KEYWORDS: ***Brazilian rock art – Children's scribbles – Cognitive development – Peruaçu valley***

SCRIBBLING THE WALLS: CHILDREN'S CONTRIBUTION TO THE ROCK ART OF PERUAÇU VALLEY, MINAS GERAIS, BRAZIL

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Abstract. Given that rock art is generally taken to have been made by adults, with studies only rarely venturing to attribute its production to other age groups, we investigate the possibility of children taking part in its execution. Field research conducted in caves and rockshelters in the Peruaçu valley, Minas Gerais state, Brazil, found strong evidence of the scribbles of very small children, made with black crayons, located on the periphery of their exuberant polychrome panels. To substantiate this interpretation, children's graphic production was studied, taking into account theories of cognitive development during infancy. With the same objective, ethnographic research was undertaken in a pre-school, analysing the drawings of contemporary children, in order to obtain material for comparison. The results seem to support the hypothesis of a universality of the initial stage of infant graphic production and its considerable temporal depth. They constitute another significant contribution from the investigation of rock art, this time to the wider field of studies of the cognitive development of the human species.

Introduction

Throughout almost the entire Brazilian territory, just as occurs in other parts of the world, rock paintings and petroglyphs that were produced by human groups in pre-Historic times are found. They were made on rock surfaces like cave and rockshelter walls, boulders, rock platforms and so on, concentrated especially in the north, north-eastern and centre-west regions of the country.

Observed in Brazil since the beginnings of European colonisation, due to their high visibility in some locations, this rock art began to be systematically studied by archaeologists from the start of the 1970s (Calderón 1970, 1971; Laming-Emperaire et al. 1974; Guidon 1975), inaugurating a line of research that began to unite an increasing number of scholars. Their work has been disseminated since then in academic publications but also in science outreach materials for the general public. A large proportion of these studies has been dedicated to recognising styles (grouped into different traditions and complexes); identifying similarities and differences; establishing tentative chronologies; developing methods of classification, analysis and interpretation; tracing possible routes of dispersion of the populations that produced them; and applying methods and techniques for their dating and conservation. These subjects were supplemented by chrono-stylistic analyses and studies of the spatial distribution of the sites; critiques of the validity of traditions as analytic categories; the redefinition of the concept of style; a greater emphasis on the physical attributes of the sites and on their forms of insertion in the landscape, among other topics of investigation. Despite the high relevance of all these studies, there remain questions about who made the rock art and when, problems with its interpretation, as well as difficulties in relating it to social contexts and understanding it through what it actually is: a social representation.

Rock art has always been conceived as the product of groups rather than individuals, with few attempts being made so far to discuss the gender of their authors. Lindgren (1999), Mandt (2001), Dowson (2001), Hays-Gilpin (2004, 2012), Bevan (2006), Goldhahn and Fuglestvedt (2012), among others, investigated gender issues with the understanding that this is a category indissociable from the individual who produces the rock art, from who should see it, that is, its audience (as in Chippindale and Nash 2004) and, above all, from the codes of its production (Dowson 2001). The age range of its authors is a question even less explored, the assumption being that it was made by adults. Even among those who argue gender studies, few scholars have focused their work on identifying the participation of children in the production of rock art. The topic has mostly been discussed in studies of impressions of small hands and feet, footprints and finger flutings

in caves from the European Upper Palaeolithic (Bednarik 1986, 2008; Clottes and Lewis-Williams 1996; Roveland 2000; Clottes et al. 2005; Sharpe and Van Gelder 2006; Bahn 2010; Van Gelder 2015). In addition to these impressions, Van Gelder (2015: 136) proposes that children may have made some of the figurative designs in the Rouffignac Cave in the Dordogne, but only as a tentative possibility. In 2008, Watson et al. opened up a new avenue of investigation by publishing the hypothesis that some graphics occurring in rock art may be the result of doodling behaviour, presumed to be common to the human condition in any time and space. Consisting of either abstract or figurative marks, doodles are understood as absent-minded marking when someone is otherwise engaged or bored. On the basis of this definition, however, doodling behaviour does not apply to children, only to juveniles and adults.

Children, of course, are numerous in all human groups and actively involved in social life. Ethnographic works demonstrate this intense participation, alongside adults, including in the making of rock art (Kamp 2002; Hays-Gilpin 2012), meaning that a larger number of their signatures should be expected on the walls of caves and shelters. But despite this fact, as one of the authors of this article observed in a previous publication (Lima 2012), archaeologists have generally shown a disinterest in children:

> […] it is only in the last two decades that archaeology has experienced a growing interest in this area. This has led to an expanding body of literature, particularly since the publication of Lillehammer's seminal article on the world of childhood in 1989. A number of researchers concerned with this pervasive omission have begun to draw attention to the apparent disinterest in children in archaeological research, despite the fact that they comprise a population segment omnipresent in any human group and, consequently, in most archaeological records.
>
> Among the explanations frequently advanced for the invisibility of children are the alleged difficulty in recognizing their remains in archaeological sites and the androcentric outlook dominant for so long in the discipline, which considers children to be uninteresting and of little importance because of their economic dependency and biological immaturity (Sofaer Derevenski 1997).
>
> Today, however, researchers are confining androcentrism to an ever remoter period of archaeology's past. Furthermore, the involvement of children in economic, social, religious, and political activities in a wide range of cultures is being clearly demonstrated ethnographically (Sofaer Derevenski 2000: 11; Bugarin 2005: 14; Bird and Bird 2007; Rosen 2007). A question remains concerning their overall low visibility in archaeology, but this is a problem not limited to children and also affects other societal segments, especially minority and marginal groups. In reality, it results from researchers focusing their attention in other directions, as well as from the limitations imposed by the nature of the archaeological records and the methods of investigating them (Lima 2012: 63).

In this context, specifically in relation to rock art, the interest in children seems to have remained largely confined to sites from the European Upper Palaeolithic. It can be expanded, however, by looking more closely for potential evidence of their presence and involvement in rock paintings in other times and spaces. Observing in detail the abundant pictorial manifestations that occur in different points of the Brazilian territory, we encounter paintings in some locations that seem to have been made by children.

Taking them to be a relevant topic of research for the reasons set out above, we decided to search for their signatures in an area with abundant sites covered with rock paintings: the Peruaçu River valley in Minas Gerais, in Brazil's south-east region, a national park today. This area has been studied in detail by André Prous and his team of researchers from the Federal University of Minas Gerais since the end of the 1970s, with important findings already published (Solá et al. 1981/2; Prous et al. 1984; Lima et al. 1989; Prous 1994; Prous and Ribeiro 1996/1997; Ribeiro and Isnardis 1996/1997; Isnardis 2004, 2009; Ribeiro 2006; Prous and Rodet 2009) and generously placed at our disposal for the present study.

The Peruaçu valley and its rock art

The Peruaçu valley is situated in the north of Minas Gerais state, close to the border with Bahia (Fig. 1). The river is a left tributary of the upper/middle São Francisco, one of the country's most important rivers, flowing through five Brazilian states. On its middle course, fluviokarst processes have sculpted innumerable scarps, caves, sinkholes, dolines, sheer walls, fissures and lapiés erosion surfaces in the limestone outcrops dominating the landscape of this stretch of the river. Covered mostly by dry forest, the river's canyon contains the highest number of archaeological sites in the valley, located in rockshelters and cave entrances.

A large number of these sites feature paintings and, less frequently, petroglyphs, with some of the sites containing exceptionally exuberant and highly visible panels. In those that have been excavated there is no evidence of permanent occupations. According to Prous (in Prous and Rodet 2009), the canyon must have been a stopover place intended for the performance of specific activities. These certainly included, we believe, some activities of a ceremonial nature, given the imposing grandeur of some of the painting-covered sheer walls. In our view, the paintings imbue these places — some of which are clearly special and unique — with a feeling of introspection, reverence and connection with the sacred domain.

The oldest vestiges of human occupation in the canyon have been dated between 12 000 and 11 000 bp, with other dates from the Middle Holocene existing in different shelters, trace evidences of groups that, as pioneers, survived by gathering plant resources and hunting small to medium-sized animals (Kipnis 2009). Their lithic equipment, with better-quality tools made during the earlier period, was gradually replaced by a simpler and technically more rudimentary industry

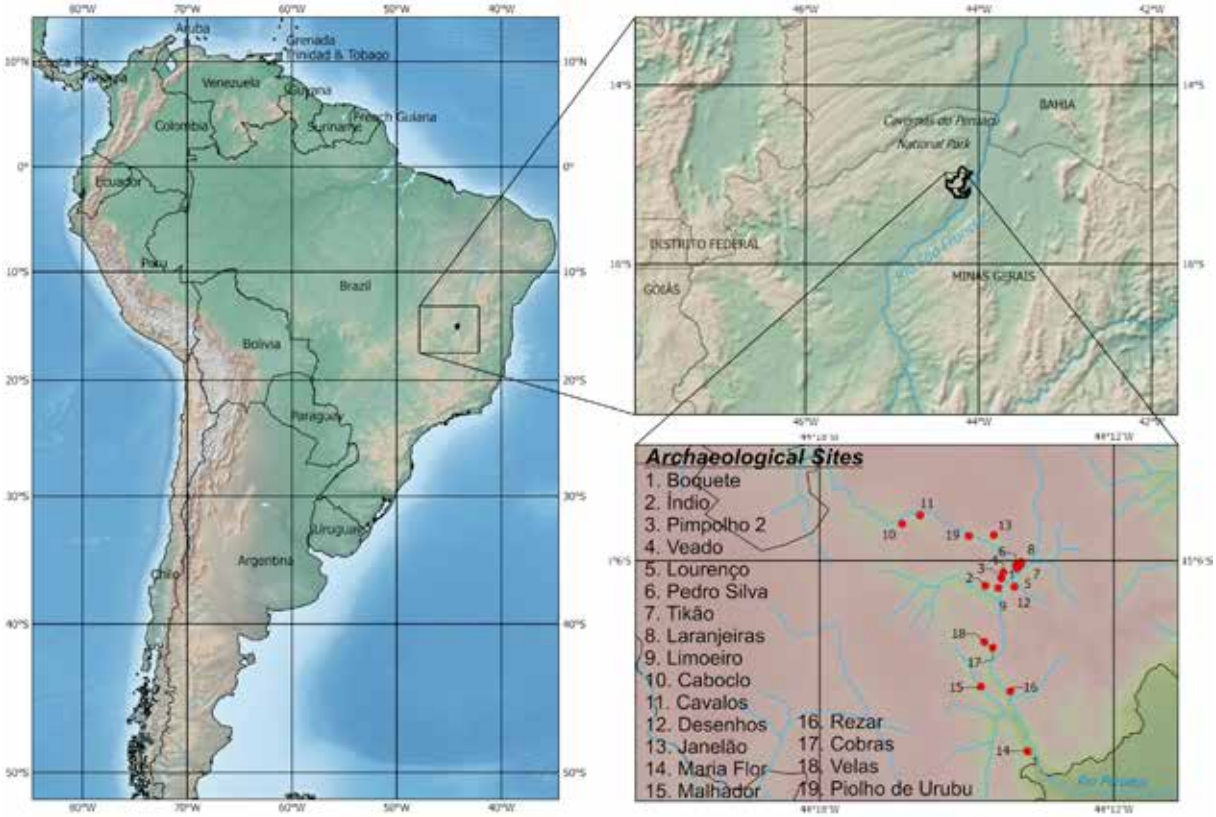


Figure 1. *Location of archaeological sites in the Peruaçu valley, Minas Gerais. Image by DC.*

where the final products are little different from the initial forms (Rodet 2009). In the recent Holocene, ceramists from at least two culturally distinct groups, the Una and Tupiguarani, left their traces in the caves and shelters (Mello 2009; Carvalho 2009). At the time of the arrival of European colonisers in the region, in the sixteenth century, it had become the territory of natives from the Je and Tupi groups (Baeta 2009).

Intensive and detailed studies recognised six different stylistic units in the Peruaçu valley (Ribeiro and Isnardis 1996/1997; Ribeiro 2006; Isnardis 2004, 2009). Attempts were made to establish chronological relations between these categories through the analysis of thematic and stylistic similarities, the texture and colouring of the pigments used, execution techniques, overlaps, associations, differences in patina, exfoliated areas and other features. The most recent group to have painted the walls of Peruaçu was associated with the 'northeast tradition'. Originally defined for the São Raimundo Nonato area in Piauí state (Pessis 1989; Guidon 1991), this tradition is dispersed throughout much of the Brazilian Northeast where it assumed local forms, classified as sub-traditions, and also the north of Minas Gerais. Centred on small-sized anthropomorphous and zoomorphic representations, ranging between 5 and 15 cm, always highly dynamic, they compose extremely busy scenes of diverse kinds: apparent hunts, fights, dances, acrobatics, rituals, sexual practices, packs of animals in motion and so on, perhaps constituting veritable accounts of the everyday life of these populations.

In the Peruaçu canyon, where it occupied shelters with very diverse characteristics, the local version of this tradition is manifested in the form of equally small and dynamic figures, composing some of their classic scenes, painted with pigments in suspension and fine brushes in black, red, yellow and white. They always appear on the edges of large previously elaborated rock art panels and are chronologically more recent than all the other manifestations. Along with these figures, scribbles were made with dry pigment sticks, mostly in black and occasionally in red, also small in size. Always occurring on the margins of the panels, in a few cases these were made in niches and exfoliated areas. Crayons were used exclusively by this group and by no other in the Peruaçu valley (Lima et al. 1989; Isnardis 2004, 2009; Ribeiro 2006).

Field research: searching for the children

In field research conducted in July 2017 and February 2018, a total of nineteen cave shelters and entrances were visited, aiming to identify the participation of children in the elaboration of the abundant rock art panels found at these sites. Lapas do Caboclo, Boquete, Tikão, Malhador, Janelão, Indio, Desenhos, Rezar, Limoeiro, Lourenço, Laranjeiras, Veado, Piolho do Urubu, Cavalos, Velas, Pedro Silva, Pimpolho 2, Cobras and Maria Flor (Fig. 1) were all analysed, each of them featuring scribbles, in larger or smaller numbers, save for Lapa do Veado where they were not found. On the walls of these shelters innumerable graphic marks were recognised that can be attributed to children of

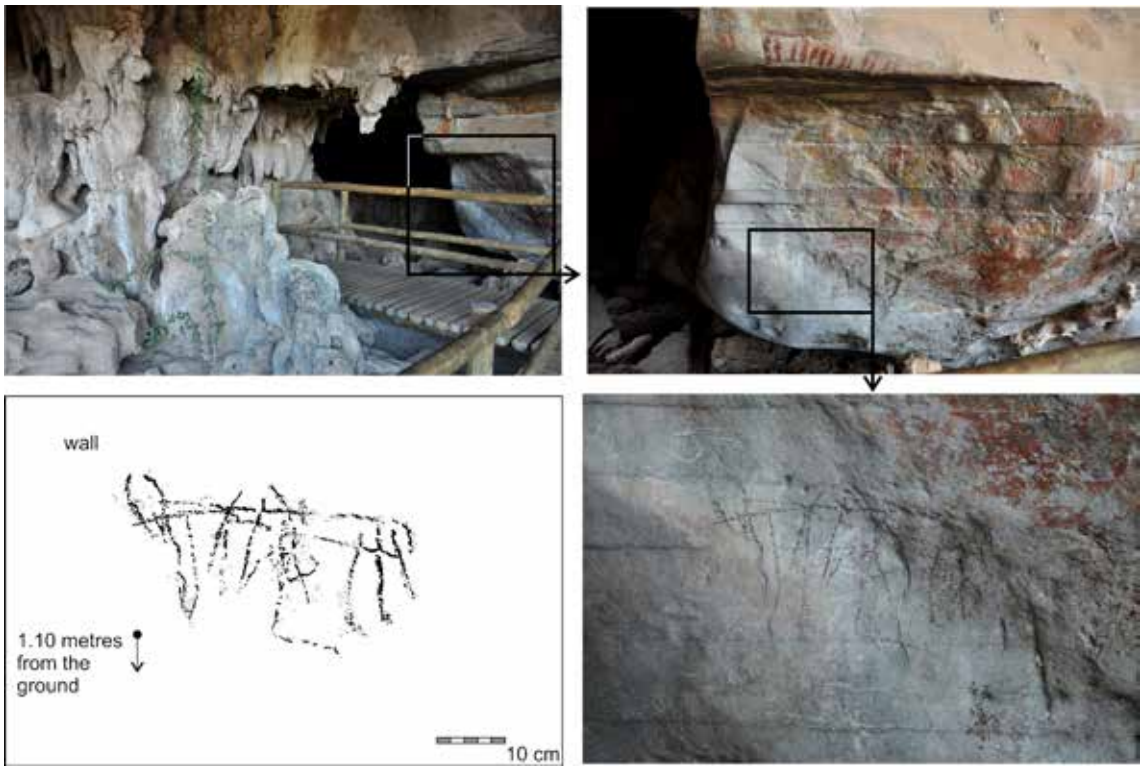


Figure 2. *Scribbles found at Lapa do Índio, Peruaçu valley. All images by DC and LP unless noted otherwise.*

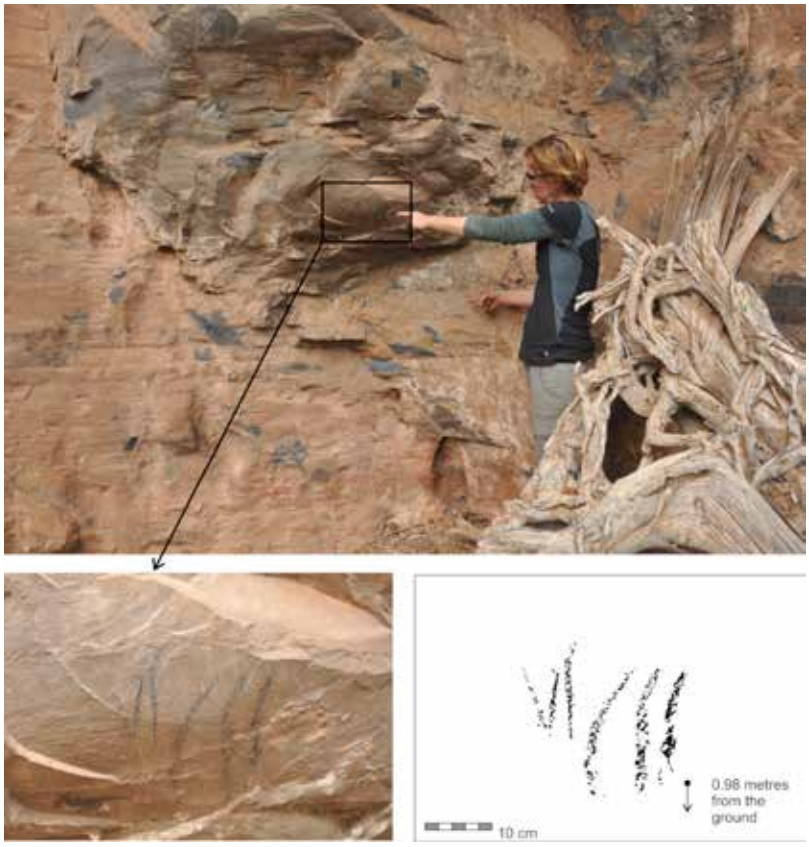


Figure 3. *Scribbles found at Pedro Silva Cave, Peruaçu valley.*

different age groups, such as scribbles and crude copies of other designs. However, in the present article we confine our analysis to the scribbles, here understood as a series of meaningless and uncontrolled lines and marks, which were interpreted as having been produced by children of a very young age, between approximately 18 months and four years old. Examples of this evidence are presented in Figures 2 to 11.

In order to properly ground our interpretation, we turn to theorists of cognitive development and researchers on the emergence of artistic expression who have investigated children's graphic marks in depth.

Theories of the development of drawing in children

The interest in the graphic production of children emerged in Europe at the end of the nineteenth century and the start of the twentieth, related to the then nascent experimental psychology. Children finally began to be taken as a relevant topic of investigation and, as Mèredieu (2006) writes, the originality of the infant universe was discovered. In parallel, as highlighted by the author, artistic manifestations that had once been marginal, such as those of the mentally ill and native groups, or those considered minor, such as folkloric folk and artisanal works, were seen in a new light. Valorising their creativity, ingenuity, and above all spontaneity, produced outside the canons of so-called traditional art, some artists began to seek out simplic-

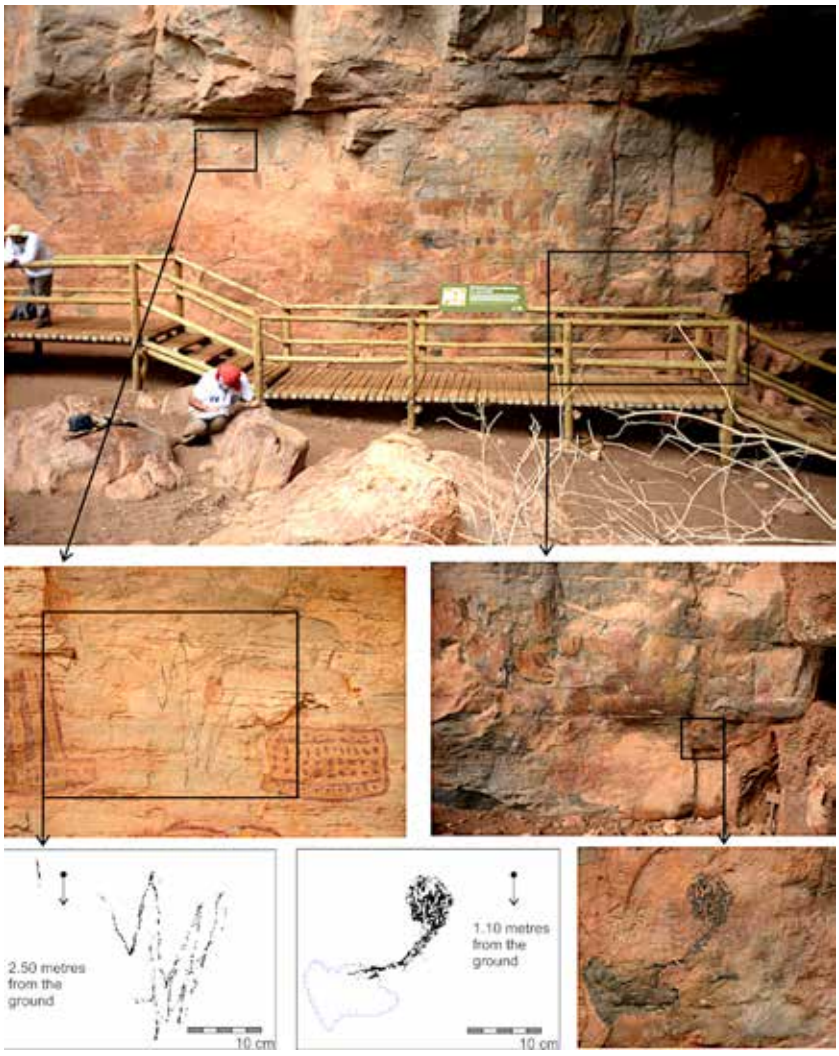


Figure 4. *Scribbles found at Lapa do Caboclo, Peruaçu valley.*

ity, naturalness, a return to roots and a 'clean sheet' found 'in a pure state' in children's drawings. As Picasso said in his famous phrase: 'It took me four years to paint like Raphael, but a lifetime to paint like a child'. Raised to the status of art, it inspired major artists like Dubuffet, Miró, Kandinsky and Klee, among others.

Consequently, thinkers (understood here as philosophers, psychologists, psychoanalysts) as much as artists and scholars of art inaugurated children's graphic marks as a field of investigation, beginning to study it from different perspectives (Kindler and Darras 1994). Over the twentieth century, researchers from various fields of knowledge explored the graphic production of children in detail, constructing theories to explain the development of human cognition. Conceived under the influence of a strongly evolutionist perspective, a product of their time, these theories left deep roots and influenced those who dedicated and still dedicate themselves to the study of children's drawings, to the extent that even today they provide the basis for many studies, despite the fact that contemporary trends privilege semiological approaches.

The precursors (1910–1980)

Georges-Henri Luquet (1876–1965)

One of the first researchers of cognitive development to analyse graphic evolution in infancy was the French philosopher Georges-Henri Luquet, a student of Bergson and Lévy-Bruhl, who, in 1913, published his doctoral thesis at the École des Hautes Études entitled *Les dessins d'un enfant.* Étude *psychologique*. Analysing around two thousand drawings, he identified four sequential phases in children's drawings (Luquet 1969). These follow the initial stage of disordered scribble, in the first two years of life. Recognised and identified, this initial stage was not included in his model:

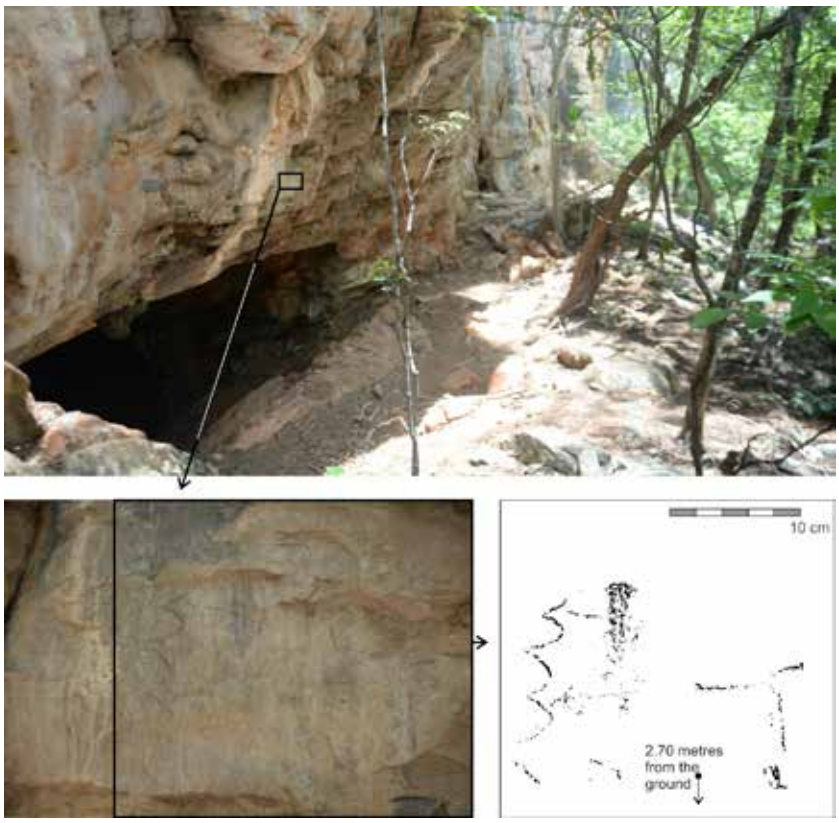


Figure 5. *Some of the scribbles found at Lapa do Cavalo, Peruaçu valley.*

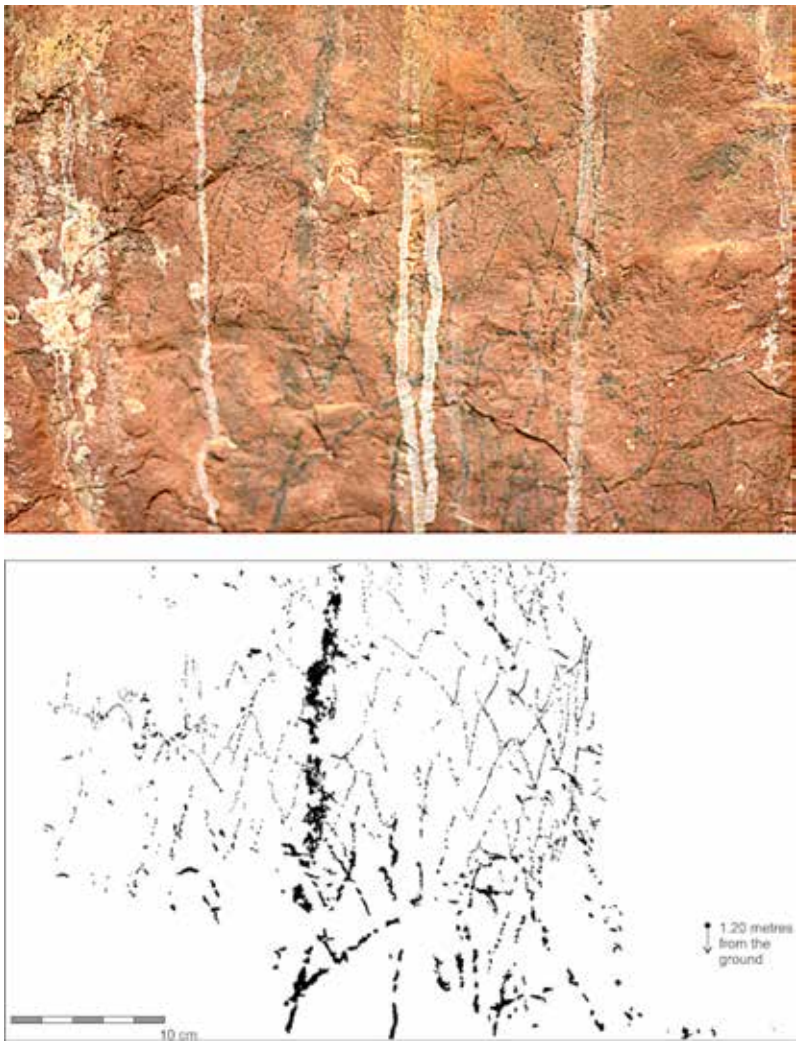


Figure 6. *Some of the scribbles found at Lapa do Pimpolho 2, Peruaçu valley.*

1. The first phase, *fortuitous realism*, spans from two to four-year-olds, a period in which the child begins to establish a relation between what he or she is scribbling and the real object, giving a name to what is drawn;
2. The second phase, between three and four-year-olds, is *failed realism or synthetic incapacity*, when the intention to represent something is emerging but the child still lacks the necessary physical and psychic skill to do so, sometimes being successful, sometimes unsuccessful.
3. In the third phase, which spans from four to ten/twelve-year-olds, labelled by Luquet as *intellectual realism*, the child begins to reproduce what is out of view but known to him or her. Resources like transparency are very often used, when the child draws something located inside something else (like an x-ray).
4. Finally, the child reaches the stage of *visual realism*, around the age of 12, when he or she draws something as it is effectively seen. Perspective is discovered, abandoning the resources used previously, such as transparency, which is replaced by opacity.

This seminal study, which became a classic, was the first to distinguish the main stages of children's drawing. It was adopted by other researchers, who, with few variations, maintained its sequenced model. It has been criticised for being an insufficiently explanatory analysis: according to Mèredieu (2006), it does not clarify what makes the child pass from one stage to another, not how figuration emerges, lacking a 'genetic perspective' that not only describes the stages but also explains them.

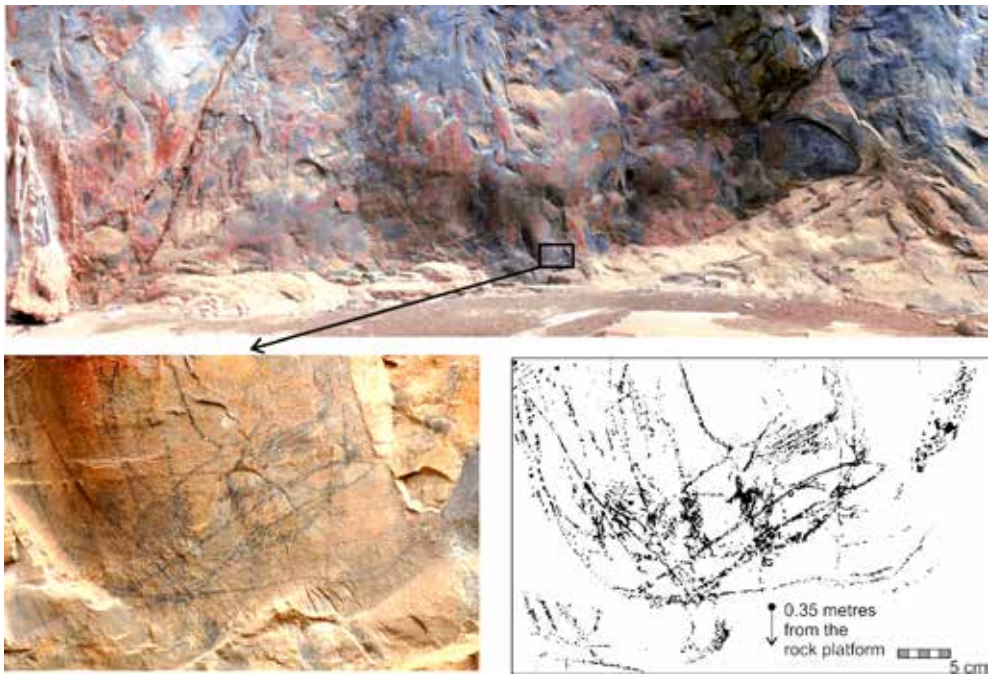
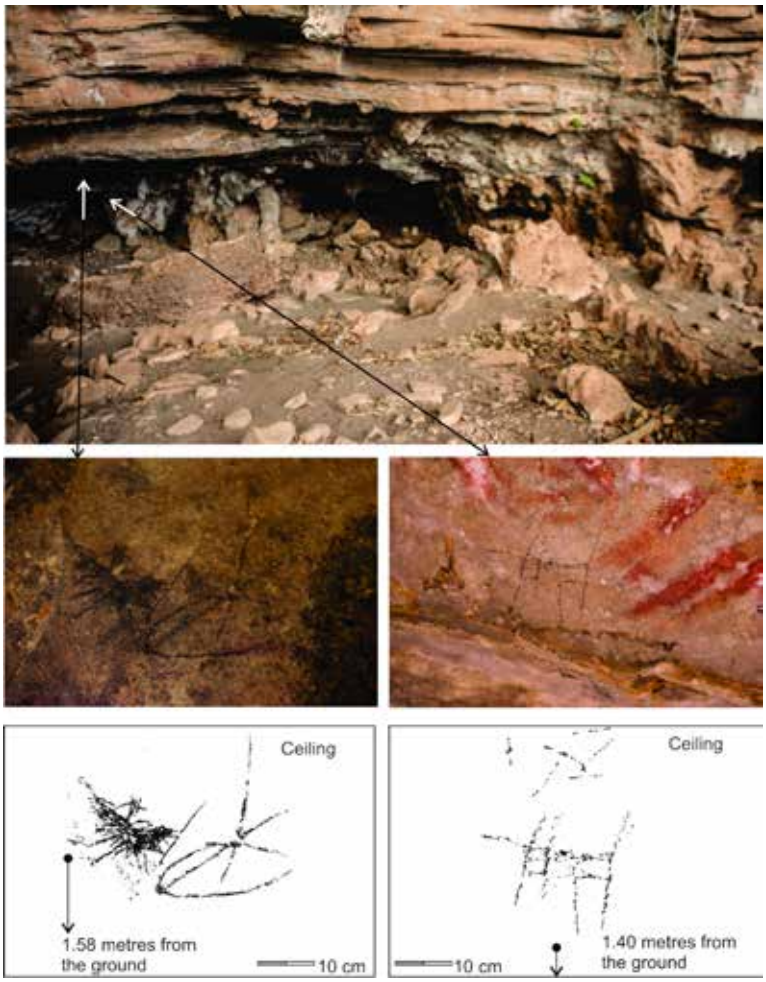


Figure 7. *Some of the scribbles found at Lapa do Janelão, Peruaçu valley.*

Marthe Bernson (1887–1963)

Another scholar of children's drawing, Marthe Bernson was born in Strasburg where she studied philosophy and psychology. Along with her husband, Bernard Bernson, she was persecuted under Nazism and took refuge in Paris, where she studied

Figure 8. *Some of the scribbles found at Lapa do Tikão, Peruaçu valley.*



psychoanalysis and dedicated her work to studying the scribbles and drawings of small children in light of Jungian analytic psychology. In her work *Du griboullis au dessein (*évolution *graphique des tout-petits)*, first published in 1957, she recognised three stages in the evolution of scribbles (*apud* Mèredieu 2006):

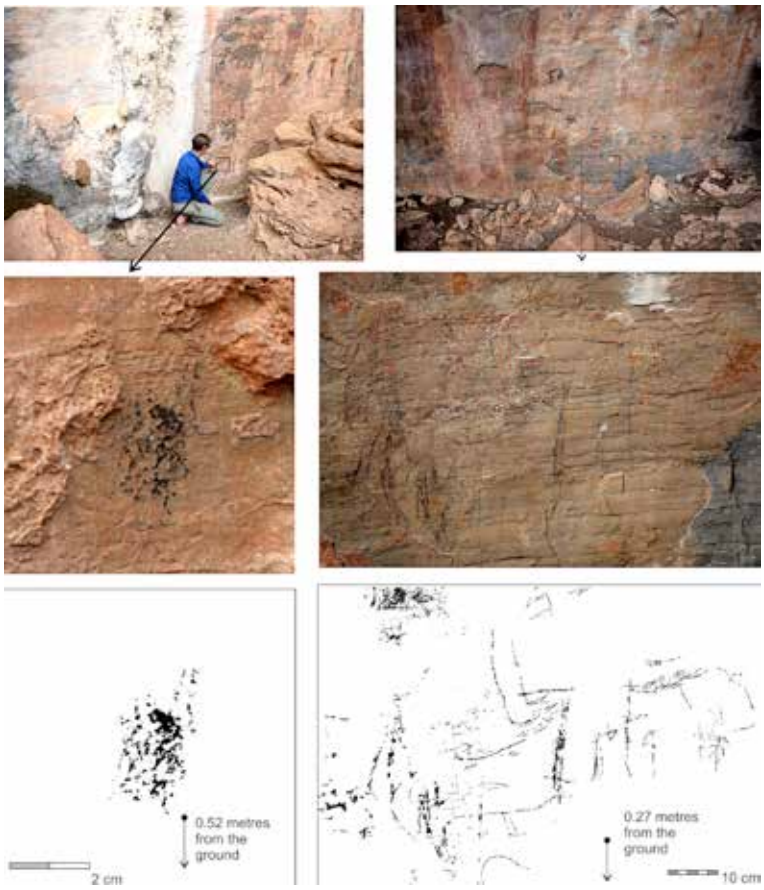
1) First, called *vegetative-motor*, between 18 months and two years, is characterised by disorderly, continuous marks in elongated and rounded forms. The child performs his or her psychomotor movements with considerable pleasure;
2) Second, *representative*, between two and three years, in which the marks become discontinuous, acquiring aim and direction. Isolated forms appear and the child is more aware of the surrounding world;
3) Third, *communicative*, between three and four years, when the scribbles become defined and the child attributes meaning to them.

Unlike Luquet and other authors, as we shall see below, Bernson valorised precisely the scribble phase, the children's first manifestations, recognising them as a fundamental stage of psychomotor maturation.

Jean Piaget (1896–1980)

Considered one of the major thinkers of the twentieth century and with a vast number of publications, the Swiss Jean Piaget, a naturalist by training, turned his attention to philosophy and more specifically epistemology, which ended up awakening his interest in how knowledge is constructed. Strongly attracted to psychology, he began investigating the reasoning process in children, believing that by studying their development, he would discover the elements needed to respond to epistemological questions. He thus established the foundations for what would become an influential theory with a cognitivist and structuralist basis, genetic epistemology. Understanding knowledge construction to be an individual action and cognitive development a universal process, which occurs through progressive biological maturation and through the child's experience and interaction with the environment, he turned to investigate the roots of different

Figure 9. *Some of the scribbles found at Lapa dos Desenhos, Peruaçu valley.*



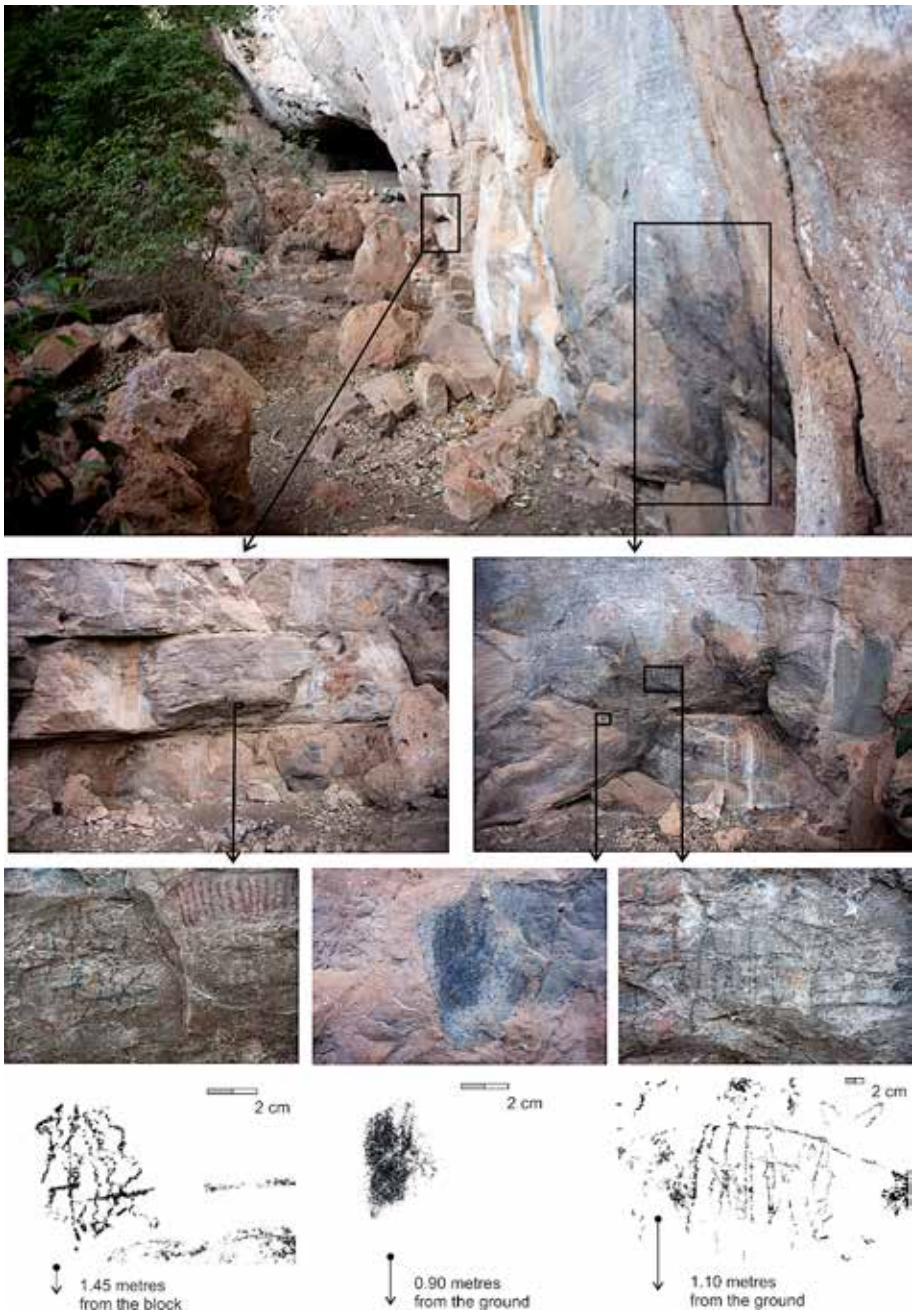


Figure 10. *Some of the scribbles found at Lapa do Boquete, Peruaçu valley.*

forms of knowledge (Piaget 1969, 1976, 1978; Piaget and Inhelder 1978).

For Piaget, the infant mind develops through four successive stages — *sensorimotor* (0 to 2 years), *preoperational* (2 to 7 years), *concrete operational* (7 to 11 or 12 years) and *formal operational* (11 or 12 years and above) — with each of these stages not only the necessary foundation but a precondition for the following stage to be achieved. The passage from one stage to another is gradual with transitions; the age ranges are approximations rather than being rigid, and this flexibility stems from individual and social characteristics. In the production of graphic marks, Piaget validated the stages proposed by Luquet (Piaget and Inhelder 1978: 56), which he used as the basis for his own model.

1. In the *sensorimotor* phase the child produces disorderly scribbles, using broad movements that are particularly pleasurable. The child draws with great delight for him or herself and there is no representation of the human figure.
2. In the first stage of the subsequent phase, *preoperational* (from two to four years), movements become more orderly, along with the scribbles, with longitudinal and circular marks, and an emerging interest in forms. The random scribbles evolve into circular human forms in a frontal position. The child names what is drawn, but this designation is not fixed and the same representation may correspond to different objects. In the second stage of the preoperational phase (from four to seven years), *preschematic*, the relationship between thought, drawing and reality is established, but the figures remain dispersed and without any relation between themselves. Children at this stage draw plants, animals and buildings, with the colour of the objects secondary.
3. In the concrete operational phase, *schematism* emerges**.** Realistic representations of objects are made, including more details, and the human figure assumes various forms. The baseline appears along with phenomena like transparency. The relationship between colour and object is established.
4. At the end of the schematic phase, *realism* emerges. The sex of the human figures becomes recognisable through attributes such as clothing. The baseline is abandoned, geometric forms appear and the drawings display more rigidity and formalism. Planes and overlapping are discovered.
5. Finally, in the abstract operational phase, drawing ceases to be a spontaneous manifestation and becomes what Piaget calls *pseudo-naturalism*. The onset of adolescence brings with it the investigation of the child's own personality, worries and anxieties. The drawings acquire depth, realism, objectivity and the conscious use of colour. In the

human figure, the sexual features may be reinforced.

Piaget's thought was highly influential, not only in the practice of teaching and in the formulation of educational policies (although he refutes the association with pedagogy), but also in different fields of knowledge far beyond psychology. His ideas have received numerous critiques, but we confine ourselves here to mentioning those that are of more direct interest. Among them, the sample with which he worked is considered small and biased; the universal stages, which take no account of cultural differences; and intellectual development, understood by many as a continuous process, not one divided into stages.

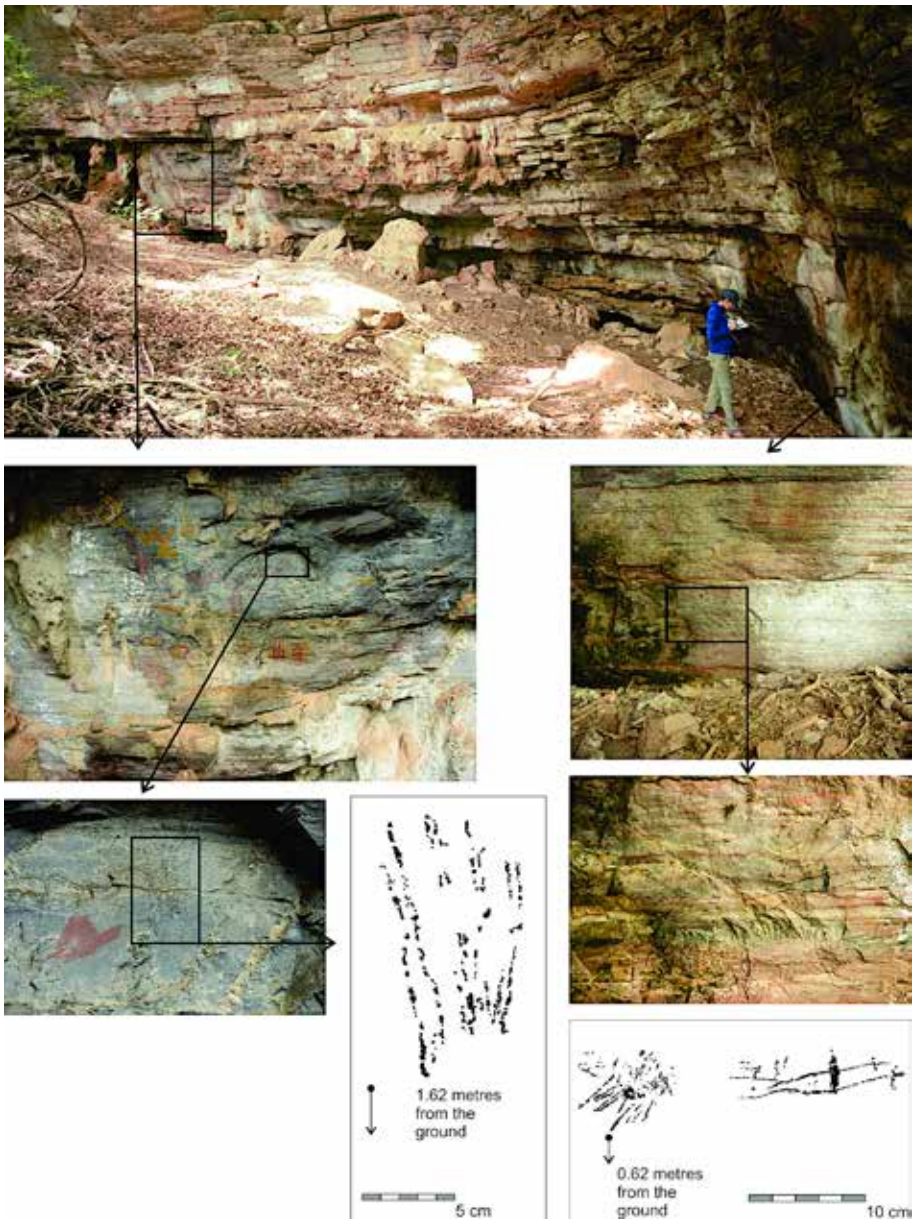


Figure 11. *Some of the scribbles found at Lapa do Lourenço, Peruaçu valley.*

Lev Semenovich Vygotsky (1896–1934)

Equally focused on the study of cognitive development, the Soviet Lev Vygotsky was trained in law at the University of Moscow. Although a student of history, philosophy, literature and medicine, he dedicated himself more deeply to psychology during his short life-time. Dying prematurely at the age of 37 from tuberculosis, his dense work founded on historical and dialectic materialism remained ostracised for decades, censured by the Stalinist regime. As a consequence, it arrived in the West only much later in the 1960s. A pioneer of historico-cultural psychology and an avid reader of Piaget, he disagreed with the latter owing to his greater emphasis on the internal processes in the child's intellectual development instead of sociohistorical processes, since in Vygotsky's view culture is the foundation for the constitution of the subject and the functioning of the psyche (Ivic 2010).

In exploring children's drawings in his work *Imagination and art in childhood* (*Imaginação e arte na infância*, 2009), originally published in 1930, Vygotsky refers to the thought of contemporaries like Luquet, Barnés (who analysed more than fifteen thousand children's drawings) and the Gestaltist psychologist Karl Bühler (1879–1963), among others. However, he describes and analyses in more detail the four-stage model for the entire development process of children's drawings proposed by the German pedagogue Georg Kerschensteiner (1854–1932) in his work *The development of artistic creativity in the child*. This sequence deliberately leaves out the scribble stage, like Luquet, though valorised by other authors. This 'prehistory' of the drawing (Vygotsky 1984) was not taken into account in his model, being of little interest to his purposes, especially the intention to demonstrate the influence of culture on children's graphic production. During this initial period, drawings are genuinely spontaneous, pulsional and kinetic, making them identical across all cultures. Hence, the first effective stage identified by Vygotsky is the *level of schemas*, when the child begins to draw actual figures in schematic form, though still very distant from their real appearance. The child draws from memory without copying a model. The representation of the human figure is limited to the head and feet, sometimes including arms. In the next stage, the

level of formalism and schematism, which mixes both, the drawings are still schematic, but a greater mastery of the real form of what is being represented already becomes perceptible. There is much more detail and the drawing is closer to the real model. In the third stage, the *level of representation* closer to the real appearing around the age of ten years, schematism disappears completely, giving way to faithful representations of reality. Figures are drawn in silhouette or with outlines. Finally, the fourth stage, the *level of actual representation*, appearing around the age of 11, is characterised by a sense of volume and perspective, the use of colour and shadow, and the attribution of movement to figures. The rhythm of the drawings decreases.

Vygotsky's thought, also highly influential still today, retains a contemporary relevance insofar as it is impossible to dissociate the production of children's graphic marks from the sociocultural context in which they are produced.

Rhoda Kellogg (1898–1987)

An American psychologist and nursery school educator, Kellogg studied the graphic expressions of children, based on her work at the Golden Gate Kindergarten Association's nursery schools in San Francisco. Between 1948 and 1966, she collected an impressive sample of around one million drawings by children from a variety of cultural backgrounds, concluding that children follow the same graphic evolution, and that this evolution is universal.

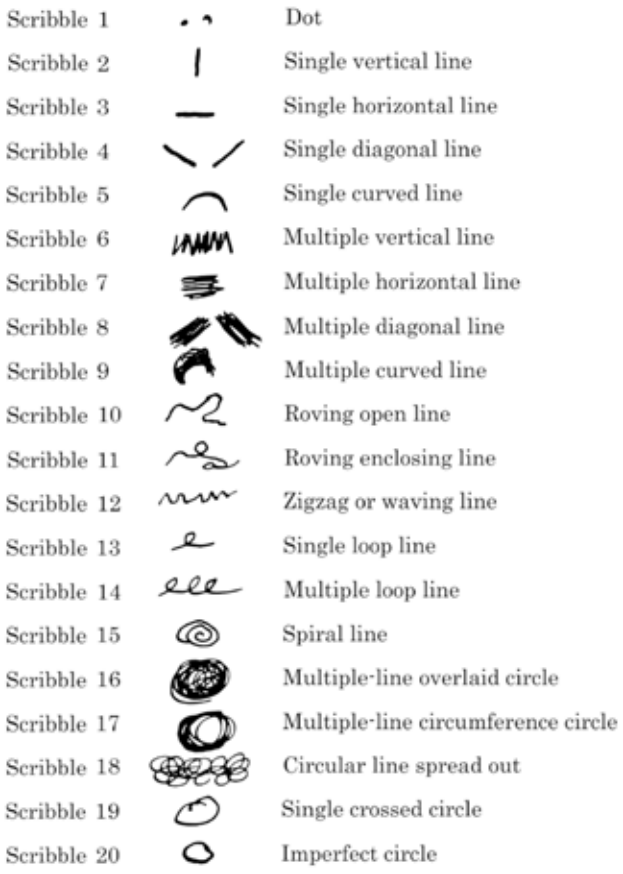


Figure 12. *The basic scribbles (Kellogg 1969: 15)*

In her work *Analyzing children's art* (1969), Kellogg recognises four general stages in this development, which spans from the first scribbles to roughly the age of five: *pattern*, *shape*, *design* and *pictorial*. During this period children draw through their own perceptions, and only from the age of five years they begin to copy formulas favoured by society.

In *pattern stage*, elementary line formations result from spontaneous movements and can be made without the control of the eyes. The directions of these line movements may be vertical, horizontal, diagonal, circular, alternating, or no line movement, and correspond to variations of muscular tension. Considered a natural capacity in very young humans, single or multiple scribbles are the first to be made by two-year-olds and even younger children. Kellogg identified twenty basic line elements that she called the *basic scribbles*, with the objective of permitting a detailed and comprehensive description of the work of young children (Fig. 12).

A different kind of analysis can be made, considering that in many cases scribbles show a relatively precise limit of placement. This enables them to be delimited geometrically within a well-defined perimeter, like a sheet of paper, configuring what Kellogg called the *placement patterns*. In these cases, the eyes guide the hand. She recognised a total of 17 different patterns (1969: 24–25) for descriptive and classificatory purposes, which demonstrate that children already have a perception of form at this stage.

Next is the *shape stage*, which begins between two and three years, with an intermediate phase designated *emergent diagram shapes.* In this phase, children draw lines that form crosses, circles, triangles and other forms, albeit still only vaguely defined. This phase prepares for the *diagrams* proper, when definite shapes are drawn in outline form. Numbering six in total, five are geometrically regular (rectangle/square, oval/circle, triangle, the Greek cross, the diagonal cross), while the sixth is classified as an odd shape diagram, a catchall classification for any deliberate line formation that encloses an irregular area (op. cit.: 45).

Between three and four years old, the child begins to integrate different diagrams. A unit of two *diagrams* is called a *combine* and a unit of three or more is designated an *aggregate.* Both are characteristic of the *design stage*. In this stage the child begins to draw what Kellogg called mandalas (circles), Suns and radials. At about four years old the child enters the *pictorial stage*, drawing humans, animals, buildings, vegetation and other subjects. From the age of five, the child begins to incorporate cultural elements from the surrounding universe into his or her drawings.

For Kellogg, basic scribbles, placement patterns and diagrams appear in the drawings of children and adults alike and in all cultures.

Viktor Löwenfeld (1903–1960)

Another influential source in the study of the development of the creative capacity was the work of Austrian Viktor Löwenfeld, who, involved from an early age in forms of artistic expression, graduated from the Vienna School of Applied Art and gained a doctorate in education at the University of Vienna. During the Second World War he left his homeland, went to England and ended up settling in the United States.

Löwenfeld is considered by many to be the father of artistic education (Grandstaff 2012). His theory of artistic development, constructed through the observation and analysis of thousands of children's drawings in the 1940s and 1950s, recognises five progressive stages. This theory was published in the work *The nature of creative activity* in 1939, and in a revised edition in 1952, reproduced here from Löwenfeld and Brittain (1972):

1. Scribble stage (from 2 to 4 years), the beginning of self-expression. Initially uncontrolled, the first marks are generally meaningless and the child does not seem to realise that they can make of them what they want. The marks vary in length and direction with the child moving the arm backwards and forwards. The quality of the line may vary considerably with somewhat accidental results. A small child can cover a surface of 30 cm at most. Without precise muscular development, only wide movements can be produced. At two and a half years, children cannot copy a circle, though they can copy a line. Sometime later, they discover that there is a connection between their own movements and the marks produced and are able to exert some visual control over them. Managing to coordinate their visual and motor development now results in coordinated scribbles. Around the age of three and a half, the child begins to attribute meaning to the drawings and explain who or what they are.
2. Preschematic stage (from 4 to 7 years), the first attempts at representation. At the end of the period of scribbling begins the conscious creation of form, related to the world around the child. The scribbles cease to be a product of body movements and begin to be controlled. The child establishes a relation with what he or she is trying to represent and begins to make recognisable forms, including the human figure, similar to a tadpole, limited to a large head and lower members. Form is more important than colour in the sense that the recently discovered ability to draw forms is what interests the child most. It is the beginning of graphic communication.
3. Schematic stage (from 7 to 9 years), the acquisition of the concept of form. The child forms a definite concept of people and the environment. This concept is designated by Löwenfeld as a *schema*, which is repeated continually until a particular experience makes the child modify this concept. For example, the human schema. Flexible, it presents deviations and variations according to the particularities of each child (such as the exaggeration of important parts, the depreciation or suppression of unimportant parts, the alteration of symbols for effectively significant parts). The baseline emerges, considered universal, which expresses the relation between the child and his or her environment, and x-ray type drawings showing the inside and outside of something simultaneously. The relation between colour and object is discovered.
4. Realist stage (from 9 to 12 years), the beginning of realism. The child discovers that he or she is a member of society and becomes increasingly conscious of the real world. A growing awareness emerges that it is possible to make more things in a group than alone, and that the group is stronger than one person in isolation. A greater visual awareness is acquired with the abandonment of recourses to exaggeration, omissions and other deviations in the forms of expression. The capacity to break with the schema and recognise details in the world around leads to the representation of details of the human figure, such as the characteristics associated with gender. The repetition of symbols that marked the previous schematic phase gradually vanishes and new forms appear that are not constantly repeated.
5. Pseudonaturalist stage (from 12 to 14 years), the age of reasoning. Marks the end of art as a spontaneous manifestation and signals the beginning of a period of reasoning, particularly self-critical. In their drawings, children begin to consciously produce what they see with a growing interest in the naturalism of the drawings of objects and figures.

From then on, now on the threshold of adolescence, drawing falls by the wayside, unless made by especially talented children or those stimulated in some way to improve their forms of graphic expression. Without these stimuli, on reaching adulthood, people will continue to draw in the same way as they did at the end of childhood.

Current reflections

Though recognising the important and strong influence, over decades, of the models of progressive development of children's drawing advanced by Luquet, Löwenfeld and Piaget, among others, some researchers today identify a number of problems with these theories. Such is the case of the French semiologist Bernard Darras, who, trained in visual arts, artistic education and psychology, obtained a doctorate in aesthetics and science of art at the Sorbonne in 1985. Professor of semiotics and research methodology at the University of Paris 1, one of his current topics of interest is cognitive semiotics. Approaching the question from the viewpoint of human development in the domain of art, understood in the contemporary postmodern world as an 'open textured' concept (Weitz 1979: 438, in Darras and Kindler 1997), he argues, along with Kindler, that such theories are incompatible with this open definition of art. For both authors, the linearity

of the sequenced stages is unable to account for the diversity existing within each.

Arguing that the development of the pictorial image cannot be explained through these linear progressions, Kindler and Darras (1994) constructed their own model to explain their emergence and development as a semiotic process. This process occurs in an interactive social environment that results, during the first years of childhood, in pluri-media manifestations (vocal/verbal language, graphic production, gestures and posture). The model was configured as a map that presents diverse possibilities, emphasising the meaning of processes stimulated by the influence of generic and individual tendencies. In this model, designated *iconicity*, a term taken from the semiotic theory of Peirce, the authors identify five phases, understood as points where bifurcations occur, rather than as evolutionary stages. These phases are not correlated with age groups, since each level corresponds to a range of behaviours and possibilities, as well as the fact that different factors affect the localisation of children on the map, including the context in which the children develop. These phases are:

Iconicity 1. This phase corresponds to the start of the emergence of the pictorial image. It involves the perception of the basic relation between an action and the marks that it leaves behind. According to Peirce, the fact that the child observes and takes an interest in the mark that he or she produces can be considered a cognitive and semiotic act. The origins of the pictorial image are rooted in this initial indexicality, through which the repetition of the kinetic actions performed by a child amounts to a form of self-imitation. Through this self-imitation, the child begins to comprehend the production of this analogy between actions and marks, something that she or he had never experienced before. The great pleasure that this gives leads the child to other pictorial explorations. In this phase, the child is still not very attentive to what she or he is producing; the principal interest is in the fact that she or he is capable of producing marks, not in the quality of these marks per se. During this phase it is possible to observe the first bifurcation by distinguishing the continuous non-iconic motor activity of the actions that produce marks and impressions. The first marks are random gestures, but they become increasingly delineated as the tendency towards repetition exerts its influence.

Iconicity 2. This phase is characterised by predictability, which is a function of the general tendency, and by invention, which results from the individual tendency. The child's attention, initially focused merely on causing an effect, shifts to the effect itself and they begin to explore the relation between the marks. On the contrary to the previous phase, the child now understands that certain actions result in certain marks. In Piaget, this phase corresponds to the sensorimotor stage. The control acquired over marks, combined with the search for repetition and with a certain regularity, allows an increasing predictability of the marks produced and allows the opportunity for diversification. The first forms emerge.

Iconicity 3. This phase marks a new bifurcation. Despite the graphic production varying only a little compared to what is observed in the Iconicity 2 phase, the marks begin to carry a new meaning: they register actions rather than things. The pictorial manifestations are interested in dynamic events more than static objects. In Piaget's model, this phase corresponds to the emergence of the representation phase from the sensorimotor period. In this bifurcation, on one hand the graphic manifestations represent actions, on the other informal scribbles. At the same time, the experimentation with forms continues and more attempts are made to increase the predictability and regularity of the forms.

Iconicity 4. The basic distinction in relation to the previous phase is that in this phase there is a recognition of the potential of graphic forms (rather than graphic actions) to symbolise objects and things (rather than dynamic events). This phase is dominated by the generic tendency to recognise and classify forms. They acquire meaning though some basic similarities, along with visual and functional attributes. The geometric and informal scribbles, as well as the marks of actions, continue to permeate the pictorial images during this phase.

Iconicity 5. This phase involves a competent use of the semiotic process and extensive explorations in the domain of visual imagery. An interesting intercourse emerges between two tendencies. There is an increase in the influence that the images of others have on the development of the pictorial image of the child. She or he engages spontaneously in imitative behaviour, which goes beyond what could be seen as an attempt to make copies of the images produced by others, involving a reinterpretation and reinvention of themes, as well as of images made by their peers and by older children.

Darras and Kindler consider their thought congruent with Vygotsky's notion concerning the nature of human development, taking into account processes of biological origin and psychological functions of sociocultural origin. But they rule out the idea that this occurs through evolutionary stages.

Equally contrary to the stages through which children must pass before they are able to produce visually realistic pictures, and opposing many aspects of Piaget's work, the British artist and educator John Matthews (2005) has focused on early childhood development and art. For around twenty years he accompanied the graphic production of his three children, having also studied Chinese, Malay and Indian children's representation in Singapore. In addition, Matthews (2015) studied a group of chimpanzees in Singapore Zoo over a three-year period, analysing the origin of expression and representation in human and non-human primates.

For Matthews (op. cit.), children share the same

deep structural principles, which he considers universal. However, this universality does not imply homogeneity. These principles are grounded in the possibilities and limitations of the motor and visual systems and drive processes of representation and expression. These processes are dynamic and non-linear in such a way that they give rise to a multiplicity of variations emerging from the same deep structural principles (Matthews 2005: 155).

Working with very young children, he argues that they move through successive generations of visual and dynamic structures that can be conceived as waves. Three such waves are recognised, designated as the *first, second* and *third generation of structure*. The *first generation of structure*, which he observed in an age group between approximately six months and two years, is related to children's early movements. It corresponds to the first marks in the form of the horizontal arc (using the movement of the arm crossing over the body), the vertical arc (using the up-down movement of reaching outwards), and those made by the push-pull movement to and from the self, generally using large arm actions. *The second generation of structure* redefines the first and elaborates on it, introducing *continuous rotation, demarcated line-endings, travelling zigzags, continuous lines and seriated displacements* in time and space. *The third generation of structure,* observed between 2 and 3.5 years, involves *inside/outside relations, closure, core and radial, parallelism, collinearity, angular attachments, right-angular structures* and *U-shapes on baseline*. These may also be combined with earlier structures, organising and transforming them. For Matthews (2005) these structures form the basis of later visual representations and expressions and of symbolic and representational thinking.

Although some contemporary theorists reject the classic models of progressive development, it should be emphasised here that humans undeniably have a biopsychic development that unfolds in stages, during phases of life such as infancy, adolescence, maturity and old age, each of them with its gradations. Furthermore, a correspondence exists between these phases and cognitive structures, which does not allow us to preclude the evolutionists. But with a caveat: these stages should not necessarily be understood as progress, since the peculiarities of children's psychomotor development, as well as particularities like stagnations and regressions, also need to be considered, such that rigid linear progressions should be viewed with caution.

The ethnographic observations

With the objective of obtaining elements for a comparison between the scribbles and the present-day graphic production of children during their first years, we made use of ethnographic observation. Taking ethnography not only as a method but, following Peirano (2008), 'as a form of seeing and hearing, a way of interpreting, an analytic perspective, theory itself in action', we decided to make direct contact with the universe of the investigated subjects — in this case, very small children. This aim in mind, we selected a private pre-school, Escola Nova, situated in the Jardim Botânico district of Rio de Janeiro, which generously agreed to our work proposal. Accompanying graphic activities of children between 24 and 48 months old, it was possible to observe and analyse their scribbles with the objective of comparing them to those that appear on the walls of the Peruaçu rockshelters in light of the presented models.

Methodologically, 24 children aged between two and four years old were observed randomly without distinction, in groups of four to five in each age group (24 to 36 months, 36 to 48 months). The children were asked to draw freely without any kind of suggestion or guidance. At our request, they were supplied with black crayons and A4 sheets of white paper (Fig. 13).

What the theorists of cognition assert was indeed observed: between 24 and 36 months, uncontrolled scribbles were produced, made solely for the pleasure of the movements, in some cases frenetic, such was the delight obtained from the act of scribbling. Straight and curved lines mix chaotically without direction, sometimes comprising roughly circular scribbles, sometimes rectilinear movements back and forth, which at times result in filled, dense forms.

A little over three years of age, some children managed to coordinate their visual and motor movement, resulting in more coordinated scribbles, in some cases carefully avoiding overlaps. Others, however, continued to make uncontrolled scribbles. There are also cases of exceptionally talented children who, even before the age of four, have full control over what they want to draw. Such cases completely elude the fixed age ranges of the evolutionary models, providing grounds for them to be questioned and relativised.

As a result, what was observed ethnographically in children in preschool education today is structurally (and in some cases formally) similar to what can be seen on the walls of the Peruaçu shelters (Fig. 14), suggesting that the production of uncontrolled scribbles may in fact be a universal stage of cognitive development, observable in any time and space.

Interpreting the scribbles

Based on the theorists of the emergence and development of graphic marks, we believe that the scribbles produced almost in their entirety with black crayons and encountered on the periphery of the graphic space of the panels found in the Peruaçu canyon correspond to marks made by very small children, in different directions, the majority of them uncontrolled. They amount to elementary, primary graphic marks, resulting from purely motor gestures, impelled by the pleasure of producing effects. In some, progressive visual and motor development enabled the production of better coordinated scribbles with elongated and rounded forms. They clearly correspond to what was

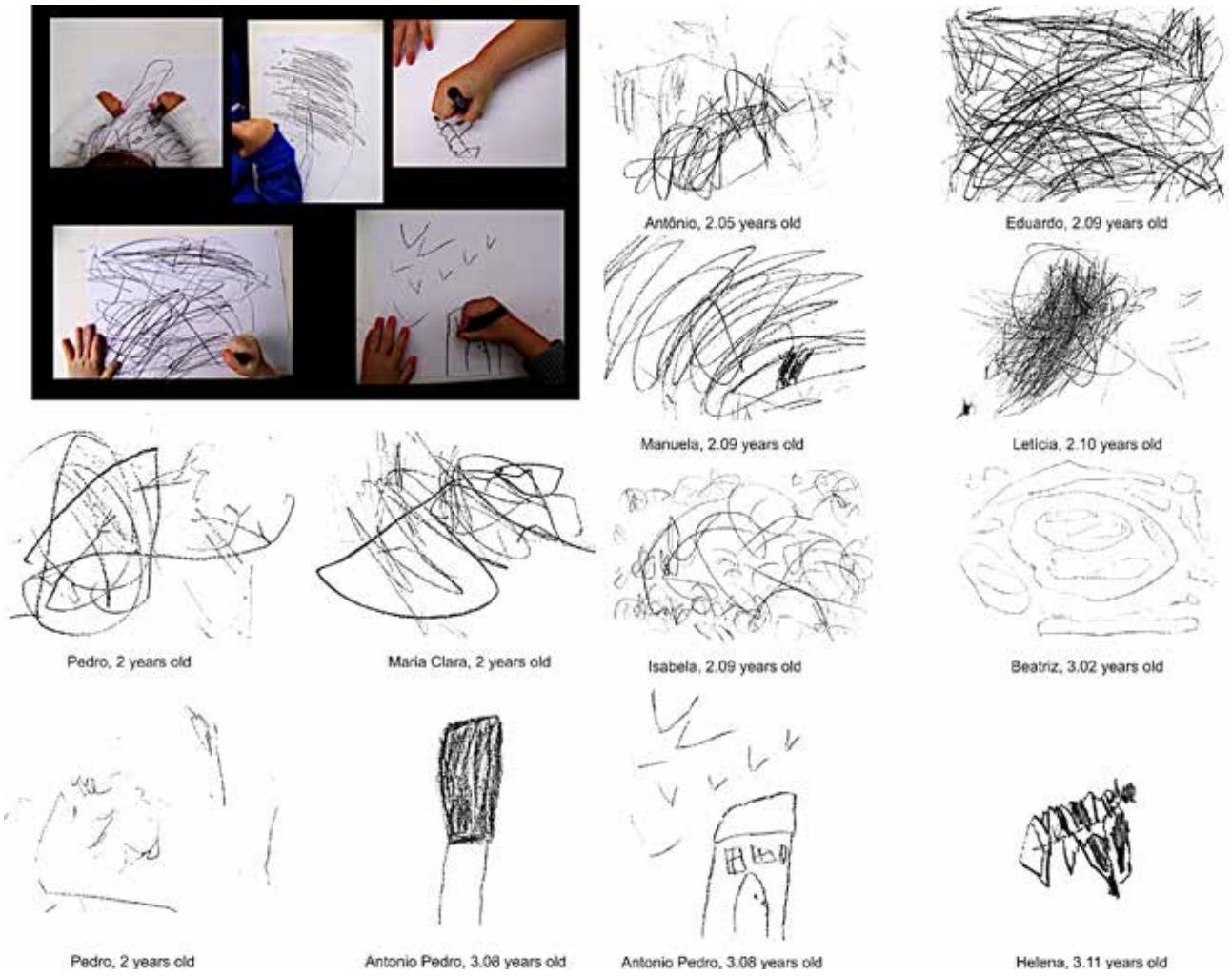


Figure 13. *Children scribbling at Escola Nova. Photos: TAL.*

described by Luquet as the disorderly scribble and fortuitous realism stages; by Bernson, as the vegetative-motor, representative and communicative stages; by Piaget, as the sensorimotor phase and the start of the preoperational phase; by Kellogg, as the basic scribbles, placement patterns, and shape stage; by Löwenfeld, as the scribble stage; by Kindler and Darras (1994) as Iconicity 1; and by Matthews, as the first, the second and the third generation of structure. In other words, they comprise the first graphic expressions of very small children in their first years of life. Considering the models of these theorists, these scribbles can be associated with children between approximately 18 months and two or three years old.

In some cases they were made some 16 to 20 cm above the present-day ground level, which allows us to suppose that they were made by very small children. In those instances where the scribbles appear in higher places, up to 1.50 m off the ground, some form of support may have been used, such as protuberant rocks, scaffolds, or the shoulders, arms or laps of older people. It should be emphasised that according to geomorphological and geoarchaeological studies conducted in the area (Moura 1998, 2009), the rockshelters in the Peruaçu valley region exhibit a very slow rate of sedimentation. The shelters located at the top (over 750 m in altitude) and those in the fluviokarst region (between 560 and 730 m) both present an average rate of sedimentation of around 0.01 m every 100 years, or even lower in some cases.

Possibly as a result of their motor immaturity and consequent lack of dexterity, they were not offered brushes for their scribbles but hard sticks made of dry pigments that they could handle with ease and some efficiency for their objectives, as they indeed did. Furthermore, the crayons supplied to the children were almost all black in colour. It should be emphasised here that both Piaget and Löwenfeld consider that, in the stages mentioned, the colour of the represented object is a completely secondary element for the child: what matters is the form produced. It is only in Piaget's concrete operation phase and in Löwenfeld's schematic stage, which begin around the age of seven, that the relation between colour and object becomes established. It seems fairly unlikely that the adults of the period had perceived this relation through empirical observations, but all the indications are that providing just crayons to the children, almost the entirety black, seems to have been a deliberate decision on their part. In any event, for now it is only possible to observe

this monochromatism and speculate on the reasons for the phenomenon. It should also be observed that, according to Kellogg (1969), small children tend to produce scribbles with more rounded forms, while in the Peruaçu valley the scribbles are predominantly rectilinear. This difference is probably related to the facility offered by paper in contrast to the restrictions imposed by the harsh rock surface.

It is unquestionably the case that the scribbles were executed with the consent of adults, who allowed the graphic expression of their children on the walls of the shelters. On this point, it is important to emphasise that their signatures attest to their active participation in the practices that were performed in these locations, whatever their nature. They were undoubtedly permitted to scribble, but with some restrictions: they were not given access to the full palette of colours, nor allowed to interfere in the paintings of the groups that preceded them. This is suggested by the consistently peripheral positions of their scribbles on the main panels. Overlaps were occasionally observed, but in secondary graphic spaces, as well as the use of exfoliated areas. There is no question that their scribbles were made after the panels that they bordered were already completed, suggesting that they indeed amount to manifestations that postdate the others.

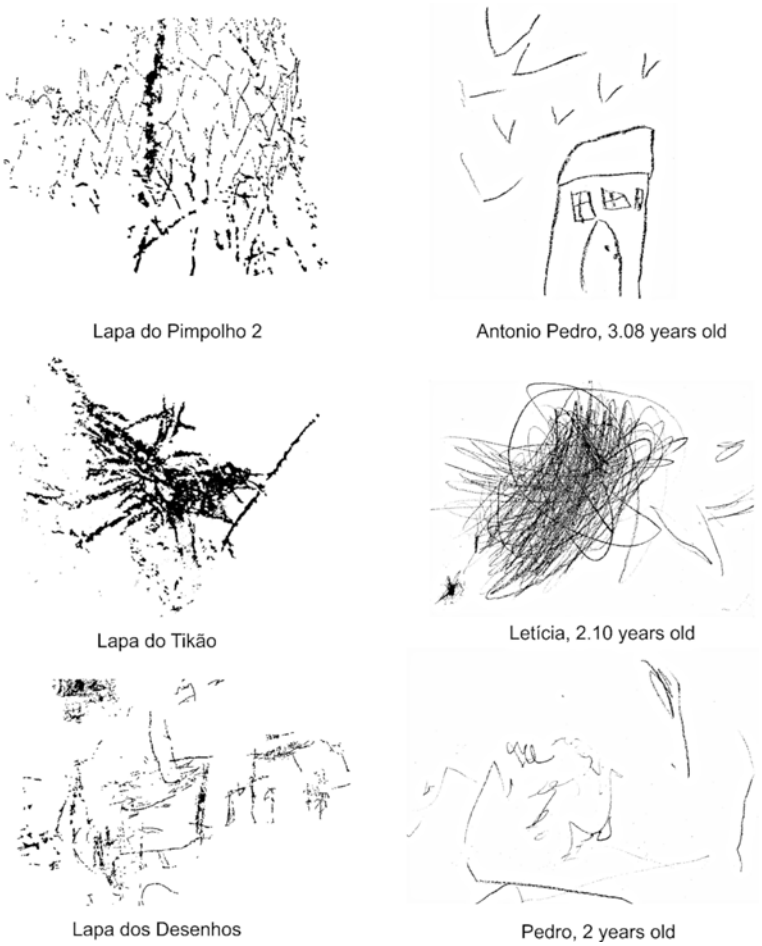


Figure 14. *Scribbles at the Peruaçu shelters (left) and children's scribbles at Escola Nova (right).*

These uncontrolled and disordered scribbles should not be confused with doodles, a behaviour developed at a later stage by juveniles and adults, who have much more control of their body and movements.

Final considerations

According to Mèredieu,

> […] the appearance of what is called infant art was conditioned by the evolution of graphic and visual techniques, and by the increasing availability of paper and pencils, enabled by the low manufacturing costs of these products. This explains why a study of children's drawing cannot travel back very far in time. An expensive product, paper was for a very long time reserved for more profitable uses; children could not use it freely and had to content themselves with more ephemeral surfaces like sand. *Hence we can only formulate hypotheses concerning the first drawings of our ancestors* (Mèredieu 2006: 4, our emphasis).

Mèredieu is mistaken. The scribbles of children who lived in pre-Historic times were made not only on ephemeral surfaces but also on rocky surfaces and, many millennia later, they can still be seen today on the walls of caves and shelters, as in the case of the Peruaçu valley. This observation effectively seems to support not only the hypothesis of a universality of the initial stage of infant graphic production, characterised by scribbles, identified unanimously by the theorists that have dwelt on their study, but their considerable temporal depth. The spontaneous impulse deriving from the need of human species to experiment with the body and hands, and thus express itself graphically, has resulted in very similar forms being made in the first years of childhood, irrespective of time, space, culture, social environment or environmental conditions where they were produced, or the technologies available to them. It is not for nothing that Vygotsky ignored this stage in his model, given that only in subsequent stages do the sociohistorical processes imprint their particularities during the course of the socialisation process.

In the Peruaçu valley, the scribbles of very small children on the walls of its painted shelters constitute another significant contribution from the investigation of rock art, this time to the wider field of studies of the cognitive development of the human species.

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