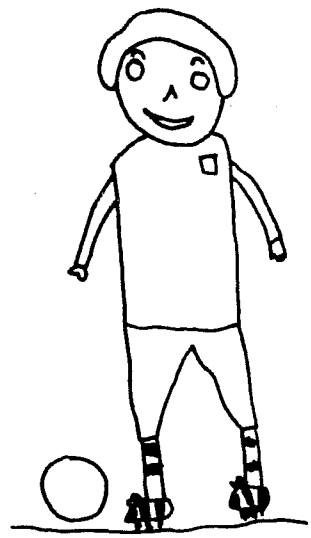

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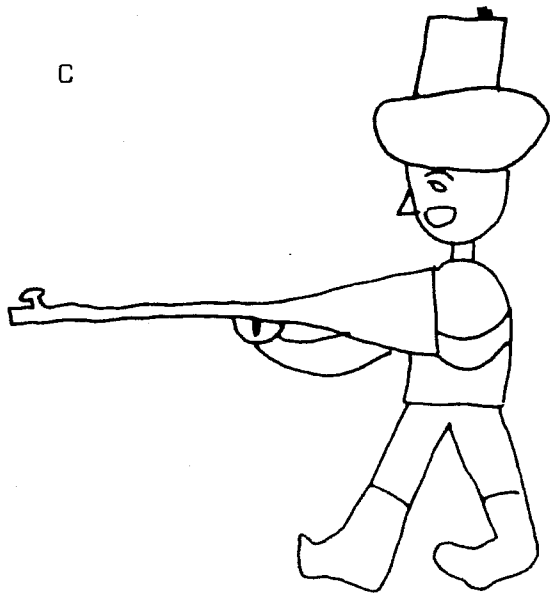

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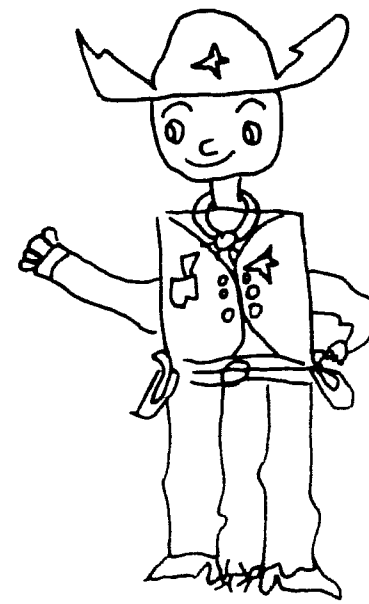

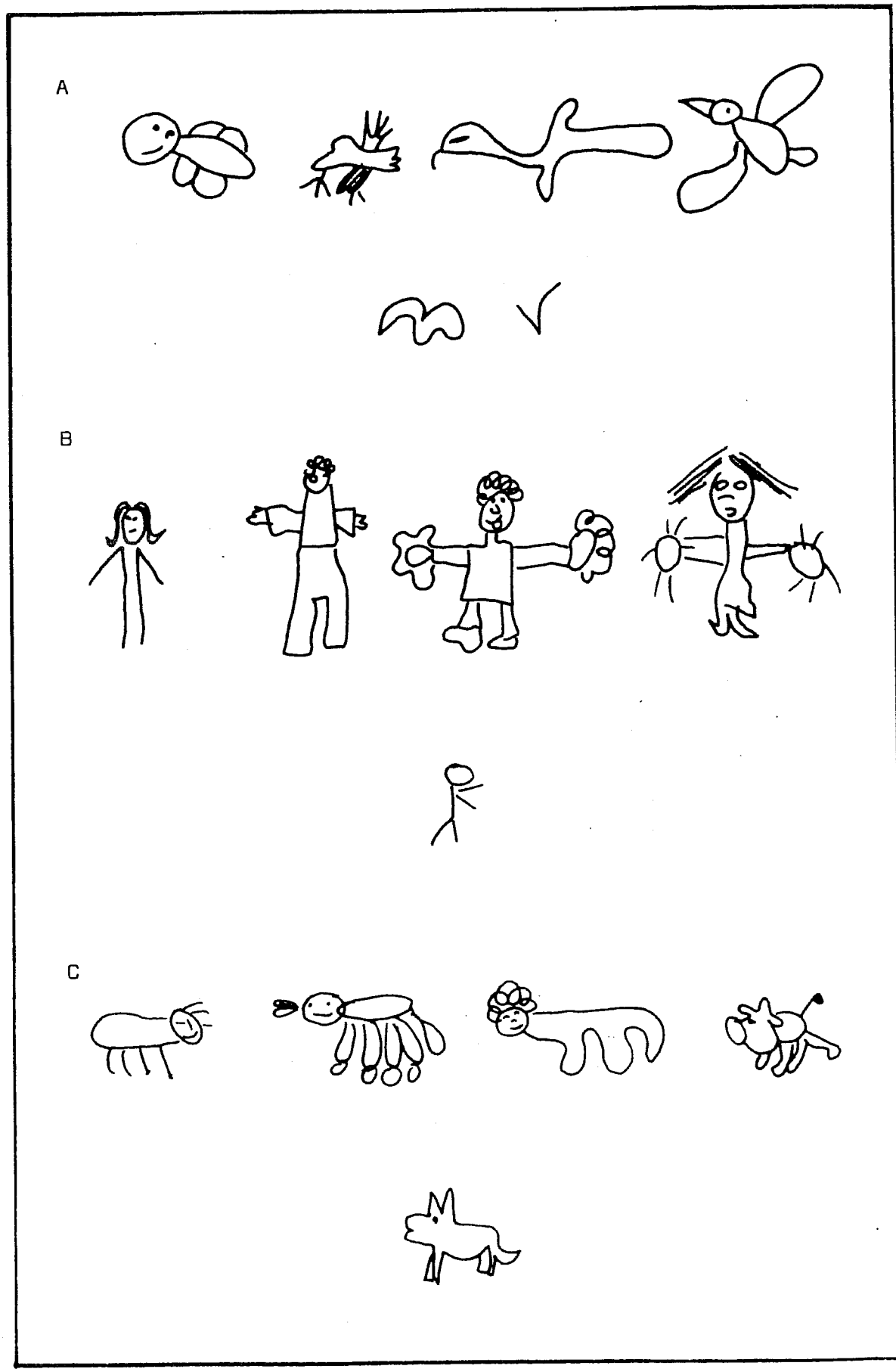
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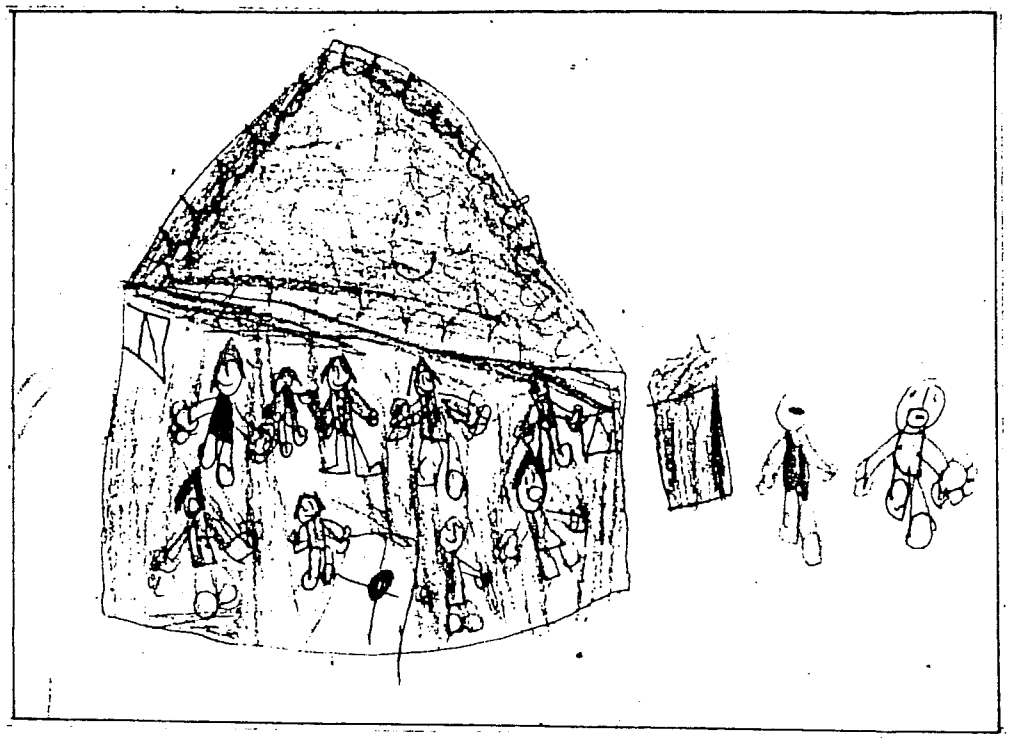

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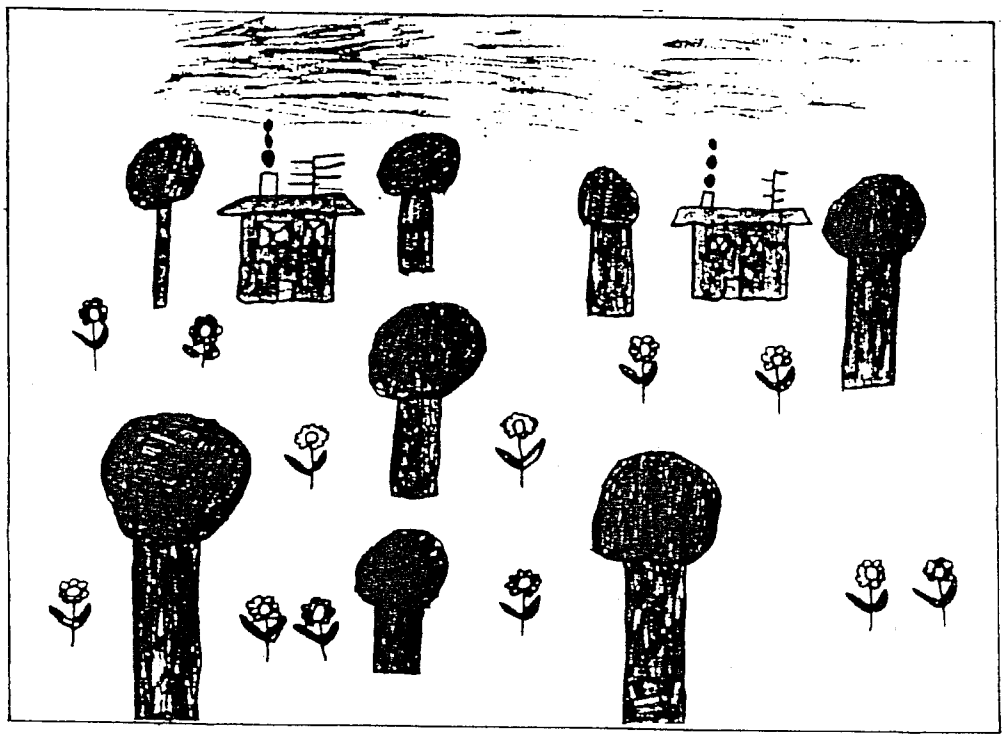

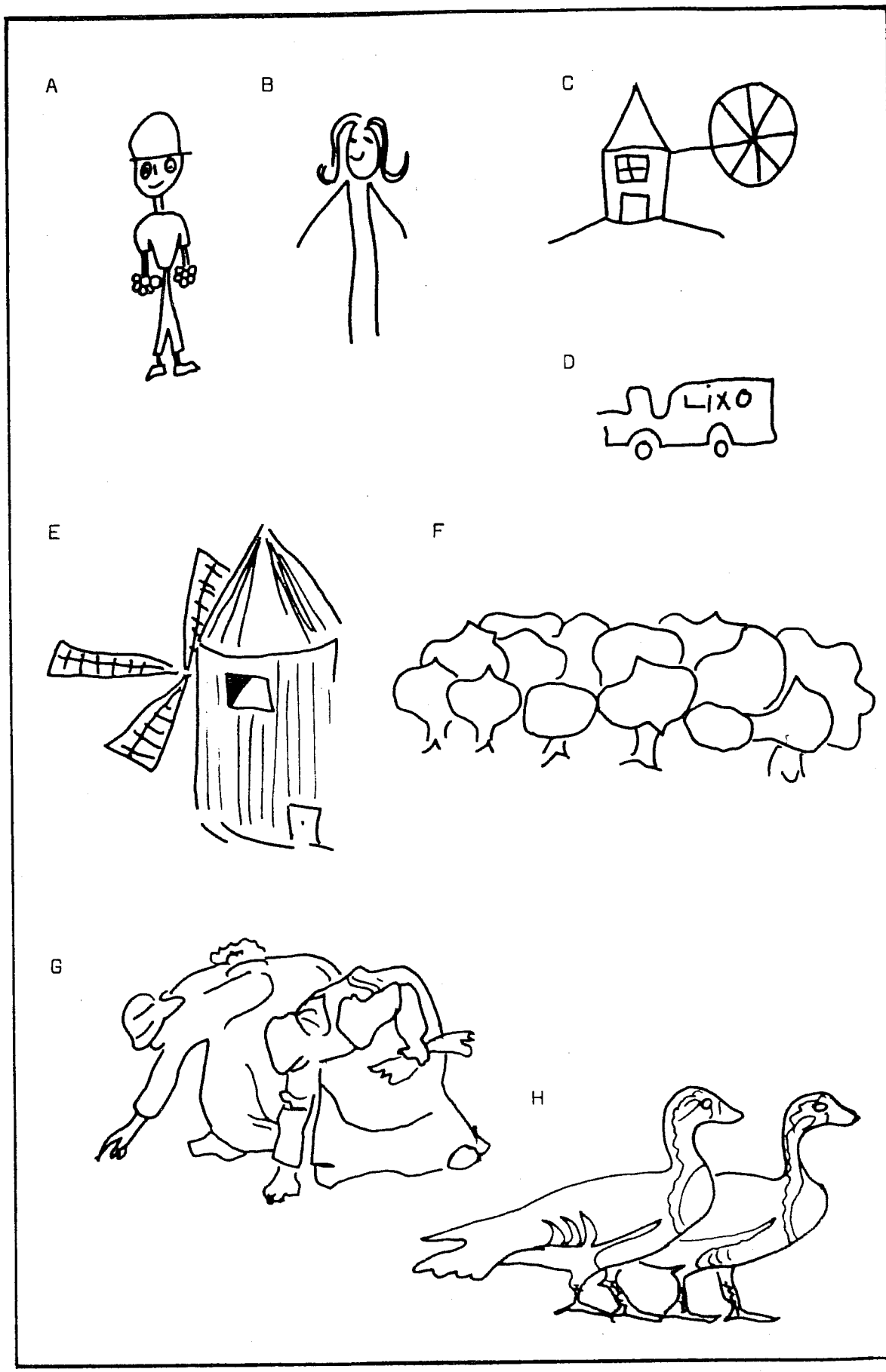
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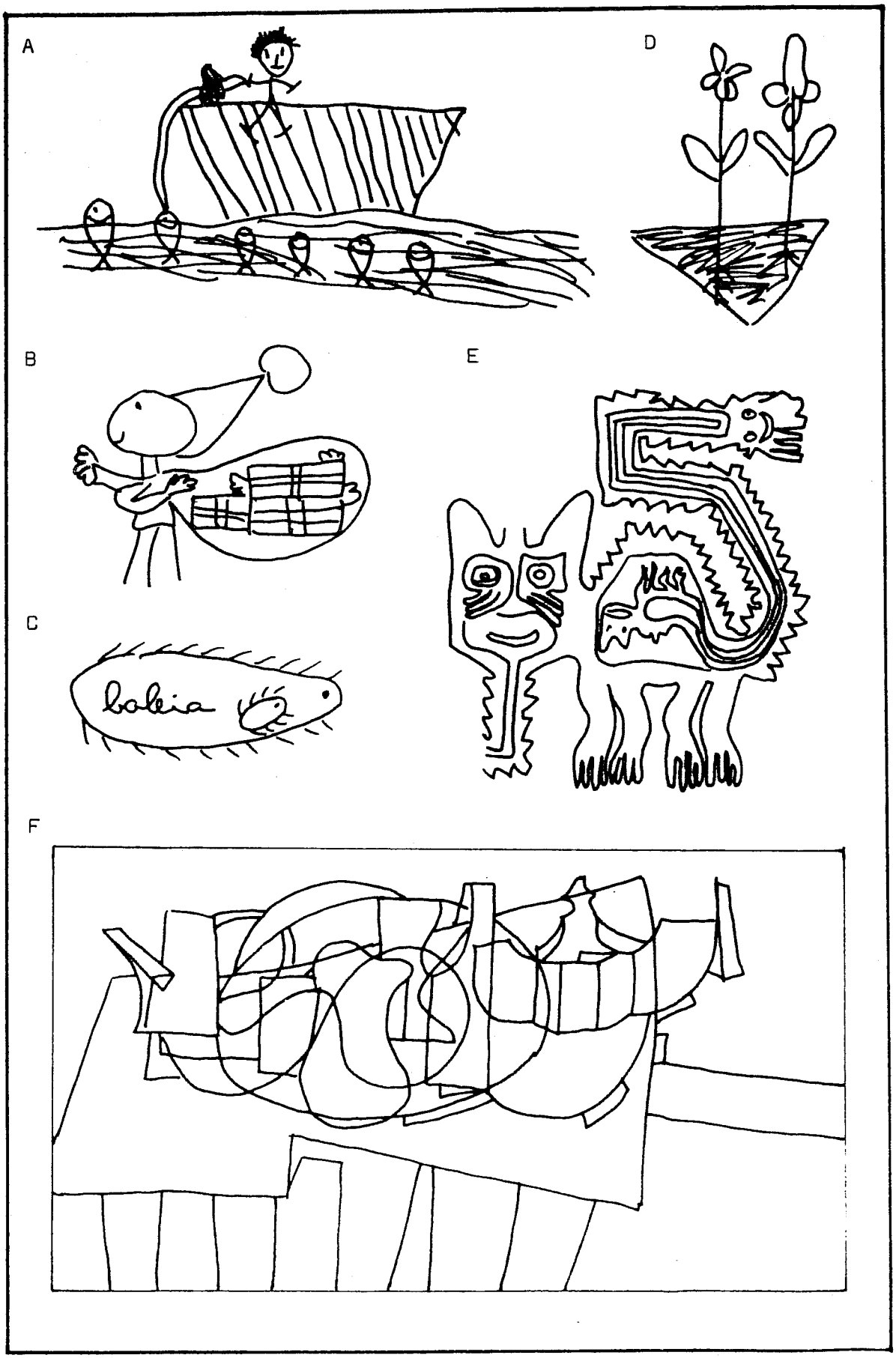
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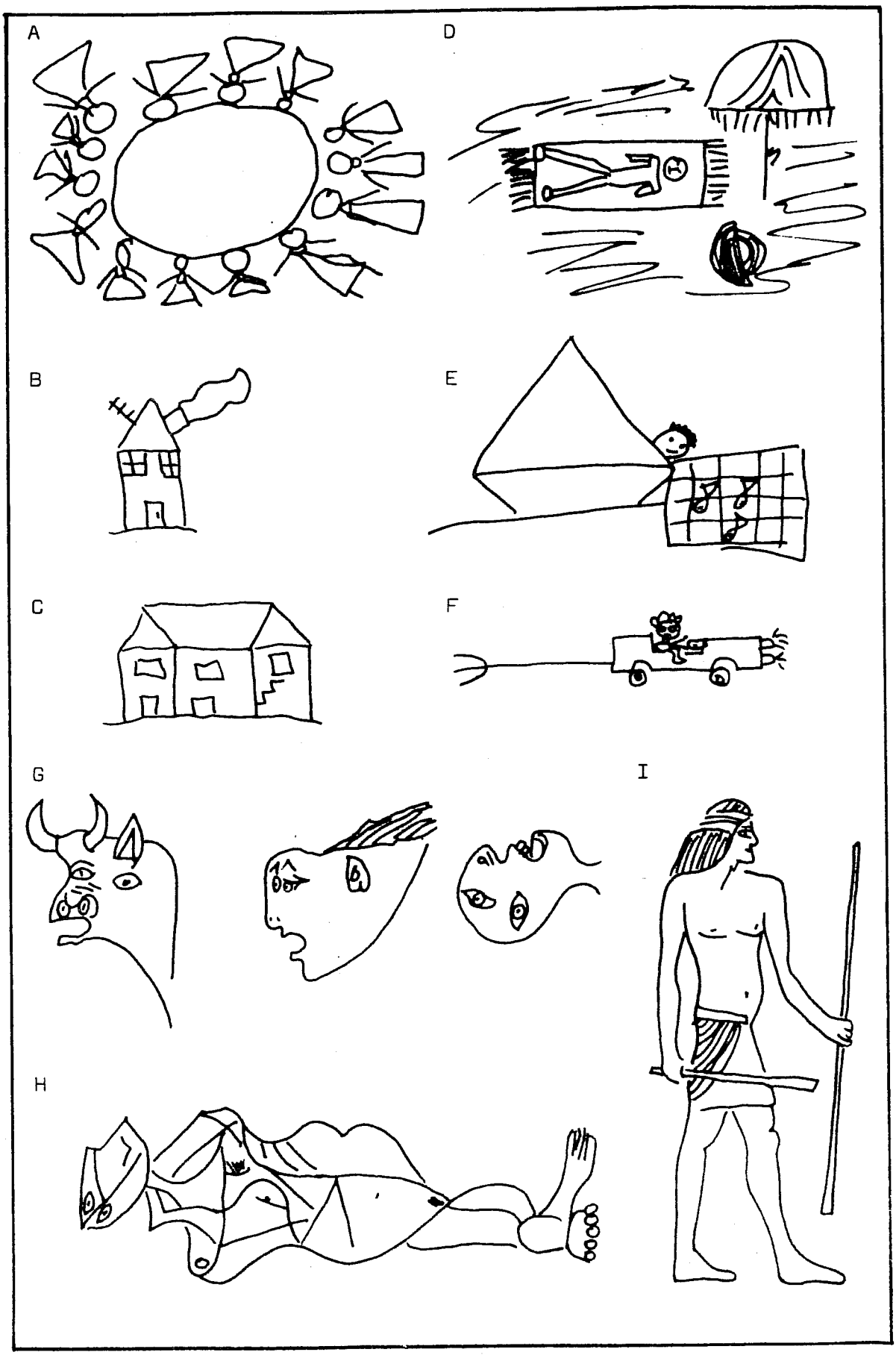
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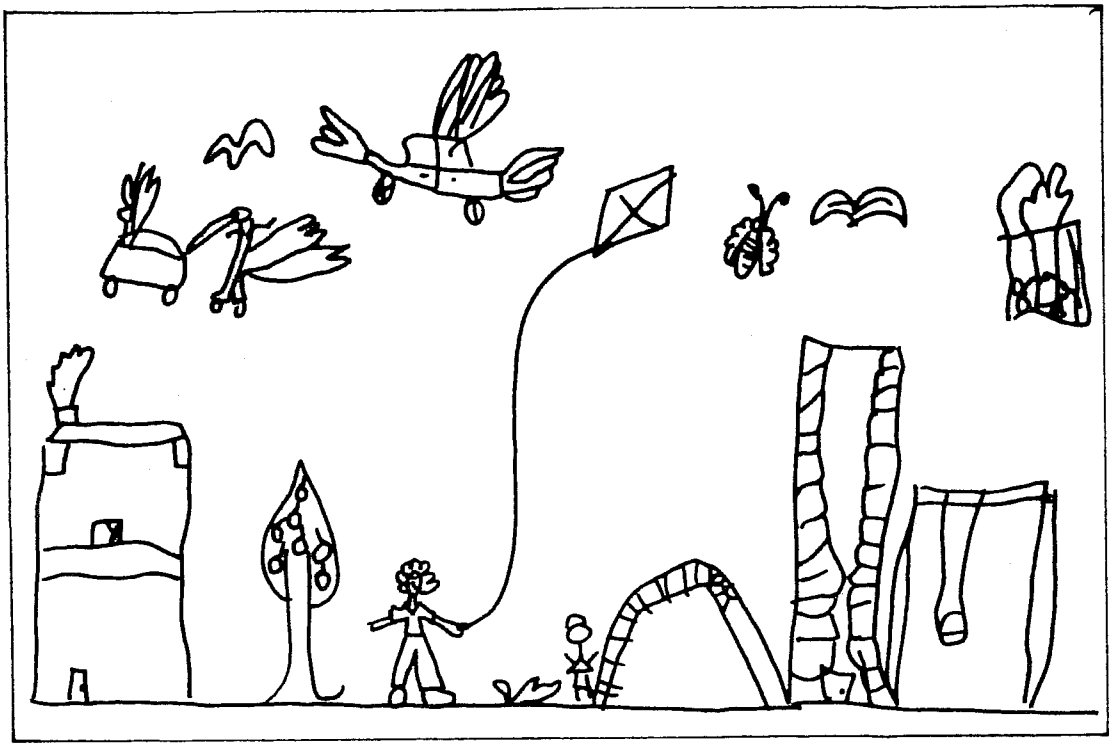

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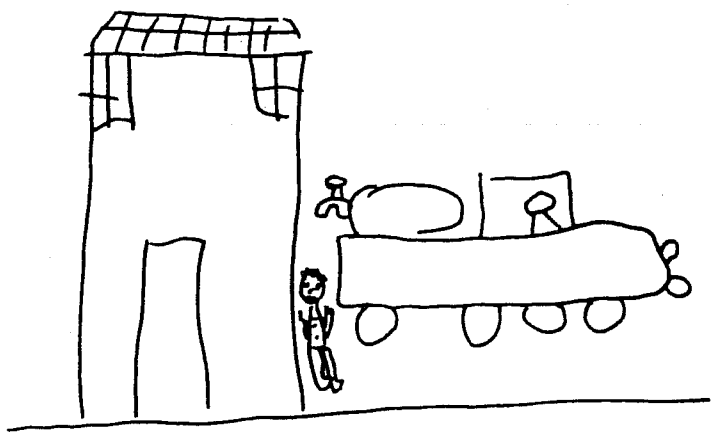

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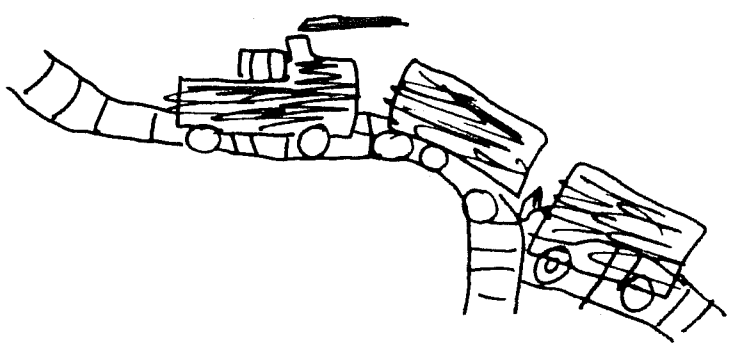

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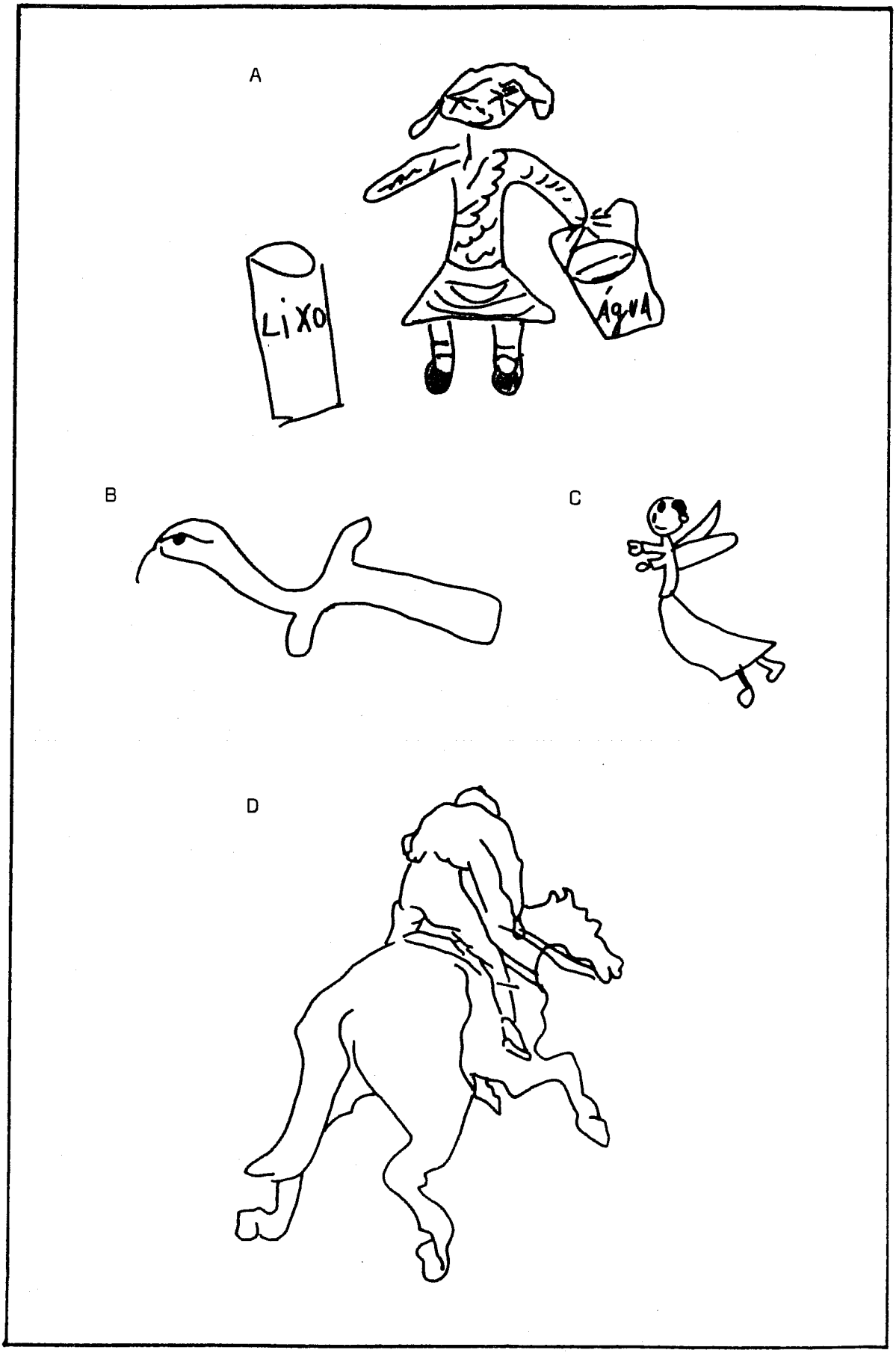
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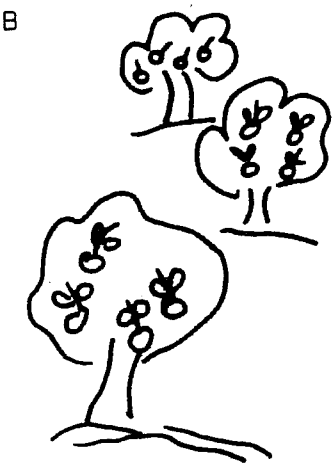

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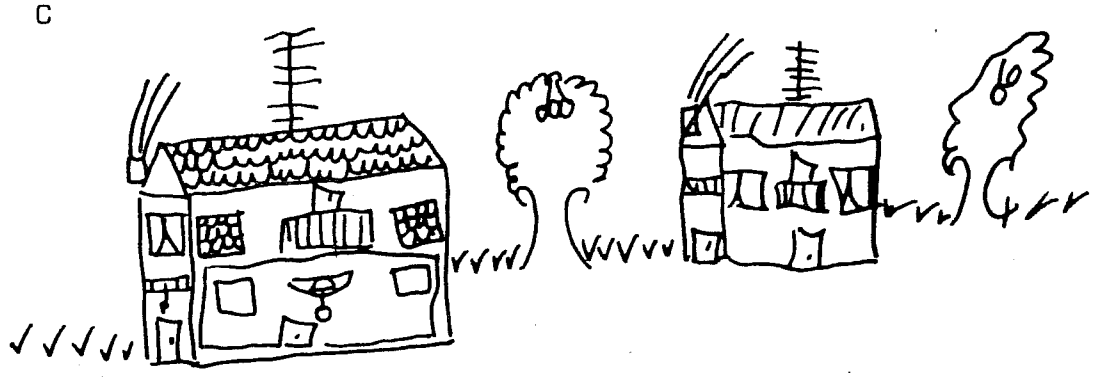

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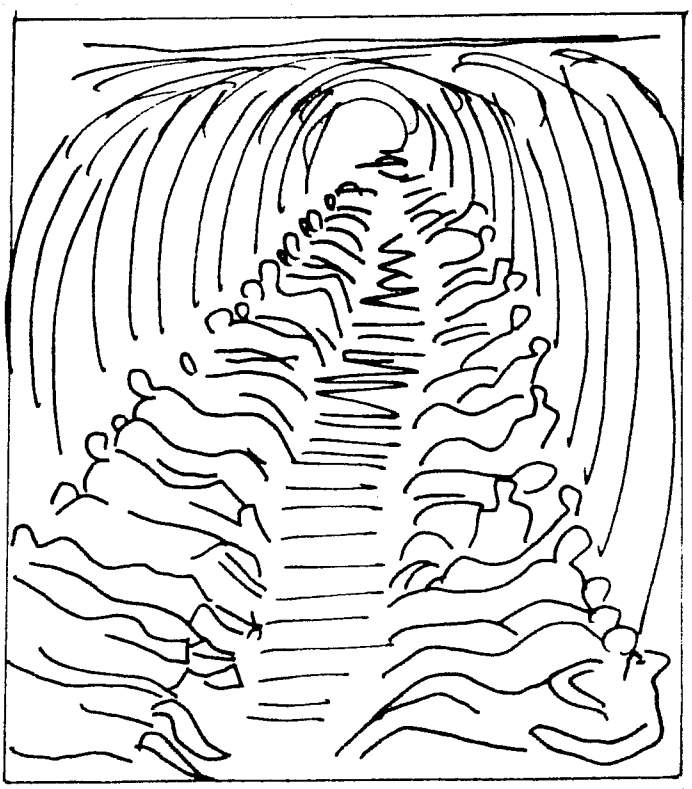

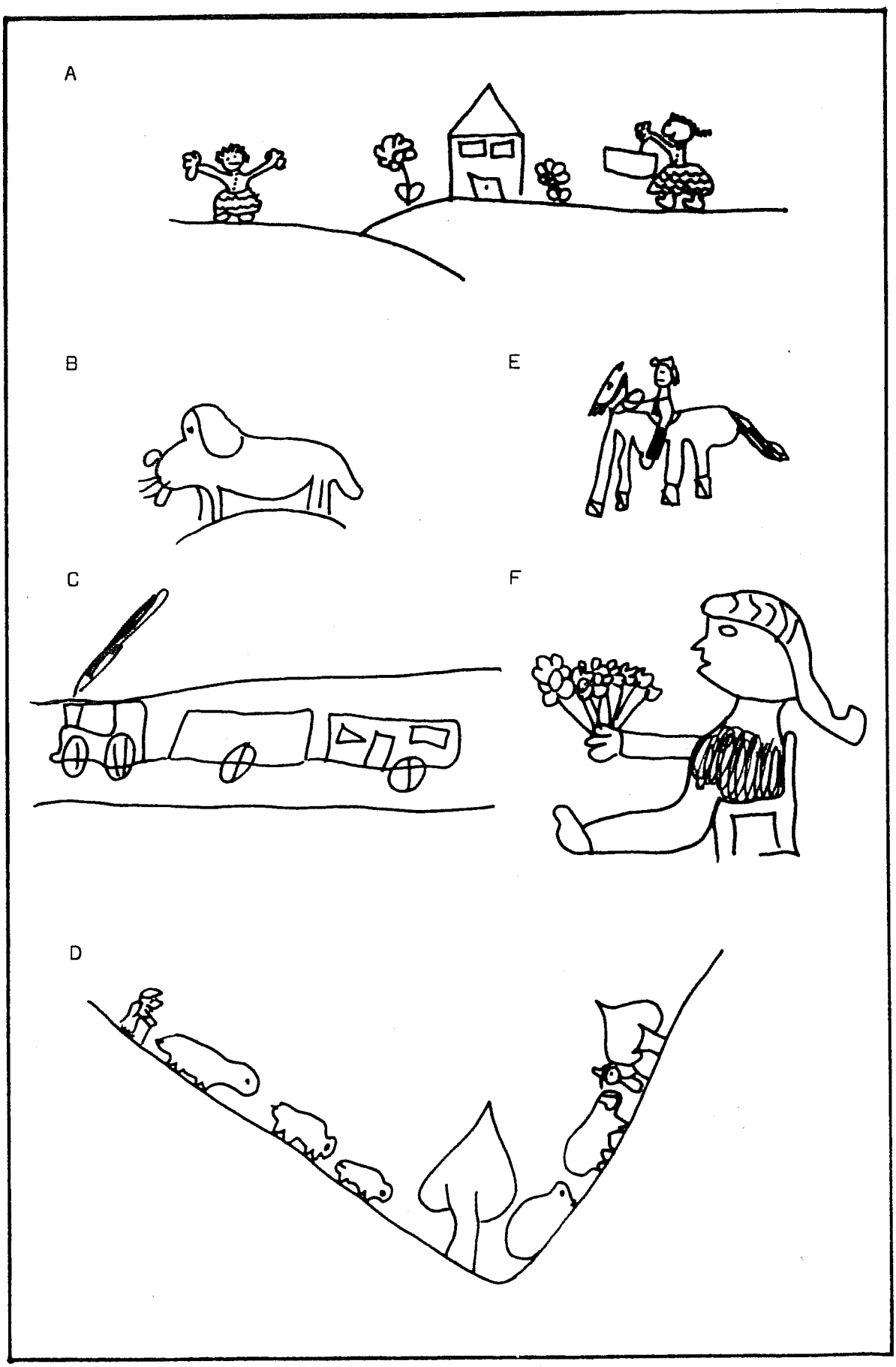
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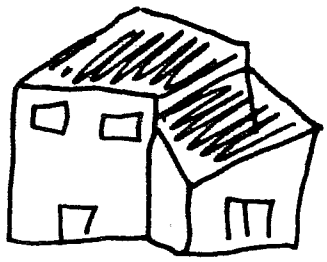

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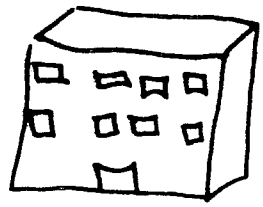

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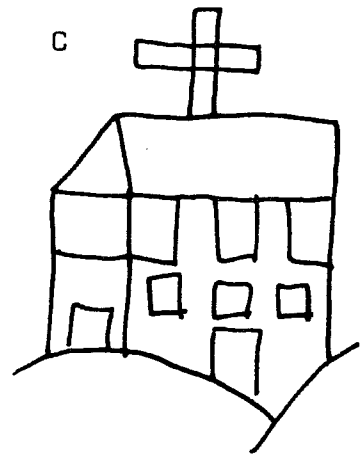

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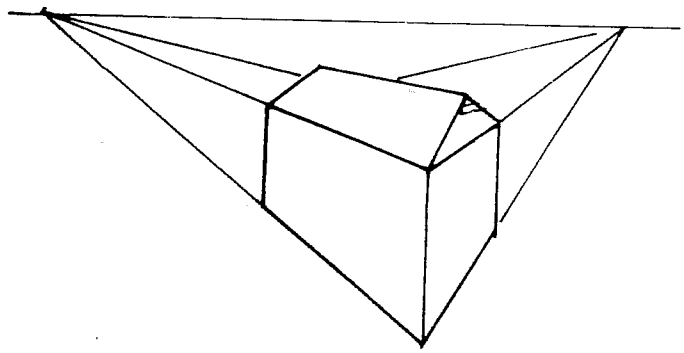

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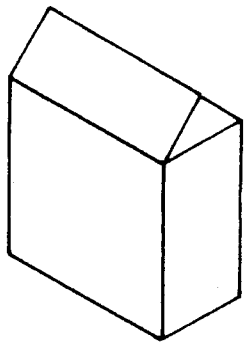

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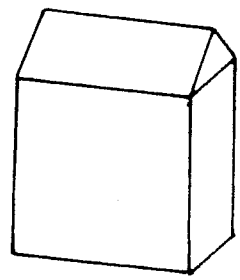

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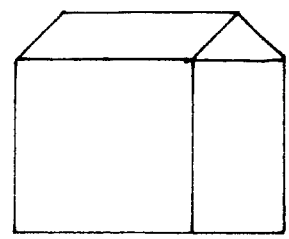

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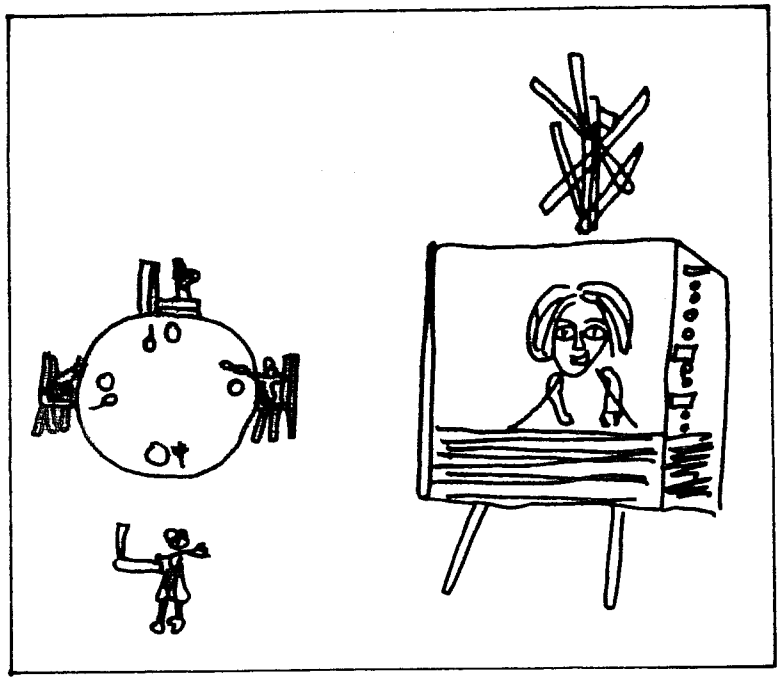

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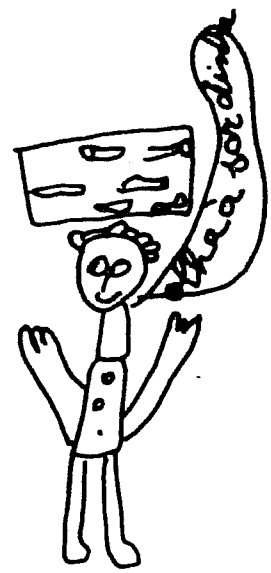

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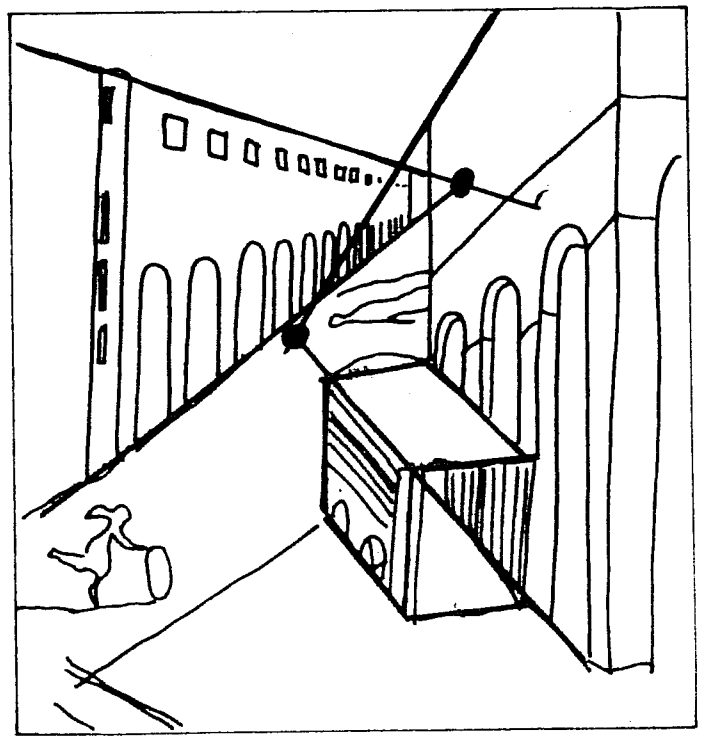

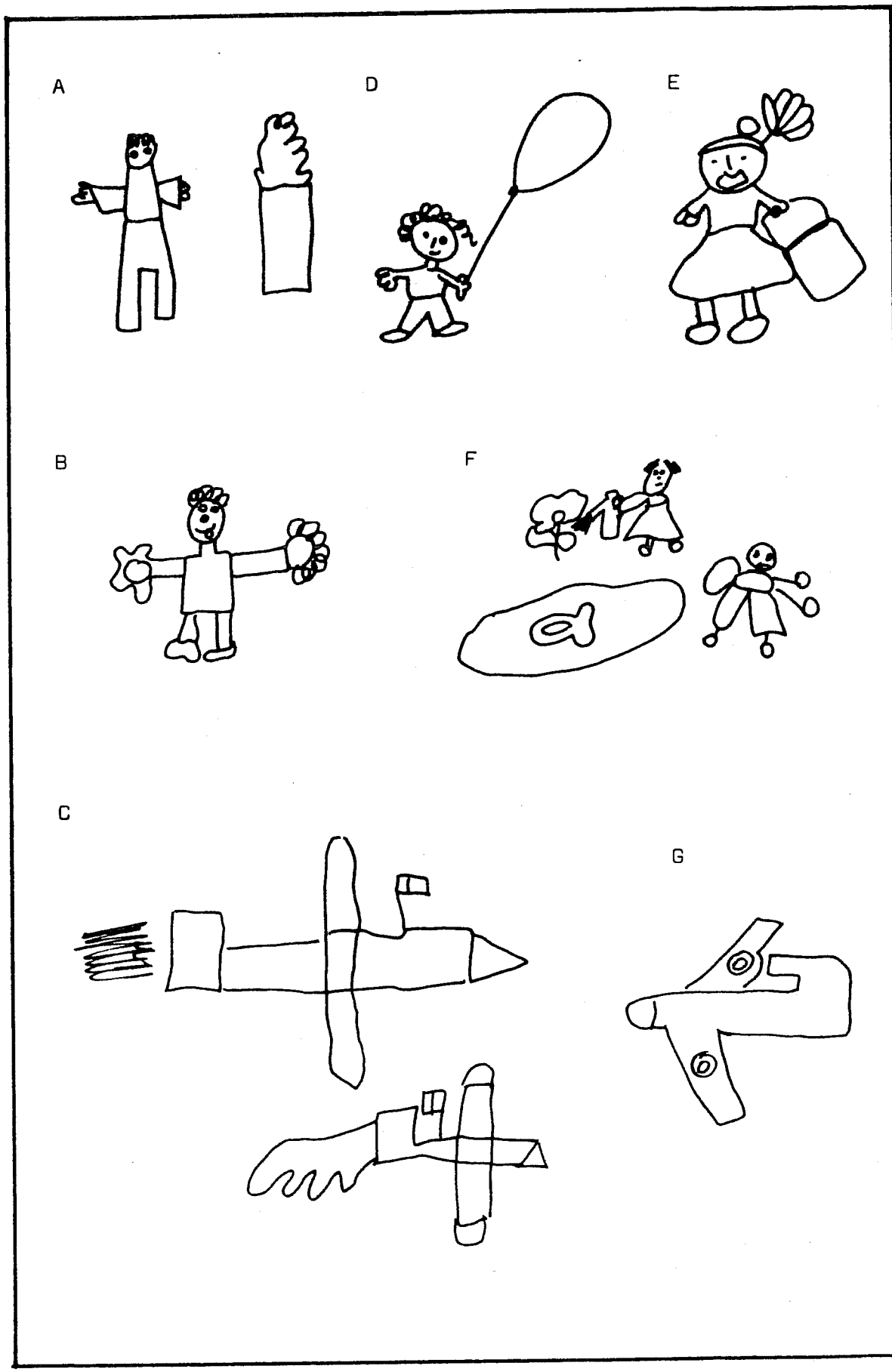
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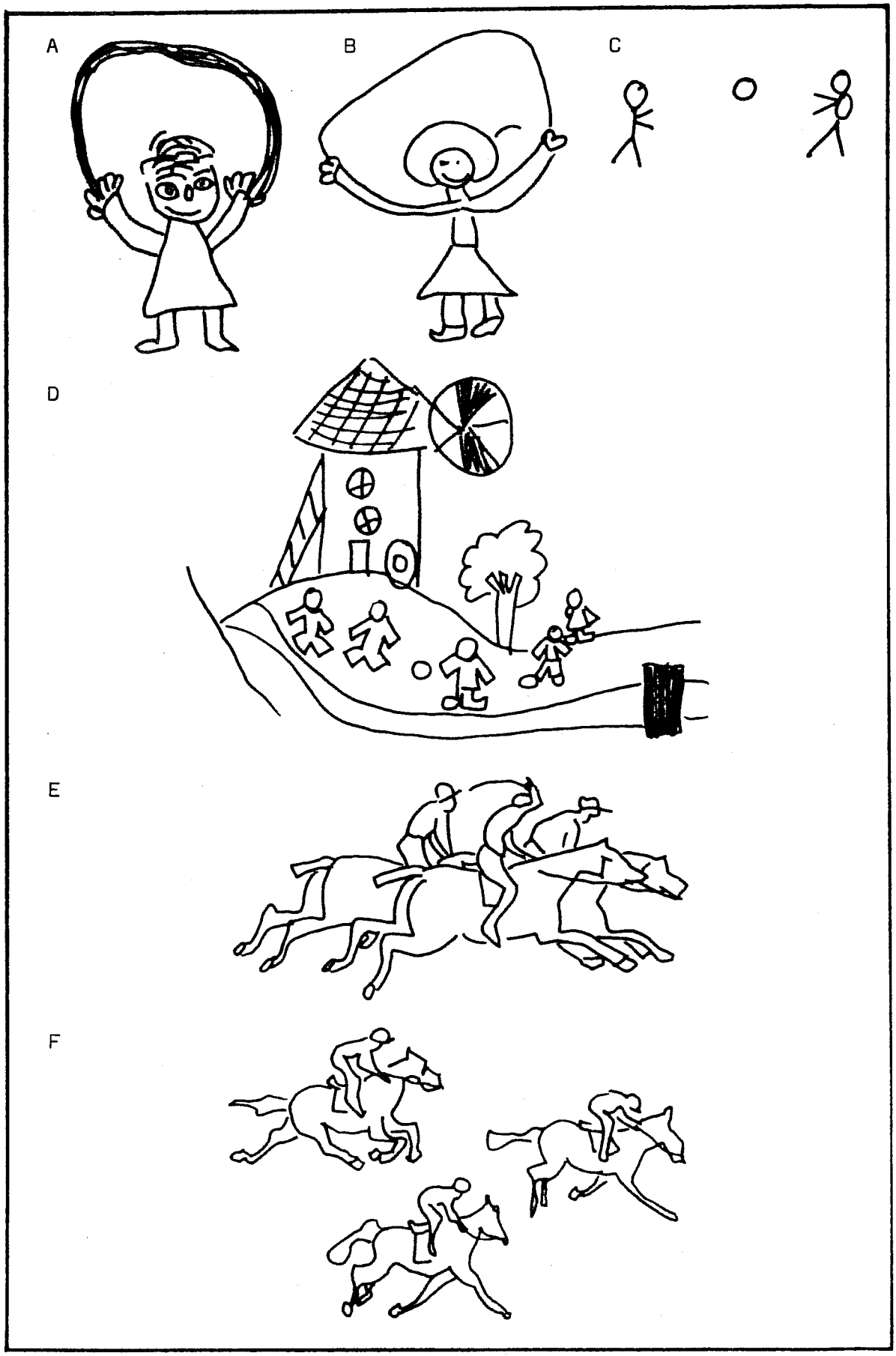
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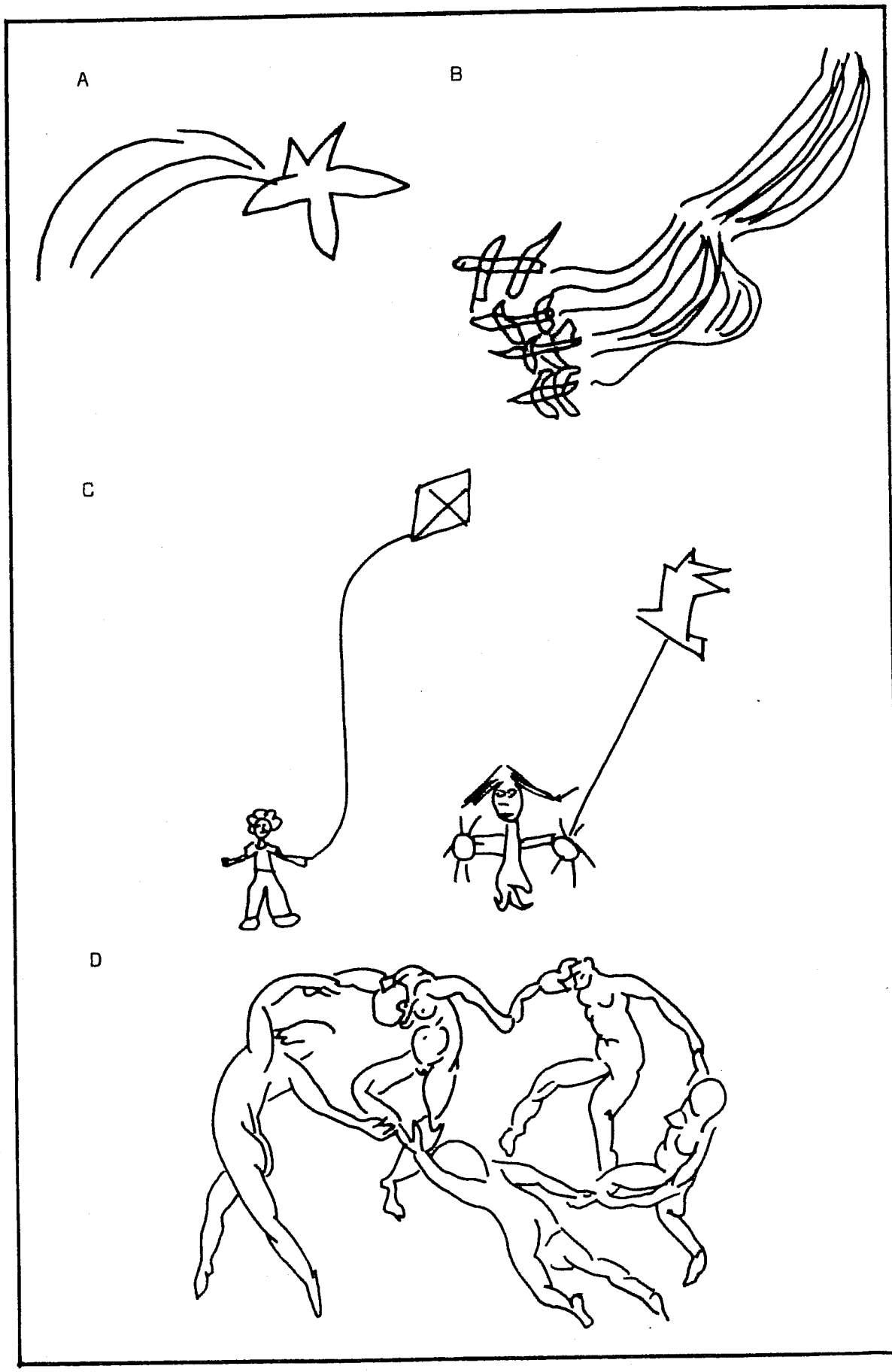
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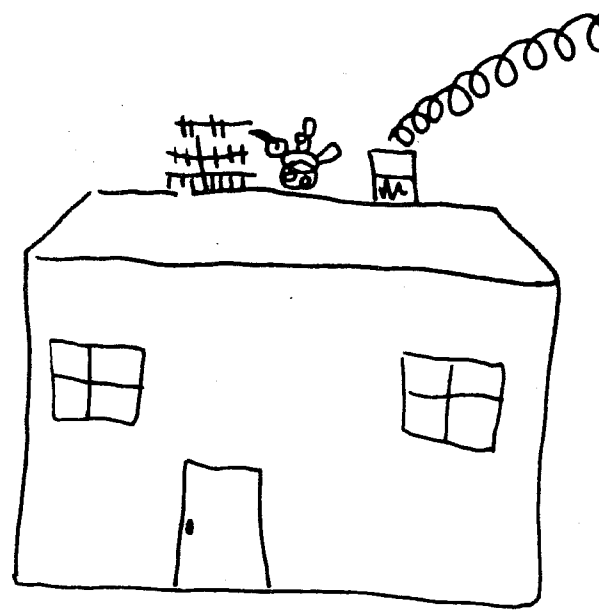

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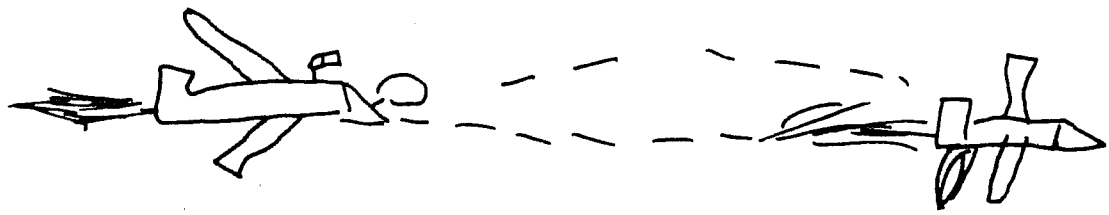

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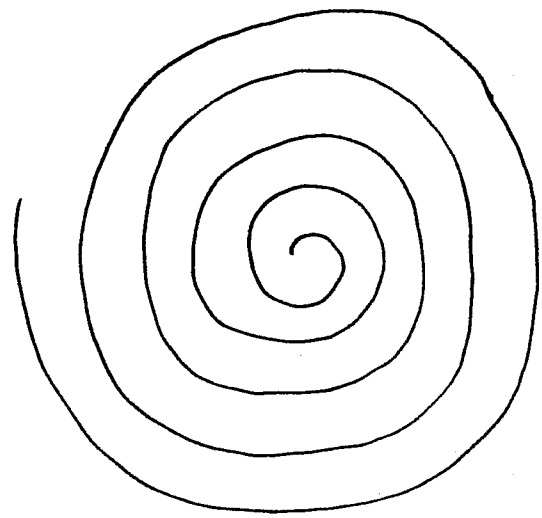

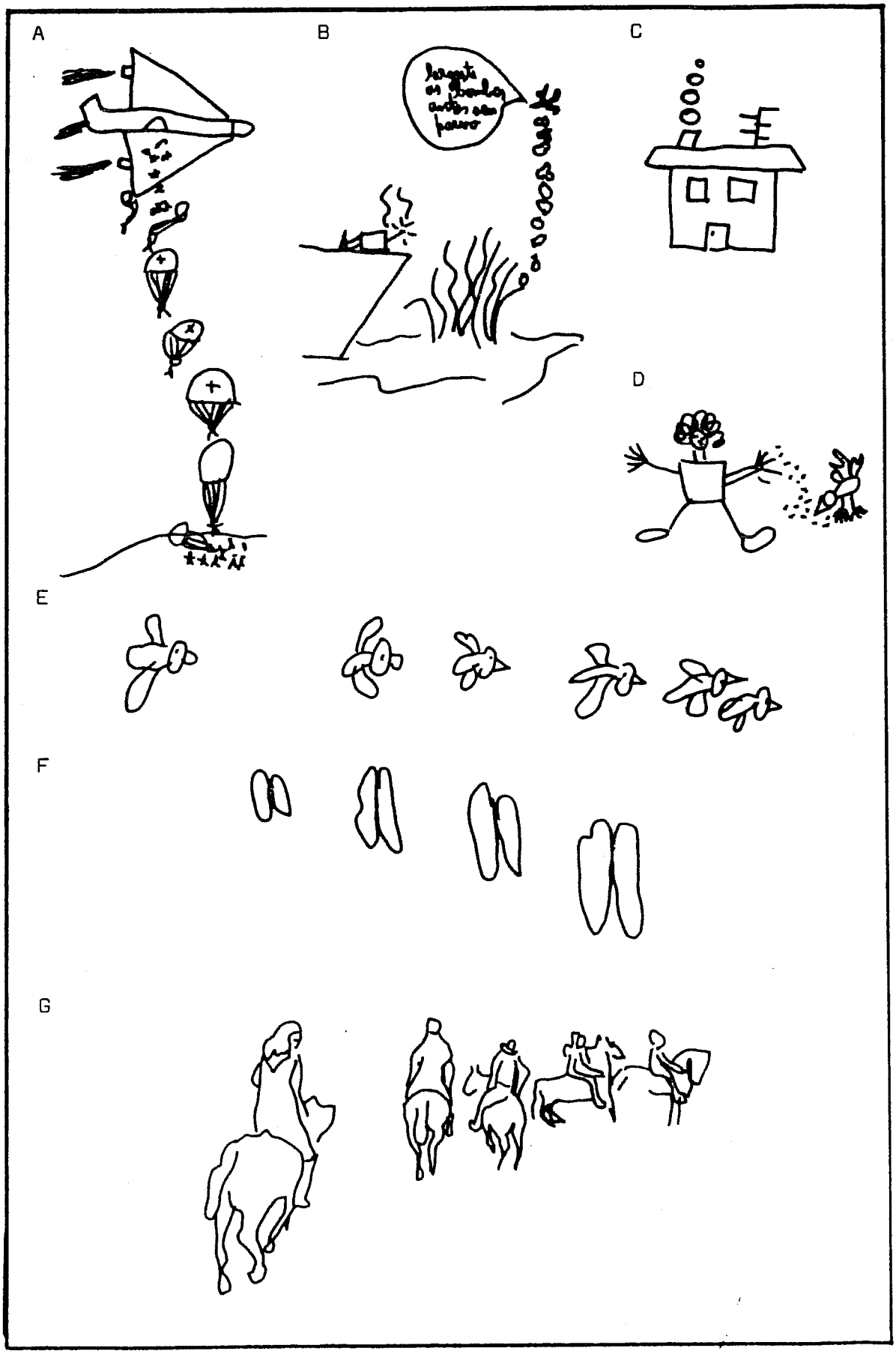
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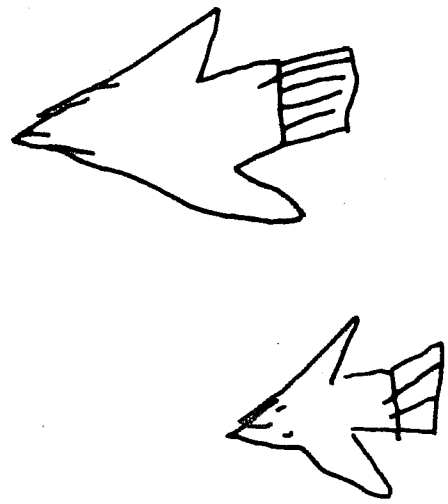

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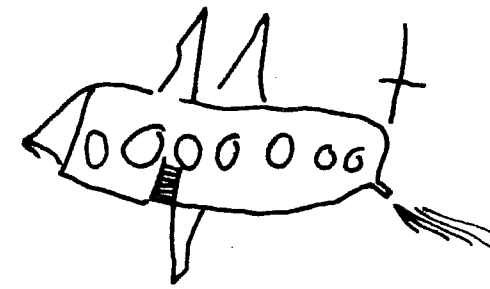

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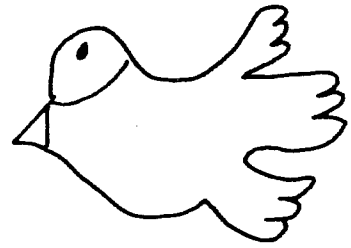

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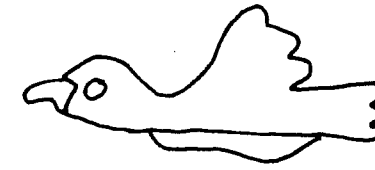

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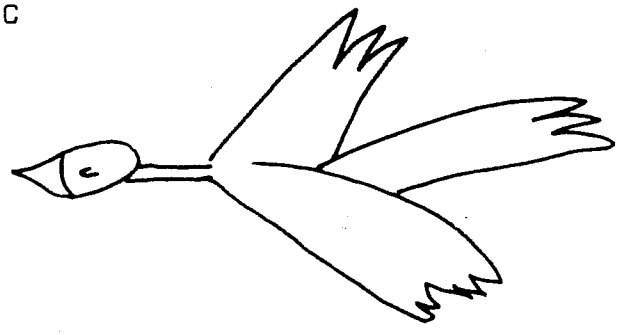

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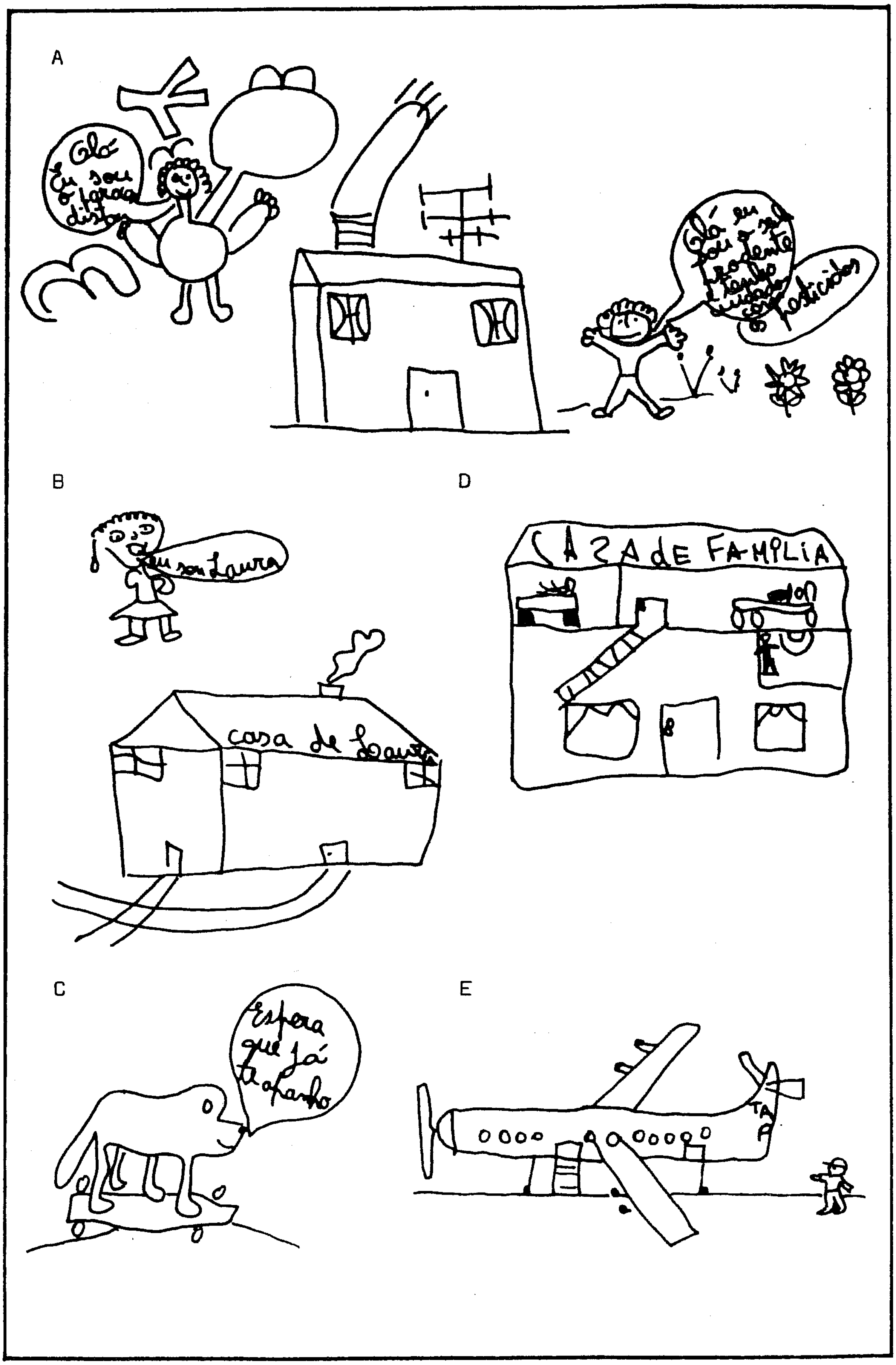
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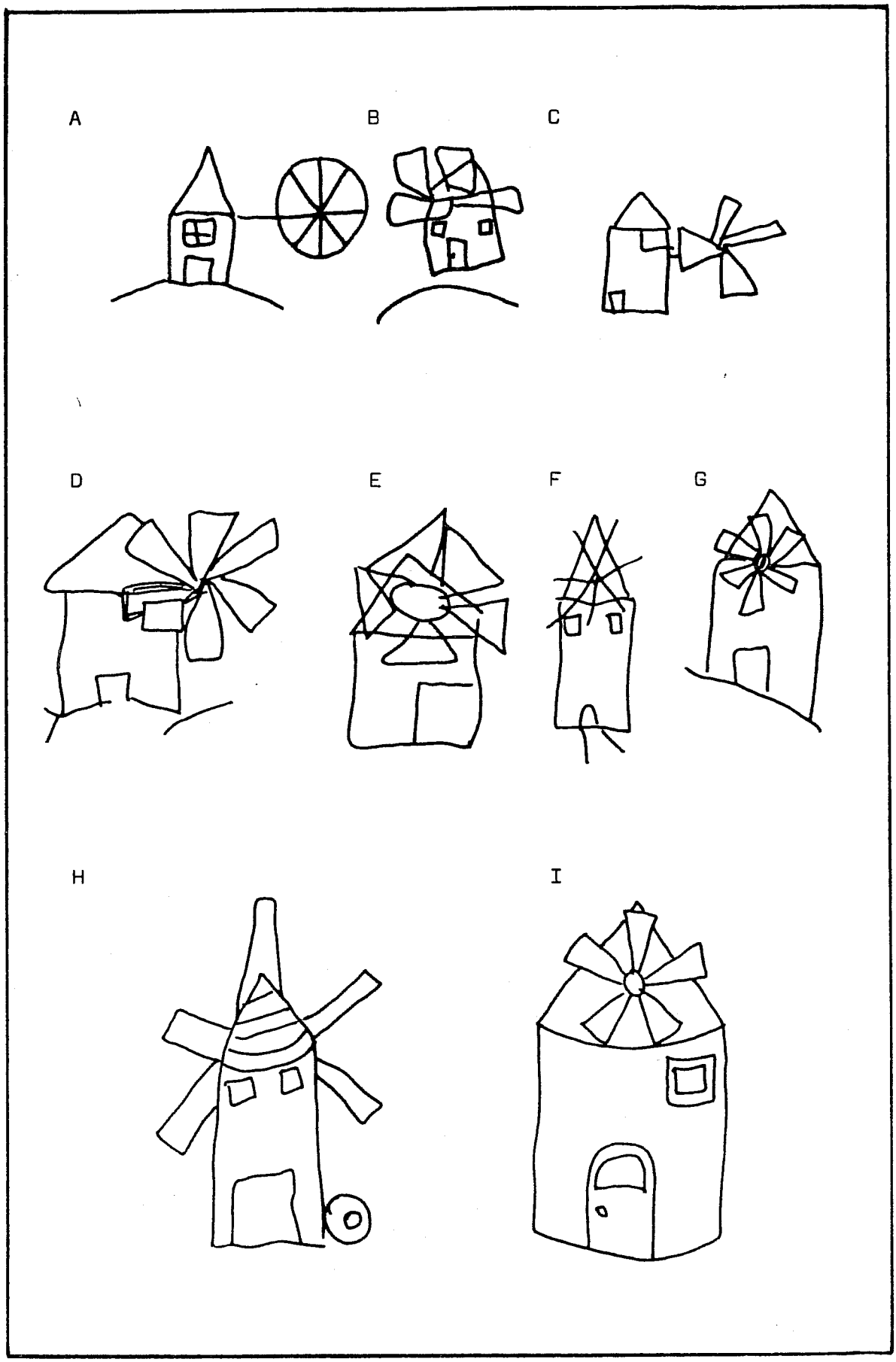
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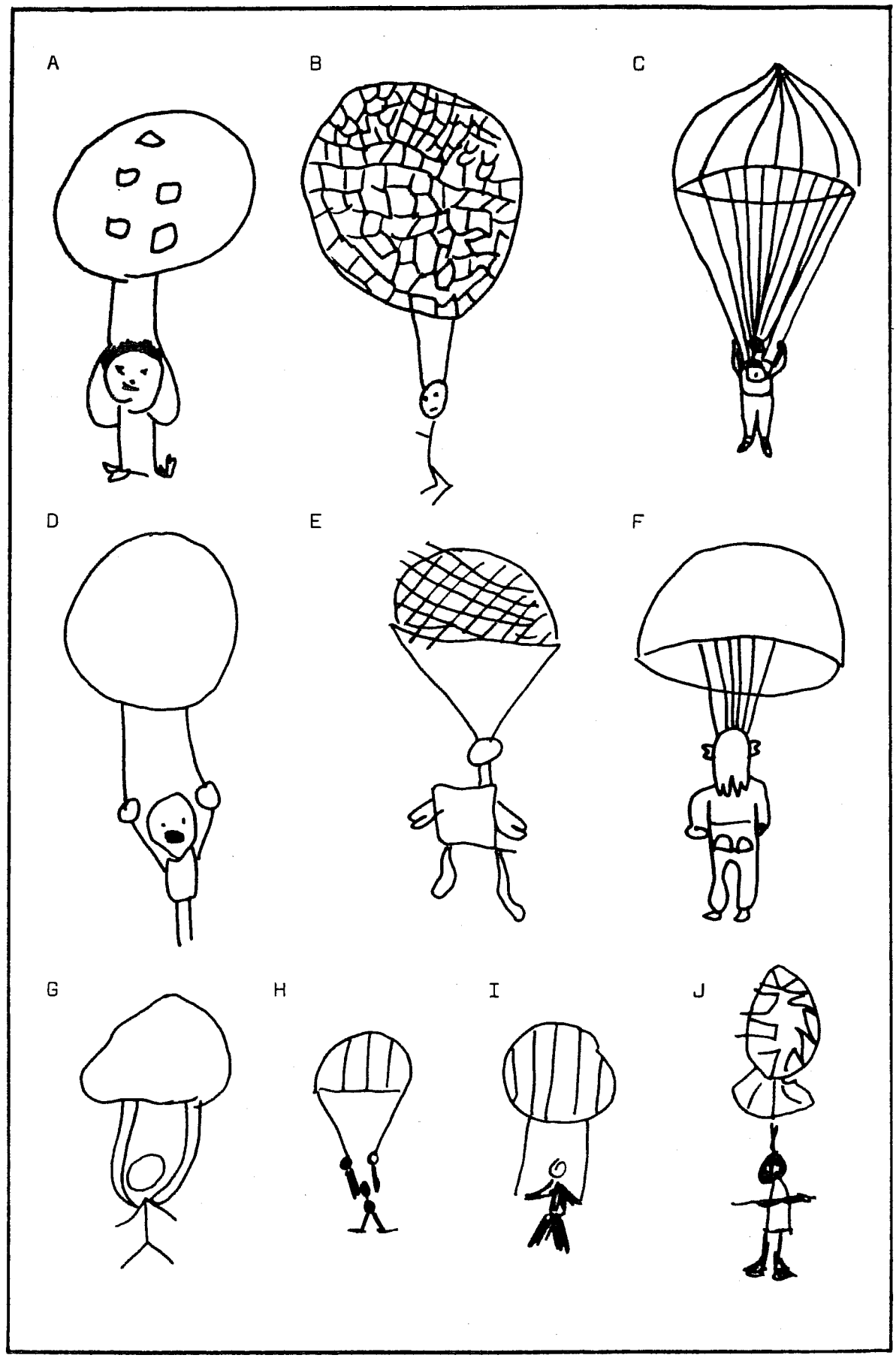
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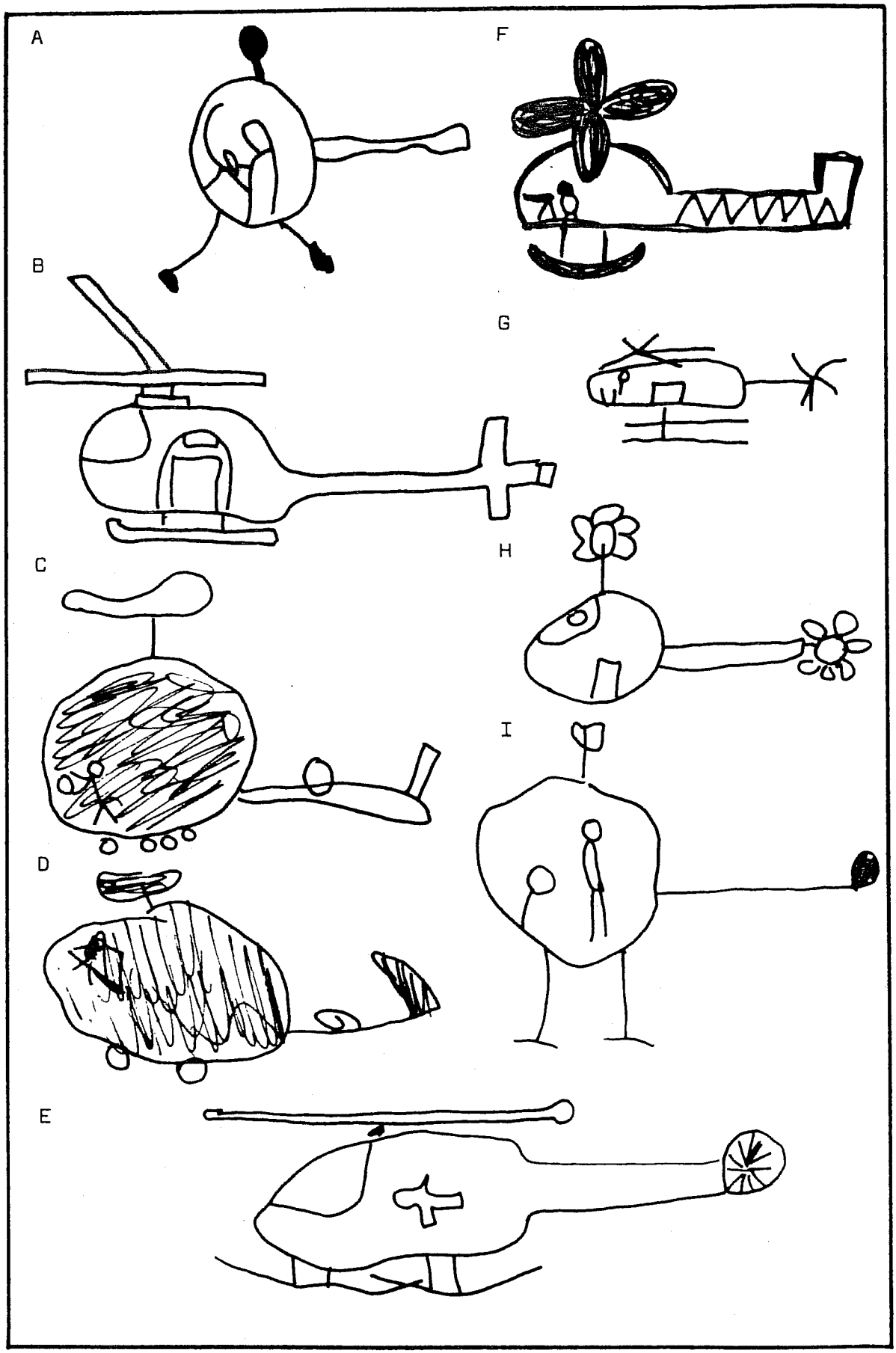
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PART III

1. OBSERVATION METHODOLOGY - ELLABORATION

1.1. INTRODUCTION

1.2. CHILDREN AND TEACHERS POINTS OF VIEW

1.3. METHODOLOGY ELLABORATION

1.3.1. COLOUR

1.3.2. REPRESENTATION STRATEGIES

1.3.3. SUBJECT

2. OBSERVATION METHODOLOGY - APPLICATION

2.1. INTRODUCTION

2.2. DATA COLLECTION PROCEDURES

2.3. SAMPLING

PART III

1. OBSERVATION METHODOLOGY - ELLABORATION

1.1. INTRODUCTION

Our first main question was " What is important to notice in children drawings? " (What factors? How?)

The present methodology was aimed at children older than 6, that is the reason why some points included in the literature and concerning younger children were not included.

We will present the final version of our obervation grid and we will describe some of the procedures we used to ellaborate it.

We will first refer how children and teachers points of view helped to confirm our initial three factors relevance.

1.2. CHILDREN AND TEACHERS POINTS OF VIEW

Children enquired to expose their theories about what information they could have from finished pictures in what concerns its producers, considered mostly gender and grade informations, giving reasons that we could include in one of our three initial groups:

Colour

" Girls use " lighter" colours than boys " (yellow, pink)

" Girls paint surfaces gently "

" 4th grade paints surfaces more gently "

" Girls cover biggest surfaces "

" 4th grade covers biggest surfaces "

" 1st grade uses " brighter" colours " (red,yellow, orange)

Subject

" Girls draw more things to make the drawing pretty " (hearts,flowers)

" Boys draw cars,planes, ball games more often "

(" I don't know why they do it, but they do ")

Representation strategies

" 1st grade makes things look strange, they draw things flat "

"1st grade draws lines very strong "

"1st grade looks confusing, things in the air "

"1st grade draws little houses and big persons next to them "

" 4th grade draws things very far away "

" 4th grade draws persons viewed by a side "

" Girls draw better, with more details "

Primary school teachers enquired to expose their theories about the same question , point some factors we could also include in our three groups. They also considered mostly gender and grade informations.

Colour

" 1st grade uses "brighter" colours " (yellow,orange,red)

" 1st grade enjoys colouring their drawings a lot, using apparently any colour "

Representation strategies

" 1st grade prefers markers, thick markers "

" Girls are better in motor control, it is the same with writing; or they have more care!... "

"1st grade finds it difficult to control fine movements, things look strange and imprecise "

"4th grade uses the effect of distance by making the objects smaller "

"1st grade draws things in their particular strange way, but they do not allow others to do so. They seem excellent observers. Once I drew a bird on the blackboard and I put 4 legs on it absentmindedly: no one could recognize my bird, and then they were all laughing "

Subject

"1st grade draw a few similar elements in all their drawings"

" There are some elements that girls draw (decorative elements, dolls) that boys usually do not "

" Boys draw more frequently cars, planes, guns "

" 4th grade, specially boys don't like drawings. They say they are not able"

" 1st grade drawings are more similar in boys and girls "

" 1st grade seems to enjoy drawing very much. Apparently they are usually happy with their products "

We obtained those remarks in quite informal conversations, mostly because we intended to avoid " fear for criticism " and for " answering wrong ". Besides we only intended to know what information from the drawings was considered important, and how it was related to their producers in order to have a general idea of the agreement between pupils and teachers theories and the literature.

1.3. METHODOLOGY ELLABORATION

We will start with the hypothesis that when children are asked to make a drawing, they have a sequence of problems to solve :
What to draw first,and next, and next...how to represent the objects or the ideas ... how to colour them.

According to the different authors the way they are going to solve those problems depends on:
how they perceive the objects
what they retain as relevant characteristics from the objects
their motor control capacity
their will or ability to question themselves about their products
affective factors such as mood, temperament, perceived self-efficacy ...

Our interest in those factors is that they seem to produce informations about the picture producers. Grade and gender seem to be relevant to those products variability.

1.3.1. COLOUR

In what colour usage is concerned we tried a notation in which we put

the names of the colours and note if each colour was used or not. We first tried to note how many times each colour was used in each drawing but we could not find a reliable way to assess and register each colour frequence in each drawing.

We noticed that some times colour was used as a little detail and other times it could cover a surface. We decided thus to consider colour use: as a line (if it was used to draw the units borders), as a point / detail (if it was used to draw details), and as surface (if the surface coloured was larger than 0.5 cm)

We noted if the white piece of paper was used as a basis, or if children coloured the largest part of that basis. If colour was used in a realistic way (colours similar to reality usual ones), or in a decoretive way (colour used without a concerning about real usual colour of the objects or/and with an intention of obtaining " nice " effects or merely to try the colours effect on the paper.

We took in consideration if the drawings were coloured by covering the surfaces homogenously, or if the coloured effect was obtained by means of lining the surfaces with the graphic medium. If the graphit black pencil was used, or if the drawing was drawn and/or coloured with the graphic medium directely.

Using this grid, we are however missing a few informations that would be interesting for the study: the size of the whole coloured surface, the size of the surface coloured with each colour... However our grid risked to be too complex and we had to make some decisions in order to assure a suitable simplicity and reliability.

Colour (extra-grid)

Afterwards we ellaborated an extra-grid for colour, being mostly concerned with primary colours and their opposite (Itten). We intended to observe the relationship between two colours used side by side.

We kept the same notation system (presence or absence) and we considered first the contrast between primary colours and their opposite. Then the contrast between other pairs made by those six colours. All those nine pairs included a warm colour and a cold colour (Itten).

Then we considered six pairs of colours in which continuity was established between either two warm colours or two cold colours.

Finally we considered black and brown as establishing a transition between two colours.Black effect was considered as increasing each of the colours strenght while elliminating the contrast between them, since the strongest contrast would be with the black itself. Brown effect was considered as elliminating the contrast between two colours by creating a continuity border - the brown itself.

In a second part we considered if there was a notorious preferential colour, covering most parts of the drawing.

In that extra-grid we only considered "colours " and not the light or dark tonalities, since we adopted mostly Itten and Da Vinci theories which do not refer them. We elliminated pink as well for being a mixture white + colour.

We included a last point which was considered quite questionable : we had considered colour use as "homogeneous" and "lined", some of us

thought that the effect of a drawing looking "soft" or "strong" in what colour is concerned, was not included in the former difference. That is children could use lined colours both in a soft or in a strong way, the same being true for homogeneous use.

We also noted if children took advantage of colour pressure in an intentional way, in order to produce different effects in the same drawing, and if children coloured the same place twice with different colours in order to obtain a new tonality.

The final grids for Colour are presented in the next pages.

colour – final grid

COLOUR	
Light blue	line
	point
	surface
Dark blue	line
	point
	surface
Yellow	line
	point
	surface
Red	line
	point
	surface
Light green	line
	point
	surface
Dark green	line
	point
	surface
Orange	line
	point
	surface
Pink	line
	point
	surface
Violet	line
	point
	surface
Light brown	line
	point
	surface
Black	line
	point
	surface
Light brown	line
	point
	surface
Graphit pencil	line
	point
	surface
Others	
White paper basis	
Coloured basis	
Homogeneous colour use	
Lined colour use	
Decorative colour	
Realistic colour use	

AGE	
SEX	

colour – extra grid

COLOUR II (ITTEN)	
Contrast WARM/COLD (opposite)	Red/green
	Blue/orange
	Yellow/violet
	Green/orange
	Green/yellow
	Blue/yellow
	Blue/red
	Violet/orange
	Violet/red
Continuity WARM	Yellow/orange
	Yellow/red
	Orange/red
Continuity COLD	Green/blue
	Green/violet
	Blue/violet
Transition WARM/COLD	Black
	Brown
Dominance of single colours	Blue
	Yellow
	Red
	Green
	Orange
	Violet
	Black
	Brown
Soft colour	
Strong colour	
Take advantage of colour pressure differences	
Superposition	

AGE	
SEX	

1.3.2. REPRESENTATION STRATEGIES

In what representation strategies were concerned we considered four subgroups and an additional subgroup concerning the graphic medium. Mostly we followed the literature (Arnheim op. cit; Goodnow op.cit.)

Also here we noted the presence or absence of each strategie, and not its frequency in each drawing. We considered a strategie used if the child produced at least a good example of it. We also missed the information about how frequent each strategie was for each child;but counting was not easy nor reliable and possibily not relevant enough, since we were interested in the use and not in the quantity. We will refer later an opposite problem which is when a child do not use a certain strategie because it was not necessary in that particular representation.

We considered and noted processes used to obtain tridimentionality effects, following mostly Arnheim: obliquity, deformation, gradation, superposition, lateral projections, axonometric projections, planifications, transparencies. We kept for notation purposes the definitions we gave in the literature review, Part II.

Next we noted processes used to obtain movement and tension effects, following mostly Arnheim as well : obliquity, deformation, gradation, sharpness, incomplete shapes, curves. We kept the literature definitions.

As we can see, some of the items are the same for both subgroups. We noted (for instance) gradation in the first subgroup or in the second, according to its more relevant effect (see picture 11 and picture 19)

We did not note, as we saw in the literature, opposite colours effects in

what movement or tridimentionality effects were concerned.

Next we considered space occupation, mostly following Goodnow points of view. We intended to note which features that appeared were provoqued by lack of available space, lack of a previous plan sharing the space with all the units to be drawn.In that case the drawing of an element could limitate or alter the configuration of the followings. We noted:

separated units - (and we were here concerned with shapes, not subjects) We considered if children draw elements isolated from each others , leaving a space between the units.

related elements - If children draw the different units having in mind the space available, and the units already drawn , and to draw next.

problems - If the units configuration, size or place is altered, suggesting a problem to insert them in the space available (picture 8 A,B,C; picture 5 A).

Finally we included a subgroup concerning specially the performance, following Arnheim literature.Teachers and children also referred motor performance problems as a factor that may limit children productions. We noted:

pressure - If children do not control the pressure made by their hands on the pencil or medium used, when they draw or paint.

configuration - If children do not control the direction of the lines in order to close shapes or draw straight lines, altering its configuration. (picture 4 A e.g.)

skidding - If children can't end the lines in a controlled way thus do not respect the limits imposed by previous shapes where they want to add some details or that they want to colour. (picture 4 A)

At last we considered the graphic medium used, since it can determine some of the drawings characteristics and provoque different representation problems. We considered coloured pencils, coloured markers, finger painting, brush painting, wax pencils, coloured chalk.

We can see in picture 4 two children productions, in A the child uses coloured pencils on butter paper, in B the child uses coloured markers on common paper.

For broader studies we should perhaps include an item for the basis of the drawing,size and characteristics.

The final grid for Representation Strategies was as following:

representation strategies — final grid

REPRESENTATION STRATEGIES																											
Tridimentionality effects	Obliquity																										
	Superposition																										
	Deformation																										
	Gradation																										
	Lateral proj.																										
	Axonometric p.																										
	Transparency																										
	Planification																										
Movement effects	Obliquity																										
	Deformation																										
	Gradation																										
	Sharpness																										
	Inc. shapes																										
	Curves																										
Space occupation	Units sep.																										
	Related E.																										
	Problems																										
Motor performance problems	Pressure																										
	Skidding																										
	Configuration																										
Graphic medium	Pencil																										
	Marker																										
	Finger																										
	Brush																										
	Wax																										
	Chalk																										
Others																											

AGE																											
SEX																											

1.3.3. SUBJECT

In what subject was concerned we considered the more frequent elements in several samples of primary school pupils that we had collected for different purposes. We grouped those elements in three groups:

Natural elements - (elements existing in the nature, including vegetals and excluding persons and animals). We found more frequently: the sun, the sky, the clouds, the moon, the stars, lakes, the sea, rivers, mountains,threes, flowers, grass. We left an item " others".
We included a notation for the ground line or space limits representation.

Alive elements - (persons and animals) . We found more frequently persons, air animals - birds, butterflies -, land animals - dogs, rabbits, ducks, cows, horses, chicken -, water animals - fishes -. We found as well unusual beings apparently connected with T.V. heroes or B.D. . We included a special item for register the sun antropomorphism - the sun with a face-, by suggestion of Bord and coll. (1987) work.

Elements made by men - (all the elements non existing in nature origi - nally) . We found more frequently houses, interiors of houses - living rooms, kitchens,bedrooms, libraries -. We found so frequently chimneys with smoke and T.V. aerials that we made a special item for them. We also found pads, means of transport - boats, cars, planes, not so often trains.Helicopters, parachutes and wing-mills were not only frequent but also very interesting units: they envolved a quite complicated process of representing the main body, the wing or baloon, the connections between them, and an additional movement effect. We present some of the solutions found by children in pictures 22, 23, 24.

We found frequently words written - the child name,an information about the unit meaning, dialogues , as we present in picture 21 and picture 14 B . We found some decorative patterns - hearts, lines, repeated shapes, geometric patterns -, guns carried by persons or in boats or planes, We included an item "others" as well for different units that might appear- flags, all sort of objects carried,toys, playgrounds -.

Next we considered if those elements were drawn as independent from each others, or if there was a suggestion of a relationship between them. We intended to note the general meaning of the drawings concerning the kind of activity the drawing was suggesting. We intended to avoid subjectif interpretations such as happiness,loneliness, hostility and so on, we only noted if it suggested a quiet game or activity, an action game or activity, a wargame or a work activity which we thought could cover all the ensemble suggestions. We included an item " others".

In what subject was concerned we only noted the presence or absence of each of those elements, just as we did for the other factors . We could thus repeat for subject what we said on that purpose for the formers.

However, although we did not make it, our grid may be used adopting other notation system, for instance counting all the examples related to each item and noting totals instead of presences. We could also adopt a 5 point scale to evaluate each item frequence in each drawing. We did not adopt any of those solutions because we thought that our grid larger sensitivity would not compensate the reliability loss.

The final grid for Subject was as following:

subject – final grid

SUBJECT		
Isolated units		
Contextual units		
UNITS		
Natural elements	sun	
	sky	
	moon	
	clouds	
	stars	
	lake	
	sea	
	river	
	mountain	
	rain	
	trees	
	flowers	
	grass	
	ground	
	others	
Alive elements	persons	
	air animals	
	water animals	
	land animals	
	unusual elem.	
	sun face	
	others	
Elements made by men	houses	
	pads	
	interiors	
	smoke/TV aer	
	boats	
	planes	
	helicopters	
	parachutes	
	cars	
	words	
	decorative e.	
	guns	
	others	
ACTION		
Quiet games/activity		
Action games/activity		
Work activity		
War games		
Others		
AGE		
SEX		

2. OBSERVATION METHODOLOGY - APPLICATION

2.1. INTRODUCTION

Our second main question was " (How) do children differ in what their pictorial productions are concerned? "

We collected drawings from children in a primary school, from the first to the fourth grade.We chose Primary school nº 23 - Casais do Campo - S. Martinho do Bispo - Coimbra. Data collection took place in February 1987. Casais do Campo is a small village, 3 km from Coimbra - the thirth biggest town in Portugal, situated in the center ouest of the country .

The choice of that particular school did not mean that that particular school population has been by any means considered representative of Portuguese primary school population, our aim was applying our observation grid to a set of drawings expressly collected for that effect and that particular school had the advantage that teachers were familiar to us from previous works thus authorizations and teachers collaboration were assured.

We collected drawings from all grades, in four classes one from each grade (total 89 drawings).

2.2. DATA COLLECTION PROCEDURES

Drawings were collected during class time, a class at a time. We had not a time limit but we spent about one hour with each class.

Instructions were the same for all the classes:

" We would like you to draw a " view " with at least a house and a person and whatever else you want to; you have near you a box with 12 colou_ red pencils but we would like you to use only 6 out of those twelve ".

Instructions were repeated at each child request but no further comments were made.

We gave each pupil a rubber, a pencil, a box with 12 coloured pencils, a A4 format white piece of paper.

Pupils were requested to write their gender and age on the back of their drawings. In the first grade we did it ourselves.

That particular procedure envolved a few previous decisions that we would like to comment and justify.

When working in our observation grid we used primary school children drawings collected for different purposes to help us reflect about pupils processes and products.One of the facts that we observed and which was quite common was that the tonalities of the coloured pencils differ, as well as the kind of colours included in a box for twelve, depending on pencils quality and mark. Besides the graphic medium used to colour differed as well. That is the reason why we decided to supply the boxes with coloured pencils ourselves . We supply the rest of the materials as well both to assure their equality and to avoid the quite frequent use of ruler without forbiding it.

We asked them to chose 6 colours out of 12. In a previous sample we had observed that children tended to use about 8 colours out of 12 when they have no restritions in the number of colours they may use. That decision

to make them choose 6 out of 12, perhaps not so fortunate if we reflect about it now, intended to make them CHOOSE, instead of merely USE the colours.

We decided to give a kind of " subject - guide " - " a view with at least a house and a person ... ". Our idea was not exactely to fix a subject, nor had we a special interest in " views ", houses or persons. With that instruction we intended to avoid:

Drawings representing only fancy letters or fancy geometric patterns , single big objects or persons, abstract patterns (...) .

Drawings in which the drawn subject could be for itself enterely responsible for the choice of the colours.

Drawings in which boys and girls would draw their favourite and possibly typified subject which could by itself bias their productions.

Those restrictions are obviously neither necessary nor acceptable when children are asked to draw, and our methodology was ellaborated in order to suit a broader range of children productions without initial restrictions. Our point here was to see if our methodology could observe different things in different drawings being reliable in such a way that two different observers would make similar observations. Then we intended to compare some factors in older and younger children and in the two genders and for that purpose those restrictions appeared to be suitable.

Obviously when we formulate our initial second main question we really intended to mean " ... in our sample, produced under the present conditions and observed with that proposed observation methodology ".

2.3. SAMPLING

Although we had collected pupils drawings from the four grades we decided in this preliminary study to observe only first and fourth grades . As those grades were respectively the first and the last year in primary school we thought that contrast would be greater between those extremes.

According to Luquet and Piaget those two groups would belong to two different " stages " respectively " intelectual realism" and " visual realism ".

We were that way missing factors whose evolution might be inversed U or U shaped, during the four years of primary school. But the characteristics of our methodology made it time consuming and we had not strong reasons (theoretical or empirical) to believe in an extreme relevance of that kind of factors and so we decided to begin with only two groups.

First we selected the drawings from the first and fourth grades (23 drawings and 22 drawings respectively).

From those we selected the drawings that obeyed to general instructions (a " view " with at least a house and a person; using 6 colours out of 12 e.g.); then we excluded the drawings produced by children who were attending for the second or more times the same grade (since in Portugal children are not socially promoted) . Those drawings were excluded in order to control age; in that way children were 6-7 years in the first grade and 9-10 years old in the fourth grade. Age difference in each grade would not be superior to 11 months.

We tried to control variables such as socio-economic status, school achi-

evement and medical or emotional special problems excluding a few drawings produced by children referred by their teachers to have important problems at those levels.

By that time we had 7 drawings in one of the subgroups (girls from the fourth grade) and, since the other subgroups had a larger number of drawings, we picked up by chance the same number of drawings from the three remaining subgroups.

It was not perhaps the best way of sampling, surely not the only one; it seemed important to us to restrain that preliminary application of our methodology to a group of children we could call " average " , although that assumption was roughly made; and to a rather small sample since we did not even know if we would be able to use that methodology as an observation instrument.

PART IV

1. DATA ANALYSIS - COLOUR CHOICE

2. DATA ANALYSIS - COLOUR USE: LINE,POINT,SURFACE

3. DATA ANALYSIS - COLOUR USE - INDIVIDUAL CHOICES

4. DATA ANALYSIS - COLOUR - OTHER FACTORS

5. DATA ANALYSIS - REPRESENTATION STATEGIES

6. DATA ANALYSIS - SUBJECT

7. DATA ANALYSIS - PAIRS OF COLOURS

8. INTERPRETATION OF THE RESULTS

8.1. COLOUR

8.2. REPRESENTATION STRATEGIES

8.3. SUBJECT

1. TOTAL COLOURS CHOICES

COLOURS / PUPILS		light blue	dark blue	yellow	red	light green	dark green	orange	pink	violet	light brown	black	dark brown
first grade	boys	5	1	7	7	4	2	4	4	2	1	2	3
	girls	3	4	6	6	4	2	6	5	1	1	1	3
total		8	5	13	13	8	4	10	9	3	2	3	6
fourth grade	boys	4	3	7	7	5	2	4	1	1	3	2	3
	girls	2	5	7	6	4	3	2	7	0	3	1	2
total		6	8	14	13	9	5	6	8	1	6	3	5
TOTAL		14	13	27	26	17	9	16	17	4	8	6	11

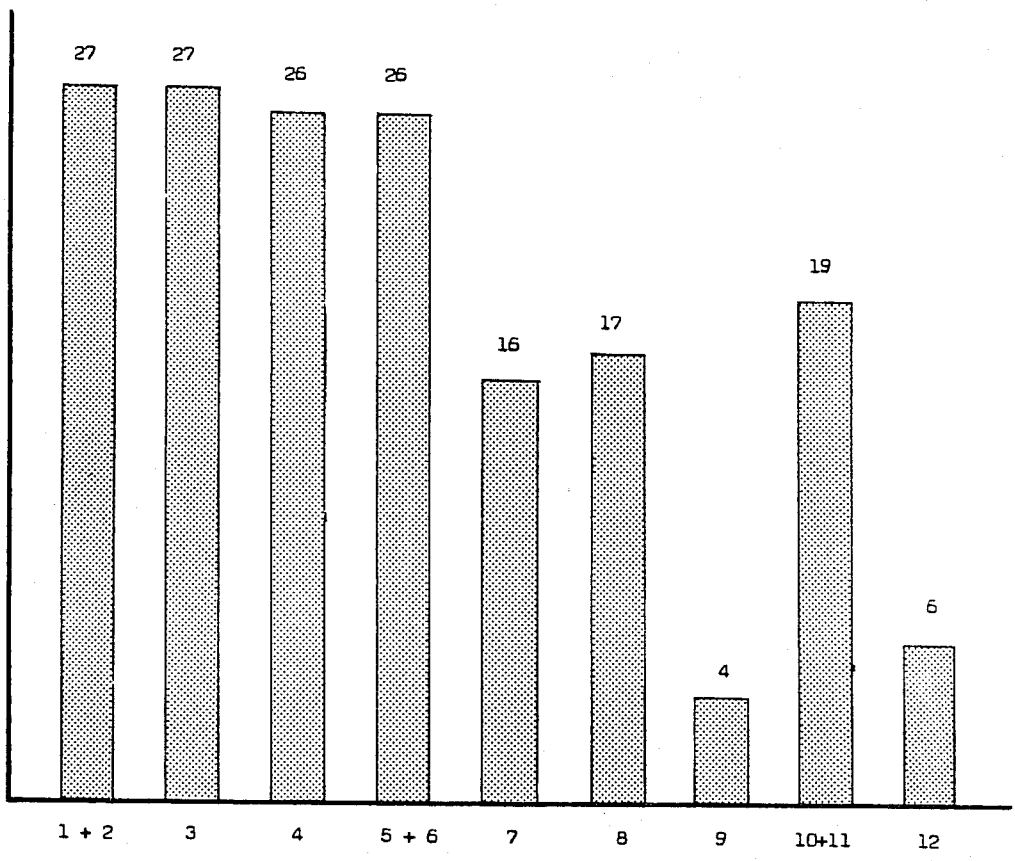
1.1 COLOUR CHOICE- - RANK ORDER

COLOUR	first grade boys	first grade girls	fourth grade boys	fourth grade girls
1- l. blue	3.0	7.5	4.5	9.0
2- d. blue	11.5	5.5	7.0	4.0
3- yellow	1.5	2.0	1.5	1.5
4- red	1.5	2.0	1.5	3.0
5- l. green	5.0	5.5	3.0	5.0
6- d. green	9.0	9.0	9.5	6.5
7- orange	5.0	2.0	4.5	9.0
8- pink	5.0	4.0	11.0	1.5
9- violet	9.0	11.0	11.0	12.0
10- l. brown	11.5	11.0	7.0	6.5
11- black	9.0	11.0	9.5	11.0
12- d. brown	7.0	7.5	7.0	9.0

12 COLOUR CHOICE - CORRELATION MATRIX

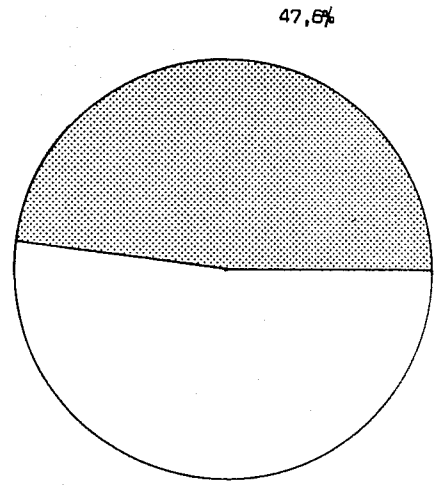
	I BOYS	I GIRLS	IV BOYS	IV GIRLS
I BOYS		0.726	0.653	0.385
I GIRLS			0.564	0.673
IV BOYS				0.385
IV GIRLS				

1.3 COLOUR CHOICES - GROUPING LIGHT AND DARK TONALITIES



1.4 COLOUR CHOICES - PRIMARY (ITTEN)

blue, yellow, red (4/12 tonalities)

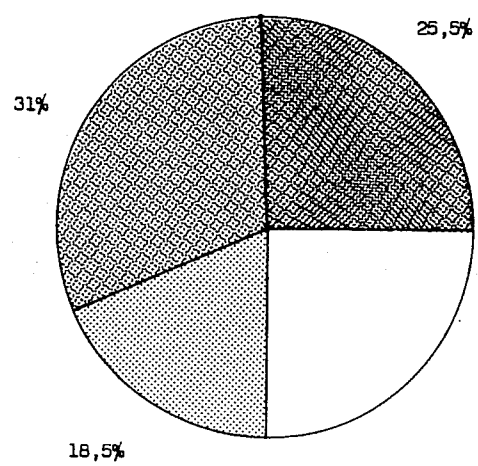


1.5 COLOUR CHOICE - PRIMARY COLOURS AND THEIR OPPOSITE (ITTEN)

blue / orange (3/12)

red / green (3/12)

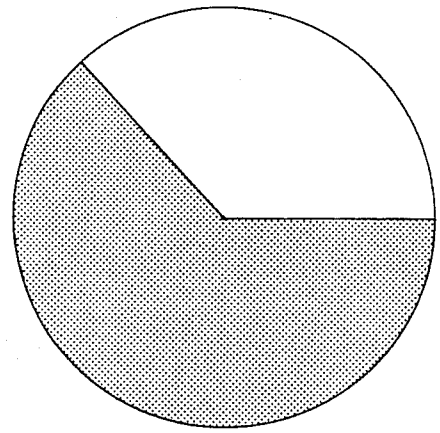
yellow/violet (2/12)



1.6 COLOUR CHOICE

blue, yellow, red, green (6/12)

vs the others

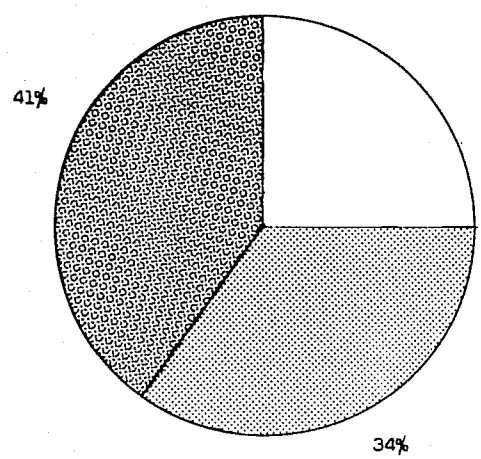


63,1%

1.7 COLOUR CHOICE - CONTRAST WARM / COLD (ITTEN)

warm colours - yellow, red, orange (3/12)

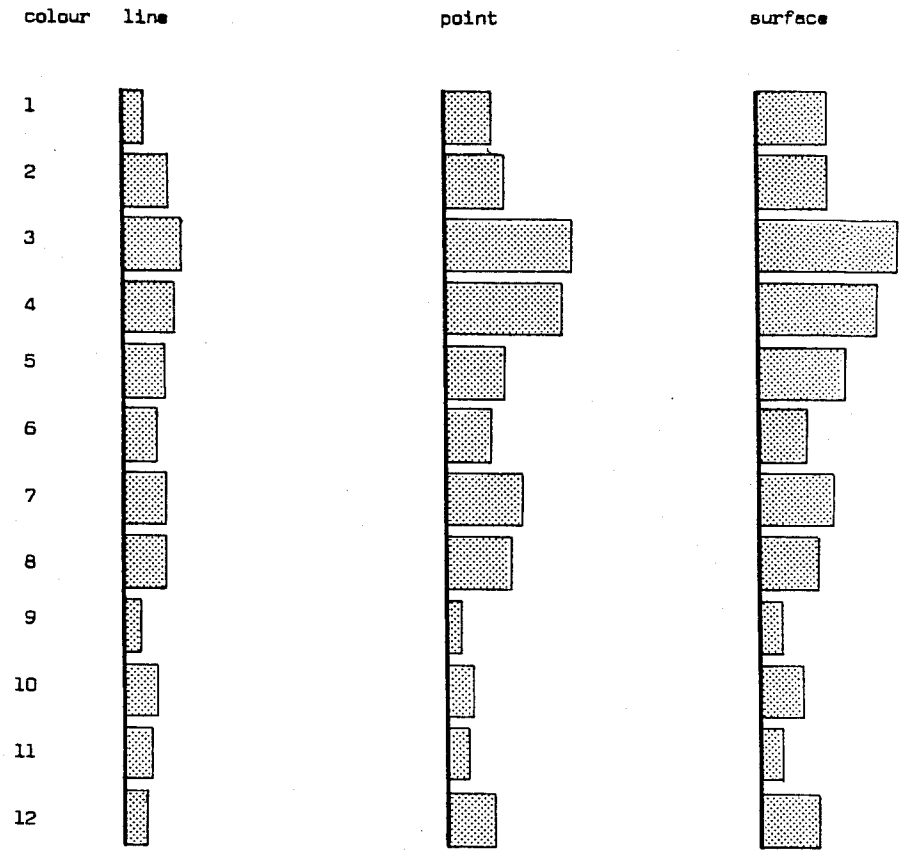
cold colours - blue, green, violet (5/12)



41%

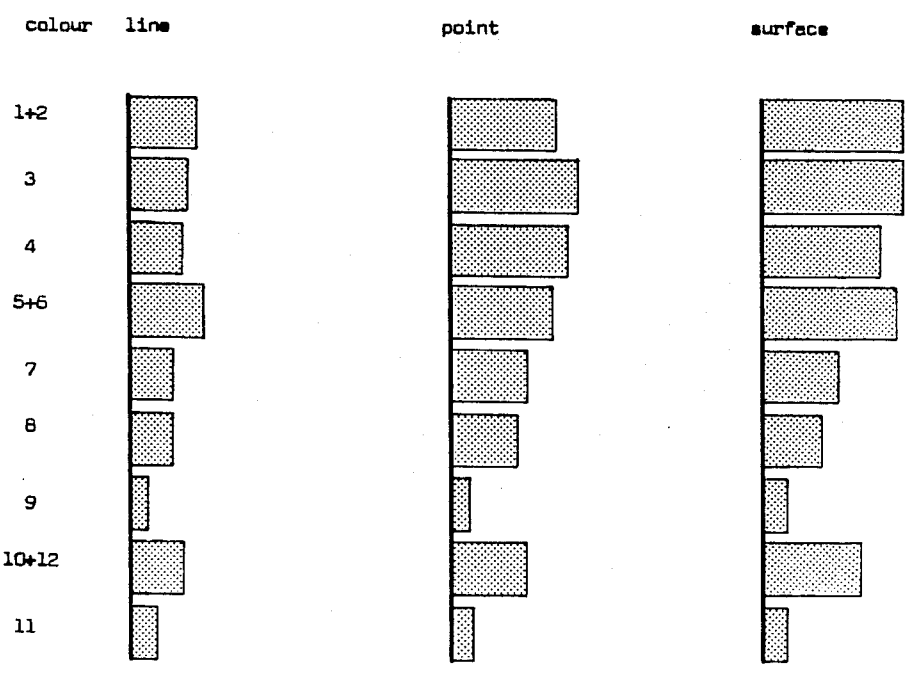
34%

2 COLOUR USE - LINE, POINT / DETAIL, SURFACE



2.1 COLOUR USE - LINE, POINT / DETAIL, SURFACE

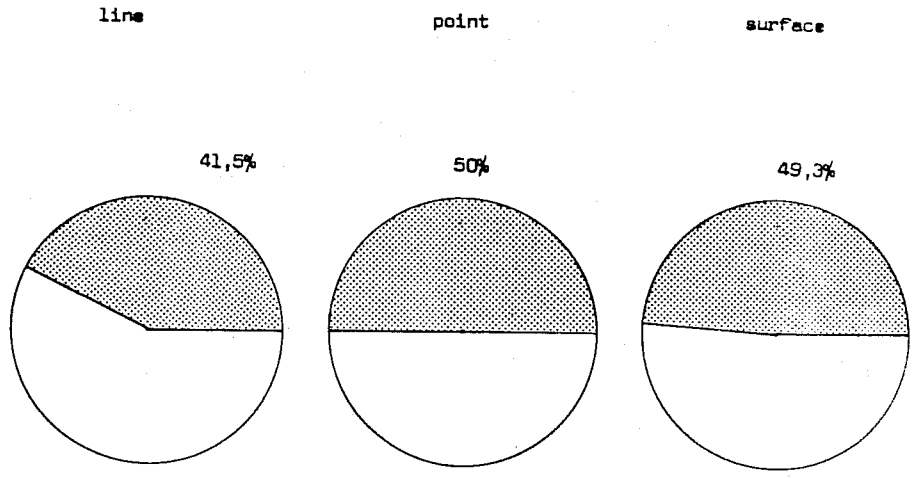
GROUPING LIGHT AND DARK TONALITIES



2.2 COLOUR USE - LINE, POINT / DETAIL, SURFACE

PRIMARY COLOURS (ITTEN)

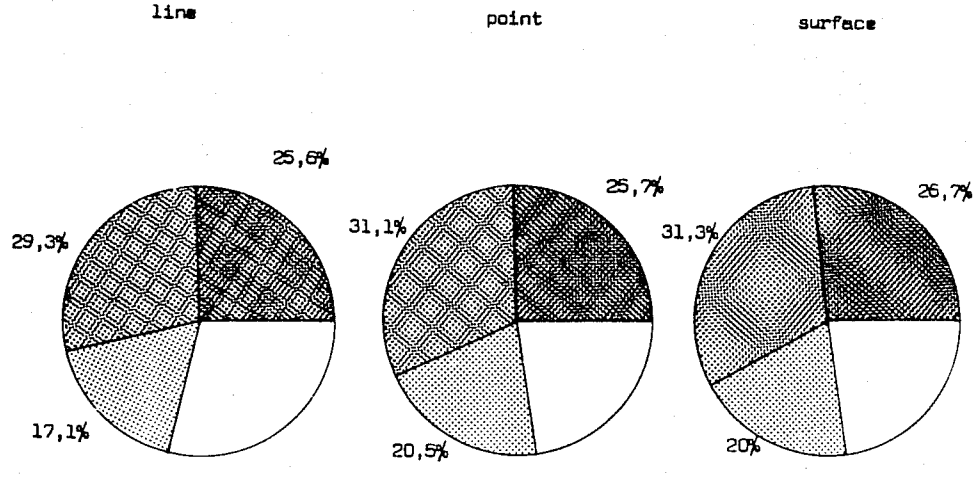
blue, yellow, red (4/12)



2.3 COLOUR USE - LINE, POINT / DETAIL, SURFACE

PRIMARY COLOURS AND THEIR OPPOSITE (ITTEN)

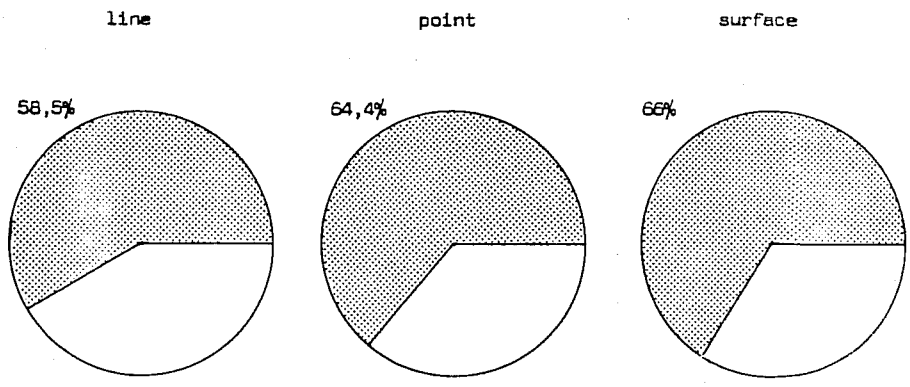
blue / orange (3/12)
red / green (3/12)
yellow / violet (2/12)



2.4 COLOUR USE - LINE, POINT / DETAIL, SURFACE

blue, red, yellow, green (6/12)

vs the others

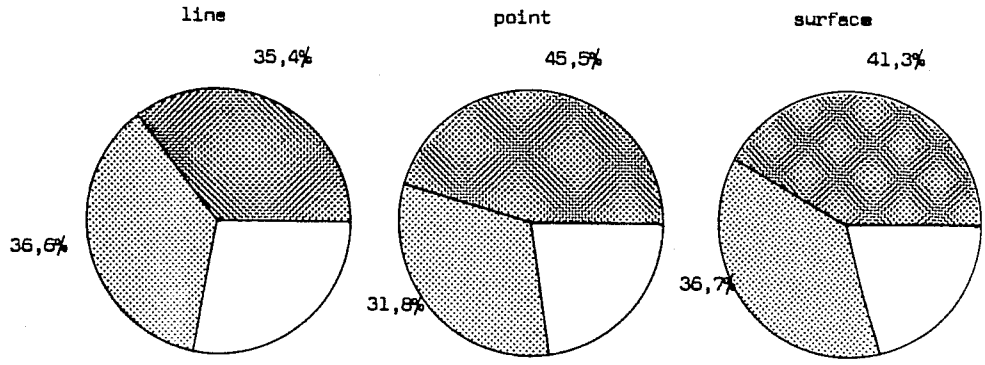


2.5 COLOUR USE - LINE, POINT / DETAIL, SURFACE

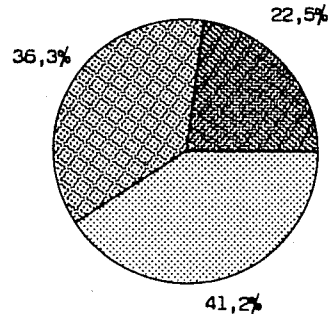
CONTRAST WARM / COLD (ITTEN)

warm colours - yellow, red, orange (3/12)

cold colours - blue, green, violet (3/12)



2.6 COLOUR USE - TOTAL LINE, POINT / DETAIL, SURFACE



3. COLOUR USE - LINE, POINT/DETAIL, SURFACE

INDIVIDUAL CHOICES

	line	point (detail)	surface	sex	class (grade)
1	3	5	6	boy	first
2	0	6	6	boy	first
3	0	6	6	boy	first
4	0	5	6	boy	first
5	0	4	5	boy	first
6	0	6	6	boy	first
7	0	6	5	boy	first
8	6	6	5	girl	first
9	6	6	2	girl	first
10	6	4	6	girl	first
11	5	5	6	girl	first
12	6	6	6	girl	first
13	1	5	6	girl	first
14	6	5	3	girl	first
15	4	6	6	boy	fourth
16	5	4	6	boy	fourth
17	1	6	5	boy	fourth
18	5	2	5	boy	fourth
19	1	2	6	boy	fourth
20	5	1	5	boy	fourth
21	2	5	6	boy	fourth
22	2	4	6	girl	fourth
23	2	6	3	girl	fourth
24	5	4	5	girl	fourth
25	0	0	6	girl	fourth
26	6	6	5	girl	fourth
27	0	5	6	girl	fourth
28	5	6	6	girl	fourth

3.1. Data analysis - colour USE

One Factor ANOVA X_1: sex Y_1: line

Analysis of Variance Table

Source:	DF:	Sum Squares:	Mean Square:	F-test:
Between groups	1	32.143	32.143	6.25
Within groups	26	133.714	5.143	p = .0191
Total	27	165.857		

Model II estimate of between component variance = 27

One Factor ANOVA X_1: sex Y_1: line

Group:	Count:	Mean:	Std. Dev.:	Std. Error:
boy	14	1.857	2.107	.563
girl	14	4	2.418	.646

One Factor ANOVA X_1: sex Y_1: line

Comparison:	Mean Diff.:	Fisher PLSD:	Scheffe F-test:	Dunnett t:
boy vs. girl	-2.143	1.762*	6.25*	2.5

* Significant at 95%

3.2. Data analysis - colour USE

One Factor ANOVA X_1: sex Y_2: point

Analysis of Variance Table

Source:	DF:	Sum Squares:	Mean Square:	F-test:
Between groups	1	.571	.571	.203
Within groups	26	73.143	2.813	p = .6559
Total	27	73.714		

Model II estimate of between component variance = -2.242

One Factor ANOVA X_1: sex Y_2: point

Group:	Count:	Mean:	Std. Dev.:	Std. Error:
boy	14	4.571	1.742	.465
girl	14	4.857	1.61	.43

One Factor ANOVA X_1: sex Y_2: point

Comparison:	Mean Diff.:	Fisher PLSD:	Scheffe F-test:	Dunnett t:
boy vs. girl	-.286	1.303	.203	.451

3.3. Data analysis - colour use

One Factor ANOVA X_1: sex Y_3: surface

Analysis of Variance Table

Source:	DF:	Sum Squares:	Mean Square:	F-test:
Between groups	1	2.286	2.286	2.112
Within groups	26	28.143	1.082	p = .1581
Total	27	30.429		

Model II estimate of between component variance = 1.203

One Factor ANOVA X_1: sex Y_3: surface

Group:	Count:	Mean:	Std. Dev.:	Std. Error:
boy	14	5.643	.497	.133
girl	14	5.071	1.385	.37

One Factor ANOVA X_1: sex Y_3: surface

Comparison:	Mean Diff.:	Fisher PLSD:	Scheffe F-test:	Dunnett t:
boy vs. girl	.571	.808	2.112	1.453

3.4. Data analysis - colour USE

One Factor ANOVA X_1: class Y_1: line

Analysis of Variance Table

Source:	DF:	Sum Squares:	Mean Square:	F-test:
Between groups	1	.571	.571	.09
Within groups	26	165.286	6.357	p = .7667
Total	27	165.857		

Model II estimate of between component variance = -5.786

One Factor ANOVA X_1: class Y_1: line

Group:	Count:	Mean:	Std. Dev.:	Std. Error:
first	14	2.786	2.86	.764
fourth	14	3.071	2.129	.569

One Factor ANOVA X_1: class Y_1: line

Comparison:	Mean Diff.:	Fisher PLSD:	Scheffe F-test:	Dunnett t:
first vs. fourth	-.286	1.959	.09	.3

3.5. Data analysis - colour USE

One Factor ANOVA X_1: class Y_2: point

Analysis of Variance Table

Source:	DF:	Sum Squares:	Mean Square:	F-test:
Between groups	1	11.571	11.571	4.841
Within groups	26	62.143	2.39	p = .0369
Total	27	73.714		

Model II estimate of between component variance = 9.181

One Factor ANOVA X_1: class Y_2: point

Group:	Count:	Mean:	Std. Dev.:	Std. Error:
first	14	5.357	.745	.199
fourth	14	4.071	2.056	.549

One Factor ANOVA X_1: class Y_2: point

Comparison:	Mean Diff.:	Fisher PLSD:	Scheffe F-test:	Dunnett t:
first vs. fourth	1.286	1.201*	4.841*	2.2

* Significant at 95%

3.6. Data analysis - colour USE

One Factor ANOVA X_1: class Y_3: surface

Analysis of Variance Table

Source:	DF:	Sum Squares:	Mean Square:	F-test:
Between groups	1	.143	.143	.123
Within groups	26	30.286	1.165	p = .729
Total	27	30.429		

Model II estimate of between component variance = -1.022

One Factor ANOVA X_1: class Y_3: surface

Group:	Count:	Mean:	Std. Dev.:	Std. Error:
first	14	5.286	1.267	.339
fourth	14	5.429	.852	.228

One Factor ANOVA X_1: class Y_3: surface

Comparison:	Mean Diff.:	Fisher PLSD:	Scheffe F-test:	Dunnett t:
first vs. fourth	-.143	.839	.123	.35

3.7. Data analysis - colour USE

Anova table for a 2-factor Analysis of Variance on Y_1: line

Source:	df:	Sum of Squares:	Mean Square:	F-test:	P value:
class (A)	1	.571	.571	.158	.6946
sex (B)	1	32.143	32.143	8.882	.0065
AB	1	46.286	46.286	12.789	.0015
Error	24	86.857	3.619		

There were no missing cells found.

The AB Incidence table on Y_1: line

	sex:	boy	girl	Totals:
class	first	7 .429	7 5.143	14 2.786
	fourth	7 3.286	7 2.857	14 3.071
Totals:		14 1.857	14 4	28 2.929

Data analysis - colour USE

Anova table for a 2-factor Analysis of Variance on Y_2: point

Source:	df:	Sum of Squares:	Mean Square:	F-test:	P value:
class (A)	1	11.571	11.571	4.607	.0422
sex (B)	1	.571	.571	.227	.6377
AB	1	1.286	1.286	.512	.4812
Error	24	60.286	2.512		

There were no missing cells found.

The AB Incidence table on Y_2: point

	sex:	boy	girl	Totals:
class	first	7 5.429	7 5.286	14 5.357
	fourth	7 3.714	7 4.429	14 4.071
Totals:		14 4.571	14 4.857	28 4.714

3.9. Data analysis - colour USE

Anova table for a 2-factor Analysis of Variance on Y_3: surface

Source:	df:	Sum of Squares:	Mean Square:	F-test:	P value:
class (A)	1	.143	.143	.125	.7268
sex (B)	1	2.286	2.286	2	.1701
AB	1	.571	.571	.5	.4863
Error	24	27.429	1.143		

There were no missing cells found.

The AB Incidence table on Y_3: surface

	sex:	boy	girl	Totals:
class	first	7 5.714	7 4.857	14 5.286
	fourth	7 5.571	7 5.286	14 5.429
Totals:		14 5.643	14 5.071	28 5.357

4. COLOUR - OTHER FACTORS

	I boys	I girls	IV boys	IV girls	T.I	T.IV	T. B	T. G	Total
pencil use	7	3	6	4	10	10	13	7	20
paper basis	7	5	4	4	12	8	11	9	20
lined colour	7	7	2	0	14	2	9	7	16
decorative colour	7	7	0	0	14	0	7	7	14

4.

	total	total B.	total G.	total I	total IV
pencil use	71,4%	92,8%	50%	71,4%	71,4%
paper basis	71,4%	78,5%	64,2%	85,7%	57,1%
lined colour	57,1%	64,2%	50%	100%	14,2%
decorative colour	50%	50%	50%	100%	0%

4.

	boys I	girls I	boys IV	girls IV
pencil use	100%	42,8%	85,7%	57,1%
paper basis	100%	71,4%	57,1%	57,1%
lined colour	100%	100 %	28,5%	0%
decorative colour	100%	100 %	0%	0%

5. REPRESENTATION STRATEGIES

5.1. TRIDIMENTIONALITY EFFECTS (%)

	boys I	girls I	boys IV	girls IV	T.I	T.IV	T.B.	T.G.	Tota
Obliquity	14,2	14,2	42,8	57,1	14,2	50	28,5	35,7	32,
Superposition	0	0	100	28,5	0	64,2	50	14,2	32,
Deformation	28,5	0	57,1	28,5	14,2	42,8	42,8	14,2	28,
Gradation	28,5	28,5	57,1	71,4	28,5	64,2	42,8	50	46,
Lateral proj.	57,1	57,1	42,8	28,5	57,1	35,7	50	42,8	46,
Axonometric proj.	0	0	0	14,2	0	7,1	0	0	3,
Transparency	42,8	28,5	42,8	57,1	35,7	50	42,8	42,8	42,
Planification	100	71,4	100	85,7	85,7	92,8	100	78,5	89,

5.2. MOVEMENT EFFECTS (%)

	boys I	girls I	boys IV	girls IV	T.I	T.IV	T.B.	T.G.	Tota
Obliquity	14,2	28,5	71,4	71,4	21,4	71,4	42,8	50	46,
Deformation	14,2	0	0	0	7,1	0	7,1	0	7,
Gradation	28,5	14,2	28,5	71,4	21,4	50	28,5	42,8	35,
Sharpness	85,7	14,2	57,1	28,5	50	42,8	71,4	21,4	46,
Inc. shapes	14,2	0	14,2	0	7,1	7,1	14,2	0	7,
Curves	42,8	100	42,8	42,8	71,4	42,8	42,8	71,4	57,

5.3. SPACE OCCUPATION (%)

separated units	57,1	71,4	0	0	64,2	0	28,8	35,7	32,
Problems	100	100	28,5	28,5	100	28,5	64,2	64,2	64,
related units	42,8	28,5	100	100	35,7	100	71,4	64,2	67,

5.4. MOTOR PERFORMANCE PROBLEMS (%)

Pressure	85,7	71,4	42,8	0	78,5	21,4	64,2	35,7	50
Skidding	100	71,4	14,2	14,2	85,7	14,2	57,1	42,8	50
Configuration	100	100	14,2	28,5	100	21,4	57,1	64,2	60,

5.5. GRAPHIC MEDIUM - only coloured pencils were available.

6. SUBJECT (%)

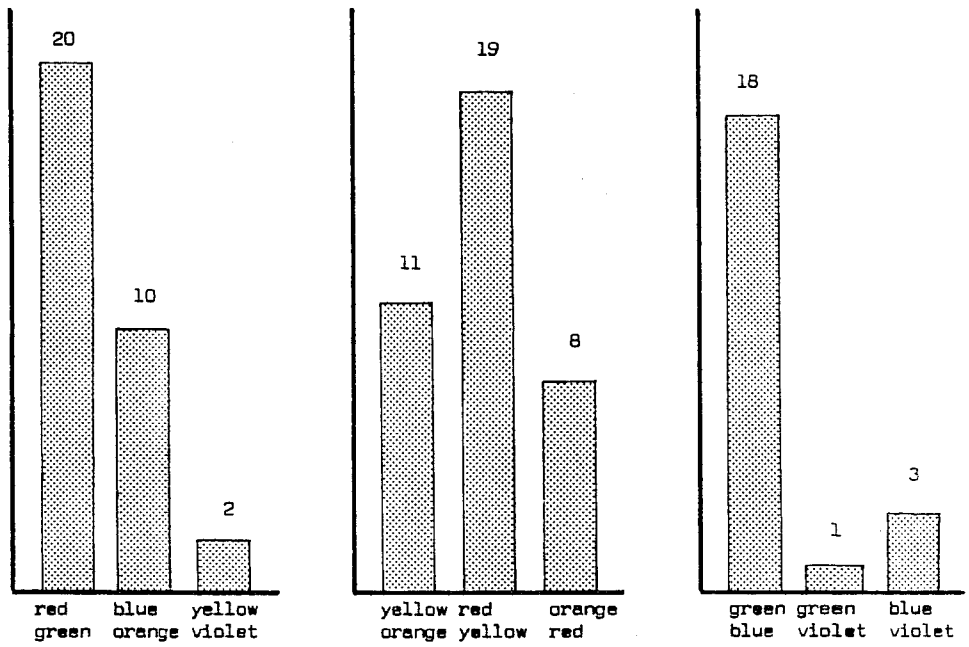
	boys I	girls I	boysIV	girlsIV	T.I.	T.IV.	T.B.	T.G.	Total
Isolated units	52,1	28,5	0	0	42,8	0	28,5	14,2	[illegible]
Contextuel units	42,8	71,4	100	100	57,1	100	71,4	85,7	[illegible]

Natural elements									
sun	100	100	100	85,7	100	92,8	100	92,8	[illegible]
sky	0	14,2	71,4	71,4	7,1	71,4	35,7	42,8	[illegible]
moon	0	14,2	0	14,2	7,1	7,1	0	14,2	[illegible]
clouds	100	100	28,5	28,5	100	28,5	64,2	64,2	[illegible]
stars	14,2	28,5	0	14,2	21,4	7,1	7,1	21,4	[illegible]
lake	0	28,5	14,2	14,2	14,2	14,2	7,1	21,4	14,2
sea	0	0	14,2	0	0	7,1	7,1	0	3,5
river	0	0	28,5	57,1	0	42,8	14,2	28,5	21,4
mountain	14,2	0	71,4	28,5	7,1	50	42,6	14,2	28,5
rain	0	0	0	0	0	0	0	0	0
trees	57,1	57,1	85,7	100	57,1	92,8	71,4	78,5	75
flowers	71,4	85,7	42,8	57,1	78,5	50	57,1	71,4	64,2
grass	14,2	57,1	14,2	14,2	35,7	14,2	14,2	35,7	25
ground	42,8	42,8	100	100	42,8	100	71,4	71,4	71,4
others	42,8	14.2	28,5	42,8	28,5	35,7	35,7	28,5	32,1
Alive elements									
persons	100	100	100	100	100	100	100	100	100
air animals	100	100	57,1	42,8	100	50	78,5	71,4	75
water animals	0	28,5	0	42,8	14,2	21,4	0	35,7	17,8
land animals	42,8	14,2	42,8	42,8	28,5	42,8	42,8	28,5	35,7
unusual el.	14,2	0	14,2	0	7,1	7,1	14,2	0	7,1
sun face	85,7	71,4	28,5	42,8	78,5	35,7	57,1	57,1	57,1
others	0	0	0	0	0	0	0	0	0
El. made by men									
houses	100	100	100	100	100	100	100	100	100
pads	28,5	71,4	0	14,2	50	7,1	14,2	42,8	28,5
interiors	0	0	0	0	0	0	0	0	0
smoke/TV	100	100	42,8	42,8	100	42,8	71,4	71,4	71,4
boats	0	14,2	14,2	28,5	7,1	21,4	7,1	21,4	14,2
planes	100	0	42,8	0	50	21,4	71,4	0	35,7
helicopters	0	0	0	0	0	0	0	0	0
parachutes	0	0	0	0	0	0	0	0	0
cars	85.7	14,2	0	0	50	0	42,8	7,1	25
words	14,2	14,2	57,1	57,1	14,2	57,1	35,7	35,7	35,7
decorative e.	0	100	0	0	50	0	0	50	25
guns	14,2	0	14,2	0	7,1	7,1	14,2	0	7,1
others	85,7	57,1	100	71,4	71,4	85,7	92,8	64,2	78,5
Quiet games	28,5	57,1	14,2	85,7	42,8	50	21,4	71,4	46,4
action games	71,4	42,8	85,7	28,5	57,1	57,1	78,5	35,7	57,1
work activity	0	28,5	28,5	28,5	14,2	28,5	14,2	28,5	21,4
war games	14,2	0	14,2	0	7,1	7,1	14,2	0	7,1

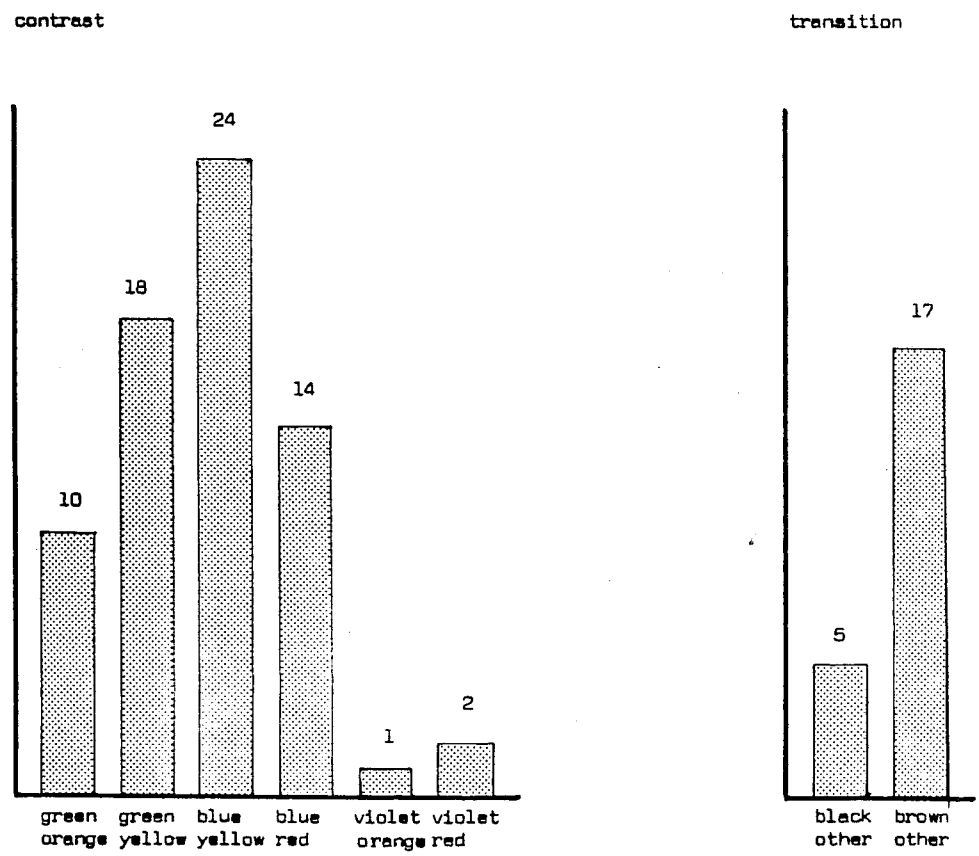
7. COLOUR CHOICE - PAIRS OF COLOURS

Pairs of colours / Pupils		red green	blue orange	yellow violet	green orange	green yellow	blue yellow	blue red	violet orange	violet red	yellow orange	yellow red	orange red	green blue	green violet	blue violet	black	brown
first grade	boys	6	1	1	1	4	5	4	0	2	2	4	3	2	0	1	2	3
	girls	4	5	0	4	4	6	5	1	0	5	5	3	4	0	1	0	3
total		10	6	1	5	8	11	9	1	2	7	9	6	6	0	2	2	6
fourth grade	boys	5	2	1	3	5	7	3	0	0	2	5	2	7	1	1	2	8
	girls	5	2	0	2	5	6	2	0	0	2	5	0	5	0	0	1	5
total		10	4	1	5	10	13	5	0	0	4	10	2	12	1	1	3	11
TOTAL		20	10	2	10	18	24	14	1	2	11	19	8	18	1	3	5	17

7.1 COLOUR CHOICE - PAIRS OF COLOURS - CONTRAST / CONTINUITY



7.2 COLOUR CHOICE - PAIRS OF COLOURS - CONTRAST / TRANSITION



7.3. COLOUR USE - OTHER EFFECTS - II (%)

	boys I	girls I	boys IV	girls IV	T.I.	T.IV	T.B.	T.G.	Total
soft colours	28,5	42,8	42,8	71,4	35,7	57,1	35,7	57,1	46,4
strong colours	71,4	42,8	28,5	14,2	57,I	21,4	50	28,5	39.2
intentional ≠	0	14,2	28,5	14,2	7,1	21,4	14,2	14,2	14.2
superposition	0	0	57,1	14,2	0	35,7	28,5	7,1	17.8

8. INTERPRETATION OF THE RESULTS

8.1. COLOUR

If we look tc 3ox 1, the most obvious feature is the similarity between boys and girls, and first and fourth grade in what colour choices are concerned . We present the colours chosen in rank order of popularity (Box 1.1) and a correlation matrix between those choices (Box 1.2.).

As we can see, all the correlations are positive. Colours choice are quite similar in all the four subgroups. First grade boys and girls agree quite closely, as well as girls in both grades and boys in both grades . Fourth grade boys and girls are only weakly correlated.

Inspection of the rank order correlation suggests that boys resemble girls closely in the first grade but less in the fourth grade. Boys choices remain stable between the first and fourth grade as well as girls.

If we consider the colours themselves, red and yellow were the most popular (Box 1 ; Box 1.1) , violet and black were the less popular.

Next we present the frequences of colour choices, grouping dark and light tonalities (Bcx 1.3.). The rational behin that ensemble is that our theoretical main references do not consider those different tonalities as different colours (Itten, Da Vinci op. cit.). We indicate the colours by means of numbers, and the correspondance number / colour is presented (Box 1.1.). The upper numbers correspond to the number of pupils (N = = 28) who chose each colour.

Blue, red, yellow, green are thus the more popular; violet and black the less popular.

Each pupil could choose 6 colours, the total for choices being 168 (6 x 28). We can see (Box 1.4.) that primary colours (1/3 of the available pencils) represent 47,6 % of those 168 choices which suggest its greater popularity.

If we consider primary colours and their opposite (2/3 of the available pencils), they represent 75 % of the choices (Box 1.5.). The pair red--green was the most popular.

If we consider Da Vinci basic colours, we have for 6 pencils out of 12 , 63,1 % of the total choices (Box 1.6)

Next we considered the effect warm / cold. Warm colours (1/4 of the available pencils) represented 41 % of the total choices. If we have another look to Box 1.5. , we can see that in each pair of primary colours and their opposite, warm colours seem to be more popular. However if we look back to Box 1.3., it is quite clear how that difference can be explained by the difference between orange and violet popularity.

We considered then colours use as lines, point / detail, or surface . If we look to Box 2 and Box 2.6., it would seem that colours were mostly used to cover surfaces.

If we compare Box 2.1. and Box 1.3., the most the most obvious feature is the similitude of the distributions of colour choices. Yet we could per - haps notice that yellow and red are not so frequently used to draw lines. Orange and pink frequences suggest that pink was more often used (Box 1, 1.3), but not so often used for lines, details and surfaces in the same drawing (Box 2 and Box 2.1.).

If we next have a look at Boxes 2.2 to 2.5, and if we compare the results

to those presented in Boxes 1.4. to 1.7. respectively, we can see that all the comments that we made for colour choise, are also true if we consider separately colour use as a line, a detail or a surface.

On the whole the results suggest that the more popular the colours are , the more often they are used either as lines, details or surfaces. We saw a few exceptions (red and yellow, and orange and pink) and we could add (Box 2.5) that cold colours were more frequent than warm colours when used as lines. That effect was not explained by a wider use of violet , neither by a lower use of orange, but rather by the lower use of red and yellow (warm colours) as lines (Box 2 and Box 2.1.)

Next we considered individual uses of colour as lines, details or surfaces (Box 3) and we made an ANOVA on gender (Box 3.1., 3.2., 3.3.) and on grade (Box 3.4., 3.5., 3.6.) for each of the three uses. Finally we made a two factors ANOVA gender/ grade for each of those three uses as well (Box 3.7., 3.8., 3.9.).

As we had already commented, significance testing is perhaps of no great value, since in each of the 4 subgroups we had only seven elements. In the other hand we have no great guarantee (theoretical or other) about high individual consistency from a drawing to another, in what colour choice or use are concerned.

With those limitations in mind, results suggest that girls used significantly more often colours as lines than did boys (Box 3.1). There was no difference for gender, considering colour use as details or surfaces. There were no differences for grades considering colour use as lines and surfaces. (Box 3.1 to 3.6). Fourth grade used significantly less colours as details than first grade did (Box 3.5).

A two factor ANOVA on line use (Box 3.6) shows a significant difference for gender and for the combined influence gender/grade. Colour use as a line was less frequent in first grade boys and fourth grade girls.

A two factor ANOVA on surface (Box 3.7) shows no significant difference for gender.

A two factor ANOVA on detail (Box 3.8) shows a significant difference for grades, suggesting fourth grade use less colours for details, specially boys.

A two way ANOVA on surface (Box 3.9) shows no significant difference for gender, grade or combined influence gender/grade.

Results suggest that although girls and boys as well as first and fourth grade are quite similar in what concerns colour choices (Box 1), the different colours for themselves are not equally popular, and some differences appear as well in what concerns colour use as lines, details, and surface.

We considered other factors in colour analysis from which frequences and percentages are presented in Box 4.

Graphit pencil use occurs in 71,4% of the drawings ,more frequently in first grade boys (100%). If we compare those results to those in Box 3.7. we can see that first grade boys who were great graphit pencil users, used colours as lines significantly less. However that regularity does not occur in the other subgroups.

Fourth grade uses more frequently a coloured basis for their drawings instead of keeping a white paper basis.

In what concerns the use of a colour by lining the paper surface in order to give a colour effect, differences were extreme between grades (100 % in the 1st grade 0 % in the 4 th grade). 100 % of 1st grade used colour in a decorative way (correspondence was occasional between the colour they chose and the real colour of the objects). 0 % of the 4th grade used colour in a non-realistic way.

By that time we were not very happy about our methodology adequacy to characterise children choises and use of colour. As we have referred we added an extra-grid where we observed other characteristics in colour use, as well as colour choice in what the relationship between the colours in a same drawing is concerned. The frequences of colour choices - pairs of colours used side by side, are presented in Box 7.

For the reasons we referred we did not make a significance testing on pairs choice. If we compare the popularity of each pair in the two grades and in different genders, similarity is the most relevant feature. However it is perhaps interesting to notice that 1st grade girls regularly got higher frequences for pairs of colours which include orange; 1st grade regularly got higher frequences for the pair blue / red while 4th grade got regularly higher frequences for the pair blue / green.

The most popular contrastable pair, considering the highest contrast primary colours (Itten) and their opposite, was the pair red / green, and the less popular was the pair yellow / violet. These results suggest that red and green together not only were the most usually chosen colours (Box 1.5.) and the more often used as lines, details or surfaces (Box 2.3.) but were also the more often used as a contrastable pair. The same is true for the pair yellow / violet in the opposite sense. However if it

is quite obvious that if violet is not frequent then the pair yellow / violet could not be popular either, in what the pair red / green is con - cerned, it could be that each of those colours were popular,as it was the case, but not popular together as a contrastable pair, which was finally the case as well.

In what a warm continuity effect (Itten) is concerned, the pair yellow/ red was the most popular; and to a cold continuity effect, the pair green / blue was the more frequent. It is interesting to notice that as a whole the warm continuity was preferred either to the contrast or to the cold continuity. Besides warm continuity was more homogeneously assured by the three pairs of colours envolved, choices being more extreme among the three pairs considered for contrast or cold continuity effect.

If we consider now intermediate contrasts between pairs of colours which are not opposite (Itten), we see (Box 7.2.), the pair blue / yellow was the most popular. This pair was besides the most popular of all the pairs, corresponding mostly to thecontrast sun / sky - clouds in the drawings (Box 7.2.).

Next we considered black and brown while transition borders. Results suggest that children did not use often the effect of isolating colours by means of colouring black borders, but they did use brown to " cut " the contrast effect between two colours.

We observed as well if any colour was predominant in the whole drawing (see colour - extra grid , appendix C). A single colour predominance only happened in fourth grade (57,1 %) where four boys and four girls used a single colour more extendly than the others. More predominant colours were yellow (once), brown (once), green (six times)

That predominance is probably connected with the fact that children were asked to draw a " view "; but the fact that only 4th grade shows that predominance seems to be connected with several other signs of a wider concern about a holistic context, as we will see again for other points.

Considering the softness of colour use, either in a lined or in an homo - geneous way (Box 7.3), 4th grade used colour softly more often , and girls in both grades seemed to show that preference, just as it happened for homogeneous colour use (Box 4). But indeed the results were not coincident: some first grade used colours softly but not homogeneously, and some 4th grade girls used colours homogeneously but strongly.

Very few pupils (14,2 %) used different colour pressure in order to obtain different effects, 1st grade boys did not use that process at all (Box 7.3.); 17,8 % of the pupils, mostly 4th grade boys, superposed colours in order to obtain different tonalities.

8.2. REPRESENTATION STRATEGIES

In what the effects used to obtain tridimentionality are concerned (Box 5.1.), planification was the most frequent process in both grades and gender, slightly more frequent in boys (100 %). Planification is, as we saw in Part II, quite a failed process in what products correspondence to the reality are concerned and/ or in tridimentionality effects obtention. Still it is more than twice used as any of the other processes, 4th grade included.

Transparency is also a quite failed process, since it also lowsthe representation adequacy to reality. Yet it was not so frequently used as plani-

fication (42,8 %).

As for the other processes which would allow a better correspondence to reality, obliquity, superposition, deformation, gradation were more often used by 4th grade (Box 5.1.). Girls did not use superposition and deformation as frequently as boys. First grade used more often lateral projections than did 4th grade, specially 4th grade girls. Axonometric projections were only found in one 4th grade girl drawing (Box 5.1.).

In what processes used to obtain movement effects are concerned (Box 5.2.) , 4th grade used more frequently obliquity and gradation (gradation was more frequent in girls) , while 1st grade used more frequently sharpness (boys), and curves (girls). In the whole incomplete shapes and deformation were not frequent (7,1 %), and curves were the most frequent (57,1 %).

Next we see (Box 5.3.) that 1st grade draw more frequently separated elements in drawings (64,2 %). Yet they had problems placing all their units in the available space (100 %). Fourth grade created a contextual visual environment for their units (100 %), yet they had less problems with space occupation (28,5 %).

At last (Box 5.4.), motor performance problems were more frequent in 1st grade: 78,5 % of 1st grade showed problems to control pencil pressure on the paper. If we compare those results with those presented in Box 7.3 we can see that 1st grade who apparently were able to colour their drawings in a soft maner, presented yet pressure problems when drawing with the graphit pencil. Only 21,4 % of 4th grade presented problems to control pencil pressure on the paper.Girls were better performers (35,7 %

of the girls and 64,2 % of the boys showed pressure problems).

First grade had also biggest problems to respect the limits of the surface to be coloured (85,7 % skidding problems in the 1st grade and 14,2 % in the 4th grade). If we compare those results to those in Box 4 and Box 7.3. , we notice that at least a girl who coloured her drawing in an homogeneous way, showed skidding problems , and at least two girls who coloured their drawings in a lined way did not show skidding problems.

First grade showed much more configuration problems (100 %) than 4th grade (21,4 %). If we compare those results with those in Boxes 5.1. and 5.2., we can notice that configuration deformation was not coincident to an intention to obtain tridimentionality or movement effects.

We are not here concerned with graphic medium differences, since only coloured pencils were available.

In our sample we found no drawings with a visible use of rubber. However we thought that for a broader application of that methodology, an item concerning rubber use must be added.

8.3. SUBJECT

All the fourth grade in our sample, not only related visually the units they draw (Box 5.3.), but they also included them in a coherent whole in what the subject they intend to represent is concerned, at least as far as that subject was to be understood by another person. The observation of the drawings suggested us a comparison : 4th grade drawings were more like a stage prepared for an exhibition, where the objects are ads-

quately placed where they are necessary, and where the spectator can understand what relates all the objects with each others ; while 1st grade were more as a stage where the spectator do not understand very well what kind of a play is to be acted, and where all the objects seem to be placed just where there was enough room (Box 5.3,and Box 6 : contextual vs isolated units).

First grade girls were more concerned about units integration in a coherent whole (71,4 % of the girls and 28,5 % of the boys in 1st grade). If we compare those results with those in Box 5.3. we can notice that at least some 1st grade girls draw visually separated units and yet they related them in what the subject to be represented is concerned.

Concerning the units themselves, only a fourth grade girl did not represent the sun (writing on her drawing " what a wonderful moonlight "). First grade preferred to represent clouds in the drawings (100 %) instead of the sky surface (7,1 % - as it is obvious, a children who represent both the sky and the clouds). On the opposite 4th grade represented more frequently the sky surface (71,4 %) instead of separated units that stood for the clouds (28,5 %).

Elements such as stars, lakes, sea, river, rain were not very popular (Box 6) while mountains appeared specially in 4th grade, mostly to define land limit (50 % in the 4th grade, 7,1 % in the 1st grade). Ground line was more frequent in 4th grade (100 %) than in 1st grade (42,8 %). If we compare those results with those in Box 5.3. and Box 6 (isolated vs contextual units) , we notice a regularity between the percentage of 1st grade boys who draw the ground line and who related their units either visually or concerning subject. That regularity is true for the

other subgroups except for 1st grade girls.

75 % of the children included trees in their drawings, more frequently 4th grade (92,8 %). Flowers were represented in 64,2 % of the drawings, more frequently in 1st grade (78,5 %) and in girls drawings (71,4 %). Grass was not very popular (25 %), and was represented mostly in 1st grade girls drawings (57,1 %).

" Other elements " (natural elements) appeared in 32,1 % of the drawings, but there was no regularity in the representation of a particular object , so as to be necessary to include it in a separate item.

Following our instructions all the children represented persons and ~~houses~~ in their drawings. Air animals were present in all 1st grade productions, and 50 % of the 4th grade. Water animals were not present in any boy drawing and existed in 35,7 % of the girls, more frequently in 4th grade girls. Land animals were present in 37,7 % of the drawings, less frequently in 1st grade girls (14,2 %). Unusual alived elements (E.T., B.D. monsters e.g.) were present in 7,1 % of the drawings, but not in girls'. The sun appeared with a face in 57,1 % of the drawings, more frequently in younger pupils as we could expect according to the theory (Piaget op. cit.) (78,5 % of the 1st grade and 35,7 % of the 4th grade),less frequently in 4th grade boys (28,5 %).

Pads appeared more frequently in 1st grade, specially in girls (71,4 %). Interior spaces were not present, which had also surely to do with our initial instruction (" draw a view "). On the opposite smoke in the chimneys and T.V. aerials were present in all 1st grade drawings and in 42,8 % of the 4th grade.

Helicopters, parachutes,boats and guns were not very popular which contrasts to our previous experience, at least in what boys drawings are concerned. Cars were present in 50 % of the boys, specially 1st grade boys. (85,7 %). Planes were also present in 71,4 % of boys drawings, and 100 % of the 1st grade boys.

Words appeared in 35,7 % of the drawings, more frequently in 4th grade (57,1 %). Decorative elements (hearts flotting in the air, little coloured spots or lines) appeared in all 1st grade girls and no where else. A great percentage of children included other elements in their drawings (78,5 %), but there was not a notorious consistency among those extra elements, in order to make us consider worth while to include them in separated items.

In what the activity suggested by the drawing is concerned, 71,4 % of the girls represented a quiet activity while 78,5 % of the boys represented actions.For 28,4 % of the children the activity either quiet or not , envolved a work purpose, 1st grade boys never represented work activity. War activity was not as frequent as we would expect (7,1 %) , althought only represented by boys as we could expect.

PART V

1. DISCUSSION AND CONCLUSIONS

1.1. THE OBSERVATION METHODOLOGY

1.1.1. RELIABILITY

1.1.2. LIMITATIONS

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PART V

1. DISCUSSION AND CONCLUSIONS

1.1. THE OBSERVATION METHODOLOGY

Our first initial question was " What is it important to notice when observing children drawings? (What factors ? How?), and our initial hypothesis was that it was important to notice a few points that we could include in three big groups : colour, representation strategies and subject. We presented then an observation grid in order to observe and register those points.

1.1.1. RELIABILITY

The drawings were observed by two independent observers. We include the observation grids (appendix A and B).

A reliability between observers were established and we got 88 % for colour, 86 % for representation strategies, 87 % for subject (87,5 % for the whole grid). We think that that high reliability was possible because both the observers participated in the ellaboration process, thus a common language was surely improved by this fact.

Anyhow, this methodology was ellaborated as a guide to understand the relevant factors in children drawings. Observers should always get familiar to the literature in order to understand those factors and thus be able to identify them accurately.

1.1.2. LIMITATIONS

Colour

In what colour is concerned, it was particulary difficult to note "light" and "dark" (blue, green, brown). It was sometimes hard to make a difference between a light blue, very strongly applied and a dark blue very softly applied (e.g.). That fact had surely to do with the graphic medium we used (coloured pencils) and their quality which was merely average. We had also some problems to make a difference between noting the biggest details and the smallest surfaces accurately, although we had determined sizes beforehand.

In the whole our methodology can be used for observing drawings with or without limitation in the number of available colours.

We could have noticed not only if each colour was used or not, but also how many times and how important was its use. We decided not to use our grid in such a way for fearing an important reliability loss.

As for contrast, we looked for contrasts and continuities in each drawing in terms of the products. That is, we were able to notice if a colour stood side by side with some other,but not if it was an immediate effect, by the use of one of the colours being immediately followed by the use of the other.

In order to know "following what sequence" colours were used, we had to collect drawings individually,or asking children to note sequence themselves which would be obviously neither easy nor too reliable and could interfer in their productions.

In order to know "how important was each colour use "we had either to

ellaborete a complex process of measuring or then to rely on a subjectif measuring. We tried both those processes and were not able to find a suitable reliable solution.

In what gender and grade differences for colour preference were concerned considering children and teachers theories, at least some of them could be connected with that "how important is the use" thus, with the way we used the present methodology we could not have noticed them.

We also must take in consideration that colour may differ according to the subject. That was one of the reasons that make us fix a similar broad subject for all the drawings in our present sample. For a free drawing we can observe the colour preference, but this factor is hardly comparable in different drawings, at least if colour is used in a realistic way.

It could be interesting to study regularities in colour preference in the same child (with different or the same subject), and between groups of children according to other variables (socio-cultural, personality characteristics...).

Colour preference and use may also be altered by the graphic medium characteristics, and that would also be an interesting point to study-regularities in colour use and preference with different graphic mediums .

Representation strategies

In what representation strategies are concerned, the most complicated was to state if a particular effect suggested movement or tridimentionality. Indeed sometimes it suggested both, either probably by chance or because there was an intention of representing movement in a tridimentional space, both those factors being important in that representation.

We were also sorry we could not note the sequence of the register, in order to have a full idea of the problems that children had to face so as to be able to draw all the units sharing the available space; and to have a full idea in what extent the processes used for tridimentionality or movement effects were intentional or if they were provoqued either by those space occupation problems or by motor performance problems .

As we chose to note " if " a strategie was used, and not " how often " in each drawing, we missed some informations that could help to state differences: for instance planification was used as frequently in 1st grade as in 4th grade, but possibily 1st grade planificated more objects in each drawings.

We must take in consideration that sometimes children avoid representation problems, for instance separing the units or drawing simpler shapes , and some other times they take risks. That fact make the later drawings looking less realistics than the formers thus indeed new solutions had being tried. That fact suggests that children who are more to take risks, althought they may improve from those trials,in a first time apparently produce " lower quality " drawings.

On the other hand, drawing simpler shapes do not mean necessarily that children can not draw more complex ones. Sometimes, as we said in Part II, a simple shape can suit the representation purpose, or children criteria of exigence.

With our methodology we partially miss those nuances. For that purpose we could perhaps try to collect drawings individually enquiring children about their procedures, or then, as some authors did (Freeman op. cit.;

Goodnow op. cit. e.g.) presenting them structured representation problems and investigating their solutions systematicly. This last process would also enable us to understand to what extent children are able or not to use particular strategies, when those are the only way to solve a proposed problem.

Something we would also like to be sure is if those strategies can be taught. Children sometimes use particular strategies in one situation, and then seem to be unable to reproduce them elsewhere in the same drawing.It can be that the first use occurs by chance, or that only the first use was relevant for children representation purposes, or that children got fed up in the meantime and are any longer concerned with doing their best (...) but it is possible as well that children use particular strategies for particular objects representation before being able to use that particular strategie whenever it is necessary (for instance super - position of a cloud hidding partially the sun is used in drawings where all the other units are either isolated or related by the use of transparences, or by deforming the units shape in order to be possible their representation in the available space).

We tried once to teach 8 years old children to draw a frontal view of a corridor in order to obtain a depth effect by using perspective laws. Results suggested that children learnt what we could call " local solutions" as well : they did learn to draw frontal views of corridors using perspective laws, yet being not able to transfer that Knowledge / skill using perspective for other purposes. That fact suggested that children may use single examples of particular strategies for particular units (as we saw the sun and the cloud) without being able to generalise that strate-

gie use. With our methodology we can not notice such a difference.

In what motor performance problems were concerned, we are not actually sure that all the features that we noted as motor performance problems were connected with lack of motor control. Indeed they could be connected with an extreme lack of motivation, emotional problems, visuo - perceptive problems ... It would be interesting to compare groups of children in order to isolate those variables from the former motor performance problems in a more accurate way.

Graphic medium also raise different problems that it could be interesting to study in a systematic way. Teachers opinions about 1st grade preference for markers and painting , and fourth grade complaint about the low accuracy those graphic mediums allow, suggest that at first drawing would be easy with thick mediums but not so when accuracy is aimed ; or as Alschule and Hattwick(op. cit.) referred that they serve different purposes .

Subject

Notation for subject was particulary easy, but some of the elements we were expecting were quite uncommon (the sea, the rain, stars, rivers, helicopters, parachutes, guns, boats). By the time we ellaborated our grid, we had seen quite a lot of children drawings and those elements were apparently familiar to us ; that was besides the reason for their inclusion. We can see a partial explanation in the fact that most of the drawings that we had collected till then, came from primary schools in the suburbs of Lisbon, while those in the present sample came from a primary school in the suburbs of a smaller town, where perhaps the influence of B.D., ficti

on movies and fiction literature was not so wide. It was also a village in the country , instead of suburbs near the sea, as happened in Lisbon.

We did collect other drawings in that same primary school before, but they were more restricted ones (" draw a person", " the lady that walks and it rains"; or a sample of free drawings we collected by Christmas , and which included too many elements Christmas most probably suggested). On the opposite in the present sample some farm elements appeared that were not frequent in previous samples.

Those facts suggested, as does literature, that children are somehow influented by their familiarity with subjects or units. Geographical situation, socio-cultural factors, special times of the year., special events in a recent past are surely only some of the variables that can influence the units drawn in children drawings.

In what our methodology is concerned those facts suggested us that perhaps we had better leave an open ended list of items for the kinds of units drawn, that would allow to include all the units represented in each particular sample; or that we might include all the elements in relevant categories, being not such much concerned about all the different units that might appear, but rather with relevant ensembles; or finally that we could note only particular units that might interest us particularly for the purpose of the study.

As we have already referred it would be specially important as well, to get sure about children own consistency from a drawing to another.

Representation strategies would be, according to the literature and to what we could observe, probably the most consistent factor.

In what colour and subject are concerned , we thought that probably any attempt to study them, had better be more restrict (studying special units, or special aspects of colour use e.g.) and more systematic .

1.2. DATA ANALYSIS

Our second initial main question was " (How) do children differ in what their pictorial productions are concerned? ", and our initial hypothesis was that differences would exist between gender and / or grade in what colour, representation strategies and subject were concerned. We also considered the existence of some regularities in the use of some of the items included in each of those three factors, for the whole sample. Those could perhaps make a difference between primary children drawings characteristics and children from other levels, or adults e.g.

In what our methodology application is concerned, we would like to stress once more that our results must be considered having in mind the limitations due to sample size, sampling procedures, data collection procedures, data analysis procedures as well as a not so clear theoretical evidence about children consistency from a drawing to another. We will also keep in mind that the observation results were issued from our methodology and that with different methodologies different factors would appear, or the same factors would possibly be expressed in a different manner (Aubin op. cit. e.g.)

With those limitations in mind we will expose the more relevant results considering:

- how those factors appeared in children drawings
- how boys and girls drawings differed
- how 1^{st} and 4^{th} grade drawings differed

We will then relate those results to teachers and pupils opinions about gender and grade differences in drawings .

1.2.1. FACTORS VARIABILITY (how the factors appeared in the drawings)

Colour

We could conclude that boys and girls both in the 1st and in the 4th grade were quite similar in what colours choice is concerned. Colours were mostly used to colour surfaces .

Instead of talking about colour preference we should perhaps talk about colour availability and familiarity. In fact results suggest that pupils tend to use more frequently the colours they use more often in academic tasks , and that seems to have to do with tradition and availability : if we want to buy a four pens set for writing, colours will be usually black, red, blue, green. Pupils do not use red for writing since the teacher usually do; yellow is not frequent as a pen either. Our children in their drawings did not use red and yellow for lines neither. Black is often used for writing, but when drawing pupils have the black graphit pencil if they want to make black lines. In the same way, if we buy a six coloured pencils box, colours will be red, yellow, green, blue, black and brown, the same for a six coloured markers box. If we look into a six colours painting set, the most frequent ensemble till nowadays is red, yellow, green, blue, black and white (that last colour mostly used to mix with some other or to superpose white to another colour) .

Representation strategies

The most relevant feature of our results for the whole sample is that all pupils (4th grade included) used planifications similarly , when at least considering Piaget theory, older pupils in our sample were expected to make less use of that strategie. In the same way , and accor-

ding to Piaget as well, we were not expecting an inferior use of transparencies, comparing with planifications, neither a similitude between its use by older and younger children .

Axonometric projections were not frequent , as expected, in both grades,

According to at least Luquet theory we were not supposed to find such an important number of superposition solutions, since Luquet referred they almost only appear in graphically mature adults.

Subject

Besides persons and houses, as suggested , the most frequent elements in all drawings were the sky / clouds with the sun; air animals in the air, trees and flowers in the ground, which is quite as expected if we remember we had suggested that children drawings were supposed to be " views ".

1.2.2. GENDER DIFFERENCES

Colour

Girls used more frequently colours as lines, specially 1st grade; used less frequently graphit pencil; used more frequently colours in a soft way; used more frequently orange for a contrast / continuity with another colour , specially 1st grade.

Boys superposed colours more frequently than did girls, specially 4 th grade.

Representation strategies

Girls used more frequently gradation to obtain tridimentionality effects, specially 4 th grade; they used more frequently curves to obtain a movement effect; they had less problems controlling pencil pressure on the paper and respecting the units borders, specially 4 th grade.

Boys used more frequently superposition and deformation to obtain tri - dimentionality effects, specially 4th grade; used more frequently sharpness in order to obtain movement effects.

Subject

Girls were more concerned about making a coherent whole in their representations; drew more frequently pads, decorative elements, flowers, grass, specially 1st grade; and their drawings were more frequently related to a quite activity.

Boys drew more frequently cars, specially 1st grade, and planes; their drawings showed more action, less frequently work activity , specially 1st grade, and more often (yet not frequently) games involving guns and war intentions.

1.2.3. GRADE DIFFERENCES

Colour

Boys and girls resembled more in 1st grade than in 4th grade, in what colour choice is concerned.

1st grade used more frequently a white paper basis for their drawings while 4th grade coloured the basis more frequently; they coloured surfa

ces more frequently by means of lining their interior while 4th grade used colour in a more homogeneous way; 1st grade used colour in a decorative way while 4th grade used colour in a realistic way; 1st grade used more frequently colours in a strong way, 4th grade used colours in a softer way, specially girls.

4th grade used less frequently colours for details; they used more often a single predominant colour in their drawings ; they took more advantage of different colour pressure in order to obtain different effects ; they superposed colours in order to obtain different tonalities (yet not very often).

Representation strategies

1st grade used more frequently lateral projections; they usually did not respect natural sizes when related with different distances (gradation) ; they drew units separeted from each other more frequently, having yet problems sharing the available space with them all.

4th grade used more often obliquity, superposition, deformation and gradation, in short they used a wider range of strategies in order to obtain tridimentionality effects; they used more frequently obliquity in order to obtain movement effects; they always related their units with each others, showing yet less problems of space occupation; they showed less problems to control pencil pressure on the paper and to respect the units borders as well as having less problems to close shapes without twisting them.

Subject

1st grade represented more often a sun with a face, as Piaget theory (op. cit.) and Bord research (op. cit.) suggested; they drew more frequently separated units standing for clouds while 4th grade preferred to cover all the upper surface of the drawing,representing the sky; they drew more frequently smoke in the chimneys and T.V. aerials on the roofs, as well as air animals.

4th grade were more concerned with a meanful coherent whole in their drawings; they drew more frequently a ground line, as well as mountains as land limits, specially boys; they represented more frequently words, trees, rivers, as well as work activities.

In the whole our results were a fairly good illustration of Arnheim points of view (op. cit.). In what colour realism is concerned our results illustrate Piaget and Luquet points of views, referred in Part II. However, at least according to our visual art teachers, it is questionable if colour realism is a progress in children productions, or it is rather a submission to a cultural conventionalism. Indeed if drawings are not supposed to be photos but individual creative productions, why using realistic colours , unless when colours realism is included in the representation objectives? why then considering realistic colours use a progress?

1.2.4. COMPARING WITH TEACHERS AND PUPILS THEORIES

Colour

In the whole we got results coincident with pupils theories:

Girls using more details (decorative elements) and girls as well as 4th

grade using colours more softly and colouring biggest surfaces.

And with teachers theories as well:

1st grade using colours in a decorative way, colour realism being more frequent in 4th grade.

In what pupils and teachers assumption of grade and gender differences in colour preferences are concerned, results were only partially coincident, but,as we have already referred a lot of variables are included when considering a colour " lighter " or " brighter" than other, such as for instance the colours around, the strangeness of that colour on a particular unit, the use of graphit pencil borders for a coloured unit ... As we have referred as well,pupils and teachers were perhaps more concerned with the extent of the use of those colours, when they referred their popularity, and we did not note extension differences with our methodology. Or finally either our results occurred by chance or pupils and teacher were making over generalisations, or both...

Representation strategies

In the whole we got results coincident to pupils theories:

1st grade drew things " flat " and did not respect objects size, they showed less motor control when drawing and they drew less well organised drawings (units isolated , problems with their relatedness) .

And with teachers theories as well:

Girls and 4th grade being better performers; girls apparently taking more care; 4th grade producing better and wider tridimentionality effects.

Our results were not coincident with pupils theories in what lateral projection wider use in 4th grade was concerned. But we think that pupils meant human profile when they referred " as viewed by one side ", and in our item we noted every lateral projection and not only faces'.

Subject

We got results coincidents to pupils and teachers theories:

Girls drawing more frequently decorative objects and boys drawing more frequently cars and planes; and 1st grade drawing the ground line less frequently.

And to teachers theories in what colour choices are more alike in 1st grade than in 4th grade; in what other factors are concerned that regularity was not easy to state .

The results that we have just discussed suggested that on the whole our methodology of observation was reliable and adequate both to describe children solutions at representation problems and to state gender and grade differences in problem solving, that on the whole agreed to the literature and with pupils and teachers theories.

With all the limitations of that methodology application it is not prudent to be too conclusive.Althought we could state gender differences, as well as grade differences, we think that differences between younger and older children, specially in what representation strategies are concerned

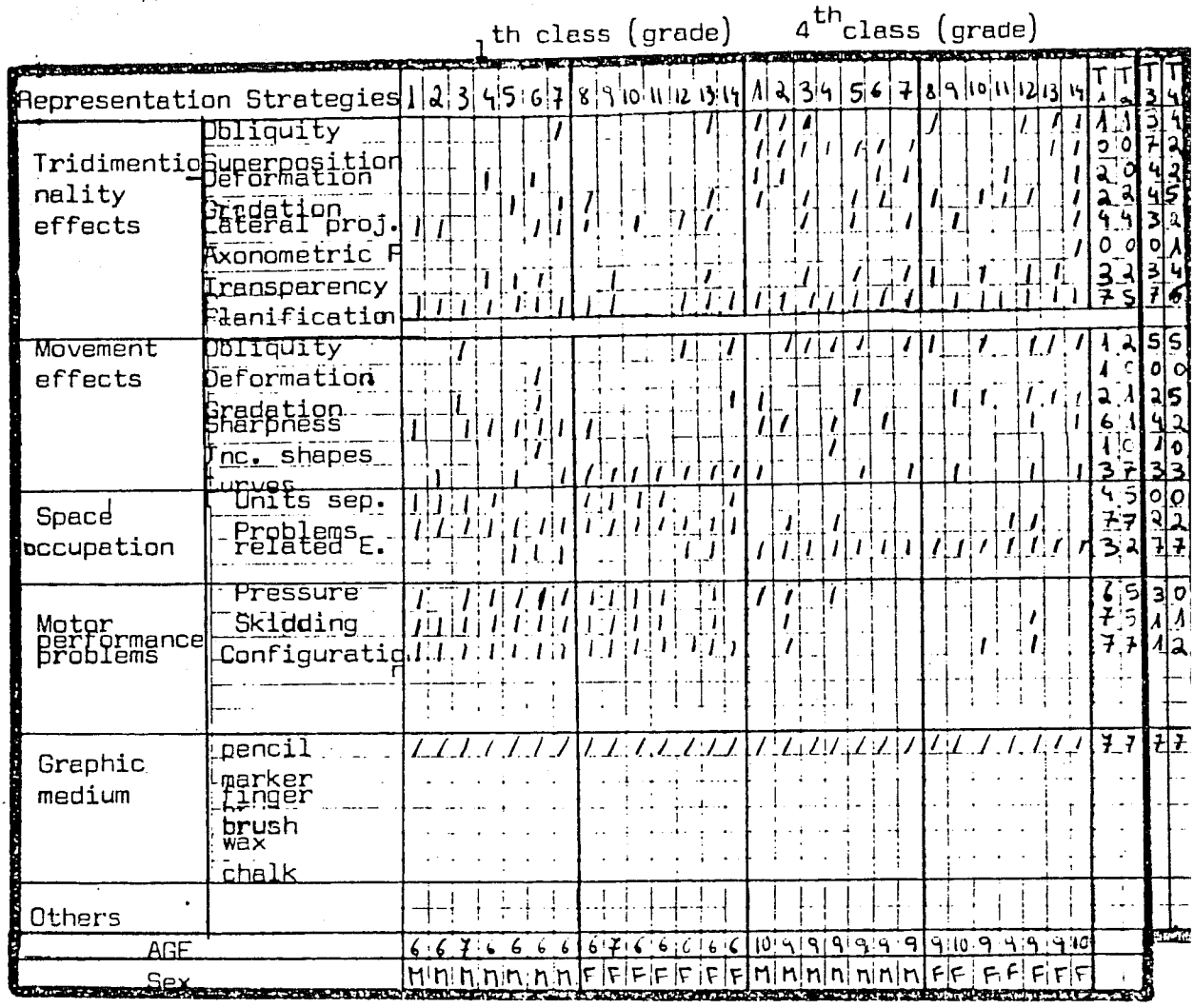
are the most promising field for future research.

As for contrasts between different authors' approaches, we were specially close to Arnheim'. Nevertheless,considering Arnheim point of view that children would draw mostly what they find perceptually relevant, according to their motor possibilities; and Piaget and Luquet point of view that children before the age of 8 would draw mostly what they know about the objects, we thought about applying our methodology, being specially concerned about representation strategies, in a sample of primary children deeply deaf since birth , comparing their drawings to those from non- deaf pupils attending the same grade . The point would be in what the formers'problems in concept formation produce differences in their pictorial productions, as far as our methodology can observe them.

For the moment we hope that we suggested enough evidence that drawings are complex products that can give informations about the producers way of solving problems, and that a better knowlegde base about those representation problems could help to find a balance between allowing children individual creativity development and yet being able to help them to increase their skills of problem solving,as well as their creativity and their pleasure. As Dewey (op. cit.) referred there is no evident reason for considering that kind of thinking envolved in drawing activity as " inferior " to the kind of thinking envolved in mathematical reasoning , or any symbolization activity.

APPENDIX A

		1th class (grade)														4th class (grade)														
COLOUR		1	2	3	4	5	6	7	T	8	9	10	11	12	13	14	T	1	2	3	4	5	6	7	T	8	9	10	11	12	13	14	T	T
Light Blue	line								0					/		/	2	/			/				2								0	
	point		/		/		/		3					/	/	/	3	/		/					2						/		1	
	surface	/	/		/	/	/		5					/	/		2	/	/	/	/				4				/		/		2	14
Dark Blue	line								0	/	/	/	/				4					/	/		2	/		/		/			3	
	point							/	1	/	/	/	/				4					/		/	2	/		/		/		/	4	
	surface							/	1	/	/	/	/				4					/	/	/	3	/	/	/		/		/	5	13
Yellow	line								0		/	/		/		/	4	/	/		/		/	/	5					/		/	2	
	point	/	/	/	/	/	/	/	7		/	/	/	/	/	/	6	/	/	/	/		/	/	5	/	/	/	/	/	/	/	6	
	surface	/	/	/	/	/	/	/	7		/	/	/	/	/	/	5	/	/	/	/	/	/	/	7	/	/	/	/	/	/	/	7	27
Red	line								0		/	/	/	/		/	5		/		/			/	3			/		/			3	
	point	/	/	/	/	/	/	/	7		/	/	/	/	/	/	6	/	/	/		/	/	/	5	/	/	/	/	/	/		5	
	surface	/	/	/	/	/	/	/	6			/	/	/	/	/	4	/	/	/	/	/	/	/	7	/		/	/	/	/		5	26
Light Green	line	/							1		/	/		/			3		/		/				3			/		/			2	
	point	/			/	/		/	4		/			/	/		3	/						/	2			/		/			2	
	surface	/			/	/		/	4			/		/	/		3	/	/	/	/	/		/	5				/	/	/	/	4	17
Dark Green	line								0			/	/				3			/			/		3		/					/	2	
	point		/				/		2			/	/				2			/			/		2	/						/	2	
	surface		/				/		2				/				2			/			/		2	/	/					/	3	9
Orange	line								0	/	/	/		/		/	5	/							1				/		/	2	
	point			/			/	/	3	/	/	/		/	/	/	6	/		/	/				3				/		/	2	
	surface			/	/		/	/	4	/	/	/		/	/	/	6	/			/				2				/		/	2	16
Pink	line								0	/	/			/	/	/	5								0			/		/	/	3	
	point		/	/	/			/	4	/	/			/			3								0		/	/	/	/	/	5	
	surface		/	/	/				3	/	/			/			3							/	1	/		/	/	/	/	4	17
Violet	line	/							1	/							1	/							1								0	
	point	/							1	/							1	/							1								0	
	surface	/				/			2	/							1	/							1								0	4
Light Brown	line								0				/				1				/	/			3		/	/				/	3	
	point			/					1								0						/		1		/	/				/	3	
	surface			/					1				/				1				/	/	/		3			/				/	2	8
Black	line	/							1	/							1	/				/			2	/							1	
	point	/	/						3	/							1	/							1								0	
	surface	/	/						3								0	/							1	/							1	6
Light Brown	line								0	/			/			/	3	/							1								0	
	point			/	/		/		3	/			/			/	3	/	/	/					2					/			1	
	surface			/	/		/		3	/			/			/	3	/	/	/	/				3				/	/			2	M
Graphit Pencil	line	/	/	/	/	/	/	/	7	/			/		/	/	3	/	/	/	/	/	/	/	6	/	/		/		/		4	
	point																																	
	surface																																	
Others																																		
White paper basis		/	/	/	/	/	/	/	7			/	/	/	/	/	5	/	/	/	/				4	/		/	/		/		4	
Coloured basis										/	/						2	/					/	/	3	/		/			/	/	5	
Homogeneous colour use																									5	/	/	/	/	/	/	/	7	
Lined colour use		/	/	/	/	/	/	/	7	/	/	/	/	/	/	/	+	/	/						2								-	
Decorative colour		/	/	/	/	/	/	/	7	/	/	/	/	/	/	/	+																-	
Realistic colour use																		/	/	/	/	/	/	/	7	/	/	/	/	/	/	/	7	
AGE		6	6	7	6	6	6	6		6	7	6	6	6	6	6		10	7	9	9	7	9			9	10	9	7	7	7	10		
Sex		M	M	M	M	M	M	M		F	F	F	F	F	F	F		M	M	M	M	M	M	M		F	F	F	F	F	F	F		


1th class (grade)
4th class (grade)
Representation Strategies
Tridimentionality effects
Obliquity
Superposition
Deformation
Gradation
Lateral proj.
Axonometric P
Transparency
Planification
Movement effects
Obliquity
Deformation
Gradation
Sharpness
Inc. shapes
Curves
Space occupation
Units sep.
Problems related E.
Motor performance problems
Pressure
Skidding
Configuratio
Graphic medium
pencil
marker
finger
brush
wax
chalk
Others
AGE
Sex

SUBDECT	1th class (grade)														4th class (grade)																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	1	2	3	4	5	6	7	8	9	10	11	12	13	14	T_1	T_2	T_3	T_4
Isolated Units	/	/	/	/					/	/																			4	2	0	0
Contextual Units					/	/	/	/			/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	3	5	7	7
UNITS																																
Natural elements: sun	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/		/	/	/	/	/	/	7	7	7	6
sky								/							/		/		/	/	/	/	/	/		/		/	0	1	5	5
moon													/									/							0	1	0	1
clouds	/	/	/	/	/	/	/	/	/	/	/	/	/	/		/		/							/		/		7	7	2	2
stars		/											/	/								/							1	2	0	1
lake								/					/							/			/						0	2	1	1
see																				/									0	0	1	0
river															/						/			/		/	/	/	0	0	2	4
mountain					/										/	/		/		/	/		/	/					1	0	5	2
rain																													0	0	0	0
trees		/	/		/	/			/	/			/	/	/		/	/	/	/	/	/	/	/	/	/	/	/	4	4	6	7
flowers	/	/		/	/	/		/		/	/	/	/	/			/	/			/	/		/		/		/	5	6	3	4
grass					/				/	/			/	/			/					/							1	4	1	1
ground				/	/	/		/			/		/		/	/	/	/	/	/	/	/	/	/	/	/	/	/	3	3	7	7
others		/			/	/							/				/				/	/	/			/			3	1	2	3
Alive elements: persons	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	7	7	7	7
air animals	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/			/	/		/		/			/		/	7	7	4	3
water animels								/					/										/			/	/		0	2	0	3
land animals		/				/	/	/	/	/								/	/		/		/			/		/	3	1	3	3
unusual elem.		/															/												1	0	1	0
sun face		/	/	/	/	/	/			/	/	/	/	/		/					/			/			/	/	6	5	[illegible]	3
others																																
Elements made by men: houses	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	7	7	7	7
beds			/				/	/		/		/	/	/												/			2	5	–	1
Interiors																													0	0	0	0
smoke/ TV ant	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/				/		/	/				/	/		7	7	3	3
boats												/								/						/		/	0	1	1	2
planes	/	/	/	/	/	/	/									/	/			/									7	0	3	0
helicopters																													0	0	0	0
parachutes																													0	0	0	0
cars		/	/	/	/	/	/						/																6	1	0	0
words							/		/							/	/		/	/		/				/	/	/	1	1	4	4
decorative e.								/	/	/	/	/	/	/															0	7	0	0
guns						/													/										1	0	1	0
others		/	/	/	/	/	/	/			/	/	/		/	/	/	/	/	/	/		/	/		/	/	/	6	4	7	5
ACTION																																
Quite games/activity	/			/						/	/		/	/			/					/	/	/	/		/		2	4	1	6
Action games/activity		/	/		/	/	/	/	/			/			/	/		/	/	/	/						/	/	5	3	6	2
Work activity										/			/				/				/		/					/	0	2	2	2
War games						/													/										1	0	1	0
Others																																0
AGE	6	6	7	6	6	6	6	6	7	6	6	6	6	6	10	9	9	9	[illegible]	9	9	9	10	9	9	9	9	10				
Sex	M	M	M	M	M	M	M	F	F	F	F	F	F	F	M	M	M	M	M	M	M	F	F	F	F	F	F	F				

APPENDIX B

COLOUR		1th class (grade) 1	2	3	4	5	6	7	T	8	9	10	11	12	13	14	T	T	4th class (grade) 1	2	3	4	5	6	7	T	8	9	10	11	12	13	14	T	T
Light Blue	line								0								2									2								0	
	point		○		○		/		1			∅		/	/	/	4		/		/		∅			3						/		1	
	surface	/	/		/	/	/		5				○	/			1		/	/	/		/	/		4				/		/		2	
Dark Blue	line								0	/	/	/	/				4						/	/		2	/		/		/			3	
	point		∅		∅		/		3	/	/	○	/				3						/	/		2	/		/		/		/	4	
	surface								1	/	/	/	/	∅			5						/	/		3	/	/		○			/	5	
Yellow	line								0		/	/		/		/	4	/	/		/		/	/		5				/			/	2	
	point	/	/	/	/	○	/	/	6		/	/	○	/	/	/	5	/	/	○	/		∅	/		5	/	/	/		○	/	/	5	
	surface	/	/	/	/	/	/	/	7			/	/	/	/	/	5	/	/	/	/	/	/	/		7	/	/	/	/	/	/	/	7	
Red	line								0		/	/	/	/		/	5		/		/			/		3					∅	/		3	
	point	/	/	○	/	/	/	/	6	∅	/		○	/	/	/	5	/	/	○		/		/		4	○	/	/			/	/	4	
	surface	/	/	/		/	/		6			/	/	/	/	/	4	/	/	/	/	/	/	/		7	/	∅	/	/	/	/		6	
Light Green	line	/						/	1		/	/		/			3		/		/			/		2			/		/			2	
	point	/			○	○		/	2		/			/	/		3	/			/	∅		/		3			/		/	/		3	
	surface	/			/	/		/	4			/		/	/		3	/	/		/	/		/		5			/	/	/	/		4	
Dark Green	line								0			/	/			/	2			/		/		/		2			○				/	1	
	point		/	∅	∅	∅		/	5			/	/			∅	3			○		/		/		1	/				∅		/	3	
	surface		/					/	2			/	/				2			/		/		/		2	/	/					/	3	
Orange	line								0	/	/	/		/		/	5	/								1			∅		/	/		3	
	point			/			/	/	3	/	/	○		/		○	4	/		/			/			3					/	/		2	
	surface			/	/		/	/	4	/	/	/		/	/	/	6	/					/			2					/	/		2	
Pink	line								0	/	○			/		/	4									0		∅	/		/	/		4	
	point		/	/	/			/	4	○	/			/	∅	/	3									0	∅	/	○		/	/	/	5	
	surface	∅	/	/	/				4	/			∅	/	/		4							/		1	/			/	/	/		4	
Violet	line	/							1								1	/								1								0	
	point	/							1	/							1	/								1								0	
	surface	/				/			2	/							1	/								1								0	
Light Brown	line								0			/					1				/	/				2	/	/				/		3	
	point			/					1			∅					1					/	/			2	○	/				/		2	
	surface			/					1			/					1				/	/	/			3		/				/		2	
Black	line	/							1	/							1	/				/				2	/							1	
	point	/	/						2	/							1	/								1								0	
	surface	/	/						2								0	/								1	/							1	
Light Brown	line								0	/			/			/	3	/								1								0	
	point			/	/		/		3	/			/				3	/	/							2		∅		/				2	
	surface			/	/		/		3	/			/				3	/	/	/						3			/	/				2	
Graphit Pencil	line	/	/	/	/	/	/	/	7	/		○		/			2	/	○	/	/			/		5	/	○		/	/			3	
	point																																	C	
	surface																																	0	
Others																																			
White paper basis		/	/	/	/	/	/	/	7			/	/	/	/	/	5	/	/	/	/					4	/			/		/		3	
Coloured basis										/	/						2	/						/	/	3		/	○		/		/	4	
Homogeneous colour use																		○	/	/	/	/	/	/		6	/	/	/	/	/	/	/	6	
Lined colour use		/	/	/	/	/	/	/	7	/	/	/	/	/	/	/	7	○	/							1								4	
Decorative colour		/	/	/	/	/	/	/	7	/	/	/	/	/	/	/	7			○						1					∅			4	
Realistic colour use																		/	/	/	/	○	/	/		6	/	/	/	/	○	/	/	6	
AGE		6	6	7	6	6	6	6		6	7	6	6	6	6	6			10	9	9	9	9	9	9		9	10	9	9	9	9	10		
Sex		M	M	M	M	M	M	M		F	F	F	F	F	F	F			M	M	M	M	M	M	M		F	F	F	F	F	F	F		

1) $\frac{438}{438 + 59} \times 100 = 88\%$

		1th class (grade)													4th class (grade)																
Representation Strategies		1	2	3	4	5	6	7	8	9	10	11	12	13	14	1	2	3	4	5	6	7	8	9	10	11	12	13	14	T1	T2	T3	T4
Tridimentionality effects	Obliquity	/	/	/	/	/	/	○	/	/	/	/	/	/	/	/	/	/	/	∅	/	/	/	/	/	/	○	/	/	0	1	4	3
	Superposition	/	/	/	/	/	/	/	/	/	/	/	/	∅	/	/	/	0	/	/	0	/	/	∅	/	/	/	/	/	0	1	5	3
	Deformation	/	/	/	○	/	○	/	/	/	/	/	/	/	/	/	○	/	/	/	/	/	/	/	/	/	/	∅	/	0	0	3	3
	Gradation	/	/	/	/	/	∅	○	○	/	/	/	/	/	∅	/	/	○	/	/	/	/	/	/	/	/	/	/	/	/	2	2	3	5
	Lateral proj.	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	○	/	○	/	/	/	/	/	4	4	3	2
	Axonometric P	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	0	0	0	1
	Transperency	/	∅	/	/	/	/	/	/	/	/	/	∅	/	/	/	/	/	/	/	/	/	/	/	/	/	/	○	/	4	3	3	3
	Planification	/	/	/	/	/	/	/	/	/	∅	∅	/	/	/	/	/	○	/	/	/	/	/	/	/	/	/	/	/	7	7	6	6
Movement effects	Obliquity	/	/	○	/	/	/	/	/	/	/	/	/	/	/	∅	/	/	/	/	/	/	/	/	/	/	○	○	/	0	2	6	4
	Deformation	/	/	/	/	/	○	/	/	/	/	/	/	/	/	∅	/	/	/	/	/	/	/	/	/	/	∅	/	/	0	0	1	1
	Gradation	/	/	1	/	∅	/	/	/	/	/	∅	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	3	2	2	5
	Sharpness	/	∅	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	7	1	4	2
	Inc. shapes	/	/	/	/	/	/	/	/	/	/	/	∅	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	1	1	1	0
	Curves	/	/	∅	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	4	7	3	3
Space occupation	Units sep.	/	/	/	/				/	/	/	/	/	/	/															4	5	0	0
	Problems related E.	/	/	/	/	/	/	/	/	/	○	/	/	/	/	/	/	/	/	/	∅	/	/	/	/	/	/	/	/	7	6	3	2
		/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	3	2	7	7
Motor performance problems	Pressure	/	/	/	/	/	/	/	/	/	/	/	/	/	/	0	/	/	/								∅	/		6	5	2	1
	Skidding	/	/	/	/	/	/	/	/	/	/	/	/	/	/		/										/			7	5	1	1
	Configuratio	/	/	/	/	/	/	/	/	/	/	/	/	/	/		/								/	/	/			7	7	1	2
Graphic medium	pencil	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	7	7	7	7
	marker																																
	finger																																
	brush																																
	wax																																
	chalk																																
Others																																	
AGE		6	6	7	6	6	6	6	6	7	6	6	6	6	6	10	9	9	9	9	9	9	9	10	9	9	9	9	10				
Sex		M	M	M	M	M	M	M	F	F	F	F	F	F	F	M	M	M	M	M	M	M	F	F	F	F	F	F	F				

2) $\frac{247}{247 + 39} \times 100 = 86\%$

SUBDECT	T_1	T_2	T_3	T_4
Isolated Units	4	2	0	
Contextuel Units	3	4	7	
UNITS				
Natural elements — sun	7	7	7	6
sky	1	2	5	5
moon	0	0	0	1
clouds	6	6	2	2
stars	1	0	0	1
lake	0	2	1	1
see	0	0	1	0
river	0	0	2	4
mountain	2	0	5	4
rain	2	0	0	0
trees	4	5	6	7
flowers	5	7	3	4
grass	1	5	1	0
ground	3	3	7	7
others	3	1	2	3
Alive elements — persons	7	7	7	7
air animals	6	7	4	2
water animels	0	2	0	2
land animals	3	1	3	3
unusual elem.	1	0	2	0
sun face	0	5	2	3
others				
Elements made by men — houses	7	7	7	7
pads	2	4	0	1
Interiors	0	0	0	0
smoke/ TV ant	7	7	3	3
boats	0	1	1	2
planes	7	0	3	0
helicopters	0	0	0	0
parachutes	0	0	0	0
cars	6	1	0	0
words	1	1	3	4
decorative e.	0	7	0	0
guns	1	0	1	0
others	6	4	7	4
ACTION				
Quite games/activity	2	5	2	5
Action games/activity	5	2	5	2
Work activity	0	2	1	3
War games	1	0	1	0
Others				0

	1st class (grade) 1	2	3	4	5	6	7	8	9	10	11	12	13	14	4th class (grade) 1	2	3	4	5	6	7	8	9	10	11	12	13	14
AGE	6	6	7	6	6	6	6	6	7	6	6	6	6	6	10	9	9	9	9	9	9	9	10	9	9	9	9	10
Sex	M	M	M	M	M	M	M	F	F	F	F	F	F	F	M	M	M	M	M	M	M	F	F	F	F	F	F	F

3) $\frac{309}{309 + 44} \times 100 = 87\%$

4) $\frac{438 + 247 + 309}{497 + 286 + 353} \times 100 = 87{,}5\%$

APPENDIX C

COLOUR II (ITTEN)		1th grade														4th grade													
		1	2	3	4	5	6	7	T	8	9	10	11	12	13	14	T	1	2	3	4	5	6	7	T	8	9	10	11	12	13	14	T
Contrast WARM/ COLD (opposite)	Red Green	1	1		1	1	1	1	6		1	1	1	1			4	1	1	1	1	1			5	1	1	1	1	1		6	5
	Blue Orange						1		1	1	1	1	1	1			5	1	1						2				1		1	2
	Yellow Violet					1			1								0	1							1								0
Contrast WARM/ COLD (others)	Green Orange			1					1	1	1		1	1			4	1	1	1					3				1		1	2
	Green Yellow		1		1	1	1		4	1	1	1	1				4	1	1	1	1	1			5	1	1	1	1		1	5
	Blue Yellow	1	1		1	1		1	5	1	1	1	1	1	1		6	1	1	1	1	1	1		7	1	1	1	1	1			6
	Blue Red	1	1		1	1		1	4	1	1	1	1	1			5	1			1	1			3	1				1			2
	Violet Orange								0	1							1																0
	Violet Red	1			1				2																								0
Continuity WARM	Yellow Orange	1					1		2	1	1		1	1	1		5	1			1				2				1		1		2
	Yellow Red	1		1	1		1		4	1	1	1		1	1		5	1	1	1	1	1			5	1	1	1	1	1			5
	Orange Red			1		1	1		3	1			1	1			3	1			1				2								0
Continuity COLD	Blue Green				1	1			2	1	1	1	1				4	1	1	1	1	1	1		7	1	1	1	1		1		5
	Green Violet								0								0	1							1								0
	Blue Violet				1				1	1							1	1							1								0
Transition Warm/Cold	Black	1	1						2								0	1		1					2	1							1
	Brown			1	1	1			3	1			1		1	1	3	1	1	1	1	1	1		6	1	1	1		1	1		5
	Blue																																
	Yellow																	1							1								
	Red																																
	Green																				1	1	1		3	1	1			1			3
	Orange																																
	Violet																																
	Black																																
	Brown																										1					1	
Soft colour		1		1					2	1					1	1	3		1			1	1		3	1	1	1	1			1	5
Strong colour		1	1	1		1	1		5	1	1	1					3	1		1					2	1							1
Take advantage of colour pressure differences													1				1	1			1				2					1			1
Superposition																		1	1	1	1				4				1				1
AGE		6	6	7	6	6	6	6		6	7	6	6	6	6			10	9	9	9	9	9	9		9	10	9	9	9	10			
SEX		M	M	M	M	M	M	M		F	F	F	F	F	F			M	M	M	M	M	M	M		F	F	F	F	F	F			

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1 E - Egyptien picture, 18th dynasty (detail)

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1 F - " Little dwarf story " (detail)

Paul Klee 1925, private collection, in Gombrich (1978)

1 G - Alaska Mask for cannibal rituals

Berlin Museum, in Gombrich (1978)

2 D - Picto' Graphics copyright P. Arthur, Toronto

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5 G - " Les glaneuses " (detail)

Millet 1857, Louvre Museum, Paris, in Gombrich (1978)

5 H - Egyptien picture " Meidum gooses ", 4th dynasty (detail) 2700 A.C.

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6 E - Nazca tapestry ,South America (detail)

Royal Museum of Art and History, Bruxelles, in Pijoan (1972)

6 F - " August 1956 " (objects on a table)

Ben Nicholson 1956, Calouste Gulbenkian Museum (1987)

7 G - " Guernica " (detail)

Picasso 1937,Madrid Museum, in Clavell (1982)

7 H - " L'Aubade "

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7 I - " Hesire Portrait " 2700 A.C.

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9 A - Bull Head (detail)

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9 B - " Jaime Sabartés Portrait "

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10 D- " Le Jockey de Longchamps " (detail)

Toulouse-Lautrec , in Pijoan (1972)

11 D- " Group of Shelterers "

Henry Moore 1941, Calouste Gulbenkian Museum (1981)

13 D- Central perspective

13 E- Axonometry - Isometric projection

13 F- Axonometry - Dimetric projection

13 G- Children usual solution

14 C- " Mystery and Melancholy in a street"

De Chirico 1914, private collection , in Pijoan (1972)

16 E- " Horse races in Epsom "

Gericault 1820, Louvre Museum, Paris, in Gombrich (1978)

16 F- Horse races, photoghaph

in Gombrich (1978)

17 D- " La Danse "

Matisse 1909-1910, in França (1987)

18 C- A spiral (endless) line

19 G- " Jockey on the beach "

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