

ETHNOMATHEMATICS  
—  
NEW APPROACHES TO ITS THEORY AND  
APPLICATION

Dissertation

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Ursula Andrea Barbara Verdugo Rohrer  
geboren in Campinas, Brasilien

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*Buelita, esta "enciclopedia" es para ti...*

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# Introduction

Over the last 25 years, since the creation of the International Study Group on Ethnomathematics (ISGEm), an extensive research on the issues of conceptualizing ethnomathematics has been undertaken by several scientists and members of this community. Although research on applied ethnomathematics has developed strongly and intensely on an international scale, one did strive for a long time to achieve a consensus about a theoretical definition that could comprise all the relevant aspects, and to conceptualize this field of research. This work aims to reopen the discussion regarding the different conceptualizations so far presented. It has as well aimed to propose a new approach to ethnomathematics, one that needs to be able to answer the following open questions:

1. Is it possible to refer to a theory of ethnomathematics? Does it make sense to have a theory of ethnomathematics?
2. What are the constraints or conditions impeding a possible conceptualization and establishment of an ethnomathematical theory?
3. Is it possible to overcome these difficulties? How would they be resolved?

In my opinion, by answering these questions, we will be able to contribute to the improvement of the status of ethnomathematics as a discipline and theory. And the achievements of these answers will be the results of this study.

To render the proposed conceptualization productively, this work is both theoretical and applied. The first theoretical part is divided into three chapters. The applied part is again divided in two field researches that were pursued in Mozambique and in Brazil.

Chapter 1 studies the emergence, during the first half of the twentieth century, of research approaches, contextualized in various disciplines, considering mathematics as a cultural element, followed by the awareness of cognitive development and conceptual change. This historical study is pursued until the

appearance of ethnomathematics as an acknowledged field of research, and the creation of a study group dedicated to it.

We will prove that not only the term ethnomathematics but also research in ethnomathematics has existed and been pursued since much earlier than 1985, when ISGEm was established, and even earlier than 1978, which is usually the years given for the first use of this term. Furthermore, we will show how the notion of conceptual change and cognitive development had changed the approaches to mathematics and mathematics education. Cultural and social contexts started to be considered as elements in the development of mathematical knowledge. These changes finally converged to the notion of ethnomathematics and the establishment of an ethnomathematical community. This chapter also presents some important examples of research into ethnomathematics, and some critiques with which it became confronted.

The following chapter 2 discusses concepts of theory, especially those defined by Kuhn, and how ethnomathematics could fit within them. Some of these approaches will be presented.

Furthermore, a new *Ansatz* to the conceptualization of ethnomathematics will be introduced: to constitute an interdisciplinary discipline in the sense of supplementary interdisciplinary, that is, establishing a correspondence between the levels of theoretical integration without disregarding or devaluating those theories that have no correspondence. This chapter finishes with a discussion on how ethnomathematics has challenged mathematics in its universality. We will propose that mathematics comprises a number of at least culturally different mathematics, as a plural, and that this “worldmathematics” represents a relatively universal and objective mathematics.

This new approach in the conceptualization of ethnomathematics will require, for its theoretical framework, concepts from the social sciences. These will be introduced in chapter 3.

In the applied part, the field research pursued in Mozambique will be described in chapter 5. It was performed in Nampula, with some sculptors of the ethnic group called Makonde. It has attempted to analyze and evaluate the mathematical and ethnomathematical knowledge used in this profession. For this reason, a theoretical framework with some mathematical tools used in the idealization of the human figure, represented by the golden ratio, are introduced in chapter 4. The main questions that will be answered in this work are:

1. How can one distinguish a Makonde artist from a Makonde artisan? How

can one recognize the originality of a Makonde sculpture?

2. Which mathematical means and tools do Makonde artists use and which mathematical knowledge can be revealed in their practice?
3. Does the concept of beauty, as defined by golden ratio, fit or coincide with that defined by the Makonde sculptors?

The second fieldwork, pursued in Brazil, is presented and described in chapter 6. In this research, I introduce the consideration of a Western ethnical minority as an ethnic group: these are the *teuto*-Brazilians living in the district of Friburgo, near Campinas (São Paulo). They are descendants of German settlers who had immigrated during the second half of the nineteenth century. This study attempts to establish a parallel between the development of their professional knowledge, recognizable in the applied sections of their school arithmetics, and the corresponding evolution in Germany. The assumption of identifying Western ethnic groups as subjects of related research constitutes also a challenge to the further development of ethnomathematics. Furthermore, the questions posed for this study are:

1. Is it possible to recognize the change from traditional unit systems to metric systems in the textbooks and exercises used in the *teuto*-Brazilian school of Friburgo between about 1880 and the 1930s?
2. How does ethnomathematical knowledge develop through oral tradition?

Altogether, this work attempts to promote the further development of ethnomathematics as a new supplementary interdisciplinary theory and to open new fields of application.



# Part I

## Theory and Historiography of Ethnomathematics



# Chapter 1

## The Emergence of ethnomathematics and its Contexts

*[Fettweis,] Professore all'Accademia Pedagogica di  
Aachen, dove tenne lezioni di didattica, di storia delle  
matematiche e di etnomatematica fino al 1954 [...]  
(Olindo Falsirol)*

### 1.1 Mathematics as Cultural Element: First Approaches

During the first half of the twentieth century, many researchers, in particular social scientists, had started to consider mathematics as a cultural element and presented several theoretical and empirical results considering this assumption. For some reasons, their researches had no considerable impact on the view of mathematics, that is, their results were not considered as relevant for the development of science and of mathematics. Raymond Wilder had given one explanation:

“Anthropologists have done so [looked at mathematics as a cultural element], but as their knowledge of mathematics is generally very limited, their reactions have ordinarily consisted of scattered remarks concerning the types of arithmetic found in primitive cultures.” (Wilder, 1950, p. 260)

Given that a view of mathematics as a cultural element implied research on empirical evidence for the use of mathematics in various settings, Johann von Neumann tried to follow the idea of what would mean, to a mathematician, to believe that mathematics is nothing more than an empirical science:

“It is difficult for any mathematician to believe that mathematics is a purely empirical science or, that mathematical ideas emerge from empirical given facts. [...] And in all these fields [of mathematics] the subjective success criterium of the mathematician, [that is] the criterium to determine whether her/his efforts are worth it, to a great extent is self-referential, aesthetic and free (or almost free) of empirical ties.”<sup>1</sup>

Two very important facts that could have affected these profound convictions are Platonism and the predominance of pure mathematics, as exemplified by the fascination exerted by Hilbert’s Problems. These are presented in detail below, where I also try to explain in which way they were involved in the thinking of extended periods.

## Platonism

In *Plato’s Dialogue Meno*, the concepts of entity and idea are considered to exist in an ulterior world; this was the beginning of Plato’s *objective idealism*.<sup>2</sup> Plato had showed that a young slave could understand the truth of geometry without having any learning background, leading to the conclusion that he has possessed the mathematical knowledge already before his birth.<sup>3</sup> Plato’s exact argument to explain that learning is nothing more than *anamnesis*, i.e., the recollection of pre-existing knowledge was given in *Plato’s Dialogue Phaedo*:

“[...] when people are questioned, and if the questions are well put, they state the truth about everything for themselves - [...] if one takes them to diagrams or anything else of that sort, one has there the plainest evidence that that is so.” (Gallop, 1993, 73a7-73b2)

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<sup>1</sup>My translation of:

“*Jedem Mathematiker fällt es schwer zu glauben, daß die Mathematik eine rein empirische Wissenschaft ist oder daß alle mathematischen Ideen aus empirischen Gegebenheiten hervorgehen. [...] Und in allen diesen Bereichen ist das subjektive Erfolgskriterium des Mathematikers, das Kriterium dafür, ob sich seine Mühe lohnt, in hohem Maße auf sich selbst bezogen, ästhetisch und frei (oder beinahe frei) von empirischen Bindungen.*” (Otte, 1974, p. 40)

<sup>2</sup>“[...] *die Begriffe des Wesens und der Idee, die auch früher anzutreffen waren, [werden] hier ontologisiert, daß ihre Existenz auf eine jenseitige Welt bezogen wird.*” (Kedrovskij, 1984, p. 51)

<sup>3</sup>“*Erkenntnis ist also Wiedererinnerung dessen, was die Seele in der jenseitigen Welt gesehen hat. Der Weg vom Unwissen zum Wissen ist die Methode des Fragens und Antwortens.*” (Kedrovskij, 1984, pp. 51-52)

According to Plato, the observable world had been made by god, who masters mathematics perfectly, using it during the process of constructing it.<sup>4</sup> Moreover, Plato believed that we had been given the mathematical sciences by god; hence, mathematical objects cannot exist in, and are independent of our world. Mathematical truths are theorems, not problems: they state the existence of certain properties or objects (Kedrovskij, 1984, pp. 52 ff.).

In Plato's system, the "human thinking has consequently only the task to determine the degree of analogy between the perfect, superior idea and its real, puny stereotype."<sup>5</sup> In particular, mathematical objects exist in some objective realm independent of our knowledge, i.e., our mission as mathematicians has been to discover these objects that represent mathematical truths (Byers, 2007, p. 350). René Thom expressed, in a classical way, the platonist view as the only implicit epistemology dominant among mathematicians:

"If we set the formal definition of rigor aside [...] the mathematician should have the courage to avow himself his deepest conviction: he will then admit that mathematical objects have an existence that is independent from the human mind [...]"

In opposition to any appearance, the hypothesis which confers the platonic ideas to the universe's design is the most natural and, philosophically expressed, the most economical."<sup>6</sup>

---

<sup>4</sup>"*Die sinnlich wahrnehmbare Welt ist nach Platon von Gott gemacht. [...] Befäßt man sich damit, muß man zugeben, daß sein Schöpfer gut mit der Mathematik vertraut gewesen ist und in vielen wichtigen Etappen dieses imposanten und gewichtigen Baus mathematisches Gedankengut verwandt sowie mitunter genaue Berechnungen durchgeführt hat.*" (Kedrovskij, 1984, p. 53)

<sup>5</sup>My translation of:

"*Dem menschlichen Denken kommt in Platons System dann nur die Aufgabe zu, den Grad der Übereinstimmung zwischen der erhabenen, vollkommenen Idee und ihrem realen, kümmerlichen Abklatsch festzustellen.*" (Wußing, 1979, p. 55)

<sup>6</sup>My translation of:

"*Verzichtet man jedoch auf die formale Definition von Strenge, so muß man sich gezwungenmaßen für eine der beiden restlichen Alternativen entscheiden. In Anbetracht alldessen, sollte der Mathematiker den Mut haben, sich zu seiner tiefsten Überzeugung zu bekennen: er wird also zugeben, daß mathematische Begriffe eine Existenz besitzen, die unabhängig ist vom menschlichen Geist [...]*

*Entgegen allem Anschein ist darum die Hypothese, daß die platonischen Ideen dem Universum Gestalt verleihen, die natürlichste und, philosophisch ausgedrückt, die ökonomischste.*" (Otte, 1974, p. 378)

In conclusion, many mathematicians have believed (and still do) in the existence of Plato's world of ideas. In my opinion, this belief has to do with the fact of considering mathematics as a pure, beautiful, harmonic and most elegant discipline which is, in our eyes, beyond our reach. This could explain, in my view, why there was no emphasis, especially among mathematicians, in researching how mathematics is and has been developed in other ethnic cultures, since it was assumed that we, the Western culture, had already achieved its highest level.

### **David Hilbert's Mathematical Problems**

In 1900 in Paris, Hilbert held one of the most celebrated talks entitled *Mathematical Problems*; he introduced a list of "twenty-three problems designed to serve as examples of the kind of problem whose treatment should lead to a furthering of the discipline." (Boyer, 1968, p. 610) Intrigued by this challenge and trying to solve the problems, mathematicians and scientists piled theorem upon theorem at a rate than ever before. Hilbert expressed in his works *Zahlbericht* and *Grundlagen der Geometrie*, "the emphasis on the abstraction, arithmetization, and logical development of mathematical concepts and theories", and "the leading exponent of an 'axiomatic school' of thought" which influenced the attitudes in mathematics and mathematics education (Boyer, 1968, pp. 608-609).

David Hilbert had a strong reputation within the international mathematics community; his mathematics, focusing on analysis, was interpreted and considered as masterpieces of pure mathematics, even though Hilbert also wanted to extend the "quest of rigor in analysis" to both geometry and applied mathematics (which were considered to be disciplines of applied mathematics) (Corry, 2004, p. 102). As Leo Corry stated:

"And although Hilbert's mathematical horizons were unusually broad, they were nonetheless clearly delimited and thus, naturally, several important, contemporary fields of research were left out of the list." (Corry, 2004, p. 102)

One has to be aware that the dominance of pure mathematics was not unquestioned; in fact, during the same period of time, there were other attempts in promoting changes in what could be called applied mathematics and mathematics education, in particular those made by Felix Klein. Klein was probably the first mathematician who dedicated his work to establish a policy of disciplinary development; he searched for "the historical roots underlying the dominance of

pure mathematics at the end of the 19th century.” (Schubring, 1989, pp. 171-172) After technical colleges had obtained equal status with respect to the universities in the Germany of the 1900s, Klein realized the importance of improving mathematics teaching in schools; “his goal was clearly to forge an extraordinary broad and powerfull alliance of teachers, scientists and engineers that would advocate a series of reforms for mathematics and science curricula”. The main purpose was “to introduce the elements of differential and integral calculus,” in order to diminish the problem of transition from school to technical college or university (Schubring, 1989, pp. 188-189).

He was successful in instigating a broad movement for curricular reform. Moreover, in the pre-War period in Germany, more precisely between the years 1900 and 1904, Klein succeeded in promoting the applications and establishing a certain balance between pure and applied mathematics (Schubring, 1989, pp. 187-188). At his university, in Göttingen he achieved the creation of a new chair for applied mathematics. Carl Runge, the important promoter of numerical mathematics, was called to take it. Other universities were less active in urging for high degree positions in applied mathematics (Schubring, 1989, p. 193). However, after World War I and after Klein’s death in 1925, the emphasis for the applications faded away. Futhermore, after Runge’s death, his position was passed over to a pure mathematician (Schubring, 1989, pp. 196-197). The dominance of pure mathematics became reinforced; it was only after World War II that this dominance was broken and the disciplinary horizon widened.

In spite of the strong influence and tendencies towards pure mathematics during the first half of the 20th century, there were other mathematicians, besides from Felix Klein, and social scientists who had other viewpoints of what was of great importance within the development in all possible areas of mathematics, and dedicated their researches and work envisioning a cultural context in mathematics. Some of the most important researchers are presented in the following section.

### **1.1.1 Empirical Results**

The following three researchers dedicated themselves to ethnological research on mathematical practices or even conducted field researches in different regions of Africa and South America, evaluating the appearance and significance of mathematical objects and concepts in non-European cultures. Georges-Henri Luquet showed how these results could be associated to the Western mathematical knowl-

edge (Luquet, 1929). Ewald Fettweis has been a truly surprise in our research and has proved to be the first practitioner of ethnomathematics and to regard non-Western ethnic knowledge as being equally valuable for the development of science in a whole (Falsirol, 1959; Fettweis, 1927, 1953, 1937a). Otto Raum used the *indigenous arithmetic* to present new teaching methods to be used in African schools for achieving a better learning (Raum, 1938, 1935, 2004, 1940).

Before we present their results in detail, it is important to remark how these authors referred to the ethnic groups since these terms could be related to a cultural and social influence from those times. The French Luquet used savage or barbarian people as well as ornamental art of the *savages*.<sup>7</sup> The German Fettweis used terms like primitive, native, “lower degree civilization”, “nigger” when referring to some cultures, and even differentiates ethnic groups and cultures according to their skin color (white, black and yellow race).<sup>8</sup> Finally, the German-African Raum, in contrast to the two previous authors, used most of the time the words African, African children or African people. But he also he used primitive arithmetic to refer to the arithmetic integrated into the African life, and in some cases he made a distinction between European and African by using the terms white and black, respectively.<sup>9</sup>

### Georges-Henri Luquet

Luquet (1876-1965) obtained his first degree in philosophy at the *École Normale Supérieure* and obtained later his doctoral degree in humanities from the *École des Hautes Études*. His main fields of interest were logic and epistemology, children’s drawing,<sup>10</sup> primitive art and ethnology (Meyerson, 1966). He taught in many provincial *lycées* and, after the First World War he returned to Paris and taught at *lycée Saint-Louis* and *lycée Rollin* (Drouin-Hans, 2000, p. 573).

In 1929, Luquet presented in his article *Sur l’origine des notions mathématiques: remarques psychologiques et ethnographiques* several artisan ornaments

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<sup>7</sup>Some excerpts of Luquet’s text are: “[...] chez une foule de sauvages [...]”; “[...] dans l’art décoratif des «sauvages».” (Luquet, 1929, pp. 738 resp. 749)

<sup>8</sup>Some of the terms Fettweis used are: “*primitive Völker, Naturvölker, niedrige Kulturstufen, Yorubaneger*” (Fettweis, 1932, pp. 207;216).

“*Drei menschliche Hauptstämme [...] nach der Hautfarbe [...] weisse Rasse [...] schwarze Rasse [...] gelbe Rasse.*” (Fettweis, 1935, p. 64)

<sup>9</sup>We shall see later how Raum sees as completely obsolete to call a non-European ethnic group primitive (Raum, 1935, 1938, 1940).

<sup>10</sup>My translation of: *dessin de l’enfant* (Meyerson, 1966, p. 503)

produced with plaiting techniques by different ethnic groups in South America, e.g. Aparai (Brazil), noticing the presence of geometrical figures and some properties. In particular, he explained how the limit between two conjoined stripes could be interpreted as Euclid's' Definition 4: "A straight line is a line which lies evenly with the points on itself."<sup>11</sup> The material used for his studies had been obtained from, mostly, the *Musée d'Ethnographie du Trocadéro* in Paris, France, called nowadays *Musée de l'Homme* (Luquet, 1929, pp. 741 ff.).

His thesis was that mathematical quantities and notions are obtained directly from experience and observations, thus contradicting nativism and empiricism who agree in the fact that there must be a process of abstraction in order to reach the mathematical status, that is, pure mathematical notions do not exist in reality (Luquet, 1929).<sup>12</sup> For example, a mathematical line is presented in reality as the line separating water and sand in the beach. Such a line cannot have a thickness since, exactly in this division, there is nothing. Furthermore, a geometrical point can be defined as the intersection of 2 such lines.

Luquet gave particular consideration to the concept of geometrical point: a figure can be constituted by such points although they have no thickness nor length. How can a figure be created out of nothing? If a point has no dimension, then it is nothing; but at the same time if there are two points we are able to differentiate them. Hence, and according to him, a geometrical point appeared as the intersection point of 2 lines and as a relation, but not an object itself (Luquet, 1929, pp. 735 ff.).

According to nativists, no geometrical object is as regular in nature as they appear in mathematics, since the notions obtained from the experience cannot have the character they have in geometry and, hence, mathematical notions are innate. Luquet argued against the nativism's point of view.<sup>13</sup> As he explained, the intrinsic property of the regularity of an object is not relevant, what is important is our sensory ability to see it as regular. If we look at a razor blade we will

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<sup>11</sup>"*La limite entre deux bandes contigües du même système était donc une ligne allant toujours dans la même direction sans présenter d'inégalité en aucun de ses points, ce qui est la définition donnée par Euclide de la ligne droite: Εὐθεία γραμμὴ ἐστίν, ἥτις ἐξ ἴσου τοῖς ἐφ' ἑαυτῆς σημείοις κείται [...]*" (Luquet, 1929, p. 741)

<sup>12</sup>Nativism claims that certain abilities and skill are "native", i.e., we are born with them. Empiricism is the belief that all human knowledge arise from mere observations and experiences. To Luquet, an empirist thinks that mathematics belongs to an abstract level that cannot be concrete.

<sup>13</sup>Luquet writes in his text "*Mais cette affirmation est fausse*", showing his complete disagreement with Nativism (Luquet, 1929, pp. 736,760-761).

see a straight line defined as geometrically regular. The nativists argued that, if we looked at the same blade through a microscope, we would see a saw blade and, hence, it cannot be regular. On the contrary, Luquet's argument was that looking at the same object through a microscope makes us see, in reality, a different object. Clearly, what we see with and without the microscope differs in our eye-sense. The horizon line is a straight line for our eyes and hence it creates the notion of a regular geometrical object (Luquet, 1929, pp. 736-737).

One of the main issues in Luquet's article was how plaiting and basketry can be used as examples on how to derive several geometrical objects and properties, e.g. parallel lines, points, etc. Plaiting is considered to be one of the oldest artisan activities and probably one of the most important,<sup>14</sup> and had clearly existed much earlier than the first conceptions of geometry. Some examples of how these derivations can be obtained are the following:

1. The limit between two conjoined strips build a straight line.
2. Straight lines cross each other generating points and angles.
3. In any strip there are colored regions which are delimited by four sides (two from the same strip and other two from the strip crossing perpendicularly; these regions are quadrilaterals, moreover they are rectangles and squares when all sides coincide in their length.
4. A polygonal has four sides if and only if it has four angles.
5. The sum of the angles generated around one point equals four right angles.
6. The bottom of a basket has a center and from there the artisan plaits a strip going round building up a spiral; since the strips are so near it is also seen as a circumscribed circle. (Luquet, 1929, pp. 741 ff.)

In conclusion, Luquet claimed that the construction of figures created by plaiting techniques must have contributed to the emergence of geometrical notions and theorems, and that mathematical notions do not require any further elaboration than what is given through its empirical origin.<sup>15</sup>

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<sup>14</sup>Pottery could not have been a practical activity among nomad groups since the objects are too heavy for carrying.

<sup>15</sup>*“Mais les notions mathématiques de figure et de nombre ne requièrent ni une autre élaboration, ni une autre source que les idées dont nul ne conteste l'origine empirique, comme celles d'arbre ou d'oiseau.”* (Luquet, 1929, p. 747 ff.)

## Ewald Fettweis

Ewald Fettweis (1881-1967) presented a true surprise in our research. He had already been named by Gerdes as a forerunner of ethnomathematics (Gerdes, 1997, pp. 1 ff.). At first, our study attempted to describe the actually innovating fact that he pursued ethnomathematical research much earlier than 1985, the year of the emergence of ethnomathematics (see section 1.4.1). But it eventually proved more than this, that he was the first researcher to develop and establish not only the term ethnomathematics, but even to practice it in his lectures, bringing it into a disciplinary level.

A first biographical information obtained about him was that he had acted as a mathematics educator and had been awarded a doctoral degree from the Philosophy Faculty of the University of Bonn, Germany, in 1927 with a thesis (later published as a book) on an ethnomathematical subject, namely *Das Rechnen der Naturvölker* (The Numeracy of the Primitive People) (see figure 1.1).<sup>16</sup>

This doctorate immediately raised curiosity about the academic acknowledgement of ethnomathematical research at that time and in this country. This led to a search for his academic supervisor at the University of Bonn, to find who had inspired and encouraged him with such an unusual subject - and whether it were a mathematician. This research proved to be difficult: contrary to the usual practice, the published thesis did not contain a curriculum vitae and the archives of the University of Bonn had no longer the files of his doctoral process, due to the losses in World War II. Likewise, no files of his later professional positions, if preserved, contained such biographical data.

Eventually, it became clear that there had been no supervisor in the traditional function of a *Doktorvater*, hence of instigating and guiding the elaboration of the thesis: Fettweis had developed this research program by himself, already earlier on.

Fettweis, born in Eupen on 23 July 1881, studied mathematics at the Universities of Münster and of Bonn from 1902 to 1906. Qualified as teacher for secondary schools, he became a mathematics teacher, first as *Studienrat* at the *Städtisches Höheres Lehrerinnenbildungsseminar Düsseldorf* from 1911 until 1920. Thus, he was active in the new branch of secondary schooling for girls leading to academic careers; then he acted as *Oberstudienrat* at the *Auguste-Viktoria-Schule*

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<sup>16</sup>Actually, the English translation of the title does not at all cover the meaning of the German term *Naturvölker*. It literally means nature-bound peoples, as opposed to *Kulturvölker*, i.e., civilized peoples (Fettweis, 1927)



Figure 1.1: A portrait of Ewald Fettweis (date unknown; Reich *et al.*, 1989).

*Düsseldorf*.<sup>17</sup> The list of his publications presented by Reich *et al.* in 1989 shows that Fettweis became interested in ethnographic research on mathematics after World War I, from about 1920. Since 1921, there were numerous publications evaluating ethnographic findings, in particular about numeracy and reckoning procedures (cf. Fettweis, 1926, 1929a,b).

A decisive step in Fettweis' professional career was prompted by a radical reform in the German school system. In 1920, the traditional social separation between primary schooling for lower social classes and a proper preparatory system for the secondary schooling of the other social strata was abolished, and the teacher formation for the new primary schools - as education for all - was ele-

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<sup>17</sup>The German school system differs greatly from others like, e.g. the Brazilian and Chilean. It is, therefore, not easy to translate into English the different officeholder positions; what can be said is that, the positions Fettweis occupied were in secondary schools that can be considered as teacher education institutions.

vated to higher education. In Prussia, new institutions were established for this academic form of teacher training: the *Pädagogische Akademien*. By the time of their founding in 1926, Fettweis became professor (*Dozent*) for the mathematical part of the formation at one of them, in Bonn. Besides lectures on basics of mathematics, e.g. number theory, and on teaching methodology and practical exercises, Fettweis announced in 1926 his attempt to tackle also historical and cultural issues as part of the teacher formation (Fettweis, 1926, pp. 453-454). Based on the research he pursued independently for some years, Fettweis, then aged 46 years, submitted his thesis in 1927 at the nearby University of Bonn and obtained the doctoral degree from the Philosophy Faculty.<sup>18</sup> The entry on Fettweis in Poggendorff's *Handwörterbuch*, which is based on Fettweis' own communication, calls him a disciple of Ernst Study and of Adolf Dyroff (Poggendorff, 1937, pp. 731-732). With Ernst Study (1862-1930), specialized in geometry of complex numbers, he studied mathematics in Bonn, and Dyroff (1866-1943) was a philosopher who had also published in history of art. But none of them is known to have promoted ethnology or ethnography.

In 1928, Fettweis changed to the position of *Fachberater* (advisor for mathematics teaching) at the *Provinzialschulkollegium Koblenz*, the regional school administration for secondary schools; from 1929 on, he included geometry into his ethnographic interests. He also published two handbooks on teaching arithmetic and geometry in primary grades, for the teacher formation and for the practice of teachers; he included references to ethnographic results on the origins of concepts in arithmetic and geometry.<sup>19</sup> Both became standard textbooks, re-edited many times, until the 1970s. In 1932, he moved again and became vice-director of the *Fürstenwall-Oberrealschule* in Düsseldorf; he served there until 1945.

Fettweis claimed to have suffered during the Nazi period and to have resisted their ideology.<sup>20</sup> After the end of World War II, in 1945, he obtained a professor position at the Pedagogic Academy in Aachen and was actively lecturing until 1954 (Poggendorff, 1958, p. 30). According to the Italian ethnologist Falsirol,

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<sup>18</sup>Landesarchiv Nordrhein-Westfalen in Düsseldorf, Aktenzeichen: R3M-3-02-1900/09, Signatur: BR PE 7847. A transcription of Fettweis' Ph.D. certificate is in app. A.

<sup>19</sup>More concrete examples may be found in his book *Anleitung zum Unterricht in der Raumlehre*, where the first section of chapter II is dedicated to remarks about the cultural history of measuring surfaces and bodies, and chapter VI is dedicated to interpreting the mathematics behind decorative objects (Fettweis, 1951, Inhaltsverzeichnis).

<sup>20</sup>Landesarchiv Nordrhein-Westfalen in Düsseldorf, Aktenzeichen: R3M-3-02-1900/09, Signatur: BR PE 7847 (cf. app. A).

he lectured there on, among others, ethnomathematics (Reich *et al.*, 1989). In fact, Falsirol used, in the Italian original paper of 1959 that appraises Fettweis' achievements, the exact notion *etnomatematica*, translated to ethnomathematics - and thus, for the first time this term in print.<sup>21</sup>

Although the published lists with the announcements of the lectures of the *Pädagogische Akademie* up to 1954 are no longer preserved in the corresponding library, Heinrich Winter, a retired professor from the Rheinisch-Westfaelische Technische Hochschule Aachen, student of Fettweis and his successor as a professor of mathematics education, confirmed that Fettweis had given seminars on the subject of ethnomathematics for advanced students.<sup>22</sup>

In a programmatic paper published in 1937, Fettweis fervently pleaded for a close collaboration between ethnology and history of mathematics. In the cultures researched by ethnologists, one should be able to unravel roots for mathematical developments in the first civilizations of Antiquity. And he insisted that history of science has to embrace the entire humanity, so that also the developments achieved in the so-called lower degree civilizations (*niederen Kulturen*) should contribute to the *tree of mathematical science* (Fettweis, 1937a, pp. 277-278). This neatly corresponds to the modern programs of ethnomathematics, which challenge the one-sided restrictions of mathematics to just the Western cultures. Actually, Fettweis has never done field research, but he was eager to assess as much of ethnographic research as possible.

Fettweis' work and many of his publications have been very innovative for the first half of the 20th century, especially in Germany; his legacy may be considered as a preparation towards what is nowadays understood as ethnomathematics. One of his research interests was, as his Ph.D. thesis shows, to study how and why primitive people developed mathematical concepts and knowledge; for this he reviewed available publications in ethnology and linguistic, evaluating a considerable number of different cultures from all continents, including Europe.<sup>23</sup>

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<sup>21</sup>In the following excerpt, extracted from Falsirol's article one can appreciate the term ethnomathematics already used in 1959:

“*Professore all'Accademia Pedagogica di Aachen, dove tenne lezioni di didattica, di storia delle matematiche e di etnomatematica fino al 1954, egli dedicò e viene dedicando parte considerevole della sua attività scientifica alla matematica e all'astronomia dei popoli cosiddetti primitivi.*” (Falsirol, 1959, p. 262)

<sup>22</sup>Personal communication.

<sup>23</sup>Fettweis' following remark expresses the importance he gave to the research developed in ethnology and linguistics:

“*Der Forderung nach Kenntnis des Rechnens der Naturvölker habe ich durch Vertiefung in die*

His Ph.D. thesis already revealed a remarkable dedication to the scholarship of mathematical ethnology; Fettweis evaluated ethnological research relevant for mathematics from all continents and presented it organized systematically according to families of peoples and/or single peoples from: 1) North America and Northern Mexico, 2) Central America, 3) South America, 4) Australia, and 5) Asia (Fettweis, 1927, pp. iii ff.).

Some of the articles published by Fettweis are *Über die erste Entstehung der einfachen geometrischen Formen* published in 1929, *Ueber das Verhältnis des Mathematischen Denkens zum Mythischen Denken auf niederen Kultur-Stufen* published in 1932 and *Arithmetik, Rasse und Kultur* published in 1935, where he mainly studied the origins of mathematical objects and concepts, and of numbering and counting (Fettweis, 1929a, 1932, 1935).

Some titles of Fettweis' publications can easily lead to misinterpretations of the actual position he had in favor of the relevance and importance of studying and researching non-European cultures, particularly because of the use of the terms *race*, *nigger* and *lower degree cultures*; these terms were crucial within the scope of the National Socialist's principles, as the Nazi party practiced a strong racist policy against all non-Aryan races;<sup>24</sup> his intention was not to reinforce the belief that these cultures could be inferior, but, on the contrary, he even claimed that they have a higher ability with respect to spatial perception (Fettweis, 1927, p. 18). Some of the articles where he defended his position with strong arguments are: *Was lernt unsere Rechenmethodik aus dem Rechnen der Naturvölker?* published in 1929 and *Ueber die Entwicklung des Räumlichen Vorstellungsvermögens bei Völkern nichteuropäischer Rasse und in der europäischen Vorzeit* published in 1937 (Fettweis, 1929b, 1937b). In another article, he arrived to the conclusion that the primitives would operate with what they are able to visualize, whereas we help each other with abstract knowledge (Fettweis, 1929a, p. 121).

A concrete example of mathematical constructions can be found among the indigenous people from the Xingu region, in the Brazilian Amazonia; when the girls menstruate for the first time, they receive a piece of cloth called *uluri* (an isosceles triangle with 7 cm basis, and 3 cm height) that will be put on her pubic area and will be held with cords coming out from the three corners of the triangle, in order to protect this part of the body against witchcraft. In this *uluri* there

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*einschlägige ethnologische und linguistische Literatur zu genügen gesucht.*" (Fettweis, 1927, Vorwort)

<sup>24</sup>According to the Nazi's ideology, Aryan people were the *Herren-Rasse*, of Caucasian origin, destined to rule the world, while in particular the Jewish race represented *Untermenschen*.

is a rhombus drawn; this rhombus represents the *meréschu* fish,<sup>25</sup> which is the symbol of fertility that has to be transmitted to the girl who shall become a mother (cit. Kunike, Fettweis, 1929a, pp. 114-115).

Fettweis also explained that the construction of the rectangle was derived from the cardinal points, which were commonly venerated almost in the whole world; e.g., the hut of the fortune-teller in Imerina, Madagascar has the form of a rectangle pointing north and south in its longest side and both, the door and the window are on the west side of it (cit. Soury-Lavergne & De La Devèze, Fettweis, 1929a, pp. 117-118). Finally, the development of housing construction also shows a source for the appearance of simple geometrical forms; this has been, during all history of the humankind, a natural and empirical mathematical problem of optimization: how can I build a big room using the least amount of material as possible? He concluded that primitive people having bendable material available build beehive huts, i.e., a half sphere, whereas the cultures having inflexible material will build huts with a cone roof (cit. W. Schmidt & W. Koppers, Fettweis, 1929a, pp. 119-120).

One of Fettweis' main thesis was the importance of studying the mathematical knowledge of the living primitive cultures in order to obtain a full understanding of the state of mathematics in the old high cultures.<sup>26</sup>

The article, *Arithmetik, Rasse und Kultur*, dealt with the question on whether the development of number and computation modes are race dependent or not. Fettweis' main conclusion was one may find, in all cultures, and from all race groups (white, black and yellow), different beginnings for the numeration process. It is hence not possible to establish a connection between mathematical development and race. The range of mathematical achievements in a specific culture is conditioned to the level of development in its society. Hence, if a society has evolved to a more complex system, so will the arithmetic develop according to it.<sup>27</sup>

It is very interesting to remark that, in the article *Was lernt unsere Rechen-*

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<sup>25</sup>The name of the fish *meréschu* is given in the Bakairí language; it is a flat lagoon fish that belongs to the piranha family (cf. pp. 101,260-261: von den Steinen, 1894).

<sup>26</sup>“[...] *das Studium der mathematischen Kenntnisse jetzt lebender primitiver Völker und Naturvölker [ist] förderlich, um volles Verständnis zu erlangen für die mathematischen Zustände in den ältesten Hochkulturen.*” (Fettweis, 1932, p. 207)

<sup>27</sup>“[...] *der Umfang der Rechenkunst bei einem Volk [hängt] von der Höhe seiner Kultur ab, und dass, wenn die kulturellen Bedürfnisse wachsen, die Rechenkunst ganz von selbst mitwächst, gleichgültig um welche Rasse es sich handelt.*” (Fettweis, 1935, p. 74)

*methodik aus dem Rechnen der Naturvölker?* from 1929, Fettweis admitted that psychology would not be enough to answer the many questions in the didactics. Ethnology, linguistics (philology) and the history of culture play a strong role within the subjects and cannot be excluded. And he was convinced that primitive cultures in a lower developmental societal stage with respect to our mathematics can help us show and understand how to improve and encourage mathematics education (Fettweis, 1929b, p. 158).

### Otto Friedrich Raum

Otto Raum (1903-2002), born in Moshi, Kilimanjaro, was the son of a Lutheran missionary and spent his first years at the mission, where he learned the local language Chaga (it belongs to the Swahili family) (Sigrid, 2003; Skalník, 2004; Raum, Johannes, n.d.). He was sent to foster parents in Germany where he went to school and completed his studies as a *Volksschullehrer* at the *Lehrerseminar in Schwabach*, in Bavaria, Germany.<sup>28</sup>

Raum returned to Africa in 1928 to work as an educator at the Teacher's Training School in Marangu, Northern Tanzania; it was during this period when he wrote *Hesabuni kwa Furaha. An Arithmetic Method for Teachers in Sub-Standards*,<sup>29</sup> published in 1935 by the Vuga Mission Press in Tanganyika; this first book was written in Swahili and it was later (1938) translated and published in English (Raum, 1938). In 1935 he obtained a diploma in anthropology from the University of London and, in 1938 his Ph.D. in education with the thesis *Chaga Childhood: A description of indigenous education in an East African tribe* which is one of the major works in ethnopedagogy.<sup>30</sup> His advisor was Bronislaw Malinowski, a Polish anthropologist and one of the most important founders of the ethnology of the twentieth century (Raum, 1940; Sigrid, 2003; Skalník, 2004; Raum, Johannes, n.d.).

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<sup>28</sup>An approximate translation to the terms *Volksschullehrer* and *Lehrerseminar* is: elementary school teacher and Teacher's Training Seminar (cf. Raum, Johannes, n.d.).

<sup>29</sup>Before the Second World War and also after, the school years, in all anglophone Africa, were divided into two sub-standard classes, continuing with ten standard classes; the child entered the first year of the sub-standard class with ca. 6 years old (I am very grateful to Prof. Johannes Raum, with whom I have exchanged e-mails and received so many interesting information, not only about his father Otto Raum, but also about his own experience as he grew up in South Africa.).

<sup>30</sup>The term ethnopedagogy refers to the inclusion and integration of ethnical activities and practices into syllabuses.

In 1941, Raum was interned, as a German citizen, in a desert place called Andalusia, located in South Africa, being part of the British Empire; thirteen months later he was released on parole. Skalník believed that the decision was taken by the Prime Minister of that time, Jan Christian Smuts, who supported social anthropology (Skalník, 2004, p. 227). He became in 1949, a senior lecturer in education at the University College of Fort Hare, South Africa, the only university for black Africans. In 1959 he switched to the anthropology department where he became professor of social anthropology and was the successor of Z. K. Matthews (1901-1968) (Sigrid, 2003; Skalník, 2004).

Raum did not receive the attention he deserved. The numerous publications and contributions he left are ranged from introducing new teaching methods to African teachers, e.g. in arithmetic, to the history of art, games and writing in Africa, and the development of African cultures and traditions during the acculturation and enculturation processes; they also reflect his knowledge in many different research areas (education, social anthropology and ethnology) and also languages (Chaga, Swahili, English and German) (Raum, 1938, 1935, 1966, 2004; Sigrid, 2003; Williams, 2001, pp. 97-98). He was aware of the conflict area children and parents lived in: on the one hand, the need of transmitting the traditional ceremonies and behavioral rules and, on the other hand, the need of acquiring European knowledge in an European way. Sociocultural changes were, to Raum, constantly appearing phenomena since he held a dynamic viewpoint of his social environment. Moreover, in 1955, he and other colleagues concluded that acculturation was a rather forced process.<sup>31</sup>

Clearly, Raum was very engaged with education and the process of introducing teaching methods for the African children. Three of his publications are particularly interesting and deserve further discussion: the article *The African's gift for Mathematics*, published in 1935, the book *Arithmetic in Africa*, first published in Swahili 1935 and translated to English in 1938 and his Ph.D. thesis *Chaga Childhood: A description of indigenous education in an East African tribe*, published in 1940 (Raum, 1935, 1938, 1940).

The article *The African's gift for Mathematics* was developed during the period Raum spent at the Marangu's missionary teacher's training college, when he realized that the lack of enthusiasm in mathematics, in particular arithmetic,

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<sup>31</sup>“Akkulturation [ist] kein unilinearer Prozess, sondern [vollzieht] sich je nach Bereich, sozialer Lage und persönlicher Entscheidung, freiwillig zwischen den Stämmen, eher unter Zwang hinsichtlich europäischer Elemente.” (Sigrid, 2003, pp. 198-199)

among children was, most probably, affected by the inappropriate adaptation of European teaching method by the local teachers. To change this, Raum decided to collect the information about the mathematical knowledge African people possess (Raum, 1935). He realized that their mathematical notions appear in contexts very different from the European one; “while to an educated European the realm of numbers is an abstract system of logical relationships symbolized to make it possible to work with them properly,” to children or ordinary people of all cultures, numbers and arithmetical operations must be related to objects that project the importance and need of practicing them. To Raum, this is also how the sciences of number and geometry have developed as they have their beginnings in real tasks, i.e., in measuring and counting (Raum, 1935, p. 167). In his article, he presented some examples of where to find clear applications of mathematical notions within the native life. He furthermore brought this to light that it is the European’s task to change the method of teaching in order to soften the process of acculturation. The European has changed the African’s environment and so, it is also the first’s obligation to show the latter this new “mathematical” environment (Raum, 1935, pp. 169,171).

In his book *Arithmetic in Africa* Raum attempted to introduce a method for teaching arithmetic to African children that “combines the researches of anthropologists into the arithmetical notions and practices of Africa with those suggestions made for the teaching of arithmetic in Europe which seem to fit in with them;” (Raum, 1938, p. 6) he was probably the first educator who underlined the importance of considering and understanding the children’s cultural, social and environmental background when teaching mathematics in the classroom. Raum mentioned three important factors in such awareness process:

1. The normal African behavior provides concrete examples of the mathematical aspects with respect to the logical nature of number that have also been developed by world famous mathematics philosophers.
2. Probably, one of the best methods for teaching the number system and the main four operations to African children is by using their own tribal activities that contain a numerical bearing.
3. Arithmetical problems must be developed based in their own cultural background; with it they can acquire generalizations and abstractions as thinking processes. (Raum, 1938, p. 5)

This was a completely different approach considering that Europeans had so far criticized and/or underestimated other types of knowledge. To them, it was easier to say that Africans have no gift for arithmetic than to admit that the method of teaching was not appropriate, or to say that African people lack fantasy or intelligence because they do not respond to the tests the same way European people do. Among others, these reasons inspired Raum to develop his researches in order to explain, in an appropriate way, why initiation, fruit festivals, familiar sacrifices and other ceremonies that take place periodically in the life of an individual are so important and of so relevance (Raum, 1938, 2004, pp. 205-206). Raum did not find easy to use the concepts of ethnology given in the Western school to realize fieldworks, which is why he developed his own methods; with his methods he was able to understand the “structural background to African education and the meaning of African spirituality in the combined efforts of ritual agent and companions in facing the problems of life and death.” (Raum, 2004, p. 218)

With the book *Arithmetic in Africa* Raum proved to have obtained very specific and detailed results and conclusions for the teaching in Africa. He presented the relations between language and symbol (something that we also have in the Western culture). He became aware of the fact that intelligence is a process that needs to be developed, and is not simply a talent.<sup>32</sup> And he introduced several approaches on how to teach the number system and the fundamental operations and, finally but most important, he established the relation between arithmetic and African life (Raum, 1938).

One concrete example presented in this book is how to introduce the “=” sign to children when they are learning algebraic and arithmetic operations. Raum claimed that children see this sign of equality as a symbol separating the left and right side of the expression. In other cases they indeed considered it to represent equality, but with respect to the first symbol after this sign. Within this reasoning,  $18 + 2 = 4 \cdot 5$  was claimed to be incorrect by children since they have read  $18 + 2 = 4$ , which is clearly false. Raum suggested the use of a balance, so that children could see a relation of equality every time the two pans of the balance are in the same level or height. If this would not be the case, they needed to add or subtract from elements from the different pans; in this way, these

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<sup>32</sup>As written in the dictionary, talent is usually interpreted to be a quality that is natural in a person. The term *natural* can lead to interpreting it as a quality with which the child was born (Longman Dict., 1993).

operations were written as  $11 + 8 \equiv 19$  or  $17 \equiv 23 - 6$ , where the long parallel lines represent the beams of the balance. Once the child has grasped the role of this sign in the algebraic equation, the lines can shrink and it becomes naturally the equal sign (Raum, 1938, pp. 79-80).

Raum was probably one of the first persons, and certainly not the last, to state the following:

“By showing how the individual, if he wants to play his role in the new life, must prove his integrity and his worth, qualities which sometimes have arithmetical foundations, such teaching might also exercise a significant influence in the moral stabilization of the African peoples.” (Raum, 1938, p. 94)

In his Ph.D. thesis, Raum attempted to describe the process of growth of a Chaga child from the moment when its parents are expecting it until it is integrated into the society as an adult member. This is described by Raum as a process of education, and the definition he used for this was: “education is the relationship between members of successive generations.” It is important to remark that, he did not conceive the possibility of analyzing subjects as isolated individuals, this had to be done considering their cultural background and social environment (Raum, 1940, p. 62).

Among Raum’s conclusions to his researches, I put some stress in those referred to education considered as training. First of all, he realized that not only education was a process that could not be exhausted and would last the whole life, but also that there is no monopoly regarding which social organization, within the Chaga culture, carries out education. Every group of people may contribute for the continuity of their culture.<sup>33</sup> It is hence necessary to build a relationship between these two (integrated) systems that should be reciprocal and co-operative; “the ideal African school is thus one which teaches tribal subjects, in the sense that all culture contact problems are reflected in the syllabus. European subjects enter naturally into the sociological studies.” (Raum, 1940, p. 402)

“Education [...] is not an historical accident, but an inalienable and fundamental fact of human life. It alone makes possible the continuous biological and cultural regeneration of society.”

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<sup>33</sup>Both social organization and groups are to be understood as grouping according to age range, familiar relationship as well as tribal authorities, e.g. the age-group, the family, the tribe, a healer and even an artist (Raum, 1940).

“[...] native culture cannot be considered as being in any way a necessary preliminary stage of Western civilization. Both cultures are autonomous expressions of the biological needs and historical aspirations of the societies that produced them.” (Raum, 1940, pp. 390-392)

All these may be evident to us, but, in my opinion, it is extremely relevant to point them out and put particular attention to them. We shall not forget that these results were obtained already before the 1940s; not only did Raum become aware of the mathematics hidden in the activities of a certain culture, he also presented concrete examples and solutions on how to deal with the changes provoked by the influence and acculturation of the European society in what used to be an isolated culture.

### 1.1.2 Theoretical Results

As it commonly happens, many mathematicians develop a strong interest for history and historiography of mathematics late in their career (Schubring, 1988, p. 138). This is the particular case of Cassius Jackson Keyser and Raymond Wilder. I will also introduce the thesis developed by the American anthropologist Leslie White. The approaches presented in the following were not based on specific cultures, but on theoretical backgrounds that also give validity to a cultural context within mathematics.

As we will see, these authors categorized peoples as *primitive*, *cultures* and *societies* when referring to other ethnic groups. This represents one difference with the previous section, which may be related to the fact of them not having done any empirical research.

#### Cassius Jackson Keyser

Cassius Jackson Keyser (1862-1947) was an American mathematician and a professor at Columbia University. He presented three articles, *The Meaning of Mathematics*, *The Bearings of Mathematics* and *Mathematics as a Culture Clue* between 1932-33, in which he sought to explain the nature of mathematics, the bearings of mathematics and the relation between mathematics and culture (Keyser, 1932b,a, 1933).<sup>34</sup>

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<sup>34</sup>as the author described, the term culture is taken here to refer to any great civilization that is part of the history of humankind, e.g. Western culture, Classical culture or Chinese culture (Keyser, 1933, p. 185).

In order to understand the nature of mathematics, Keyser's first step was to define *proposition* and *propositional function*: the first can be found to be true or false whereas the second refers to a mathematical function that takes one variable and connects it to other/s resulting in a proposition (Keyser, 1932b, p. 17). According to him, either mathematical or scientific propositions become *established* if the respective scientific community accepts them (Keyser, 1932b, p. 24).

In his second article, Keyser considered mathematics to be another *cardinal forms* (e.g. science, religion, sculpture, etc.) developed in a culture; these *forms* are mutually related and contribute to the enhancement of every other and so, they build a unique *culture's physiognomy* (cit. Oswald Spengler, Keyser, 1932a, p. 93).

As Keyser explained, human knowledge was based only on observations, memory and comparisons, not on logical deduction. From the first moment a relation was suggested, society entered a period of crisis in the "evolution of knowledge-gaining method; it inaugurated a new era, destined to be endless." (Keyser, 1932a, pp. 102-103)

Later in his third article, Keyser presented his *culture clue thesis* (CCT): "the type of Mathematics found in any major Culture is a clue, or key, to the distinctive character of the Culture taken as a whole.", given by Oswald Spengler (German historian and philosopher, 1880-1936) (Keyser, 1933, p. 186). By 1933 the CCT was not an established proposition, in the sense Keyser has defined in *The Meaning of Mathematics*; interestingly, if it were established, it would be a "scientific proposition asserting a unique and highly significant relation between Mathematics and Culture." (Keyser, 1933, p. 188) His arguments for validating the CCT have to do with the fact that *forms* within a culture build a unique *culture's physiognomy*, as already stated above.

### **Leslie Alvin White**

Leslie White (1900-1975) was an American anthropologist, who worked as a professor at the anthropology department of the University of Michigan Ann Arbor. In 1947 he published the article "*The Locus of Mathematical Reality: An Anthropological Footnote*", in which he argued in favor of the thesis that Mathematical concepts are independent of the individual but can only exist within the context of a specific culture, and this latter shall determine the evolution of the first (White, 1956, p. 2364).

In contrast to Keyser's definition of culture, addressing it only to those civilizations that are part of the traditional mainstream history of humankind, White considered culture to be "the anthropologist's term for the mode of life of any people, no matter how primitive or advanced; as a scientific concept is a recent invention itself." (White, 1956, pp. 2351,2355) Hence, it had no meaning outside humanity. By considering mathematics as part of a culture, he reached to the same conclusion, i.e., its truths and concepts are meaningless in the "outer world." A person inherits a culture and this will determine her/his thoughts, feelings and behaviors. Depending on the environment, a person is favored to develop more abilities in certain activities than in others. In particular, being mathematics another *form of behavior*, its development and evolution depends on the *set of stimuli* given by the culture to an individual. For example, calculus could not have been developed in 10000 b.C. "because the requisite cultural elements were lacking." (White, 1956, pp. 2359, pp. 2353 ff.)

In conclusion, White stated that indeed it does make sense to refer to mathematics as having an existence independent of the human mind, mathematical truths reside in the cultural tradition in which a person is born. In this sense, any person has the ability to contribute to the cultural growth, in which mathematics is part of it, through inventions or discoveries, in other words, through "interaction and re-synthesis of cultural elements." (White, 1956, p. 2359, pp. 2357 ff.)

What was defined by Keyser to the "era of the knowledge-gaining method" is what White called to be "formation of a cultural tradition;" both of them stress the greatest ability of communicating through symbols that humankind has developed. With it, not only the transmission of knowledge became possible, the interaction of these information and concepts in our brains became higher and richer leading to new syntheses and propositions.

As an attempt to lower the thesis of the existence of mathematical objects outside the humanity, White wrote:

"There is no more reason to believe that mathematical realities have an existence independent of the human mind than to believe that mythological realities can have their being apart from man." (White, 1956, p. 2350)

## **Raymond Wilder**

The mathematician Raymond Wilder (1896-1982) was a professor at the University of Michigan and a past president of the mathematics Association of

America and the American Mathematical Society. He was probably one of the first persons within the mathematical community to acknowledge the fact that considering mathematics as a cultural element is not new, that indeed “anthropologists have done so, but as their knowledge of mathematics is generally very limited, their reactions have ordinarily consisted of scattered remarks concerned the types of arithmetic found in primitive cultures.” (Wilder, 1950, p. 260)

He agreed with White when he stated that mathematics is part of our culture and our *collective possession*. Culture “is the collection of customs, rituals, beliefs, [...] possessed by a group of people.” This set changes with time, producing what he defined as *cultural stream*. The two factors provoking such changes are *evolution* and *diffusion*, where this latter refers to “the transmission of a cultural trait from one culture to another.” (Wilder, 1950, p. 259, p. 263)

Under these terms, Wilder concluded that mathematics cannot be a fixed structure and has experienced a lot of changes; “there is no such thing as the absolute mathematics.” And so, the mathematician would be influenced by the mathematical culture of the period of time in which he is living and, at the same time, he would influence and change it; he assimilates the information obtained from professors, articles, books, etc., producing new results. “A necessary condition for the emergence of the “great man” is the presence of suitable cultural, including opportunity, incentive and materials [...] The mathematical genius can only carry on from the point which mathematical knowledge within his culture has already reached.” (cit. Ralph Linton quoted from Wilder, 1950, pp. 260 ff.)

According to Wilder, mathematics has an *international character* due to “the standardization of symbols it has achieved, thereby stimulating diffusion.” It is very important to account that language habits have great influence in our modes of thought; being so, it is of major concern to have and maintain the *language of mathematics* as objective as possible, otherwise it would hinder the diffusion, hence the further development of this subject (Wilder, 1950, pp. 265 ff.).<sup>35</sup>

As a last interesting remark, Wilder considered another cause for the accelerated process in the development of mathematics after 1900: “the large exodus of mathematicians from Western Europe to the United States.” This favored new contacts from different areas within mathematics, provoking a high diffusion and interaction of mathematical ideas and causing to institutionalizing new directions and accelerating others (Wilder, 1950, p. 270). With it, I think that the math-

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<sup>35</sup>I have used the term objective in the sense that, it should not matter which is the mother language, mathematical language shall be read and understood in the same way by any person.

emetician becomes even more aware of how important is the need to have the *language of mathematics* standardized and objectified.

### 1.1.3 Implications

Even though the scientists mentioned above already started to consider mathematics as a cultural object, this idea was not easily accepted nor considered by the mathematics scientific community, most probably until after World War II. Plato's *world of ideas* has continuously boosted the mathematician's intention of the further development of an abstract, aesthetic, non mundane science. Added to this, Hilbert's problems urged to new mathematical "discoveries" that would allow the expansion of this discipline to other horizons.

And although the terms used to refer to non-Western ethnic groups were, in the historical context, scientifically correct they, nonetheless, raised racial issues, sometimes only implicitly. As explained above, German researchers were, and still are, easily misinterpreted, due to the political historical background in Germany. These terms are, nowadays, completely obsolete, but we shall not disregard the research results presented in the early 1900s as they express and represent the first stage of the process of becoming aware that mathematics, like other disciplines, is part of the cultural growth. This is how the previous and maybe other scientists can be considered to be the precursors of the movement that led to the development and appearance of ethnomathematics.

Until at least the 1950s, ethnology and psychology were two strictly separated disciplines. Conceptualizing the ethnic groups investigated by ethnologists as "primitives" entailed a static view of their culture; combined with the racist views, they were perceived as limited in their intellectual capacities and thus opposed to civilization. It had been the first practitioner of ethnomathematics, the German Ewald Fethweis, who propagated the establishment of a link between these two disciplines, to explore intellectual development in these ethnic groups. Starting with the basis of an essential cognitive unity for all peoples of humankind, he understood this link as a relation between phylogenesis and ontogenesis. Thus, on the one hand, present primitive people (in his words, *Naturvölker*) should give access to the emergence of scientific notions in the early civilizations and, on the other hand, they should give hints to guide the intellectual development of children. He pleaded therefore for basing teaching methodology on "the comparison between the intellectual development of the child of today with the cultural

development of the entire humanity.”<sup>36</sup>

Fettweis was, hence, a forerunner for the new approaches towards cognitive development in psychology, education and also history of mathematics. In fact, it was the cognitive turn of psychology from about the 1950s on, what decisively changed conceptions in areas relevant to our study. Investigating cognition in a genetic way, and within psychology and education, provided theoretical categories and approaches, which proved to be usefully applicable to historical, cultural and sociological studies of science - in particular also to history of mathematics. As a consequence, the traditional dichotomy primitive/civilized could no longer be maintained. We will discuss the effects this brings to the theorization of ethnomathematics.

To prepare this, we will present the contributions of three key researchers in psychology and education who provoked breakthroughs in the understanding of cognitive development, also in the acquisition of mathematical knowledge; notions that eventually became applied in ethnology as well, effecting decisive re-conceptualisations, including revisiting their cultural perspectives.

One should be aware that the cognitive turn and the domination of structuralism from the 1950s on was an outcome of the challenge, after the end of World War II, to rebuild the societies in the industrialized countries. But the coincidence with the process of decolonization was not random.

## 1.2 Contributions of Cognitive Psychology and Constructivist Approaches in Education

In colonized countries, education was imported from the Western societies and there was no questioning whether culture could play a role in the processes of learning. Hence, it was a triviality to obtain conclusions such as, “negroes are deficient in intelligence” after applying intelligence tests during their training for a war against Imperial Germany (Raum, 2004, pp. 205-206). It was on the eve of World War II that Jean Piaget, a Swiss psychologist, made aware that education was the decisive factor in changing and rebuilding our societies, moreover he claimed that “the common wealth of all civilizations is the education of the child.” (cit. Piaget, Munari, 1994, p. 3)

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<sup>36</sup>My translation of:

“[der] Vergleich der geistigen Entwicklung des Kindes von heute mit der Kulturentwicklung der Gesamtmenschheit [...]” (Fettweis, 1951, p. 5)

Piaget's greatest contribution to education was obtained from the researches he developed with children; he realized that, not only a child learns certain things and develops its knowledge during different age stages, but also language and culture are crucial in this process. Gainotti confirms this:

“From the early 1960's, Piaget's theory aroused great interest in a number of countries as a theoretical paradigm for the comparative intercultural study of cognitive development.”

“Besides, the rapid cultural changes which have taken place since the beginning of the century brought with them a massive increase in information and knowledge. In this context, the problem of identifying the processes by which, enabling him or her to communicate and act, became an important theoretical and practical concern for social psychology.” (Amann Gainotti, 1997, p. 377)

By the end of the 1950's, Jerome Bruner not only developed educational psychology but was probably one of the first researchers to elaborate meaning making as a socio-cultural process. His theory of education directly affected the educational programs of the 1960s and 1970s, and he considered that,

“Human beings become what they are only by internalizing culture, but this acquisition of culture happens by learning the essences (or the toolkit) of culture which are encapsulated in each subject or academic discipline taught in school [...]” (cit. J. Bruner, Takaya, 2008, p. 5)

Of course Bruner did not intend to describe a person as a simple receptacle of facts, but he believed that culture was permanently present in the process of constructing and changing meanings. Changing curriculum meant, to him, to introduce subject matter such that it stimulates curiosity, and to not just make it accessible (Takaya, 2008).

By the middle of the 1970s, Ernst von Glasersfeld introduced the radical constructivist theory into mathematics education. He questioned the existence of objective knowledge; he realized that culture, which is directly related to language, is affecting how people express themselves and how they conceptualize things and experiences. Knowledge and meaning became, to von Glasersfeld, inter-subjective. William Cobern's comment on von Glasersfeld's contribution is,

“Glasersfeld's constructivism provided a very effective metaphor for how learning takes place that neatly fit with misconception and conceptual

change research providing a much needed theoretical basis in cognition, with the added appeal of being related to both [Thomas] Kuhn and Piaget.” (Tobin, 2007, p. 533)

Some of their research and theory approaches shall be presented below as they provoked and influenced the development of ethnomathematics. In fact, research on conceptual change within psychology became relevant for historical and cultural studies of the sciences, in particular of mathematics. It is not only within mathematics that we had to become aware of cultural influences within the development of societies, but more generally education has to be able to be adjusted and adapted according to the culture and to the background history of any group of people.

### 1.2.1 Jean Piaget

Jean Piaget (1896-1980) was more than an epistemologist and psychologist, he was also a biologist, philosopher, logician and sociologist; he was a great contributor in breaking the traditional barriers between these disciplines (Munari, 1994; Amann Gainotti, 1997). Born in Neuchâtel, he obtained his Ph.D. in natural sciences at the University of Neuchâtel. In 1955, he founded, together with his collaborators, the International Center of Genetic Epistemology at the University of Geneva. It was during this period when he was mostly devoted and dedicated to the “study of children in their mental development;” this represented, to Piaget, the means to understand the acquisition and growth of knowledge. He defined himself to be a constructivist and interactionist theoretician of knowledge (Amann Gainotti, 1997, pp. 373-374).

Piaget’s contribution exceeds 50 books and hundreds of publications, many of them having been published only in French leading sometimes to misconceptions of what Piaget developed and researched in his fields of interest (Munari, 1994; Amann Gainotti, 1997). This section will be dedicated to discuss two of his books, *La genèse du nombre chez l’enfant* and *Le développement des quantités physiques chez l’enfant* (Piaget, 1952; Piaget & Inhelder, 1969).

Piaget called his approach genetic epistemology: it should unravel how a child constructs its knowledge by a series of interactions and adaptations with its context, but in successive stages depending on the age, achieving to acquire higher level knowledge until reaching the next stage.

In the first book, Piaget’s goal was to confirm that “every notion, whether

it be scientific or merely a matter of common sense, presupposes a set of principles of conservation, either implicit or explicit; in particular, the conservation of something is a necessary condition for any mathematical understanding.” (Piaget, 1952, pp. 3-4) *Conservation* is to be understood as the non changing of a value or quantity, no matter how many elements of it are permuted. He performed two types of experiments with children between 4 and 7 years old: the first was made with liquids and different sized containers (continuous objects), the second was with beads (discontinuous objects). In both experiments, the hypothesis is whether the development of the notion of quantity is not the same as that of conservation of quantity. The procedure used consisted of moving a certain object from one container to another with a different shape, and then asking the child whether the amount of this object is the same as in the beginning or if it has changed (Piaget, 1952, pp. 5 ff.).

When treating the experiments with liquids, Piaget distinguished 3 stages in the rational thinking of children, depending on their age. In the first stage (4-5 years old), the child did not see any conservation whenever the container’s shape is different from the previous one. To Piaget, this meant that the child was not able to deal with the notion of a multi-dimensional quantity and it could only reason with respect to one dimension (height or width) at a time (Piaget, 1952, p. 10). In the second stage (5-6 years old), the child was able to proceed with the *logical multiplication* operation, i.e., it could realize that the amount of liquid in 2 different containers is different if the height level is the same, but they differ in width. Even though, the child failed to deal with both dimensions simultaneously since, when it tried to equal these quantities, it claimed that they could not be the same anymore the moment the height levels change. The child was still influenced by his *perceptual illusions* (Piaget, 1952, pp. 15-17). Finally, in the last stage (6-7 years old) it seemed completely obvious and logical that the quantity remained always the same and the child could not conceive the idea of not having the same amount as in the beginning. According to Piaget, this is achieved after the child is able to coordinate the *multiplication of relations* and the *arithmetical partition* simultaneously.<sup>37</sup>

When the same experiment was made with beads, it became easier to realize when the child first grasps the notion of number due to the fact that the *one-one*

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<sup>37</sup>The *arithmetical partition* becomes real when the child grasps the notion of unit, i.e., the whole amount of liquid represents one *extensive quantity* that remains proportional no matter where it is being poured (Piaget, 1952, pp. 21 ff.).

*correspondence* is enabled.<sup>38</sup> Apart from this change, there were no substantial differences between these two types of experiment (with continuous or discontinuous substances) in the sense that the stages to achieve the notion of conservation followed the same line (Piaget, 1952, pp. 25 ff.).

In the second book *Le développement des quantités physiques chez l'enfant*, Piaget and Inhelder worked with children aged between 7 and 12 years old; this age range has also been called the period of second childhood in psychology. The experiments' goals were to study the different stages through which a child passes until it achieves the notion of physical invariance. Concretely speaking, given two play dough balls (one of them being made by the child itself), one of them is transformed through partitions and changes of shape. The question here was whether the general properties of the object (substance), such as amount of matter, weight and volume, have changed. We will see that, just as the authors concluded, the children moved from a stage of egocentrism and phenomenalism (subjective impressions) to a stage of mathematical awareness and, hence obtaining an objective reasoning with respect to physical objects.<sup>39</sup>

During the experiment, we distinguish three different phases: in the first one, the child grasped the notion of invariance of substance (until 8 years old), the second was attained when it obtained the notion of invariance of weight (10-11 years old), and the third was reached when the notion of invariance of volume had been grasped (11-12 years old). It is interesting to realize that the child relates neither weight nor volume to the quantity of substance, which was why it needed to continue developing its coordination and ordering of (mathematical) operations - Piaget referred here to the categories of the philosopher Kant; according to him, the claim that matter is heavy is a synthetic judgement and, hence, the concept of weight is not analytically bound to the first (Piaget & Inhelder, 1969, p. 41). Moreover, if one considers Kant's definitions for extensive and intensive quantities,<sup>40</sup> one realizes that what Piaget and Inhelder claimed is that the child,

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<sup>38</sup>The *one-one correspondence* is a numeric relation between two sets, where the elements are considered as separate units (Piaget, 1952, p. 25).

<sup>39</sup>Egocentrism is not used in the sense of being selfish, but it is perceiving the world in terms of the self. Phenomenalism is the idea that objects exist as perceptual phenomena. In these senses, what Piaget and Inhelder claim is that children in this first stage can only see, perceive and reason from their own perspective in time and space (Piaget & Inhelder, 1969, pp. 39 ff.).

<sup>40</sup>“Extensive quantity: it is the quantity in which the representation of the parts make possible the representation of the whole. Such a quantity must occupy a determinate space and time.” (Paton, 1936, pp. 112,120)

“Intensive quantity: it is the sensed qualities of objects (color, taste, weight, etc.). This quantity

in its process of objectification, needs first to understand the extensive quantity to be able to grasp the intensive quantity.

During the first stage, the child could understand the notion of identity and reversibility, and thus the conservation in the amount of matter. If many transformations were done, the child got easily confused, especially because intuition is still a strong observational characteristic. In the second stage, the acquisition of mathematical quantification proceeded analogously to the first period, except that the child needed to coordinate, at the same time, the reverse operation and the equation “sum of parts = total.” The subjective experience suggested that the weight of a certain matter differs according to how much surface is in contact with it. In the last stage, the child needed to realize that changing the shape of the play dough would not change the concentration or density of it, i.e., it remains constant. The development of acquiring the last notion of (physical) volume is similar to the previous stages (Piaget & Inhelder, 1969, pp. 47 ff.).

As one can see, there is a qualitative process in the acquisition of mathematical notions; children learn and, through this learning, they develop the ability of realizing mathematical and physical operations in their process of reasoning. As Piaget states:

“Mathematical understanding is not a matter of ability in children. It is therefore erroneous to consider that lack of success in mathematics is due to a lack of ability [...]. The mathematical operation derives from action, and it therefore follows that the intuitional presentation is not enough. The child itself must act, since the manual operation is necessarily a preparation for the mental one [...]” (cit. Piaget, Munari, 1994, p. 4)

In some sense, language also represents an action, since it requires an exchange and interaction with another person. It hence plays a strong role in the development of knowledge because it affects the acquisition and development of notions and concepts, not only of an individual but also of groups of people, societies and ethnic groups.

The next author, Jerome Bruner, developed a theory of education in which culture is one of its pivots; he based himself in Piaget, among others, and used the strong evidences provided by Piaget’s researches in this new theory, where the

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is a degree of influence on sense. It is given in sensation at a moment: we do not apprehend each of its parts separately and successively in order to combine them into a total.” (Paton, 1936, pp. 49,143)

awareness of the ability to acquire knowledge in any child opens new perspectives that shall no longer discriminate and condemn children for making mistakes.

### 1.2.2 Jerome S. Bruner

Jerome Bruner (1915-) is an American psychologist, who has been a major contributor to the subfields of cultural psychology and psychological anthropology, breaking the historical separation of anthropology and psychology. He has also contributed to significant advances in many other fields such as medicine, perception, cultural models and education. He often calls himself a cultural psychologist, since he puts culture in the midpoint when he analyzes the understanding of mind (Shore, 1997; Mattingly *et al.*, 2008, p. 8); he was one of the leaders of the “cognitive revolution” in the late 1950s, where they formulated a new way of investigating the human psyche, putting meaning making at the center of it (Mattingly *et al.*, 2008, pp. 1-2).

To our particular interest is the legacy Bruner left in educational psychology. Moreover, he is probably the person who put these two subjects, education and psychology, together. Educational psychology demands the need of being in touch with children, power and culture; “education relates to the culture and also to technology more broadly.” (Shore, 1997, p. 56) As Ed Purcell stated,

“Jerry Bruner has had the great and interesting effect of making education an intellectual subject. Which is true of nobody else.” (cit. Ed Purcell, Shore, 1997, p. 56)

In Bruner’s legacy are included *The Process of Education* and *Toward a Theory of Instruction*; these two books are presented in this section.

In the book *The Process of Education*, first published in 1960, Bruner’s intention was to present effectively a new nature of the learning process. As the acquisition and transfer of knowledge became more relevant to psychology, it is equally important to have these considerations for the new changes in education and design of new curricula. He conjectured that the intellectual development of a student can be improved by “good teaching that emphasizes the structure of a subject,” i.e., new curricula must be based on the fundamental concepts of each discipline, being this understood as reorganized according to its modern developments. Hence, teachers have to be trained in such a manner that they grasp this structure (Bruner, 1960, pp. 2 ff.).

On a larger scale it became clear to Bruner that, as society grows and evolves and politics keeps on changing, education needs to keep updated with respect to those changes; it should serve as a means of training citizens for a democracy. A good example is the warning given by Michael Cole, when he concluded that, imposing Western European curriculum to African cultures undermined their traditional authority, and meant a profound oppression made by the West in the African cultures (Bruner, 1960, p.xi).

On the other hand, new curricula should be developed by the best university scholars and scientists; they need to follow all scientific revolutions that have occurred since the 1950s, which is why we need specialists in the different fields to develop them (Bruner, 1960, pp. 3 ff.). In Bruner's eyes, it was of outmost important to create

“A curriculum [that] is more for teachers than it is for pupils. If it cannot change, move, perturb, inform teachers, it will have no effect on those whom they teach. It must be first and foremost a curriculum for teachers.”  
(Bruner, 1960, p.xv)

The desire of involving scientists, teachers and teaching and learning specialists was not the only change that has happened since the middle of the twentieth century. With respect to the study of the nature of learning, educational psychologists have tried to achieve what would be the long-term educational effects of learning; they have studied and researched aptitude and achievement, and the social and motivational aspects of education. Within this framework Bruner claimed that “massive general transfer can be achieved by appropriate learning,” leading to a “learn how to learn” and to a “general understanding of the structure of the subject matter.” (Bruner, 1960, p. 6) In his own words,

“Grasping the structure of a subject is understanding it in a way that permits many other things to be related to it meaningfully. To learn structure, in short, is to learn how things are related.” (Bruner, 1960, p. 7)

Not only courses in language and social and natural sciences should be taught; schools should also contribute to the social and emotional development of children and prepare them to become citizens within the family and the community. The optimal teaching is achieved when knowledge is transmitted causing interest and excitement; for it, it is fundamental that teachers have patience and a deep understanding of the subject matter. What children learn should serve them in the

future; with structures they are able to continuously broaden and deepen knowledge. Bruner suggested curricular consequences, when teaching the fundamental structures of a subject (Bruner, 1960, pp. 22-26).

This book, written by Bruner, was the outcome of the famous ten-day conference at Woods Hole (USA), in September 1959, on educational reform, held by the National Academy of Sciences.

In Bruner's book *Toward a Theory of Instruction*, he defined *instruction* as an effort to "shape" growth. It is in this sense that the child will be affected and influenced by the level of encouragement and enthusiasm the teacher will be giving during the lessons (Bruner, 1960, 1966).

When studying the origins of human cognitive activity, Bruner realized that there exists the behavior that copes with the requirements of a given problem and, on the other hand, there exists also the behavior that is designed to defend against entering such problem. As David Page exemplified in mathematics learning: "when children give wrong answers it is not so often that they are wrong as they are answering another question, and the job is to find out what question they are in fact answering." The nature of intellectual growth was the focus of this book (cit. Page quoted from Bruner, 1966, pp. 3-6).

To Bruner, language (symbolic forms) is the most important element in the nature of intellectual development; "we need to go beyond the empirical properties of concrete events, just as mathematicians operate upon the language rather than upon what the language refers to." (Bruner, 1966, p. 20) In other words, we need to create a notation that is based on our experiences and that is capable of creating operations in which we may relate these symbols in several different ways.

Summarizing, by becoming aware that intellectual growth and its processes are directly related to culture, it is possible to develop a theory of instruction that stimulates the mind and encourages the development of a *desire to acquire more knowledge*.

In fact, it is with language that the learner achieves meaning-making as a socio-cultural process. Bruner plainly explained why meaning-making at first relates to a certain community, within a given culture:

"By virtue of participation in culture, meaning is rendered public and shared. Our culturally adapted way of life depends upon shared meanings and shared concepts and depends as well upon shared modes of discourse for negotiating differences in meaning and interpretation. [...] the child does not enter the life of his or her group as a private and autistic sport

of primary processes, but rather as a participant in a larger public process in which public meanings are negotiated. And in this process, meanings are not to his own advantage unless he can get them shared by others.” (Bruner, 1990, pp. 12-13)

The categories used here by Bruner for explaining meaning-making in the process of intellectual growth in children are easily lent for applying them to intellectual growth in science: it is likewise by negotiating differences in meaning and interpretation that scientists will share common notions of a discipline and thus constitute not only *normal science*, but also themselves into a *scientific community*. (See following chap. 2)

In a different approach, Ernst von Glasersfeld developed a theory that, in some sense, agrees with Bruner’s perspectives. Von Glasersfeld used Piaget’s results to develop the radical constructivist theory that should be integrated into mathematics education; within this theory, mathematical objects can no longer be considered to be objective, and he speaks of inter-subjectivity; meaning is created by the individual, but it can consensually agree with a general view given by the community, ethnic group or culture.

### 1.2.3 Ernst von Glasersfeld

Ernst von Glasersfeld (1917-) is the founder of *radical constructivism*, and one of his sources of inspiration was the theory of cognition developed by Piaget. It was first in the 1970s when he started teaching cognitive psychology at the University of Georgia, USA; previous to this time he had worked as a journalist in Italy and as a collaborator in language analysis and machine translation at the *Scuola Operativa Italiana*, also in Italy. He continues actively participating in research at the Scientific Reasoning Research Institute in the University of Massachusetts, USA (Cardellini, 2006).

His contributions go beyond the range of psychology and philosophy of mathematics education and science education. Moreover,

“by adding to radical constructivism sociocultural theories, powerful educational perspectives emerged for (i) deconstructing the hegemony of the Western Modern Worldview which lies concealed, like a Trojan horse, within the world’s exported science curricula and (ii) acknowledging the legitimacy of local (indigenous) knowledge systems as equally viable ways of knowing,

being in, and valuing the natural world.” (cit. Peter Taylor quoted from Tobin, 2007, p. 535)

Von Glasersfeld speaks four languages fluently: German, English, Italian and French; this fact is seen as one of the starting points for the development of his constructivist theory of knowledge. In other words, von Glasersfeld was “intrigued by the conceptual differences of the “realities” described by the languages” he knows and, after the philosophical readings and the teachings of Silvio Ceccato, he started to believe that what we experience is constructed by ourselves (Cardellini, 2006, p. 178).

In 1974, von Glasersfeld introduced a new constructivist theory of knowledge, namely the *radical constructivism*, which he believed could be revolutionary as it deals with the process of cognitive construction and how this can be or is related to the “traditionally presumed ontological world.” This means that what a person experiences will be interpreted and conceptualized according to how s/he perceives and conceives the observed elements, and clearly leads to the conclusion that any result obtained from a subject is necessarily subjective (von Glasersfeld, 1985, pp. 92,97). In von Glasersfeld’s words,

“We call this school of constructivism “radical” because it holds that the knower’s perceptual (and conceptual) activity is not merely one of selecting or transforming cognitive structures by means of some form of interaction with “existing” structures, but rather a constitutive activity which, alone, is responsible for every type or kind of structure an organism comes to “know”.” (von Glasersfeld, 1974, p. 103) “[. . .] there can be no rational access to any world as it might be, prior to, and independent of, our experience.” (von Glasersfeld, 1979, p. 109)

The question concerning a possible conflict between radical constructivism and the concept of objectivity appears immediately; within this framework, von Glasersfeld argued that objectivity is when “concepts, relations and operations that I have found to be viable in the management of my own experience, turn out to be viable also when I attribute them to the models of Others which I construct to manage my interactions with them.” (von Glasersfeld, 1985, p. 99) Moreover, radical constructivism is aware that a person constructing her/his reality has certain constraints that cannot be specified in terms of independently real structures, they need to be formulated according to the individual’s experiences,

cognizing activities and the interrelation between both (von Glasersfeld, 1974, pp. 105 ff.).

Once radical constructivism gives the awareness that every social theory is polysemic,<sup>41</sup> we are no longer able to teach different subjects “as if they existed independently of our historical and collective manners” and, moreover, if we want to develop better teaching strategies, we need always to consider what students already know (cit. Jacques Désautels and Marie Larochelle, Tobin, 2007, p. 537).

Von Glasersfeld conjectured that, with the trial and error method students are more likely to develop understanding and also to become interested in different lessons; the task of a teacher is then to encourage students to develop the interest for the subject by being enthusiastic and creative, as well as by having patience and the belief that they can think on their own (cit. Ernst von Glasersfeld, Tobin, 2007, pp. 182-183).

Von Glasersfeld’s theory is not far from what has been already stated by the previous authors, but maybe the influences and consequences it has provoked are seen differently. To him, language, culture and society play an important role in the education process; and mathematics loses the status of being universal and culturally independent. The comment from Taylor quoted in Tobin’s article reveals immediately how radical constructivism destroys this belief and opens widely a new possibility of approaching to mathematics, namely ethnomathematics (see above and Tobin, 2007).

#### 1.2.4 Implications

These new approaches open new perspectives within education and, in particular, they have increased, within mathematics education, the awareness of centering the teaching-learning process to the learner, of raising considerations of the learner’s cultural background, and of stimulating and encouraging a more affective teacher-learner relationship.

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<sup>41</sup>Radical constructivism asserts that no social theory can claim to be a sole truth; within this framework, each of them can be regarded to be polysemic, i.e., they have many interpretations and meanings as each person will cohere it with personal experiences (cit. John Staver, Tobin, 2007, p. 536).

### 1.3 The Convergence to Ethnomathematics

Since the beginning of the 1950s, many changes started to occur in the mathematical research, especially in the field of mathematics education. Mathematics teachers and educators realized that the mathematics exported from the developed to the developing countries were implicitly negating other forms of mathematics, e.g. in Africa, Asia and with indigenous American peoples. Until then, education was a constituent of the colonial system and, as such, the latter countries were obliged to import the curricula from the ‘mother country’ (Ki-Zerbo, 1981, p. 483). These other forms of mathematics started to be acknowledged as part of the cultural backgrounds and social environment of a specific group of people. Some definitions are given, chronologically, below:

In 1967, Gay & Cole used *indigenous mathematics* to refer to the mathematics developed by the Kpelle people of Liberia. In their book, they show the importance of building bridges between this first and the Western mathematics in order to teach mathematics properly, according to the cultural backgrounds (Gay & Cole, 1967). John Gay served as an Episcopal missionary in Liberia, working at the Cuttington College, and Michael Cole is a psychologist working as a professor at the University of California, San Diego, USA.

In 1978, Posner developed a study with *Baqule* and *Dioula* children from the Ivory Coast, and used *informal mathematics* to refer to the numerical knowledge that is developed and learned outside of the school context (Posner, 1978, p. 8). Jill Posner holds a Ph.D. in psychology from Cornell University and, in 2004, became a member of CEDPA (Centre for Development and Population Activities), Washington DC, USA.

Zaslavsky (1917-2006) defined in 1979 the *sociomathematics of Africa* as “the applications of mathematics in the lives of African people, and, conversely, the influence that African institutions had upon the evolution of their mathematics.” (Zaslavsky, 1979, p. 7) Claudia Zaslavsky was a mathematics teacher at Woodlands High School, New York, USA; her field research was undertaken in 1970, mainly in the Eastern Sub-Saharan Africa.

Marcia and Robert Ascher used the term *non-professional mathematics* in 1981 to refer to the, often implicit, mathematical endeavors used by, e.g., architects, landscape designers and individuals in our culture that are not

mathematicians. In the book, they studied ca. two hundred *quipus*, a notation system used by the Inca people (Ascher & Ascher, 1981, p. 159). Marcia Ascher is a (retired) mathematician and worked at the Ithaca College in New York, USA; Robert Ascher is an (retired) anthropologist who worked at Cornell University in Ithaca, New York, USA.

In 1982, Gerdes defined *oppressed mathematics* to be the mathematical elements that are used in the working life of people from social classes that are not recognized by the dominant societies, e.g., the colonies in Africa (Gerdes, 1997, p. 7). Paulus Gerdes is a mathematician and currently the director of the Center for Mozambican Studies and Ethnoscience of the Pedagogical University in Maputo, Mozambique.

In 1982, Gerdes also used the term *frozen mathematics* to refer to the mathematical capacities of the African and American-Indian people that were ignored and disregarded, but that are still possible to be recovered if there is social awareness (Gerdes, 1985, 1997, p. 8).

In 1984, Doumbia and Touré intend to integrate African games and artisan work into the mathematical curriculum, turning it a *mathematics in the (African) socio-cultural environment* (cit. S. Touré and S. Doumbia, Gerdes, 1997, p. 7). Salimata Doumbia is Ivorian, and the general secretary of the *Syndicat National de l'Enseignement Primaire Public de Côte d'Ivoire* (National Union of Public Elementary Teachers in Ivory Coast) and the deputy general secretary of the General Workers Union of Ivory Coast. Saliou Touré is currently the president of the *Université Internationale de Grand-Bassam* (International University of Grand-Bassam) and was formerly the minister of higher education, research and technological innovation of Côte d'Ivoire.

In 1986, D'Ambrosio considered the popular mathematical practices developed by any culture in their everyday life, and called it *spontaneous mathematics* (D'Ambrosio, 1986, pp. 189 ff.). Ubiratan D'Ambrósio is a mathematician who worked at Universidade Estadual de Campinas in São Paulo, Brazil, who, since 1970 moved to the field of mathematics education and was awarded with the Felix Klein Medal in 2005.

Mellin-Olsen (1939-1995) was a professor in education and mathematics didactics at Bergen University College, Norway. He defined in 1987 the term *folk mathematics* as being “knowledge biased by culture or social class.” In other

words, it is how people outside the mathematics scientific community use this subject (Mellin-Olsen, 1987, pp. 15,21). Stieg Mellin-Olsen was, until his death, very engaged with the people of the post-apartheid South-Africa.

The *know-how codified mathematics* used by Sebastiani Ferreira in 1987 refers to mathematical elements present in the everyday practices and are not codified, i.e., they are not acknowledgeable as academic mathematics but are, nonetheless, present and very well defined in activities such as artisanry.<sup>42</sup> Eduardo Sebastiani Ferreira worked as a mathematician at Universidade Estadual de Campinas in São Paulo, Brazil, and has spent, since the early 1990s, much time and dedication to research related to acknowledging mathematical elements in, most of all, indigenous cultures from the Brazilian Amazonia.

Terezinha Carraher, David Carraher and Analúcia Schliemann, after several studies in Recife, Brazil, suggested in 1988 that *oral mathematics* should be introduced in the classrooms, since it involves real situations, in particular, the case they examined with street children showed a great result in favor of presenting mathematics orally (Carraher *et al.*, 1988). David Carraher is a psychologist and the principal investigator of the project “Early Algebra Early Arithmetics” and works at TERC in Cambridge, Massachusetts, USA; Terezinha Carraher (née Nunes) is a psychologist dedicated to educational studies at the University of Oxford, United Kingdom; Analúcia Schliemann holds a Ph.D. in developmental psychology and works at the Tufts University in Medford, Massachusetts, USA.

In the same book, Terezinha Carraher, David Carraher and Analúcia Schliemann refer to *unorthodox mathematics* as mathematical algorithms that are used in the everyday life of a child (Carraher *et al.*, 1988, p. 155).

It was in 1978 when Ubiratan D’Ambrosio, who has been regarded as the intellectual father of ethnomathematics, suggested the term ethnomathematics as a research program focusing on the cultural bases of mathematics and how these could affect mathematics education; this was in the *Annual Meeting of the America Association for the Advancement of Science* in Washington DC, USA (Rosa & Orey, 2006). Already in 1976 at the Third International Congress on Mathematical Education in Karlsruhe, Germany, he encouraged mathematics education

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<sup>42</sup>Personal communication and (Sebastiani Ferreira, 1991, p. 34).

“to develop the ability of individuals to identify mathematics in intellectual experience, and distinguish mathematical reasoning and method in all the situations where they are either present or can be potentially inserted.” (D’Ambrosio, 1976, p. 225)

Evidently, neither D’Ambrosio nor the entire ethnomathematics community (created in 1985, see section 1.4.1 below) were aware that the term ethnomathematics had been introduced and put into practice much earlier, prior to 1959, as we were able to prove in section 1.1.1.

After this first presentation, the term ethnomathematics started to be used and discussed by many scientists on an international level. After some years, in 1984, D’Ambrosio, during the opening talk *Sociocultural Bases of Mathematics Education* at the Fifth International Conference on Mathematical Education in Adelaide, Australia, consolidated the ethnomathematics’ program as a “methodology to track and analyze the process of appearance, propagation and diffusion of mathematical knowledge.” (Rosa & Orey, 2006, p. 27)

In my opinion, D’Ambrosio’s intention was to encompass all definitions that had been given within the framework of considering mathematics as part of a culture; the term ethnomathematics is very suitable since its roots are precisely mathematics and ethnic group.<sup>43</sup> As I have showed in the previous sections, this is by no means the first time that mathematics is considered to be part of our own culture and cognitive development, but it should be used as the starting point for a new approach in mathematics education; ethnomathematics is not only about considering mathematics as part of our culture but also about considering mathematics as a creation and invention that comes from ourselves.<sup>44</sup>

It is important to note that not all definitions presented above can suit the conceptualization of ethnomathematics since they did not have the cultural approach as its main focus, rather they have intended to facilitate the learning of mathematics in the classroom: in this sense they are directly involved with mathematics education. This is especially the case of the research pursued by David Carraher, Terezinha Carraher and Analúcia Schliemann known as “street mathematics.” They have analyzed how social conditions and problems may be

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<sup>43</sup>“Uma “aproximação” etimológica mostrou-nos que efetivamente a palavra *Etnomatemática* seria o nome mais adequado para esse programa abrangente sobre geração, organização, institucionalização e difusão do conhecimento.” (D’Ambrosio, 1993, p. 8)

<sup>44</sup>D’Ambrosio commented on this: “[*Etnomatemática*] não é uma disciplina nova, pois nasce de um inconformismo com a fragmentação do conhecimento em Artes, Religião, Filosofia, Ciências.” (D’Ambrosio, 1993, p. 5)

integrated into the classroom such that children are better able to contextualize what they learn to their everyday life. Their study has not attempted to include cultural traditions into the classroom, but to contextualize a social problem in the curriculum (Carragher *et al.*, 1988).

Many definitions have been given to ethnomathematics and some researchers have been also acknowledged as fathers of ethnomathematics. These will be presented in the following section.

## 1.4 Definitions and Conceptions of Ethnomathematics

As mentioned above, ethnomathematics was proposed as a program that should encompass all results that were reflecting, on the one side, an insatisfaction in the ways curricula were presented and, on the other side, the awareness of a cognitive process that evolves and builds (mathematical) knowledge in each individual. It has been very difficult to establish ethnomathematics as an accepted theory,<sup>45</sup> but a program as well as a research methodology have been already suggested, as well as numerous possible definitions.

We start with Ubiratan D'Ambrosio, who has not only proposed some definitions for ethnomathematics but has also suggested that we should refer to ethnomathematics as a research program. The definition he gives is related to its etymology, i.e., it “covers all the practices of a mathematical nature, such as sorting, classifying, counting, and measuring, which are performed in different cultural settings, through the use of practices acquired, developed, and transmitted through generations;” (D'Ambrosio, 1992, p. 1183) it is “the art or techniques of explaining, understanding, coping with their [the ethnic group] environment.” (D'Ambrosio, 1992, p. 1184) He remarks the importance of accepting mathematics as a creation of the human mind in order to understand what he proposes to be the program of ethnomathematics; since this program covers the “study of the generation, organization, transmission, dissemination, and use of jargos, codes, styles of reasoning, practices, results, and methods.” (D'Ambrosio, 1992, p. 1184)

Marcia Ascher defines the goal of ethnomathematics to be “broadening the history of mathematics to one that has a multicultural, global perspective. It

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<sup>45</sup>Further discussion about defining a theory of ethnomathematics will be given in the following chapter.

involves the study and presentation of mathematical ideas of traditional people.” (Ascher, 1991, p. 188) “All mathematical ideas, in traditional cultures or otherwise, need be viewed in cultural context,” and none of them should be underpinned by dominated cultures (Ascher, 1991, p. 191). Ascher asserts that the study of these ideas lies at the “interface of two fields of concern - mathematics and anthropology;” moreover, social theory, educational theory and cognitive studies become involved (Ascher, 1991, pp. 192 ff.).

Claudia Zaslavsky (1917-2006), based on D’Ambrosio’s first approaches to a conceptualization, called ethnomathematics “the study of the mathematics developed by groups of people in the course of their work or during aspects of their lives. All cultures develop mathematical ideas in accordance with their needs and interests. No branch of mathematics can be more “applied” to real life, and anyone can contribute to this field.” (Zaslavsky, 1994a, p. 157)

## **Paulus Gerdes**

Paulus Gerdes has been regarded as one of the most important proponents of ethnomathematics and its applications. Gerdes has intensely realized many researches within this framework, has also defined this term and suggested how to do such research. According to him, ethnomathematics can be defined as “the cultural anthropology of mathematics and mathematics education.” (Gerdes, 2007b, p. 183). It can be understood as a research field that reflects the awareness of the existence of several mathematics which are, in a certain way, belonging to a given subculture (Gerdes, 2007b, p. 191). Due to the positive feedback given by many researchers and the lack of an acknowledged theory, Gerdes proposes an ethnomathematical movement; it is characterized by ethnomathematicians who consider mathematics to be a cultural product, and who are aware of the urgency in changing curricula by including the mathematical knowledge and traditions that are culturally specific (Gerdes, 2007b, pp. 194-195).

At first, Gerdes’ ethnomathematical research field proposal would immediately cause rejection since mathematics, as a discipline, has been so far considered to be universal and culturally independent; hence, it would make no sense to speak about many mathematics, as a plural. However, in my opinion, what Gerdes intends to say is that there are several forms of mathematics, i.e., the mathematical knowledge can be expressed and developed in different ways. In order to be more clear, let us consider the example with the term religion; the definition of religion is given by the dictionary as the “belief in the life of the

spirits and usually in one or more gods, especially the belief that it/they made the world and can control it.” (Longman Dict., 1993, p. 878) In this sense, it is an abuse of language to speak about many religions, the correct expression would be forms of religion; but this use has been adopted and we can also find it in the dictionary: “a particular system of this belief and the worship, behavior, etc., connected with it.” (Longman Dict., 1993, pp. 878-879) Taking this into account, we can conclude, following the same logic, that Gerdes makes an abuse of language as when he refers to the existence of “many mathematics,” his actual intention is probably to say many forms of mathematics, exactly how it used to happen with religion and its forms.

Gerdes has undertaken extensive field research focused on finding mathematical practices in Mozambican ethnic groups; one of his aims is the attempt to create a bridge between the mathematical knowledge existing in every culture and the academic mathematics, i.e., the mathematics taught in schools and universities. One example may be found in his book *SIPATSI: Cestaria e Geometria na Cultura Tonga de Inhambane*, where he converts these *sipatsi* into different combinations of numbers and their respective least common multiples (lcm) (see figure 1.2). More concretely, one *gipatsi* (the singular form of *sipatsi*) is woven according to: a) production of knots composed by four strips, two colored and two white; b) the total number of knots need to be even so that, when closed, it gets to equally sized sides; c) the patterns chosen need always be completely woven and both ends need to match exactly when the matting is closed. Translating these rules to mathematics, we get: a) and b) the total number of knots ( $NT$ ) needs to be a multiple of four, i.e.,  $NT = \text{multiple}(4)$  since it must be even and contains two colors in each knot; c) let  $p_i$  be the period of pattern number  $i$ , i.e.,  $p_i$  is the number of colored strips required to produce a pattern  $i$ . Hence,  $NT = \text{lcm}(4, p_1, p_2, \dots, p_i)$ , where  $1 \leq i \leq n$ . Conversely, if the total number of knots is fixed, the patterns that may be used for this matting need to satisfy  $p_i \in \{\text{divisor}(NT \cdot 4)\}$  (Gerdes, 2003, pp. 93-96).

Another example is, by using the same *sipatsi* one may also consider the different pattern-strips of the matting separately and study their symmetries: rotational (in which angle?), reflective (with respect to which axis?) and/or translational. Different groups may be constructed according to the type of symmetries that are satisfied (Gerdes, 2003, pp. 99 ff.).



Figure 1.2: Some examples of *sipatsi* (Gerdes, 2003, p. 161).

### Eduardo Sebastiani Ferreira

Another proponent of ethnomathematics is Eduardo Sebastiani Ferreira, who has also been considered to be one of the founding fathers of ethnomathematics. He defined it to be “the mathematics incorporated in the culture of an ethnic group,” and to be a subfield of ethnology (cit. Sebastiani Ferreira, Gerdes, 1997, pp. 11-12). To him, introducing ethnomathematics in the school curricula is more than a methodological posture, it is more a philosophical posture (Sebastiani Ferreira, 1989, p. 110). Sebastiani Ferreira also adopts the idea of an Ethnomathematical program, in his own words,

“The ethnomathematical program rescues the existing mathematics in the different cultural expression forms which are present in the everyday life of the student and, although it does not start from the so called academic (or Western) mathematics, we need to apply the academic terminology in its discussion. We create mathematical models as solution attempts to the questionings raised by the ethnology in a given reality.”<sup>46</sup>

Contrary to Gerdes, Sebastiani Ferreira aims to discover the traditional mathematical knowledge of different cultures and to preserve and protect it as it is. One of his projects was undertaken with the *índios Waimiri-Atroari* from the Amazonia region in Brazil;<sup>47</sup> it was focused on the instruction of the *índio*/teacher

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<sup>46</sup>My translation of:

“O programa de Etnomatemática resgata a matemática existente nas diferentes formas de expressão cultural presentes no cotidiano do aluno e, embora não se parta da chamada matemática acadêmica (ou ocidental), por necessidade empregamos a terminologia acadêmica na sua discussão. Criamos modelos matemáticos como tentativas de solução para os questionamentos levantados pela etnologia em uma dada realidade.” (Sebastiani Ferreira, 1997, pp. 89-90)

<sup>47</sup>I have decided to use the exact Portuguese term *índio* since it, nowadays, strongly represents an identity in Brazil. It may be that this term has very negative connotations in other countries,

who is both an ethnographer of his own culture and a teacher to the children of his community. In his own words:

“My work with indigenous education [...] has the aim of educating the *índio*/teacher researcher within the scope of ethnomathematics, that is, the *índio*/teacher is the ethnographer of his own culture and the one who constructs the bridge between the mathematical knowledge present in his culture and the academic (Western) mathematics, proposing to his children an educational process with criteria.”<sup>48</sup>

A program developed by *Eletronorte* (Electric Plants of the North of Brazil) and *FUNAI* (National Indian Foundation, Brazil) created 12 schools in the *Waimiri-Atroari* community; the essence is that these schools shall be conducted by the members of the community. Sebastiani Ferreira was a great contributor and participant to the development of a curriculum for mathematics; he strongly supports the teaching in the mother language, and so numbers, operations, and geometric notions, figures and shapes are all expressed in their language (Sebastiani Ferreira, 2004).

Sebastiani Ferreira also aims to bring the academic mathematics to the *Waimiri-Atroari* classroom, but in their cultural context and language. For this reason, the didactical material is developed by the same teachers, under the supervision of Sebastiani Ferreira. One example is the book *Tytypsem Benry*, where some exercises, such as dimensional comparisons, Hindu-Arabic numerals, counting, grouping and algebraic operations are introduced (see figure 1.3).

Note that D’Ambrosio’s position differs from these other researchers. This is partly due to the fact that his approaches are so far purely theoretical in so far that he has not directed any practical field research. Gerdes has undertaken many field researches involving different ethnic groups from different regions of Mozambique and Angola, Sebastiani Ferreira has spent many years working directly with different cultures (*índios*) in the Amazonia region, Marcia and Robert Ascher developed many studies regarding different mathematical methods used e.g., Chile, Peru and Bolivia, and it used to be the case in Brazil as well; but they have admirably managed to overcome this depreciation, and for this reason I want to put even more stress on it.

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<sup>48</sup>My translation of:

“*Meu trabalho com a Educação ao Indígena tem [...] sempre o intuito de formar o Professor/Índio, dentro da Etnomatemática, isto é, ser o Professor/Índio o etnógrafo de sua cultura e construtor da ponte deste saber com a Matemática dita ocidental, afim de propor aos seus alunos um processo educacional com critério.*” (Sebastiani Ferreira, 2004, p.70)

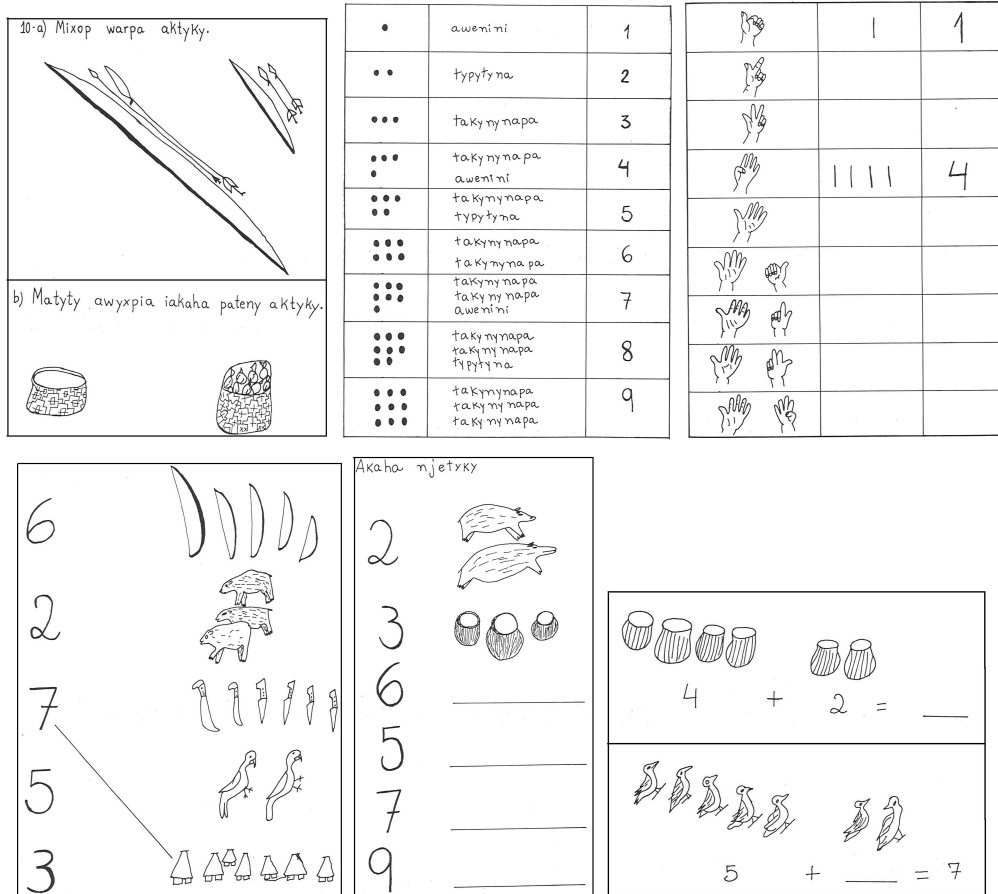


Figure 1.3: Some examples of exercises taken from the book *Tytypsem Berry* (Damyxiri *et al.*, 1995, pp. 12-13;18;22;24;30-31 resp.).

by the Inca culture and, Claudia Zaslavsky performed many studies regarding the counting methods and systems among African cultures (Gerdes, 2007b; Sebastiani Ferreira, 2004; Ascher & Ascher, 1981; Zaslavsky, 1979). This fact does not remove any validity towards what D’Ambrosio has defined and conjectured. However, we should not disregard these other scientists since they have been crucial to the growth and further development of ethnomathematics in its theory and applications. In particular, Zaslavsky, Sebastiani Ferreira and Gerdes have developed many applications within mathematics education, developing several didactical and educational material that increase the multicultural classrooms perspective. (Some examples of didactical books may be found in: Gerdes, 2007a, 2003; Damyxiri *et al.*, 1995; Zaslavsky, 1994b)

### 1.4.1 Ethnomathematical Movement

In 1985 the International Study Group on ethnomathematics - ISGEm was created, with the purpose of opening a scope where debates, discussions, thoughts

and projects in ethnomathematics could be presented and suggested; D'Ambrosio promoted this idea as he realized that ethnomathematics had generated enough interest among several researchers. A newsletter advisory board of the ISGEM was constituted by a number of key workers. Gloria Gilmer (president of Math-Tech, an organization that dedicates to the translation of interesting research results into mathematics curricula in Milwaukee, USA) was the first African American woman on the board of governors of the Mathematical Association of America (1980-82). Gilbert J. Cuevas (mathematician at Texas State University in San Marco, USA) received an award from the Mathematical Sciences Education Board of the National Research Council in 1990 for his contribution to efforts to increase the participation of minority students in mathematics education, Ubiratan D'Ambrosio (see above) and Rick Scott (retired bilingual mathematics educator from the New Mexico Texas University in Texas, USA; he is the vice president of the Interamerican Math Education Committee). Invitations to contribute to the newsletter were spread and their first aim was to receive as many papers regarding the conceptualization of ethnomathematics, as possible. The newsletter advisory board also promoted the publication of research in ethnomathematics, book reviews, annotated bibliographic reviews and ideas that could boost and encourage the study of ethnomathematics (ISGEM-Newsletter, 1985-2003, vol.1, nrs.1-2).

In the first ISGEM newsletter, published in August 1985, ethnomathematics is considered to "lie at the confluence of mathematics and cultural anthropology;" just as Ascher and Gerdes have considered it (see previous section). It needs to be conceptualized in a very broad sense:

"A broad view of mathematics includes ciphering, arithmetic, mensuration, classifying, ordering, inferring and modeling. Ethno- encompasses identifiable cultural groups, such as national-tribal societies, labor groups, children of a certain age bracket, professional classes, and so on and includes their jargon, codes, symbols, myths, and even specific ways of reasoning and inferring." (ISGEM-Newsletter, 1985-2003, vol.1, no.1, p. 2)

In the second issue of the newsletter, Marcia Ascher and Claudia Zaslavsky give further suggestions to the conceptualization of ethnomathematics: Zaslavsky remarks on the need to expand the definition of ethnomathematics, "does it include, for example, the types of patterns found in the textiles, wood work, and other rafts of various cultures?" (cit. C. Zaslavsky, ISGEM-Newsletter, 1985-2003, vol.1, no.2) Marcia Ascher defines this term to be "the serious study of the

mathematical ideas of nonliterate peoples.” (cit. M. Ascher, ISGEm-Newsletter, 1985-2003, vol.1, no.2)

In this same issue, Robert Hunting provided two definitions for ethnomathematics, the first as the results from the data raised in a research developed according to the following questions: “(1) what problems arise in traditional environments which require application of mathematics knowledge for their solution?, (2) what is the nature of the mathematical processes used to solve those problems? and (3) how does the mathematics of a culture or community change in response to changes brought about by contact with a different culture or community?,” and the second is the “mathematics used by a defined cultural group in the course of dealing with environmental problems and activities;” and he remarked that the research program should focus on “the identification of possible platforms for establishing number and measurements concepts.”<sup>49</sup>

In the ISGEm’s second anniversary issue, D’Ambrosio reflected on how ethnomathematics has been so far discussed; furthermore, he wondered about the current descriptions in history of science and mathematics. He emphasized the need for workers to become aware that not only libraries and laboratories enable scientific creativity but, most importantly, that it is motivation from the social and cultural environment which permits the growth of bodies of knowledge. It has been agreed worldwide that education is “the surest road to democracy and to development,” and ethnomathematics is about finding new approaches in mathematics education that shall help us “dealing with real problems such as those posed by modern society.” (cit. U. D’Ambrosio, ISGEm-Newsletter, 1985-2003, vol.3, no.1, pp. 3-5) In 1992, Marcelo Borba endorsed this political aspect of ethnomathematics; moreover, he suggested that this notion can be very powerful in mathematics education (cf. Borba, 1992). That is, introducing ethnomathematics in the curricula changes the approach to mathematics in classrooms, thus having pedagogical implications in the children’s way of learning.

In 1995, Gloria Gilmer, the president of the ISGEm executive board at that time, proposed two definitions of ethnomathematics:

- (1) “ethnomathematics is the study of mathematical practices of specific cultural groups in the course of dealing with their environmental problems

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<sup>49</sup>There is a typing mistake in the ISGEm-newsletter; it states that Hopkins was the person who suggested a research based on the questions (1)-(3), it should say Hunting and not Hopkins. (For more details, cp. (Hunting, 1987, p. 10) and (ISGEm-Newsletter, 1985-2003, vol.2, no.1, p. 3))

and activities. [...]

(2) [...], ethnomathematics is the study of mathematical techniques used by identifiable cultural groups in understanding, explaining, and mapping problems and activities arising in their own environment.” (cit. G. Gilmer, ISGEm-Newsletter, 1985-2003, vol.11, no.1, p. 5)

Needless to say, despite all the time and space devoted to discussing a possible definition and concept of ethnomathematics during the first years, there has not been established a general consensus about a definition. Even though the competing definitions essentially do not differ, they can all yield to one or other discrepancy, e.g. they involve anthropology, politics and/or cultural anthropology which complicates the acceptance of this new field as a purely scientific theory. Because ethnomathematics is dedicated to the study of the development of mathematical ideas in different cultures, it can immediately imply that mathematics does not have an abstract and universal character, the mentioning of ethnic groups or cultures can also lead to several misunderstandings, and whether it belongs to history of mathematics, mathematics education, mathematics or some branch of social sciences is confusing and nebulous. With all these factors, it is clear that the scientific mathematics community will have difficulties in accepting and validating the type of research produced from ethnomathematics.

Due to this theoretical uncertainty and abundance of definitions, D’Ambrosio, already in 1988, introduced and described the need for ethnomathematics research program to be focused on: (i) culturally diversified environments, (ii) curriculum development projects and classroom applications, (iii) out-of-school applications, and (iv) conceptual and theoretical foundations. He also remarked the need of a new research program in the history of mathematics which argues the importance of cultural dynamics and transfer in the evolution of cognitive processes, and which considers the history of mathematics in a much broader framework (cit. U. D’Ambrosio, ISGEm-Newsletter, 1985-2003, vol.4, no.1, pp. 5-8).

Followed by this same line of arguments, Gerdes started to consider the Ethnomathematical movement that is described by the following characteristics:

1. Ethnomathematicians use very broad concept of mathematics and try to analyze all “deviated mathematical currents.”<sup>50</sup>

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<sup>50</sup>My translation of:

“*[Ethnomathematiker] versuchen “vom Hauptstrom abweichende Mathematikströme” zu analysieren.*” (cit. A. Bishop, Gerdes, 1997, p. 12)

2. Ethnomathematicians distinguish an influence of sociocultural factors on the teaching, learning and developing of mathematics and try to analyze it.
3. Ethnomathematicians assimilate the fact that mathematics constitutes a cultural product. Every ethnic group develops their own and specific mathematics.
4. Ethnomathematicians note that the imported school mathematics does not assimilate the cultural traditions such as Africans, Asians and South Americans. Mathematical curricula in developing countries have been, as said above, imported from the developed countries. Furthermore, during colonial periods in history most of these cultures were banned and forced to disappear.
5. Ethnomathematicians try to reconstruct the mathematical knowledge of precolonial cultures by seeking elements that could form a basis to the mathematical ideas that were not erased by the colonialism.
6. Ethnomathematical studies in developing countries consist in the search of mathematical traditions and activities, and analyze the possibilities of including them in the curriculum.
7. Ethnomathematicians, both in the “North” and in the “South”, seek educational possibilities of developing mathematical ideas such that it strengthens the cultural and social self-confidence in the learners.
8. Ethnomathematicians favor a critical education in mathematics that enables students to reflect on the reality they live and to develop and use mathematics in an emancipated way. (Gerdes, 1997, pp. 12-14)

Alan Bishop described in 1994 the different foci and research approaches in ethnomathematics:

*a)* Mathematical knowledge in traditional cultures [...]. This research is informed by an anthropological approach, emphasising the uniqueness of particular knowledge and practices in relation to different cultures. Languages are also of significance in these studies, together with the values and customs of the cultural groups concerned.

*b)* Mathematical knowledge in non-Western societies [...]. This research has a historical flavour, relying as it does on past documents, rather than

on present practice. *c*) Mathematical knowledge of different groups in society [...]. This research has a socio-psychological emphasis, where the focus is on actual practice. The particular mathematical knowledge is socially constructed by the groups who are engaging in the specific practices.” (Bishop, 1994, p. 15)

As a result of the attempt to boost the further development of ethnomathematics as theory and practice, a series of international conferences in ethnomathematics has been established, in order to create roundtables and other spaces where researchers can discuss and propose new and existing approaches within research in ethnomathematics as theory and practice. The first International Conference on ethnomathematics (ICEm) took place in 1998 in Granada, Spain. The second ICEm, in 2002, was held in Ouro Preto, Brazil; the third ICEm took place in Auckland, New Zealand in 2006. The next ICEm is planned for July 2010 in Maryland, USA. This proves the positive feedback given by scientists from different areas, mathematics, mathematics education and social sciences, and from all over the world, towards the further development of ethnomathematics.

There have been many reactions against what ethnomathematics could actually mean; is it only a manifestation against eurocentrism or developed countries? Is it possible to do ethnomathematical research in European countries? Are there true ethnic groups in Europe? Alan Bishop sees as an outcome the fundamental epistemological question: “Is there one mathematics appearing in different manifestations and symbolisations, or are there different mathematics being practised which have certain similarities?” (Bishop, 1994, p. 15)

It is very important to be aware of the critiques made of ethnomathematics and how far have we been able to overcome them. This is being presented in the following section.

## 1.5 Critiques of Ethnomathematics

Probably the most important critiques regarding ethnomathematics were published in an article by R. Vithal and O. Skovmose, in 1997 (Vithal & Skovmose, 1997). In this article, on the one hand, they confirmed the productive function of its conceptualization and achieved the conclusion that “ethnomathematics emerged as a term representing an oppositional stance” on modernization theory, which “has established an understanding of mathematics and mathemat-

ics education as culturally and socially negotiated” but, unfortunately, they also suggested that “the concept ethnomathematics is itself problematic [...] and not innocent.” (Vithal & Skovsmose, 1997, p. 152) One of the goals of ethnomathematics is to impact and change school mathematics curriculum, putting emphasis in the cultural frameworks in which the learners live.

What Vithal and Skovsmose call to be modernization theory is the consideration that development is strictly related to technological development, a *techno-culture*; this movement started in the 1950s and, economical and political progress were to be a consequence of it. This “uniform conception of technology” was followed by a “uniform conception of mathematics education” and, in this context, when modernization theory started to be applied in developing countries, “westernization in education became a consequence” of it. Within this framework, ethnomathematics appeared as “a reaction to the cultural imperialism;” industrialization had brought suppression to these latter countries (Vithal & Skovsmose, 1997, p. 132).

On the other hand, during apartheid in South Africa, people were racially classified; this classification determined their education and work opportunities among other things. Schools were segregated according to their location which simultaneously reflected race, resulting in top-rated school with high-resources were “white” whilst the lowest-rated schools with a deficit in resources were “African”.<sup>51</sup> Nevertheless, apartheid policy feigned the encouragement of teaching and learning that recognize the diverse religious beliefs, cultural ways of living and languages. The following policy statement proves this characteristic pretension:

“The Government reaffirms that, in terms of its policy that each population group should have its own schools, it is essential that each population group should also have its own education authority/department.” (cit. White Papers on the Provisions of Education in South Africa (1983), Vithal & Skovsmose, 1997, p. 136)

Clearly, ethnomathematics developed a *love-hate relationship* with South Africans, since it can be easily misunderstood as if it claims to “culturally affirm the disadvantaged.” (Vithal & Skovsmose, 1997, p. 137) Moreover, terms such as culture, ethnicity and race have divisive and negative connotations under the South African context (Vithal & Skovsmose, 1997, p. 138).

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<sup>51</sup>The inverted commas are used in order to remark that, in this case, the word African refers to the apartheid South Africa’s context, i.e., “black” people.

Vithal and Skovmose continue the debate raising several queries:

- Regarding the definitions so far given to ethnomathematics, “if every practice which includes mathematics can be called an ethnomathematical practice, what then is the point of coining the term?” (Vithal & Skovmose, 1997, p. 140)
- Regarding the political impact ethnomathematics could have in education, “how does an ethnomathematical interpretation of mathematical knowing serve the empowerment of the students?” Or, “is it possible to provide empowerment with a more specific content when we consider the basic thesis of ethnomathematics (that mathematics education can be improved by considering the cultural background of the students)?” (Vithal & Skovmose, 1997, p. 142)
- Regarding *critical citizenship*, “what does people’s mathematics for people’s power mean when we have a technological society in mind?”, “does an ethnomathematical approach develop a competence which resists domination in the actual culture?” and “could ethnomathematics itself become implicated in the formatting power of mathematics?” (Vithal & Skovmose, 1997, pp. 143-144)
- Regarding ethnomathematics inside the classroom, “what could this focus on background mean in a classroom in South Africa with children from both the suburb and the squatter settlement?” (Vithal & Skovmose, 1997, p. 145)
- Regarding the teacher’s need to apprehend childrens’ cultural background knowledge in terms of mathematics, which aspects of reality have the potential of being transformed into curriculum experiences?, what happens when teachers do not share the same cultural background as their students? (Vithal & Skovmose, 1997, p. 145)
- Regarding the type of expectations children may have depending on their social contexts (*foregrounds*), ethnomathematics should also ask “where do the students want to go from here?” (Vithal & Skovmose, 1997, p. 148)

Vithal and Skovmose criticize ethnomathematics’ apparent engagement to mathematics education, as there seems to be no “crucial description of an educational practice;” ethnomathematics becomes *dogmatic*. Nonetheless, they hold

the belief that all these issues can be solved (Vithal & Skovsmose, 1997, pp. 150-151).

From a different perspective, Bill Barton stresses the importance in determining the epistemological bases of ethnomathematics; “this is one of the areas which must be addressed if the subject is to gain wider legitimacy in mathematical circles;” (Barton, 1996, p. 201) moreover, it is also required to establish if ethnomathematics is “a precursor, a parallel body of knowledge, or a precolonized body of knowledge with respect to mathematics.” (Barton, 1996, p. 210)

Barton felt that a good definition of ethnomathematics should not use the term mathematics to refer to ideas and practices in a culture where this category of knowledge does not even exist (Barton, 1996, p. 209), as it has the same difficulty as anthropology, as this tries “to describe another person’s world with one’s own codes, languages and concepts.” (Barton, 1996, p. 215)

Marcelo Borba was convinced that the only way to avoid the appropriation of knowledge and, to strengthen the exchange relations is by diminishing the gap between researchers and research subjects, and to research and to educate (Borba, 1988, p. 27). To Barton, “ethnomathematics does create a bridge between mathematics and the ideas (and concepts and practices) of other cultures.” (Barton, 1996, p. 216) How effective are these bridges, i.e., how much information is returning to the research subjects? and, how much can they learn from it?

Regarding mathematics education, other critiques can be raised when we put radical constructivism and ethnomathematics side by side. If there are no longer mathematical ideas that are objective, how can the meanings’ constructions made by each child in the classroom converge to a consensual one? And, in a larger scale, how is it possible to construct “objective” concepts in the communication and transfer between ethnic groups?

### **1.5.1 Reactions and Ethnomathematical Research in Europe**

In 2002 Luis Radford made the following assertion that, at first, can appear to be too broad and general, but can be directed to the discussion about the definitions of ethnomathematics:

“It seems that there is no cliché more popular in this day and age than affirming that cognition is related to culture. To explain how exactly the

former relates to the latter remains, however, an open problem.” (Radford, 2002, p. 439)

If we want to define an ethnomathematics that represents the mathematical knowledge and thinking which are culturally related, we need to determine how this relationship is functioning. Radford suggests that “mathematical thinking is a form of reflective, mediated social praxis where the organization of individual’s sensuous cognitive processes are related to the meaning of things as they become objectified in practical and theoretical activity;” (Radford, 2002, p. 440) he has also called this a *semiotic-cultural perspective* (Radford, 2006). He concludes that there exist a diversity of types of mathematical thinking that are *genuine* on their own; and he knows that acknowledging this fact is crucial, since it will conflict with the universality conception of the discipline mathematics (Radford, 2002).

According to Radford, meaning is a “doublesided construct;” it is subjective, because it contains the individual’s intentions and, at the same time, it is cultural because the intended object has been already endowed with cultural and theoretical content (Radford, 2006, p. 53). He suggests that instead of using the term objectivity on its own, we should add the adjectives contextual and cultural to it as,

“[. . .] to know objectively means to insert yourself into a certain reflective praxis that allows you to see and be seen, a praxis that provides you with a support or a position to engage yourself in the world, for “you can only know how the situation is if you are in a position to know.” (cit. Eagleton, Radford, 2006, p. 60)

Beyond ethnomathematics, Radford describes an anthropology of mathematical thinking that “may help us to realize nonetheless that the search for solutions should be framed by a sensitivity to other cultural traditions and new efforts to understand the Other. However, this sensitivity should neither be understood as a gesture of generosity nor as the result of our acknowledging the shortcomings of the “imperial eyes” (Pratt, 1992) and the limits of representation. It is rather a question of realizing that the understanding of the Other is at the same time the understanding of ourselves, for we can only construct ourselves through others.” (Radford, 2002, p. 459)

Arguably, it has been often criticized that ethnomathematics appeared only as a mean of opposing to the curricular systems established by the colonizing countries which are, in most of the cases, Western. Contrasting these critiques,

in 2008 Kristín Bjarnadóttir and Cecília Costa et al. have presented concrete examples of ethnomathematical research in Europe.

Bjarnadóttir studied a pagan calendar (the *misseri* calendar) that was created after the Viking's settlement in Iceland in 930 AD, due to the Althingi (parliament) annual meetings in summer; "the short summer in Iceland and its vulnerable nature demanded that the meetings take place after certain farming duties were done, and before others arose." (Bjarnadóttir, 2008, p. 1) The *misseri* calendar was based on seven-day week; the year was constituted by 52 weeks and the meeting was to be held in the ninth week of summer. In 955 AD, a farmer had realized that "the summer had moved back to the spring" because of the observations he made with respect to the position of the sunset, as it changes rapidly in northern latitudes. Upon his suggestion, an extra summer week was inserted every seventh year (Bjarnadóttir, 2008, pp. 2-4). After the parliament agreed on adopting Christianity (ca. 1000 AD), the Julian calendar was introduced in the 12th century; Oddi Helgason, an icelander farm laborer, realized that the summer and winter solstice were shifted with respect to the dates given by the latter calendar,

"Solstice in summer is four nights before the mass of John the Baptist ... It is so in the middle of the world. Some men say that it is close to a week earlier in Iceland." (cit. Beckman and Kálund, Bjarnadóttir, 2008, p. 4)

Until the 1860's the *misseri* calendar was still in use and the record of birthdates was based in it; the mid-winter, also called *Thorri*, and the first day of summer are, up to our present days, still celebrated in Iceland (Bjarnadóttir, 2008, pp. 9-10).

In a further article, Bjarnadóttir presented three-verse rhyme with mathematical properties that was used in spelling textbooks for children in 1782. She considers the composition of verses and the trade units, considered in the poems, to be forms of ethnomathematics in Iceland. She argues that the introduction of algebraic techniques "contributed to the alienation of the common people from grappling with puzzles. It disrupted the verbal tradition." (Bjarnadóttir, 2009, pp. 12,19)

Costa et al. have studied a professional group that is very traditional in Alto Douro, Portugal, *wine coopers*. They discovered several mathematical elements present during the process of building the barrels such as computing the final volume of it, creating a specific tool that establishes "nice" proportions, and

calculating the length of iron hoops needed for a barrel. For example, to compute the volume of a barrel, the wine coopers multiply the square of the half diameter with the half of the height and a 605 factor, i.e.,  $V_b = \left(\frac{d}{2}\right)^2 \cdot \frac{h}{2} \cdot 605$ ; comparing this to the volume of a cylinder ( $V_c = \pi \cdot r^2 \cdot h$ ) we obtain that, up to a factor of  $10^2$ , the approximated value of  $\pi$  used by the wine coopers equals 3,025. Costa et al. have used this and other examples to create exercises for school students; many children of the region have to deal with domestic and rural tasks and by developing a syllabus that relates to those activities, there could be an improvement in the encouragement of the young population to settle in their region and continue practicing the traditional professions (Costa *et al.*, 2008a,b, p. 35).



# Chapter 2

## Building a Theory of Ethnomathematics

*Die Wissenschaft wird uns niemals alle Antworten geben können.  
Wir können uns allerdings bemühen, die Anzahl und die Qualität  
der Antworten, die wir geben können, langsam anzuheben. Das  
aber können wir, so meine ich, nur mit Hilfe der Wissenschaft.*  
(Claude Lévi-Strauss)

### 2.1 Concepts of Theory

A recurrent issue in the ethnomathematics movement has been the debate regarding the existence of a theory of ethnomathematics, whether such a theory could or should exist and, if so, how it is to be achieved. In the first newsletter of the ISGEM (International Study Group on Ethnomathematics), D'Ambrosio posed the question "how theoretical can [ethnomathematics] be?" (ISGEM-Newsletter, 1985-2003, vol. 1, no. 1, p. 2). In 1988, a meeting of the ISGEM was held by Gloria Gilmer in the Sixth International Conference on Mathematics Education (ICME-6, Hungary) in which the conceptual and theoretical foundations of ethnomathematics appeared as one of the thrusts of ISGEM (ISGEM-Newsletter, 1985-2003, vol. 4, no. 1, p. 2). During the second ICEm (International Conference on Ethnomathematics), in 2002, there was a roundtable dedicated to debating the conception and theorization issues in ethnomathematics: Alanguí et al. addressed the methodological questions for considering it a valid field of research and Domite explored the issue "theory of ethnomathematics?" (Alanguí & Barton, 2002; Domite, 2002)

In 1989, Luis Ortiz-Franco encouraged researchers to not halt their studies

in ethnomathematics because of the diverse conceptualization approaches; he recalled that the history of human culture was full of “examples of intellectual endeavors which have taken much time to define.” (ISGEm-Newsletter, 1985-2003, vol. 4, no. 2, p. 3) It is clear that these debates have not stopped and also have not discouraged the further research in ethnomathematics. The intention of this chapter is not only to give a contribution to these deliberations but also to propose at least one possible approach to a conceptualization of a theory of ethnomathematics.

A key starting point for discussing this issue is the conception presented by Eduardo Sebastiani Ferreira. He has investigated the theoretical status of ethnomathematics using the conceptualizations of development of science as provided by Thomas Kuhn (Sebastiani Ferreira, 2004). This theoretical status could be determined by associating ethnomathematics with ethnoscience, the history of mathematics or mathematics education (Sebastiani Ferreira, 2004, p. 75).

In fact, Kuhn’s theory of scientific development is relevant to this study from two points of view: firstly, for the issue of achieving the theoretical status of ethnomathematics and secondly, for discussing the relation of ethnomathematics to mathematics. As already outlined in section 1.2, the notion of conceptual change had also become relevant for historical, epistemological and sociological studies in science. Kuhn’s seminal book *The Structure of Scientific Revolutions* (Kuhn, 1962), which paved the way for such studies, can be understood as expressing the cognitive turn in history of science (Nersessian, 2003). Within the framework of this conceptualization, the “mathematics” and “science” knowledge evidenced in *Naturvölker* or “primitive people” constitute not only elements of curiosity, cataloged as ethnology, but contributions to ethnoscience, and in our case to ethnomathematics; they are elements of science, and hence of mathematics, too. The status of the relation between ethnomathematics and mathematics presents a revealing challenge for the self-understanding of mathematics; this issue will be further discussed in the following section 2.2 .

Thomas Kuhn (1922-1996) was a physicist and a philosopher of science; in his book of 1962, he analyzed the development of scientific theories as following certain recurrent patterns. He established essentially four concepts to characterize these patterns: *normal science*, *paradigm*, *scientific community*, and *scientific revolution* (Kuhn, 1962). The following section briefly introduces these concepts, which have become quite common in historiography and sociology of science.

### 2.1.1 Kuhn's Theory of Scientific Development

Kuhn's fundamental conception stands on the elucidation that science does not develop in a linear, cumulative way as it is often assumed. It rather develops in several stages marked by abrupt changes. The main characteristic of a mature science consists in being governed by a paradigm. Stages of early development of a science have not yet found an established paradigm; Kuhn calls these stages pre-paradigm periods, and during these periods the pre-paradigm scientists develop their research independently. A paradigm is therefore the decisive element which determines each scientific discipline as a normal science. In the pre-paradigm period, a set of standard rules for undertaking research has not yet been "chosen" since, as stated above, the schools and the scientists are working in a relatively isolated manner, without established means of communication (Kuhn, 1962, p. 43).

The type of study developed within a specialized area of science reaches its mature stage, once a certain *paradigm* has evolved, that is, the paradigm is shared by a group of scientists who will constitute the respective scientific community. The third notion in Kuhn's conception, which is intimately linked to these two of *paradigm* and of *scientific community*, is *normal science*. *Normal science* is that period of development when a *scientific community* has agreed to develop research based on an accepted *paradigm*. Based on this, scientists are dedicated to the solving of different *puzzles*, being these, as described by Kuhn, a special category of problems, those who test the intellect and ability to solve them.<sup>1</sup> Each scientist, even when seemingly working alone, is moulded by the common rules practiced by her or his scientific community (Kuhn, 1962). Thus, science becomes analyzable by sociological and cultural dimensions. Given the impact of social and cultural values and of epistemological stances on the rules shared by a scientific community, the traditional notion of objectivity of knowledge is no longer maintainable.

The *paradigm* provides a set of methods that has been agreed by the *scientific community* to be acceptable tools of research. Moreover, it provides models of problems, or master problems, which define the range of puzzles and the types of puzzles solvable within the *paradigm* (Kuhn, 1962). Kuhn's notion of *paradigm*

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<sup>1</sup>The term *puzzle* has been translated to Spanish as *enigma*. This latter term seems to me even more representative for referring to the type of problems solved during a period of *normal science* since, apart from a group of persons, people are confronted to difficulties when trying to either explain or understand such problems.

has attracted enormous attention and interest. Since he gave various explanations for this key notion within his theory, researchers have tried to systematize them. It was Margaret Masterman who identified 21 different meanings and categorized them into three types:

1. *Metaparadigm*: a set of beliefs, a myth and a new way of visualization.
2. *Sociological Paradigm*: a fulfilment that is scientifically verified and universally accepted.
3. *Construct Paradigm*: a supplying of tools (Masterman, 1970, p. 65).

According to Kuhn, normal science is an enterprise that attempts to refine, expand, and articulate an existing paradigm. The overwhelming majority of scientists work within the scopes shared by their community and within the range of this present paradigm. Once a paradigm has been accepted, a scientific community has freed itself from re-evaluating its first principles, its foundations, and can concentrate on even the most esoteric phenomena (Kuhn, 1962, pp. 80 ff.).

Yet, it can happen that anomalies arise, that is, problems which can no longer be explained and studied within the established paradigm. This proves that the puzzle-solving capacity of the paradigm becomes exhausted; a crisis emerges. During the period of crisis, the stereotypes become weaker and provide necessary information and sufficient reasons for a fundamental change of paradigm (Kuhn, 1962, pp. 111 ff.).

Eventually, the proposition of a new paradigm appears - usually suggested by young members of the scientific community - and, because it is able to provide answers and solutions to the anomalies of the preceding paradigm, it supersedes this predecessor. This abrupt change of paradigm is what Kuhn called a *scientific revolution* and is a crucial event in a mature science since "to reject one paradigm without simultaneously substituting another is to reject science itself." (Kuhn, 1962, pp. 131-150) According to him, the new paradigm changes the world in which the scientists research. Hence, nothing can be compared directly, i. e., the old is not simply a special case of the new (Kuhn, 1962, pp. 165 ff.).

Kuhn's theories have been widely and intensely discussed in most of the scientific disciplines and have yielded decisive changes in their self-understanding. Within mathematics, the discussions began rather late, by the mid-1970s, and had focused on the question whether there were or can be revolutions in mathematics. Several important contributions to this debate were collected by Donald

Gillies and published in 1992, together with two appendices and one afterword where some authors reassessed their views as of the 1970s (Gillies, 1992). Most noticeable are the changes revealed by Michael Crowe: he now called his former “law” a prejudice that mathematics is developing in a cumulative way. Likewise, he admitted that mathematical notations,  $x$ , and  $y$  belong to mathematics and are, thus “in” mathematics, so that fundamental changes in mathematics became admissible. Still debated, however, is the issue whether Kuhn’s notion of a revolution, implying that the new paradigm is incomparable with the preceding one, is applicable to mathematics or whether there the old paradigm subsists as a special case of the new one (see Dauben 1992).

## 2.2 Ethnomathematics: a Kuhnian Theory?

It has been Sebastiani Ferreira in particular who discussed whether the development of ethnomathematics can be understood in terms of Kuhn’s conceptualization. According to Sebastiani, ethnomathematical research can be seen under different points of view:

1. as part of Ethnoscience, which is anthropological research, already considered to constitute a normal science. One has to be a bit careful here, since there are controversies whether social sciences can be considered to be a science in the sense of Kuhn.
2. as a research area within history of mathematics. This approach is based on cultural evolution and Sebastiani regarded it as well-acknowledged in this context.
3. as the development of an educational theory. This is the approach preferred by him for verifying it as a theory (Sebastiani Ferreira, 1991, p. 31).

While opting exclusively for the third approach, envisioning ethnomathematics as an educational theory, Sebastiani asks for the paradigm of this science. Agreeing with the three meanings of paradigm elaborated by Masterman and assuming that they are by no means mutually exclusive, he affirmed that ethnomathematics has succeeded in achieving a paradigm. He claimed it to be what Gerdes had stated as one of the research aims: to reveal and to analyze the influences of socio-cultural factors on the teaching, learning and development of mathematics (Sebastiani Ferreira, 1991, p. 35).

Even though Sebastiani was able to assert the existence of a paradigm, this being the paramount condition for the acknowledgment as a Kuhnian theory, he denied that ethnomathematics had already achieved the status of theory (Sebastiani Ferreira, 1991). He did not give further explanation why it is not yet a theory, but this seems to be related with his identification of ethnomathematics as belonging exclusively to mathematics education (I will come to this issue later in this chapter). Sebastiani's approach is nonetheless consistent with Kuhn's conceptions since Kuhn admits that paradigms can and do exist prior to theories (Masterman, 1970, p. 66).

Gerdes, on the other hand, has clearly affirmed that ethnomathematics is a well defined field of study, based primarily on the above mentioned definition, but, moreover, concretizing it in the following way: "this research area is aware of the existence of many mathematics, which are in a certain way specific for definite (sub-)cultures."<sup>2</sup>

In my view, one can say that this broad definition is, in our present days (2010), widely accepted by the community of researchers. Moreover, there are more indicators in Kuhn's conception, which one can use to determine the state of development of ethnomathematics.

The first of these indicators is the existence of a pre-paradigm period. In fact, we have seen (section 1.1.1) that, since the first half of the twentieth century, several scholars developed ethnological research on mathematical practices and were working as isolated individuals and unable to communicate with each other. It was during this period that the term "ethnomathematics" had already been established as we were able to show. This pre-paradigmatic stage lasted until about the 1960s. Immediately after this period, more intense and differentiated than ever research work was initiated, resulting in the emergence of communication that could establish networks. This is due in large part to the ethnomathematics movement, which created a scientific community of researchers and teachers of the discipline, and continues to provide extensive modes of publishing.

Ethnomathematics constitutes a discipline with a strong practice-oriented theory. Ethnomathematics has several fields of application, just like other typical scientific disciplines. Besides the canonical way of academic teaching, it is applied directly in education, such as the teaching of mathematics in schools. In partic-

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<sup>2</sup>My translation of:

"[...] ein Forschungsgebiet [...] das die Bewußtheit der Existenz vieler Mathematiken reflektiert, die auf gewisse Weise bestimmten (Sub-)Kulturen eigen sind." (Gerdes, 1997, p. 10)

ular, the application of ethnomathematics has focused on decolonized countries and those countries with significant ethnic minorities where ethnomathematics has proved to make the learning more meaningful. Other applications are in history of mathematics, in epistemology and in sociology.

## 2.3 Ethnomathematics and Interdisciplinarity

Heckhausen has studied different approaches and concepts of interdisciplinarity. For this, he has defined disciplinarity to be “the specialized scientific exploration of a given homogeneous subject matter producing new knowledge and making obsolete old knowledge.” (Heckhausen, 1972, p. 83) He furthermore established seven criteria to determine the nature of a discipline. These are: *material field* (the set of study objects of each discipline), *subject matter* (the circumscribed subset of observables of a material field), *level of theoretical integration*, *methods*, *analytical tools*, *applications of a discipline in fields of practice*, and *historical contingencies* (Heckhausen, 1972, pp. 84 ff.)

By having these criteria that characterize disciplines, Heckhausen distinguished six types of interdisciplinarity, ordered according to its maturity: *indiscriminate interdisciplinarity*, consisting of all encyclopedic endeavors, *pseudo-interdisciplinarity*, consisting of disciplines which share the same analytical tools, *auxiliary interdisciplinarity*, consisting of one discipline borrowing the methods from another, *composite interdisciplinarity*, consisting of quite diverse disciplines which seek to solve historical contingencies, *supplementary interdisciplinarity*, consisting of disciplines which partially overlap creating a supplementary relationship, and *unifying interdisciplinarity*, consisting of those disciplines which have an increased consistency in their subject matter as well as in their theoretical integration levels (Heckhausen, 1972, pp. 87-88).

Within this framework, I propose ethnomathematics as being supplementary interdisciplinarity. Supplementary interdisciplinarity consists of accounting for disciplines such that they partially overlap, creating a supplementary relationship between the common subject matters. This is achieved by establishing a correspondence between the levels of theoretical integration of these subject matters, which will have category gaps, i. e., some theories cannot be related and need to be tolerated. “The correspondence is looked for and tentatively established in order to reconstruct life or social processes more fully.” (Heckhausen, 1972, pp. 88-89)

From the two diagrams presented in figure 2.1, we observe that such an interdisciplinary approach has already been considered: in the first case, Falsirol characterized Fettweis' research and scientific interests as the intersection of ethnology and mathematics, producing ethnomathematics (Falsirol, 1959). The second diagram (right) had been already considered by Sebastiani, in his article of 2004.

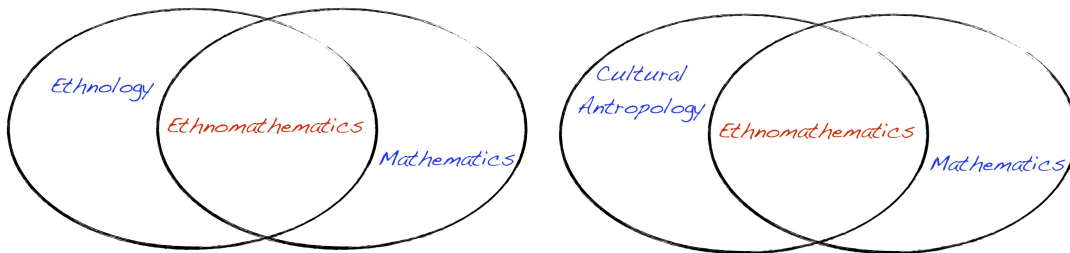


Figure 2.1: The diagram on the left side describes the approach used by Falsirol in 1959 and the right one is Sebastiani's description of one definition given in 1986.

Within a more specific approach, ethnomathematics should be regarded as a supplementary interdisciplinary discipline. It is represented by the intersection between mathematics, history and historiography of mathematics and mathematics education, and cultural anthropology, ethnology, ethnoscience and ethnography, as seen in figure 2.2. The complete study presented in this work has proved to require, up to a certain extent, all these disciplines; it is not possible, nor plausible, to consider them being part of a greater "discipline-set." In chapter 1 I partially presented this new *Ansatz* and, as it will become clear, the two following field researches perfectly completes the sense of this new conceptualization.

As a consequence, I do not think that ethnomathematics should be regarded as a discipline within mathematics education. Ethnomathematics attempts to find and determine which cultural traditions could be included in different curricula all over the world, but this is not the only aim of ethnomathematics: in my opinion, ethnomathematics seeks to revive the mathematics living in different traditions and cultures, not by considering them to be exotic, but by including them in the new historiography of mathematics.

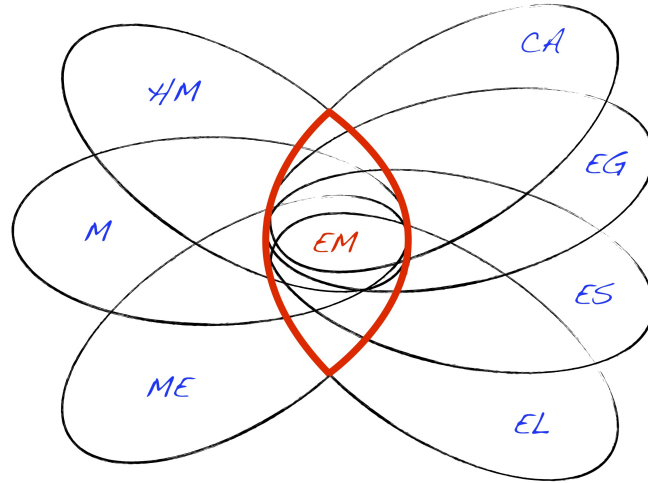


Figure 2.2: This diagram describes how I define the discipline of ethnomathematics in 2010. Abbreviations stand for: *HM* = history and historiography of mathematics, *M* = mathematics, *ME* = mathematics education, *CA* = cultural anthropology, *EG* = ethnography, *ES* = ethnoscience, *EL* = ethnology and *EM* = ethnomathematics.

## 2.4 Challenges of Ethnomathematics to Mathematics

The relation of ethnomathematics to mathematics has so far constituted controversial issues. According to traditional ethnology, the mathematical knowledge of the so-called primitive peoples was usually considered to be rather elementary and did not bear any relevance for present-day mathematics. On the other hand, some proponents of ethnomathematics propagate a likewise extreme separation nowadays: denouncing present-day highly-developed mathematics as Western mathematics and denouncing its valorization as eurocentrism, they claim a higher value for ethnomathematical knowledge, at least in curricular applications. Such separation and, moreover, rejection was already inherent in D’Ambrosio’s reflections on ethnomathematics: he understood ethnomathematics as encompassing all mathematical ideas that are not exposed by the “mainstream” (in his words, American or European) mathematics.<sup>3</sup> Likewise, he stressed the variety of mathematics:

“Those cultural groups, [...] such as farmers, engineers, and professional classes in general develop their own pattern of behavior, their own symbols and codes and their own way of mathematizing, in other words, their own

<sup>3</sup>The term American is here used as what is coming from USA, and clearly not what is coming from the American continent, otherwise it would be a contradiction (D’Ambrosio, 1985a, 1989, p.285).

Mathematics.” (D’Ambrosio, 1985b, p. 42)

This conceptualization, i. e., the consideration of ethnomathematics as being separated from mathematics has led some proponents of this research area to an even stronger assumption, that of dichotomizing Western mathematics and the other forms of mathematics as exemplified above. What this may provoke has been already mentioned by Marcia Ascher and D’Ambrosio: “that some people think ethnomathematics is trying to replace mathematics.” (Ascher & D’Ambrosio, 1994, p. 41)

Alan Bishop, a renowned mathematics educator devoted to cultural issues of mathematics and, being so, one of the specialists in the study of “enculturations” of mathematics, accused - while discussing decolonization processes - Western mathematics to be “the secret weapon of cultural imperialism.” He affirms “that with both rationalism and objectism as core values, Western mathematics presents a dehumanised, objectified, ideological world-view,” and that it was Western cultural imperialism that “imposed its version of mathematics on the colonised societies.” (Bishop, 1990, pp. 58 resp. 61) One should hence re-examine the whole history of Western mathematics itself, since it “has been written predominantly by white, male, western European or American researchers.” (Bishop, 1990, p. 61) Paul Dowling maximizes the dichotomy by even denying the analysis of non-European ethnomathematics to Westerners:

“To varying degrees, all of this [ethnomathematical] work succeeds in celebrating non-European cultural practices only by describing them in European mathematical terms, that is, by depriving them of their social and cultural specificity.” (Dowling, 1998, p. 14)

One has to admit that the concepts given so far to ethnomathematics have implied conceptual problems for mathematics itself, so that it is of great importance to reflect on its epistemological meanings. In fact, the above citation of Gerdes’ definition alluding to cultural determinations by certain (sub-)cultures opens several questions. One very provocative question was stated by Alan Bishop in 1989: “if all ethnomathematics is mathematics, why should it be named ethnomathematics and not just simply the mathematics of this culture or that sub-culture?” (cit. Alan Bishop, quoted from Gerdes, 1997, pp. 9-10)

Gerdes has radicalized this questioning in the following proposal: “world-mathematics (or mathematics) may be briefly defined as the union of all ethnomathematics.” (Gerdes, 1989, . 193). The plurality of this term had also appeared

in another quoted reflection in chapter 1; there he used mathematics as a plural of, possibly, various kinds of mathematics, which was already thought-provoking. Does this mean the loss of objectivity for mathematics? Can different forms of mathematics coexist? Is mathematics but the union of various cultural forms of mathematics? And which kind of union might this be?

As shown in section 1.1.1, Fettweis had rejected the traditional notion of cognitive inferiority of the *Naturvölker* and had rather attributed to them cognitive abilities analogous to the so-called “civilized” peoples. By considering as a starting point his assertion of humankind taken as a categorical unity, one is led to the assumption of having mathematics as the union of numerous, at least culturally different mathematics. The so-called Western mathematics would be just one among many other forms of mathematics; it could no longer be distinguished as having traditional priority. And these facts immediately open up questions on whether and how would it be possible to claim a universality and an objectivity of mathematics; these questions have been already raised by Wilder (section 1.1.2) and by von Glasersfeld (section 1.2.3).

It is in this seemingly aporetic situation that the concepts provided by the cognitive turn in psychology, education and history of science have proved to be productive. Piaget’s constructivist conception of cognitive development, Bruner’s conception of cultural specificity of cognitive educational processes, and von Glasersfeld’s radical constructivism have already questioned the objectivity of knowledge and proposed meanings shared by groups of learners as an intermediate step before relative objectivity, and Kuhn’s notions of normal science and scientific community have likewise implied the loss of the traditional claims of certainty, objectivity and universality of scientific knowledge. It is the respective scientific community that acknowledges a research result as a truth; and through cognitive change, it may very well accept a different one in the future.

Based on von Glasersfeld’s conception, it is even possible to radicalize Kuhn’s theory. In fact, Kuhn has tacitly assumed an undifferentiated community for each respective science, i.e., for a certain time period there exists (worldwide) only one such community. In other words, Kuhn has regarded each scientific community, e.g. the scientific mathematics community, to be universal during a period of normal science, that is, scientific communities cannot be differentiated according to, e.g., the country in which its scholars practice their science. However, Schubring has reflected that there is no a priori reason to assume the implied universality of communication. Using sociological conceptions of communication, he argued

for a parallel existence of, culturally shaped, different scientific communities:

“Combining the communicational approach with the system - environment - interaction model, I can specify that the social history of ideas is in its essence culturally shaped: the first interaction of the system of mathematics with its environment occurs primarily in the field of culture. The system of science, and together with it the subsystems of the various disciplines, has in any case been part of the respective system of national education and thus integrated into a defined environment of specific cultural and epistemological shape providing a common system of communication since territorial states emerged in modern times. This primary relation between system and environment makes that studies about professionalization and institutionalization are so significant for clarifying the role of “social” - or better, cultural - elements in producing ideas. In a first stage, communication is not universal, but takes place within determined cultural and social borders; and mathematical production occurs within concrete institutional structures that express historically variable social valorizations of knowledge.” (Schubring, 1927, p. 6)

Applying his notion of culturally different communities, Schubring has demonstrated their existence, in particular those national scientific communities in the case of France and Germany (Schubring, 1996, 2007). Moreover, he has proposed a notion of relative objectivity and universality of mathematics, based on the notions of constructivism:

“Not only in learning, meanings of concepts are subject to negotiation processes, so that differences in meanings established by various groups will disappear as result of interactions when these groups get into communication and achieve shared meanings, but also in science a common understanding will at first be restricted to social communities, which are tied together by certain conditions to form a basic unit of communication, say by sharing a common culture and language. Let me call this basic unit a scientific community of first order. In general, one can assume that they will share, too, a certain epistemological view of their subject. While there might co-exist different epistemological and conceptual views of mathematics in separated mathematical communities, there should begin processes of interaction at the moment when such separated communities come in contact with each other. Consequently, either the values and conceptions

remain mutually alien so that - if there are no other pressures for establishing shared conceptions - the communities will continue to be separated, or a negotiating about the differences will begin with the effect of certain compromises or dominations.” (Schubring, forthcoming)

I would like to apply these conceptions to the case of ethnomathematics and its relation to mathematics. The various kinds of mathematics developed according to definite cultural and/or national contexts constitute a “worldmathematics” and, once an effective communication has been established, also a relatively universal and objective mathematics. It is ethnomathematics, as far as being understood as part of mathematics, which constitutes a challenge for this mathematics to be conscious and aware of its culturally defined elements.



# Chapter 3

## Research Methods in Ethnomathematics

*There are as many worlds as ways to describe them.*

(Elliot W. Eisner)

### 3.1 Some Important Theories and Methods in the Social Sciences

As detailed in chapter 1, the various conceptions and approaches proposed for research in ethnomathematics embrace notions, concepts, and methodologies from a number of disciplines within the social sciences. In particular, my own field researches and their evaluation, as exposed in the following chapters, also require the implementation of relevant contributions from these disciplines. In fact, they present a research program that pursues an interdisciplinary approach, as first proposed by D'Ambrosio and Sebastiani Ferreire, and as concretized here in the special form of the supplementary interdisciplinary approach (see chapter 2). In my opinion, the following notions need explicit definition because some of them may be defined differently if addressed by one or another scientist; they may not appear to be always explicitly relevant in the next chapters, but they have been present during the analyses and considerations that need to be taken for the final remarks. These are:

**Acculturation** is the process in which different societies in direct contact transform and/or impact their cultures. In many cases, this contact “occurs under conditions of significant inequality in the scale, power or technological complexity of the societies involved” for which reason it is impor-

tant to study these conditions together with analyzing the cultural traits (Winthrop, 1991, pp. 3-4).

**Anthropology** integrates a set of disciplines, e.g. cultural anthropology, ethnography, ethnology, and seeks to explain the development, unity and diversity of the human species from both biological and cultural perspectives; in the present day, it particularly studies the different aspects and characteristics of societies. “It shares perspectives with the natural sciences, social sciences, and humanities, without being reducible to any of these.” (p. 33 Panoff & Perrin, 1981; Winthrop, 1991, pp. 12-14)

**Cultural Anthropology** deals with the relations between the elements of belief and behavior and the broad social context of a certain society. In practice, this study has been developed by people from developed (“powerful”) countries; in the 1970s and 1980s, some scholars criticized its theories and questioned the possibility of transforming it “into a discipline of global rather than merely Western significance, fostering the encounter of cultures as a dialogue among equals.” (Panoff & Perrin, 1981; Winthrop, 1991, cit. Asad, Ogan, Diamond, Pandian; pp. 14-15)

**Culture** “embraces all the manifestations of social habits of a community, the reactions of the individual as affected by the habits of the group in which he lives, and the products of human activities as determined by these habits.” (Winthrop, 1991, p. 53) In a broader sense, it comprises the knowledge, ideas, beliefs and behavioral forms that characterize a society or group of people (Panoff & Perrin, 1981, p. 175). This term has often been misused as a synonym of civilization (cf. chapter 1, section 1.1.2 Keyser, 1933).

**Ethnography** is the analysis of a culture through the method of participant observation and a discipline within anthropology; moreover, it is the active application to cultural anthropology. Such an analysis and description must aim to remain as faithful as possible with the studied aspects. The question of whether the ethnographer should become an engaged participant or stay a detached observer remains unanswered (pp. 98-101, Winthrop, 1991; Panoff & Perrin, 1981, p. 92).

**Ethnology** constitutes the synthesizing of the studies documented by ethnographies; it focuses on the diffusion, origins and history reconstruction of cultures. It also classifies and compares cultures, “often emphasizing their

development and historical interrelationships.” It is a comparative and descriptive discipline within anthropology (pp. 101-104, Winthrop, 1991; Panoff & Perrin, 1981, pp. 93-94).

**Ethnoscience** has been defined according to two different trends. The first of these represents a research method that describes how the members of a specific culture structure experiences related to phenomena occurring in their natural environment, and how these phenomena are also associated to the construction of possible behavior patterns - derived not only from the experience with nature, but also from their own social interactions. The second approach has been, sometimes, named *new ethnography* and it aims, in contrast to ethnography, to “create an explicitly scientific, formal, and verifiable mode of ethnography.” (Winthrop, 1991, pp. 104-105)

**Field Research.** It is in the *field* where the researcher meets and encounters her/his object of study. The scientist must remain continuously committed to the empirical ethnology s/he is using. Some consider fieldwork as the real laboratory of the ethnology (Panoff & Perrin, 1981, p. 103).

**Primitive** appeared as a substitution to the term *savage* and it is nowadays obsolete (Panoff & Perrin, 1981, pp. 248-249); it describes the societies that live outside the *industrialized civilization*.<sup>1</sup> Although *primitive* means etymologically “of or belonging to the first age, period, or stage,” its meaning in anthropology was often misconceived; it intended to group societies according to their size, complexity and mode of life and, on the other hand it suggested that such societies could be culturally compared to the men and women of early prehistory (Winthrop, 1991, pp. 217-218).

**Race** is, biologically speaking, a group of people that can be differentiated from another according to anatomical, physiological and pathological characteristics such as skin color, blood type and disease’s reactions. Race should be completely disregarded in the face of cultural phenomena (Panoff & Perrin, 1981, p. 257); nonetheless, it “has to a large extent reflected cultural presuppositions, particularly ethnocentrism.” (Winthrop, 1991, p. 227) In the late twentieth century, studies proved the large range of human diversity within an arbitrarily chosen population, defeating the idea of pure and primordial racial types (Winthrop, 1991, p. 230).

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<sup>1</sup>In German *wild* and in French *sauvage*

Of particular interest and importance for the research in ethnomathematics are ethnography, ethnology and ethnoscience. For this reason, these three concepts shall be further explained below.

### 3.1.1 Ethnography

Ethnographic methods may be considered as one of the fundamentals for any research undertaken in ethnomathematics; it is the science used to describe different cultures and societies. It “attempts to be holistic [...] but it necessarily falls far short of the whole.” (Fetterman, 1989, pp. 11;21)

Ethnographers need to be open minded about the cultures they will study. This fact does not intend to imply that they start the fieldwork with no knowledge at all; on the contrary, they arrive with a designed problem and have corresponding research and data collection techniques. Being open minded allows the ethnographer to uncover relevant information that is outside the aims’ scope; it gives freedom to interpret the collected data in diverse forms, even though s/he accounts for an understanding from an insider’s perspective (Fetterman, 1989, pp. 11-12).

Achieving the insider’s perspective is one of the main purposes of the ethnographer, because with it, s/he is able to accurately describe situations and behaviors with respect to the relevant cultural aspects. An objective cultural description is one that is as genuine as possible regarding the culture’s perceptions of reality, i.e., the ethnographer is assuming the existence of multiple realities (Fetterman, 1989, pp. 30 ff.).

Ethnography cannot be considered to be a deductive science, but it nonetheless attempts to achieve the most accurate and objective description of the people’s viewpoint, i.e., the ethnographer begins to think like the people under study. In reality, ethnographic work is not appropriately scientifically structured, since “it involves serendipity, creativity, being at the right place at the right or wrong time, a lot of hard work, and old-fashioned luck.” (Fetterman, 1989, p. 12) Nonetheless, it is always possible to perform a scientific analysis considering external social scientific perspectives (Fetterman, 1989, p. 32). It is important to take into account that,

“The typical model for ethnographic research is based on a phenomenologically oriented paradigm. This paradigm embraces a multicultural perspective because it accepts multiple realities.” (Fetterman, 1989, p. 15)

This type of research is generally inductive, i.e. although the ethnographer bases his investigation on a certain model or theory, it ends up with general conclusions or new theories. In other words, and particularly with regard to ethnography, the subjective reality of an individual is no less valid than the objectively defined one (Fetterman, 1989, p. 15); this new way of interpreting reality may lead to reformulation of the model being used. Thus, theories need not be strict and can even represent personal viewpoints; moreover, they must have a holistic approach (Fetterman, 1989).

Another aspect that needs to be considered before starting the ethnographic study is whether the theory framework demands a micro or a macro study; a micro study focuses on a particular social unit or activity inside the ethnic group, whereas a macro study concentrates on the large picture of the ethnographic object, e.g. a community (Fetterman, 1989, pp. 38-39).

It is during the field research that the ethnographer first refines her/his hypotheses and moulds her/his working plan; as stated above, if s/he wants to be as close enough as possible to the culture's or society's interpretation of facts, s/he needs to have the ability of redesigning her/his assumptions. Fieldwork is the most important aspect of the whole study; it is in this period that the researcher is able to observe, ask any type of question, participate in the community life (perhaps focusing on one individual), and constantly take notes that will be of great relevance, especially for those judging the complete investigation (Fetterman, 1989, pp. 19 ff.).

In the field, the ethnographer becomes the most important instrument of her/his own research; "relying on all its senses, thoughts, and feelings, the human instrument is a most sensitive and perceptive data gathering tool." (Fetterman, 1989, p. 41) The researcher uses the theoretical framework to relativize and then objectify the impressions and perceptions. At first, s/he will try to interact with every possible person, and with time the focus will narrow to a smaller group within the ethnographic community. How s/he has entered the community will ease or complicate the whole research: being introduced by a community's member or a person of trust is the *best ticket*, otherwise it may not be so simple to earn the community's confidence (Fetterman, 1989, pp. 42-43).

The fieldworker uses *participant observation* to undertake her/his research, i.e., s/he will actively participate in the community's life but, at the same time, will maintain a certain distance that allows a more substantial data collection. Within some time, the culture's understanding becomes more clear and the hy-

potheses start assuming a more definite shape. Time is also important because the community becomes accustomed to the ethnographer's presence and the researcher no longer feels like a guest, but as a member of this community (Fetterman, 1989, pp. 45 ff.).

The question types pursued during the fieldwork may be open-ended or closed-ended: an open-ended question leaves the freedom to the participant's interpretation, yet a closed-ended question is better employed to quantify behavioral patterns. Most commonly, the open-ended questions are used at the beginning of the research, leaving the closed-ended to the final stage (Fetterman, 1989, p. 54).

The time invested and spent in the field is, fortunately or unfortunately, of great relevance. Spending a long time living and/or sharing with the community gives competence to the ethnographer to achieve conclusions about "the power of dominant ideas, values, and patterns of behavior" in a more holistic approach (Fetterman, 1989, p. 27). Moreover, during this process, s/he will discover underlying cultural aspects and elements that give power to the values uniting the group; this allows the researcher to objectify the complete frame, both concrete and abstract, of the people's and individual's living aspects in this specific culture that is being studied, i.e., s/he develops a *cultural interpretation* (Fetterman, 1989, pp. 27 ff.).

It seems evident that the ethnographer's description and analysis cannot be completely neutral; s/he belongs as well to a certain culture and this will automatically bias her/his interpretations. However, s/he is aware that ethnocentrism spoils any ethnography and will hence avoid, as much as possible, expatiating the most obvious biases; in other words, the researcher will not make her/his own interpretations explicit and, for that matter, will remain as objective as possible throughout the entire fieldwork process (Fetterman, 1989, pp. 33-34).

During fieldwork, the ethnographer must assume an *ethical* posture; s/he is discovering people's achievements, failures, secrets and quirks, and in order to leave open doors for further and future research, s/he needs to show respect, admiration and appreciation for those s/he is working with. "Noninvasive ethnography is not only good ethics, it is also good science." (Fetterman, 1989, p. 120) Gaining the people's trust requires constantly showing honesty, verbally and nonverbally; once this *bond of trust* has been established, the researcher will be allowed to enter and discover all secret symbols and cultural knowledge, thus augmenting the quality of the collected data. Ethics is particularly crucial when s/he be-

comes a participant in illegal activities (*guilty knowledge*) or of illicit behaviors (*guilty hands*), although both illegal and illicit are seen and interpreted from the ethnographer's perspective and may not play any relevant or threatening role in the individual or society's life (Fetterman, 1989, pp. 132-133).

Finally, how can the ethnographer give back to the community? It is clear that the members of this community have invested time and dedication to help the researcher in obtaining her/his data, hence s/he also needs to contribute in some way. In the best cases, s/he offers her/his expertise and/or makes available the report resulting from the fieldwork. The worst-case scenario involves the legitimation of direct payment because it arouses dependence and foments biased expectations (Fetterman, 1989, pp. 133 ff.).

As contradictory as it may sound, "the good ethnography requires the researcher to pursue the detours as well as the [pre-established] paths and to become lost in the culture in order to learn its terrain." (Fetterman, 1989, p. 138)

The ethnographic research is descriptive, and therefore aims to remain as faithful as possible to the observations and annotations taken during the fieldwork. Good ethnographies become the reliable material that will give meaning to the objects of study in a more comparative approach, i.e., it is one of the main sources for ethnological studies.

### 3.1.2 Ethnology

Ethnology is a comparative discipline that first aims to study the culture of a given group of people or society in a very broad sense, i.e. its beliefs, social structures, languages, values (Servier, 1986; Winthrop, 1991, p. 101); probably one of the greatest achievements of ethnology, says Lévi-Strauss, was the conclusion that the human intellect is the same and has the same abilities within the whole humankind, regardless any cultural differences.<sup>2</sup> With the assumption of acculturation processes in modern times, ethnology assumed diffusion and migration as its principles to explain each culture's values, ideas, beliefs and concepts (Winthrop, 1991, p. 103).

One principle used in the early 1900s in ethnology was evolutionary, that is, assuming migration and diffusion, it considers the existence of a given set of cultural shapes that had been established in one center, and then later spread

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<sup>2</sup> "[...] daß der menschliche Geist, ungeachtet der Kulturunterschiede zwischen den verschiedenen Teilen der Menschheit, überall die gleiche ist und die gleichen Fähigkeiten besitzt." (Lévi-Strauss, 1980, p. 31)

to different regions in the world. It assumes the existence of *definite laws*<sup>3</sup> that determine the cultural development from every ethnic group. Such hypotheses may lead to a eurocentric implication that Western society represents the highest (living) achievement in this cultural process; if every culture started its history amounting the same traits, Western society has been the most successful in disseminating its values, beliefs and ideas (Boas, 2007, p. 40). Lévi-Strauss' claim that all intellects are the same, regardless the culture, may be interpreted in an evolutionary standpoint; it is always restricted to follow those pre-established laws. Though, on my account, he aims to state that each individual is equally capable of learning and/or developing any task or activity, that intelligence is a quality that needs to be constructed and can by no means be regarded as a genetic result. He proves this point himself:

“[...] every people [...] are capable of altruistic thinking, i.e., they have the need or desire to understand their surrounding world, its nature and their own society. And to achieve this goal, they proceed with the help of the intellect, in the same manner a philosopher and, in some degree, a scientist would do.”<sup>4</sup>

Ethnology is concerned with the dynamic phenomena of cultural change and assumes only the historical facts that come from archaeological findings, thus the method used for determining such changes “is based on the comparison of static phenomena combined with the study of their distribution.” (cit. Franz Boas, Boas, 2007, p. 42) It does not intend to explain the foundations of civilization and society; rather it regards each culture as having an independent cultural history that agrees with its own social developments and adaptations of external influences. In Boas' words:

“[...] the method which we try to develop is based on a study of the dynamic changes in society that may be observed at the present time. We refrain from the attempt to solve the fundamental problem of the general

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<sup>3</sup>the meaning of law is here used as “a statement expressing what has been seen always to happen in certain conditions.” (Longman Dict., 1993)

<sup>4</sup>My translation of:

“[...] *jene Menschen [...] durchaus zu uneigennützigem Denken fähig sind, d. h., daß sie das Bedürfnis oder den Wunsch haben, die sie umgebende Welt, deren Natur und ihre eigene Gesellschaft zu verstehen. Und um dieses Ziel zu erreichen, gehen sie mit Hilfe des Intellekts vor, genauso wie ein Philosoph, in gewissem Maße sogar ein Wissenschaftler es tun würde.*” (Lévi-Strauss, 1980, p.28)

development of civilization until we have been able to unravel the processes that are going on under our eyes.” (cit. Franz Boas, Boas, 2007, p. 43)

Ethnology uses the results obtained in an ethnographic research to study cultural change. Hence, the respect of the ethnologist towards any ethnic groups is the key to give, in a broad sense, a scientific meaning and acknowledgment to their theories. However, Lévi-Strauss was convinced that equality and acceptance between all different cultures was not possible without endangering their differences; his frameworks claimed that every culture considers itself as the only true culture (cit. Lévi-Strauss Ritter, 2009). His work and legacy deserve a meritorious distinction:

**Claude Lévi-Strauss** (1908-2009) has been acknowledged worldwide as the intellectual founder of modern anthropology and, in his late years, he was often renowned for the achievements in ethnology; in France he was also responsible for the development of social anthropology. Born in Brussels, he grew up in France and after World War I, attended the *Lycée Janson-de-Sailly* in Paris where he became a socialist. From 1927 until 1932, he studied law and philosophy at the Paris Sorbonne University and, in 1935 he left to work at the University of São Paulo in Brazil. In 1937 he started his fieldwork in the Amazon region, where he researched the *Caduveo* and *Bororo* ethnic groups, and later the *Nambikwara*; he replaced the name *primitive societies* with *illiterate cultures* in his academic work. The collection of objects obtained in this period are at the *Musée de l’Homme* in Paris and his complete research is presented in the book *Tristes Tropiques* (Kuper, 2009; Ritter, 2009; Rothstein, 2009).

Lévi-Strauss returned to France in 1939 but, with the outbreak of World War II, left to the United States of America to become, thanks to the Rockefeller Foundation, a visiting professor at the New School for Social Research in New York. During this period, he taught himself anthropology. He returned to Paris in 1949 to obtain his *doctorat d’état* and found work in the *Musée de l’Homme* and the *École Pratique des Hautes Etudes* of the Paris Sorbonne University. In 1959, Lévi-Strauss established the first Laboratory of Social Anthropology in France, at the *Collège de France*; in 1973, he was elected to the *Académie Française*. He remained, until his last days, “an advocate of the indigenous peoples movements.” (Kuper, 2009; Rothstein, 2009)

On his 95th birthday, Lévi-Strauss spoke about the disappearance of anthropology since it is no longer possible to study human experiences that are *free of Western contamination*; according to him, the repertoire of differences

is exhausted and he worried about the growth of a *modern monoculture* (Ritter, 2009; Rothstein, 2009). He was aware that ethnological research was always accompanied by a loss of a people's particular world (Altwegg, 2009).

I agree with Lévi-Strauss that ethnographers and ethnologists not only describe and interpret another culture's ways of living, but also affect its lifestyle and habits. The presence of the researcher is to some extent invasive; the simply being an observer changes the people's behavior and, though this may come back to normality in time, during observation the members of the community have become observers themselves and, moreover, they have been affected by the researcher's ways of behaving, almost as if diffusion and acculturation would be continuous phenomena in time.

The next term to be described, ethnoscience, also gives some clues about the processes of exchange and transfer concerning scientific knowledge and regarded as part of the cultural skeleton of a community, ethnic group or society.

### 3.1.3 Ethnoscience

The term ethnoscience is a postwar terminology, developed within cultural anthropology (Winthrop, 1991, p. 104). It is not uniquely defined, but we may distinguish two main tendencies; the first defines ethnoscience as an ethnographic research method and the second explains it as the systems of classification and taxonomies developed by ethnic groups (Sturtevant, 1964). There have been critiques presenting the causes and reasons why this discipline failed in achieving any maturity as a theory, although I will not disregard the possibility that ethnoscience might have melted into ethnology or cognitive anthropology (see, e.g. Amundson, 1982). My intention is not to open a historiographic debate on how it has been defined, used and/or misused; this section will focus on the latter definition given above, but I shall briefly describe the first definition.

As an ethnographic research method, ethnoscience may be described according to the techniques used in the following steps: 1) *asking descriptive questions*, 2) *making a domain analysis*, 3) *asking structural questions*, 4) *making taxonomic analysis*, 5) *asking contrast questions*, and 6) *making a componential analysis*. In other words, the researcher tries first to determine the main cultural settings, and then follows with the choice of domain that will be investigated in-depth. In the next step, the type of questions will provide the researcher, with more exactitude, the boundaries of this domain, and further on s/he will look for other relationships between this latter and other domains. Finally, the researcher aims to find

concepts that can be defined when contrasted with others, and this is followed by an analysis that focuses in determining the different *components of meaning* (cit. Spradley, Morey & Luthans, 1984, pp. 30-32). Within this framework, some researchers had confidence that ethnoscience could raise the “standards of reliability, validity and exhaustiveness in ethnography.” (Sturtevant, 1964, p. 123)

The second definition emerged in the 1980s, and it may have been the result of extensive research in taxonomies; within the system of classifying terms, it is possible to open a wide field of research in the natural sciences as described by ethnic groups. The following definition to ethnoscience was given:

“[...] “ethnoscience” is defined [...] as the set of concepts, propositions, and theories unique to each particular culture group in the world. [...] each culture has its own ethnoscientific knowledge system and ours in the United States is known as “Western science”.” (cit. Peter Meehan, Brokensha *et al.*, 1980, p. 379)

It is in the context of the above definition that we are able to consider the systems of knowledge that may be developed by all ethnic groups, that is ethnobotany, ethnozoology, ethnoastronomy, ethnomedicine, and ethnomathematics among many others. Research in ethnoscience has been undertaken predominantly by anthropologists, both theoretical and applied, ethnologists, ethnographers and linguists; and so, this research area has been considered to be a theoretical framework or methodology within both theoretical and applied anthropology. Some of the results presented in the book *Indigenous Knowledge Systems and Development* are how ethnic groups classify and organize living beings and body parts, how they develop models for pastoral development or fish marketing and trading, etc., and how they develop agricultural and population censuses (Brokensha *et al.*, 1980).

It is revealing to observe that ethnologists from the so-called Western culture have been ready to admit that indigenous or ethnic knowledge can be regarded as contributions to science and to technology. Thus, for example, rural knowledge in some parts of Europe may be considered an ethnoscientific knowledge. Some authors have claimed the importance of taking indigenous knowledge into account since it can be used as an interface between the abstract scientific knowledge and real-world situations (cit. Roy Ellen and Holly Harris, Sanga & Ortalli, 2004, p. 299). A more concrete example for this assertion is a research study undertaken in the Philippines with upland farmers, where the author concluded that further

innovations need to be developed with the aid of the farmer's knowledge and practices (Fujisaka, 1987).

Following this same line, D'Ambrósio defined ethnosience to represent a body of knowledge developed by every culture motivated by their natural and cultural environment. This body of knowledge is constituted by the ways of classifying observational systems and explanations based on experiences, which are developed according to certain cultural, social and economical backgrounds; science has been long acknowledged as the intellectual instrument of progress and technology, so it is very important to realize that scientific practices appear in many daily activities (D'Ambrosio, 2002, pp. 59-60).

Sebastiani Ferreira has regarded ethnosience as the models used by an ethnic group, which result from the analysis and observation of natural phenomena occurring in their specific surrounding. Following his conceptualization, it is a research field within ethnology and aims to determine which notions amount to the institutionalized science (Sebastiani Ferreira, 2004). Ethnomathematics has been the latest developed discipline compared to other ethnosciences, e.g. ethnobotany, ethnozoology, ethnoastronomy, ethnolinguistics etc.; these terms are used to refer to the system of knowledge and perception typical of a specific culture (Gerdes, 1997, p. 10).

Now that these notions and disciplines have been accordingly defined to the aims and purposes of constructing an interdisciplinary ethnomathematical research program, I can now introduce some methods that have already been suggested. They happen to be, in some sense, country-related; how this may complicate the attempt to find a consensual definition to ethnomathematics will not yet be considered, but it will be discussed in the final conclusions (see chapter 7).

## **3.2 Research Methods in Ethnomathematics**

Sebastiani Ferreira has introduced several methods for researching in ethnomathematics. His intentions are directed towards the integration of ethnomathematical elements in different curricula, and also the creation of ethnomathematical syllabi that are uniquely determined by the ethnic group. A general overview of his approaches is presented below.

Research in ethnomathematics, first of all, acts on the assumption that mathematics is a social construct; its goals are to determine the mathematical concepts

people use, create and redefine according to their needs and interests (Sebastiani Ferreira *et al.*, 2004, pp. 22-23).<sup>5</sup> This type of research can be described using an anthropological, historical and/or educational approach. Emphasizing the anthropological aspects of it requires a field research based in ethnographic methods that determine the description of the observed mathematical knowledge from a respective ethnic group. The goals of research from a historical approach aims to critically change and reconstruct the history of mathematics, including all aspects and facts that had been ignored by the traditional mainstream historiography. The research with educational emphasis argues about the mathematical knowledge present in the social context and that which is legitimized in the school context (Sebastiani Ferreira *et al.*, 2004, pp. 55-56).

Fieldwork can be undertaken using either of these research types and its main goal is to understand and/or find answers to a given hypothesis; it is important that this latter goal remains flexible, since in most cases, the questions may change during the investigation. Moreover, it is after the first encounters that the researcher refines her/his aims. The information regarding mathematical elements and/or tools s/he unexpectedly obtains needs to be considered; other aspects within this same scope come only after there is a committed and trustful connection with the group (Sebastiani Ferreira *et al.*, 2004, pp. 60-61).

It is not easy to enter the everyday life of a community or ethnic group, especially if their people are aware of the scientist's intention to undertake a study; under these circumstances, to earn their confidence becomes even more complicated. It seems almost fundamental to have a reliable person present who knows the scientist and who, at the same time, has the respect and/or trustfulness of the community members; if this is not the case, the scientist has to consider within the framework of her/his research the time needed to earn this confidence. In both cases, the mutual respect is essential; in particular, the other person's opinion needs to be respected and this means not only carefully listening to, but also understanding the meaning of what is said. This understanding has to be clear of the scientist's preconceptions (Sebastiani Ferreira *et al.*, 2004, pp. 62-63).

Data considered to be of mathematical relevance can be collected either through the analysis of documentation, such as newspapers, magazines, books, certificates, etc. or by having a direct contact and communication with the ethnic group; in most cases, the optimal method is a combination of these two.

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<sup>5</sup>the term people is used in a very broad sense and represents any different cultural or ethnic group.

The latter method can be developed by making observations and/or interviews. In the first, the observer is a learner and a participant in the activities of the group as s/he needs to understand the group dynamics according to their own cultural rules. Visual resources need to be part of the records of the observed events and, in the fieldwork diary, the researcher can note her/his impressions and own interpretations of what s/he has experienced during the stay. Interviews shall be recorded (and later transcribed) and can either be well structured, half structured or open, in all of these many conflicts and contradictions will meet as both interviewer and interviewee fight for certain type of information. The interview is prepared according to the scope of objectives, the language knowledge of the interviewee, and the type of questions that allow more descriptive and narrative answers, i.e. those that are not inductive, and that enables changes from one trend to another that may appear during the interview (Sebastiani Ferreira *et al.*, 2004, pp. 63-67).

Organizing the collected data requires an extensive and intensive reading of the information obtained in order to detect all relevant mathematical elements that will be used in the final analysis. These elements will be interpreted according to the established goals and objectives; it is in this latter process when the mathematical practices of the different observed activities will be acknowledged and become valid (Sebastiani Ferreira *et al.*, 2004, p. 68).

### 3.3 Ethnographic Research in Africa

Most probably, the terms ethnoscience, ethnology, ethnography, ethnobotany, etc. have found great difficulties in being accepted among African cultures, particularly South African communities. During apartheid, ethnicity was an alternative term used to refer pejoratively to every “non-white” society.<sup>6</sup> The same problematic was presented in section 1.5 of chapter 1 where the appearance of the term “ethno” in ethnomathematics caused particular rejection and unacceptance in South Africa; the racist politics were strongly discriminative and segregative toward “non-white” local ethnicities. The long and painful struggle that these South African ethnic groups had to endure is immediately evidenced in their criticism and skepticism against any concept and notion that contains the prefix “ethno.” This fact also represents a great difference with respect to acceptance

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<sup>6</sup>I have used the inverted commas because, nowadays, it is unacceptable to refer to cultures according to their skin colors.

of “ethno”-disciplines and ethnographic research in other African countries.

Nonetheless, there has been a number of scientists who have achieved respect and approval among African countries. These authors have found their way in introducing and, sometimes redefining some of these disciplines, ethnomathematics being one of them. It is important to point out that ethnomathematical practices in the classrooms are visible, most notably, in post-apartheid South Africa.

In 1986, during apartheid in South Africa, Adam Kuper (anthropologist, 1941-) expressed the difficulties of developing anthropological and ethnographic research in African regions; studying traditional and tribal institutions can easily be confused or included in what was defined *ethnos theory*, the “emphasis in culture, tradition and ethnicity” practiced by the apartheid Afrikaans supporters. The main problem is that such research can be misinterpreted and considered to underpin apartheid (Kuper, 1986, p. 2). Evidently, there was a number of anthropologists and ethnographers who developed a completely different *form of scholarship*: Isaac Schapera, N. J. van Warmelo, Otto Raum and Z. K. Matthews. Even though the *Black political movements* had encouraged anthropology as a “contribution to national identity,” it was nonetheless divisive (Kuper, 1986, pp. 1-3).

“The anthropology (and historiography) of southern Africa is dominated by locally based scholars. [...] Any contribution from outside must pass through the filter of this local discourse before it is absorbed. [...] The problem is in part that the theoretical fashions which may rule in Europe or America at any particular time can be quite different from those which may be current in South Africa.” (Kuper, 1986, pp. 4-5)

Interestingly, Kuper remarks that every rural and urban African society, no matter how small, “will be penetrated by powerful social, economic, political and cultural influences from outside.” Anthropological field methods which consider these communities as objects for ethnographic research need to abstract these inferences, but “their power should not be underestimated.” Anthropologists, argues Kuper, may contribute for the documentation and understanding of history in South Africa (Kuper, 1986, pp. 7-8).

Otto Raum has also expressed his skepticism towards ethnology; an article published in 1913 in *Archiv für Anthropologie* stated that “Africans lacked fantasy/ imagination.” (cit. O. K. Knittel Raum, 2004, p. 206) Raum and his father opposed this view and were convinced that African ethnic groups, in particular the Chagga and Kamba with whom they lived, possessed a rich repertoire of

legends, ghost stories, sagas, etc. This fact encouraged Otto Raum to dedicate himself to ethnological research; he concluded that not only intelligence, morality and spirituality were denied to Africans, but “the fact that education took place in their society was often completely overlooked.” (Raum, 2004, p. 207) He engaged to change these assertions and became one of the most acknowledged ethnologists in Africa.<sup>7</sup>

The most important research method that needs to be described in more detail is that regarding ethnomathematics; the following section is dedicated to this.

### 3.3.1 Ethnomathematics in Southern African Countries

Since the end of apartheid in 1994, South Africa has experienced a lot of changes and radical reforms, particularly with respect to education and the implementation of new curricula. Ethnomathematical research has been developed as an attempt to include cultural artifacts and practices in the new curricula; the term ethnomathematics needs to be carefully used; it may generate conflicts since the concepts of ethnicity and culture were formerly referred to race. Both cultural artifacts and practices are very representative and directly related to a culture’s everyday life; they are part of this culture’s identity (Laridon *et al.*, 2005).

The procedure goes as follows: using an ethnographic approach, the researcher attempts to find the cultural practices and artifacts that may be analyzed with respect to their mathematical elements and, moreover, to their potential mathematical curricular elements. Once these have been determined, a workshop for teachers shall take place in which they learn how to apply and use such materials in the classroom; during these sessions, adaptations and improvements changing their use need to be evaluated and absorbed. Most of the cultural artifacts do not require special techniques and procedures that are taught in school or another formal place of apprenticeship; this fact by no means implies that they may be regarded as not containing mathematical tools, quite the contrary (Laridon *et al.*, 2005, pp. 140-141).

There exist some examples of including cultural practices with an ethnomathematical pedagogical approach in the classroom; the choice of these practices was very wide in the sense that they did not belong to a specific ethnic group

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<sup>7</sup>An extensive description of his research interests and developments, as well as his life and career is given in section 1.1.1 of chapter 1.

and could be found in several South African cultures. Unfortunately, teachers had great difficulties in differentiating between ethnomathematics and academic mathematics, moreover they were not completely able to appreciate the mathematics behind the cultural practices and they seemed insecure in whether the contents could be covered within the same time period. These problems are justified by the fact that mathematical syllabi intended to be essentially academic, thus the mathematical elements behind ethnomathematical practices seemed too simple compared to the level requirements and teachers felt under pressure to fulfill the school demands (Laridon *et al.*, 2005, pp. 137 ff.).

There are, of course, results that favor the fostering of ethnomathematical research. D. Mogari associated several mathematical elements that are taught in school from the process of building wire cars; these were used by teachers who followed either a learner-centred approach or a teacher's dominant perspective. The results achieved proved a better performance in children learning according to the first case's tendency (Laridon *et al.*, 2005, p. 145).

The overall picture has been given by the RADMASTE Ethnomathematics Project (University of Witwatersrand, Johannesburg, South Africa) and concluded that teachers found ethnomathematical elements and practices to be useful for the teaching of mathematics, they agreed that children felt more motivated to learn when the syllabus had been connected to their everyday life; unfortunately the learner-centred strategy was not easily adopted and children felt mostly frustrated when the activities were dominated by their teachers. The fact that the state was in a transitional phase from very repressive policies to those that are open and allow more freedoms, can be seen in the difficulty teachers have in adopting this new posture (Laridon *et al.*, 2005, p. 146;155).

Irrespective of the results presented above, it is very important to remark that already the ethnographic ethnomathematical research and description gives evidence to the existence of mathematical elements and practices in the everyday life of any culture. Some examples of these findings can be found in the research developed by P. Gerdes with Mozambican weaving and basketry, by A. Ismael with a *mancala*-type game played in Ilha de Moçambique, Mozambique, and by D. Mogari with wire cars, a typical toy for children in South Africa. Moreover, M. Cherinda has pursued Gerdes' results finding different mathematical ideas, such as sequences, series and notions of symmetry that can be used in the classroom (Laridon *et al.*, 2005, pp. 142-143).



## Part II

# Ethnomathematical Research



# Chapter 4

## Theoretical Framework: The golden Ratio, Le Corbusier and Albrecht Dürer

In the following chapter I shall introduce first the golden ratio and follow with a presentation of the research on idealized human proportions and its applications made by Le Corbusier and Albrecht Dürer. I will also show some results related to the proportions of facial features. Finally, I introduce a statistical tool, called *t*-test, developed to compare empirical values to a given/known hypothesis. These represent the framework that will be used for the analyzes in the following chapter.

### 4.1 The golden section

The third definition of Book IV of the *Elements* of Euclid states the following:

**Theorem VI, def. 3.** “A straight line is said to be divided in extreme and mean ratio (DEMR) when the ratio of the whole line to the larger segment is the same as the ratio of the larger segment to the smaller segment.”<sup>1</sup> (Herz-Fischler, 1987, p. 12)

The *division in extreme and mean ratio* defined by Euclid in 300 B.C., was found under the name *proportion having a middle and two ends* in Arabic books; probably the first author to use it was Abu Kamil (ca. 850-930 A.D.) (Herz-Fischler, 1987, p. 166). From the sixteenth century on, many names were given to

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<sup>1</sup>The original statement in Greek is:

γ'. Ὡς ἂν ἄκρον καὶ μέσον λόγον εὐθεῖα τετυμῆσθαι λέγεται, ὅταν ἡ ὅλη πρὸς τὸ μείζον τμήμα, οὕτως τὸ μείζον πρὸς τὸ ἔλαττον. (Kayas, 1978, p. 104)

refer to this description, e.g., *divina proportione* which was the title of Paccioli's book, *continuous proportion* used by Kepler in 1597 and *golden section*,<sup>2</sup> the most popular nowadays and probably first used in 1835 by Martin Ohm.<sup>3</sup> Interestingly, this last term was first introduced to the Oxford English Dictionary in 1972, i.e., one century after it had been scientifically and artistically established and acknowledged by the academic community. With regard to the question on the origin of the term *golden section*, Schubring suggested that it had already existed prior to 1835, but only orally, most probably among artisans and engineers. (cit. Schubring quoted from Herz-Fischler, 1987, p. 169) It became very popular in the late nineteenth and in the twentieth century, but, as we have seen, its history remotes to Euclid.

Not only the term used for describing Euclid's definition was changed, but also the way this description was given. By considering the rule of three, we can obtain Euclid's definition as given by Huntley in the following way:

“Let a line  $AB$  be divided into two segments by the point  $C$ . If  $C$  is a point such that  $AB : AC = AC : CB$ , then  $C$  is the *golden section* of  $AB$ .” (see figure 4.1; Huntley, 1970, p. 25)



Figure 4.1: A straight line divided in extreme and mean ratio. (Herz-Fischler, 1987, p. 1)

Moreover, if  $|AB| = 1$  and  $|AC| = x$ , then  $|CB| = 1 - x$  and we obtain the following algebraic expression:

$$\begin{aligned} \frac{1}{x} &= \frac{x}{1-x} \\ 1-x &= x^2 \\ x^2 + x - 1 &= 0 \\ x_{\pm} &= -\frac{1 \pm \sqrt{5}}{2} \end{aligned} \tag{4.1}$$

The numerical solution  $\varphi := -x_+ = \frac{1+\sqrt{5}}{2} = 1.6180339887$  is called the *golden ratio*.

<sup>2</sup>in German *goldene Schnitt*.

<sup>3</sup>“*Diese Zertheilung eine beliebigen Linie  $r$  in 2 solche Theile, nennt man wohl auch den goldenen Schnitt; auch sagt man in diesem Falle zuweilen: die Linie  $r$  werde in stetige Proportion getheilt.*” (cit. Martin Ohm quoted from Herz-Fischler, 1987, p. 168)

In the first quarter of the thirteenth century, Fibonacci (1175-unknown)<sup>4</sup> defined a number series as follows:

**Definition.** Given  $a_1$  and  $a_2$ , a series  $A = \{a_1, a_2, \dots, a_j, \dots\}$  is called a Fibonacci series, if  $a_{n+1} = a_n + a_{n-1} \forall n = 3, 4, 5, \dots$

This series satisfies the following limit:

$$\lim_{n \rightarrow \infty} \frac{a_{n+1}}{a_n} = \varphi \quad , \quad a_n \in A \quad (4.2)$$

**Proof.** We will prove this result for the case  $a_1 = 1$  and  $a_2 = 1$ .

First, we find a formula for the  $n$ th term of the Fibonacci series with  $a_1 = 1$  and  $a_2 = 1$ . Let  $u = \frac{1+\sqrt{5}}{2}$  and  $v = \frac{1-\sqrt{5}}{2}$ . Note that:  $u > 1$ ,  $-1 < v < 0$ ,  $u + v = 1$ ,  $u - v = \sqrt{5}$ ,  $u \cdot v = -1$  and  $\frac{u}{v} = -u^2$ . Moreover,  $u$  and  $v$  are the solutions of the following quadratic equation:

$$\begin{aligned} 0 &= (x - u)(x - v) \\ &= x^2 - (u + v)x + uv \\ &= x^2 - x - 1 \end{aligned}$$

Claim: The Binet formula for the  $n$ th term of the Fibonacci series is:

$$a_n = \frac{u^n - v^n}{u - v}$$

Proof: by induction we have:

$$\begin{aligned} a_1 &= \frac{u - v}{u - v} = 1 \\ a_2 &= \frac{u^2 - v^2}{u - v} = \frac{(u + v)(u - v)}{u - v} = 1 \end{aligned}$$

$$\begin{aligned} n \mapsto n + 1 : \quad a_{n+1} &= \frac{u^{n+1} - v^{n+1}}{u - v} = \frac{uu^n - vv^n}{u - v} \\ &= \frac{uu^n - uv^n + uv^n - u^n v + u^n v - vv^n}{u - v} \\ &= \frac{(u + v)u^n - (u + v)v^n + uv(v^{n-1} - u^{n-1})}{u - v} \\ &= \frac{u^n - v^n}{u - v} + \frac{u^{n-1} - v^{n-1}}{u - v} = a_n + a_{n-1} \end{aligned}$$

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<sup>4</sup>Fibonacci is the short for *Filius Bonacci*, and his name was Leonardo of Pisa. there is no exact date for his death but his last published text was from 1240. He published in 1202 *Liber Abaci*, where he introduced the Hindu-Arabic numeration system in Europe; there exists a journal named after him, *The Fibonacci Quarterly*, which has as focal aim the Fibonacci numbers. (Walser, 1993, p. 72) and (Huntley, 1970, p. 141)

The quotient  $\frac{a_{n+1}}{a_n}$  can now be written as follows:

$$\begin{aligned} \frac{a_{n+1}}{a_n} &= \frac{u^{n+1} - v^{n+1}}{u^n - v^n} \\ &= \frac{uu^n - uv^n + uv^n - vv^n}{u^n - v^n} \\ &= \frac{u(u^n - v^n) + (u - v)v^n}{u^n - v^n} = u - \sqrt{5} \frac{1}{1 - (-u^2)^n} \end{aligned}$$

Since  $u > 1$ , the last fraction  $\frac{1}{1 - (-u^2)^n}$  converges to 0 as  $n \rightarrow \infty$ . Hence,

$$\lim_{n \rightarrow \infty} \frac{a_{n+1}}{a_n} = u = \varphi$$

concluding the proof.  $\square$

Let us consider one example of a formula converging to  $\varphi$ : (Walser, 1993)

$$\varphi = 1 + \frac{1}{1 + \frac{1}{1 + \frac{1}{1 + \frac{1}{\dots}}}}$$

In order to prove this result, we first construct the following series:

$$\begin{aligned} b_1 &= \frac{1}{1} & , & \quad b_2 = 1 + \frac{1}{1} = \frac{2}{1} \\ b_3 &= 1 + \frac{1}{1 + \frac{1}{1}} = \frac{3}{2} & , & \quad b_4 = 1 + \frac{1}{1 + \frac{1}{1 + \frac{1}{1}}} = \frac{5}{3} \\ b_5 &= 1 + \frac{1}{1 + \frac{1}{1 + \frac{1}{1 + \frac{1}{1}}}} = \frac{8}{5} & , & \quad b_6 = 1 + \frac{1}{1 + \frac{1}{1 + \frac{1}{1 + \frac{1}{1 + \frac{1}{1}}}}} = \frac{13}{8} \\ & \dots & & \end{aligned}$$

As we see, both numerator and denominator build, separately, a Fibonacci series, i.e.,  $\text{NUM}\{a_{n+1}\} = \text{NUM}\{a_n\} + \text{NUM}\{a_{n-1}\}$  (resp.  $\text{DEN}\{\}$ ). Furthermore,  $\text{DEN}\{a_{n+1}\} = \text{NUM}\{a_n\}$ . We can now derive the limit of the series  $\{b_n\}_n$  from the result of equation 4.2:

$$\lim_{n \rightarrow \infty} a_n = \lim_{n \rightarrow \infty} \frac{\text{NUM}\{a_n\}}{\text{DEN}\{a_n\}} = \lim_{n \rightarrow \infty} \frac{\text{NUM}\{a_n\}}{\text{NUM}\{a_{n-1}\}} = \varphi$$

Another example of a Fibonacci number series is represented in the structure of a bee hive. In it, a drone (male bee) hatches from an unfertilized egg, and a female bee, on the contrary, comes from a fertilized egg, i.e., it has both parents. The construction of the genealogy of a drone is showed in figure 4.2. We will see that the total number of bees, female as well as male, in each generation follows a Fibonacci series  $\{1, 1, 2, 3, 5, 8, 13, 21, 34, \dots\}$ .

Each row from figure 4.2 consists of one generation of bees. Each drone is hatching from one female bee, and each female bee is coming from one drone

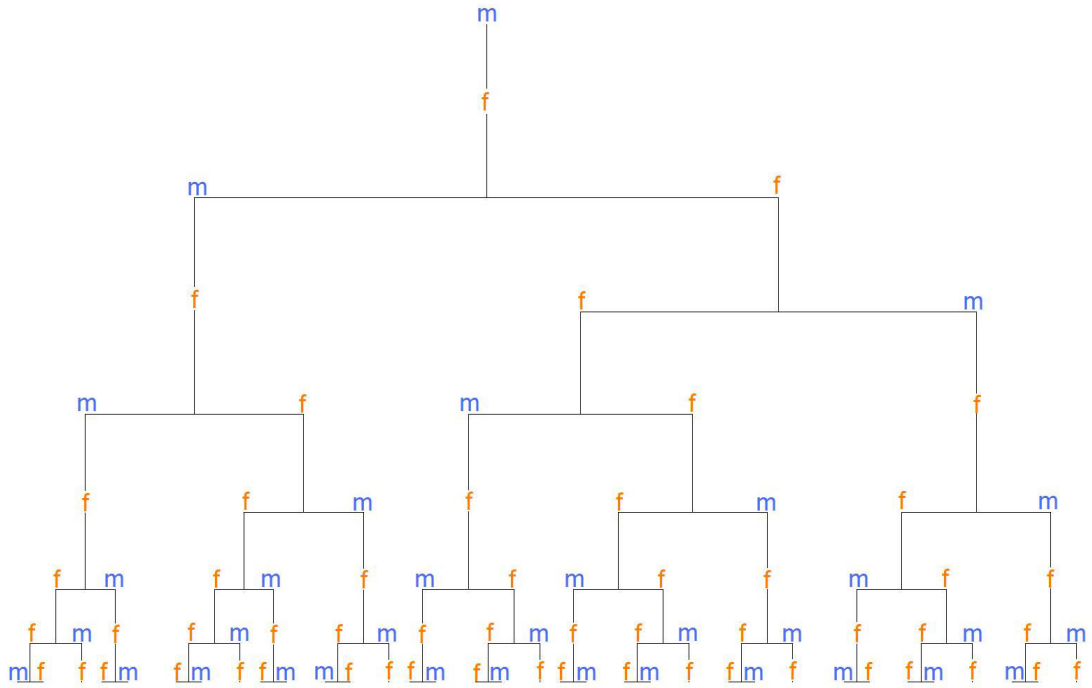


Figure 4.2: The genealogy of a male bee, counted until the ninth generation (Huntley, 1970, p. 160).

and another female bee. We start the first generation with 1 drone and 0 female bees. In the second generation we need 1 female bee and 0 drones. Following this procedure, we obtain figure 4.2. Furthermore table 4.1 indicates the number of male and female bees in each generation, and the total number of bees as well (Huntley, 1970; Walser, 1993).

generation	female	male	total
#	f	m	#
1	0	1	1
2	1	0	1
3	1	1	2
4	2	1	3
5	3	2	5
6	5	3	8
7	8	5	13
8	13	8	21
9	21	13	34

Table 4.1: The cardinality of female and male bees counted in each generation (Atalay, 2004).

In conclusion, what has been historically called beauty in mathematics is related to finding and/or associating this number  $\varphi$  with several patterns, laws and/or behaviors throughout all kinds of different objects; not only in mathematics but also in architecture, art, physical sciences, nature and even games, e.g. origami (Huntley, 1970; Walser, 1993). For a mathematician, beauty has become an objective concept; on the one side it is related to perspective, proportion and symmetry, and on the other side it is the ability of predicting or determining the behavior of an object, either mathematical or physical.

In particular, the *golden ratio*  $\varphi$  has been used to idealize the proportions of the human body. The Vitruvian Man, by Leonardo da Vinci (see figure 4.3) was probably obtained from the oldest representation of this ideal of human proportions, made by Marcus Vitruvius Pollio in the Ancient Greece. It consisted of Zeus inscribed in a circle of radius equal to the navel's height and in a square of size length equal to the height (Elam, 2001). Since those times the relation between the height and the navel's height of a person has been considered beautiful if it satisfies the *golden section*. It may be true that the proportions of the human body are determined by the persons living a certain period of history, and it is through them that the canons are established (Giesen, 1930, p. 3). Nonetheless, the idealized concept of beautiful proportions has been able to survive through ages in the history of mankind, at least in the Western Culture.

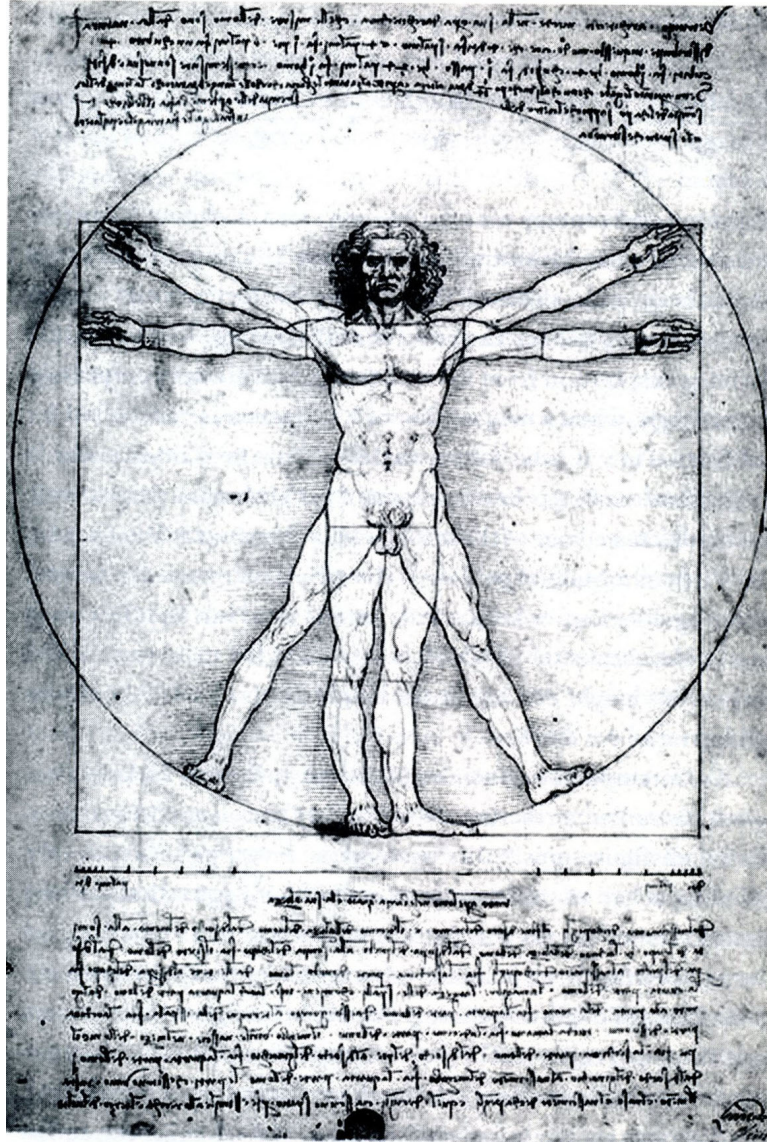


Figure 4.3: The Vitruvian Man, by Leonardo da Vinci (Atalay, 2004, p. 106).

## 4.2 Le Corbusier and the *modulor*

Since the Golden Era in Greece, the Roman Empire until our days we can find that, many sculptures have used the *golden ratio*  $\varphi$  as the ratio between the height of a person and the height of her/his navel. Le Corbusier studied this proportion design with the goal of achieving an architecture that was simple and functional and yet regarded space and proportions (Atalay, 2004; Walser, 1993).

Le Corbusier (1887-1965) was born as Charles-Édouard Jeanneret in Switzerland. He was sent to school in 1902 for becoming a watchmaker; one of his teachers, Charles L'Eplattenier taught him to draw from nature, the ideas of the Arts and Craft movement and the vocabulary of the *Style Sapin*, a local variety of Art Nouveau. From this moment Jeanneret decided to continue his career as an ar-

chitect and travelled through Europe, where he visited many studios, e.g. Perret brothers studio in Paris and Peter Behrens studio in Berlin. It was apparently his visit, in 1907, to the Charterhouse of Galluzzo, near Florence which influenced his later determination in designing simple and functional buildings. In 1920 he and other collaborators founded the journal *L'Esprit Nouveau*; most of his articles were signed with his pseudonym, Le Corbusier (his maternal grandfather's name was Lecorbésier) (Le Corbusier, 2009) .

After World War II he was offered to design a large-scale residential complex, the *Unité d'habitation*; the advantage was that they were very low in costs and precisely during the post-war period, the housing demands were very high. These complexes were built in Firminy, Berlin, Marseille (the first *Unité d'habitation*, built in 1945), Rezé-lès-Nantes and Briey-en-Fôret. All the dimensions in these buildings are determined by the *modulor*: a system based on human proportion developed by Le Corbusier himself (Le Corbusier, 2009). Le Corbusier has been acknowledged as one of the greatest architects from the twentieth century, and there has been a huge amount of studies and exhibitions dedicated to his legacy, unfortunately there has not been much emphasis in his *modulor* which represented the first element or unit within his developed system.

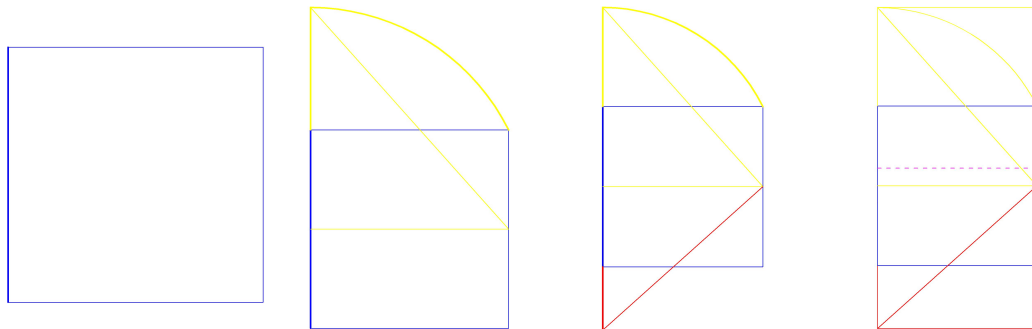
Le Corbusier published in 1954 the book *The Modulor* and, in 1958 he continued with *Modulor 2 Let the user speak next*), which consisted of a collection of testimonies and feedbacks he received after publishing *The Modulor* (Le Corbusier, 1954, 1958). In this first book he gives the following instructions to one of his collaborators, Hanning:

“Take a man-with-arm-upraised, 2.20 *m.* in height; put him inside two squares, 1.10 by 1.10 metres each, superimposed on each other; put a third square astride these two first squares. This third square should give you a solution. The *place of the right angle* should help you to decide where to put this third square.”

“With this grid for use on the building site, designed to fit the man placed within it, I am sure you will obtain a series of measures reconciling human stature (man-with-arm-upraised) and mathematics. . .” (Le Corbusier, 1954, p. 37)

The sequence in figure 4.4 explains how Hanning solved the problem. First he drew a square and extended one of the sides with the length corresponding to the golden ratio of it. He then drew a line from the end of this extension until the midpoint of the opposite side, and built a right triangle, which is showed in

the last image on the right hand side of figure 4.4. This became the *modulor* (see figure 4.5), which Le Corbusier defined as “a measure based on mathematics and the human scale: it is constituted of a double series of numbers, the red series and the blue.”



(a) A square. (b) Its golden section. (c) The right angle. (d) The *modulor*.

Figure 4.4: Procedure taken by Hanning to obtain what Le Corbusier explained in words, i.e., the *modulor*.

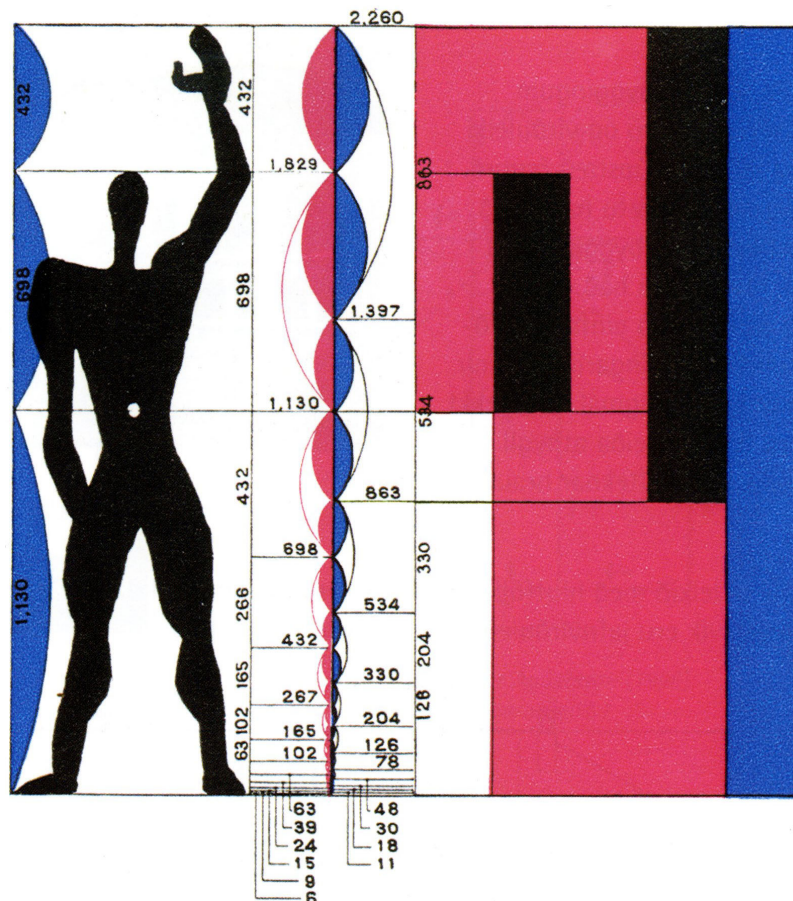


Figure 4.5: The *modulor*, the red and blue series, and the golden rectangle (Bjarnadóttir, 2006, p. 7).

The values for the different heights changed: it resulted more convenient

Red cm	Blue cm
⋮	⋮
16.5	33.0
26.7	53.4
43.2	86.3
69.8	139.7
113.0	226.0
182.9	365.8
⋮	⋮

Table 4.2: Some *modulor*'s values from the red and blue series.

to have 2.26 m since it is better transformed to inches (= 89 in). The *law of the modulor*, as Le Corbusier called it, was to determine the best measures for all manufactured objects as they “apply to measures very close to the human stature.” (Le Corbusier, 1954, p. 60) Based on this the red and blue series were developed. Both are particular cases of the Fibonacci number series, as defined above (see table 4.2). Moreover,  $\frac{a_{n+1}}{a_n} = \varphi, \forall n = 1, 2, 3, \dots$ , which is the result of taking the *golden sections* of the *golden rectangles* as the elements of the series.

Le Corbusier used the *modulor* and both series to create a measuring tape that he always carried with him; he intended to build a new metric system that would refashion architecture. The unity was the *modulor* and represented a person, who has a room (of height 2.26 cm), which is part of a house or flat, which belongs to a complex where more people live and where these people can find places to interact with each other. This was the ground basis for his *Unité d'habitations*; inside the complexes there are even kindergardens, shops and banks. Inside each flat, the stair's height would be 12.6 cm, sofas are 33 cm high, chairs 43.2 cm, tables 69.8 cm, the height in working surfaces in the kitchen 86.3 cm, the balcony fence's height would be 113 cm, shelves 139.7 cm, etc. Clearly, by standardizing all measures, architecture would have become, in deed, much more simple and functional.<sup>5</sup>

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<sup>5</sup>In May 2009 I had the opportunity to visit one of Le Corbusier's *Unité d'habitation* in Firminy, France.

### 4.3 Albrecht Dürer and *die menschliche Proportion*

The first theoretician from Northern Europe who tried to solve the problem of distinguishing between true and beautiful human proportions with graphics was Albrecht Dürer (Nuremberg, 1471-1528), a painter and a printmaker. Dürer's aim was to determine the "beauty" of mankind with the means of mathematics. He was fascinated by this latter and was convinced that mathematics was the tool to use in teaching how to perform constructions (Andersen, 2007).

The *Vitruvian Man* from Leonardo da Vinci (see figure 4.3) was his starting point; it is possible that the measuring methods used in Italy were borrowed by Dürer to systematize the coordinates procedure.<sup>6</sup> The studies started during the first years of the sixteenth century, and in 1528 Dürer's book "*Hierin sind begriffen vier Bücher von menschlicher Proportion*" was published (Dürer von Nürnberg, 1528).<sup>7</sup> His problem consisted in determining and establishing the lengths and widths in all, to him, relevant parts of the body. This problem of shape consisted of differentiating three aspects, the true shape, the beautiful shape and the architecture of the shape (Steck, 1969, p. 23). Dürer was convinced that he was not able to fulfill the optical beauty without mathematical laws.

This approach illustrates a difference between the Italian and Northern Theories; while the first searched for what was standard in people and from this derived regularity, beauty and proportionality, the latter first established regularity as the composition model for beauty, where the beautiful human form was required to fit in. Nonetheless, he managed to unify in his book both concepts of proportion, the North and the South European (Giesen, 1930, pp. 53ff.).

The most important axiom used by Dürer was: "*every form/shape is a mathematical form/shape.*"<sup>8</sup> Clearly, subjectivity plays an important role within the decision of the true form, and for every artist, from the antiquity until the renaissance, beauty and truth have been completely and directly related to shape. Under this aspect, beauty could be objectifiable as long as it is explained through the means of mathematics (Steck, 1969, p. 40). According to Dürer, human beauty

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<sup>6</sup>"*Nach der Auffassung, die wir bei den Italienern in den beiden vorigen Kapiteln als eine additionell objektive Vermessungsmethode hingestellt haben, könnte dies arithmetische Koordinatenverfahren aus Italien entlehnt und durch Dürer systematisiert sein.*" (Giesen, 1930, p. 39)

<sup>7</sup>The book of Trost includes some translations of Dürer's tables for human proportions (Trost, 1859).

<sup>8</sup>"*Alle Gestalt ist mathematische Gestalt.*" (Steck, 1969, p. 36)

was prone to change in time, but its value should oscillate about the same midpoint, which remains essentially constant. This midpoint should be the *golden ratio*  $\varphi$ , which is the idealized human beauty.<sup>9</sup>

In Figure 4.6 there are different points placed in specific places of the human body: these were used by Dürer to compute his measures and proportions. Most of these values are presented in table 4.3. (Trost, 1859) It becomes now much more visible how precise, accurate and serious Dürer was about building up these standard measures. The numbers I, II and III in table 4.3 represent different builds and, with the help of the columns for width and profile measures, we can see that number I represents what could be an overweight body and number III would be a rather slim person. The height of the person is given by 600; this does not mean that it is always the same, but rather that Dürer built a relation between the person's actual height and the number 600 to ease calculations.

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<sup>9</sup>“*Das Schönheitsideal ist in den Zeiten variabel. Aber die ihm zugrunde liegende Sehform pendelt um eine Mitte, um einen Kern, der als Kennniszeichen der Sehform im wesentlichen konstant ist.*” (Steck, 1969, p. 42)

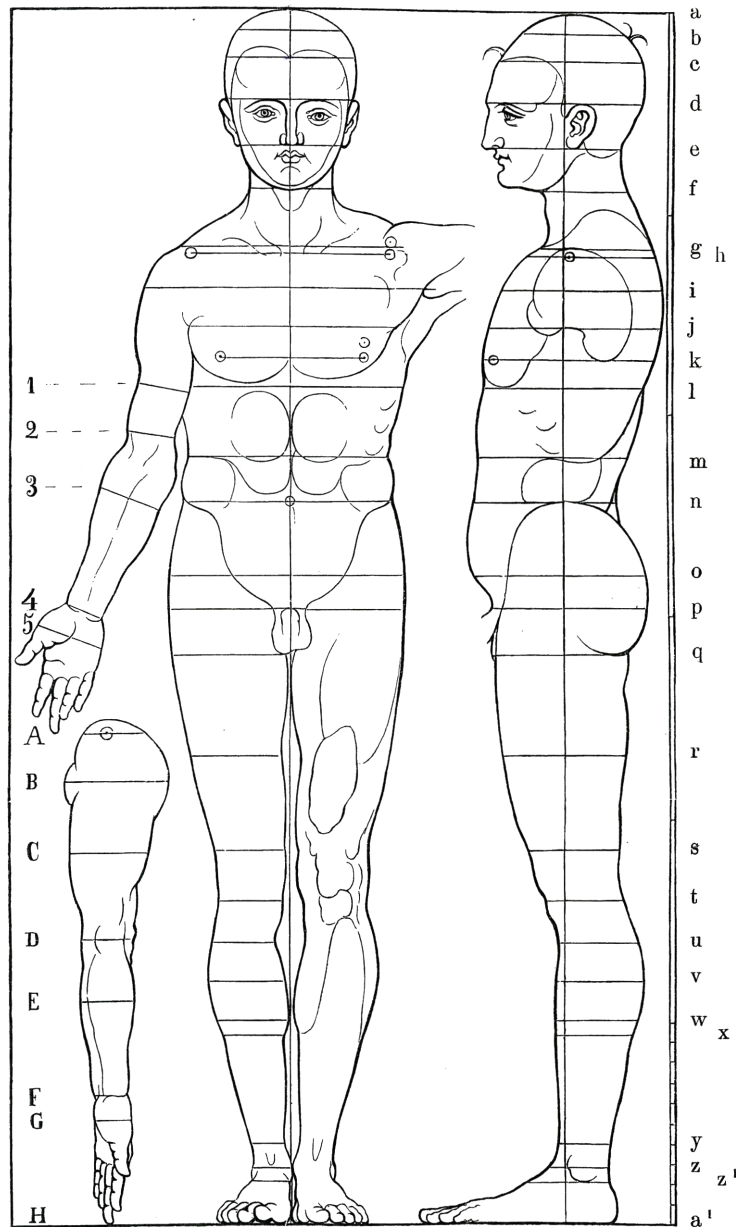


Figure 4.6: Man seen from the front and profile with the respective points and lines measured by Dürer. (Trost, 1859, p.I.)

The ratio between the height and the navel's height in the *Vitruvian Man* satisfies the *golden section*. This is what Dürer used as his starting point, hence it should be possible to obtain approximately the same value  $\varphi$ , when we compare the measures that he established. We need to compare  $aa'$ , which represents the height, with the navel height, which is not given but can be computed by  $ta' + qt + mq - mn$ , as these values appear in table 4.3. If we consider, for example, Man I in Table 4.3 we have

$$aa' = 600$$

$$ta' + qt + mq - mn = 159 + 110 + 110 - 15 = 364$$

	Length Measures						Width Measures				Profile Measures			
	Man			Woman			Man		Woman		Man		Woman	
	I	II	III	I	II	III	I	II	I	II	III	II		
<i>ab</i>	5	10	10	8	10	6	<i>b</i>	55	48	<i>b</i>	52	46		
<i>ac</i>	16	22	22	16	24	24	<i>c</i>	72	65	<i>c</i>	70	71		
<i>af</i>	85	86	84	83	86	84	<i>d</i>	73	60	<i>d</i>	75	72		
<i>ag</i>	106	114	115	114	120	110	<i>e</i>	60	49	<i>e</i>	70	65		
<i>gj</i>	50	40	35	44	34	28	<i>f</i>	43	38	<i>f</i>	50	40		
<i>gk</i>	64	58	50	67	60	45	<i>h</i>	124	93	<i>h</i>	50	55		
<i>gm</i>	115	107	100	125	116	107	<i>i</i>	180	139	<i>i</i>	70	70		
<i>mn</i>	15	22	23	16	19	26	<i>j</i>	123	90	<i>j</i>	79	80		
<i>mo</i>	67	60	75	56	63	62	<i>k</i>	82	74	<i>k</i>	85	82		
<i>mp</i>	80	77	85	90	91	84	<i>m</i>	114	93	<i>m</i>	73	64		
<i>mq</i>	110	98	110	111	110	105	<i>n</i>	127	126	<i>n</i>	67	80		
<i>qr</i>	45	50	32	36	27	45	<i>o</i>	146	140	<i>o</i>	84	104		
<i>qs</i>	80	97	74	72	77	90	<i>p</i>	145	138	<i>p</i>	76	90		
<i>qt</i>	110	121	105	95	101	116	<i>q</i>	67	67	<i>q</i>	61	72		
<i>tu</i>	16	19	16	20	20	19	<i>r</i>	60	62	<i>r</i>	61	71		
<i>tw</i>	60	59	68	64	63	64	<i>t</i>	44	40	<i>t</i>	38	41		
<i>tx</i>	72	66	77		74	73	<i>u</i>	40	38	<i>u</i>	37	40		
<i>tz</i>	126	133	146	126	127	133	<i>v</i>	50	40	<i>v</i>	44	44		
<i>tz'</i>	140	143	154	136	135	142	<i>w</i>	47	35	<i>w</i>	40	40		
<i>ta'</i>	159	160	170	155	153	162	<i>y</i>	22	17	<i>y</i>	25	25		
<i>aa'</i>	600	600	600	600	600	600	<i>z'</i>	24	18	<i>z'</i>	49	44		

Table 4.3: Part of a synthesis of Dürer's tables illustrated in (Trost, 1859, p. 18).

$$\frac{aa'}{ta' + qt + mq - mn} = \frac{600}{364} = 1.64835$$

which is a good approximation of  $\varphi$ , considering that there is an oscillation interval.

## 4.4 Comparison of Dürer's *proportions* and Le Corbusier's *modulor*

As seen above, Albrecht Dürer used a different numerical system to set the human proportions. For example, the height of a person was always given by

600. Table 4.4 shows us the respective values of Dürer’s proportions, in the case of a man and a woman, and those of Le Corbusier, who had them independent of gender.<sup>10</sup>

	Le Corbusier	Albrecht Dürer			Albrecht Dürer		
		male			female		
Body Height	182.808	600	600	600	600	600	600
Navel Height	112.9779	364	357	362	345	345	357
Navel upper Height	69.8301	236	243	238	255	255	243
Knee Height	43.1528	159	160	170	155	153	162
Knee upper Height	69.8250	205	197	192	190	192	195

Table 4.4: Body sizes with respect to navel given by Le Corbusier and A. Dürer.

Let us define  $BH :=$  Body Height,  $NH :=$  Navel Height,  $NH' :=$  Navel upper Height,  $KH :=$  Knee Height and  $KH' :=$  Knee upper Height. Table 4.5 presents the relations between these proportions.

	Le Corbusier	Albrecht Dürer					
$\frac{NH}{BH}$	0.61801	$0.60\bar{6}$	0.595	$0.60\bar{3}$	0.575	0.575	0.595
$\frac{NH'}{NH}$	0.61809	0.6484	0.6807	0.6574	0.7391	0.7391	0.6807
$\frac{KH}{KH'}$	0.61801	0.7756	0.8122	0.8854	0.8158	0.7969	0.8308
$\frac{KH'}{NH}$	0.61804	0.5632	0.5518	0.5304	0.5507	0.5565	0.5462

Table 4.5: Respective proportions obtained using Table 4.4.

We know that Le Corbusier’s *modulor* satisfies the golden section since it was built from the golden rectangle, and therefore we obtain  $1 - \varphi$  in its respective column of table 4.5. On the contrary, the values from Dürer’s measures oscillate between 0.53 and 0.88. These results show Dürer’s intention of not creating an idealized beauty of the human body and yet remaining within a certain interval about it.

## 4.5 Facial features and the *golden ratio*

Already in ca. 1500 and with an astonishing precision, Leonardo da Vinci had written more than eight hundred words describing only the different proportion

<sup>10</sup>The values of table 4.4 were computed based on the data given in (Tabelle A, Trost, 1859, p. 18).

relations of the face. But he was not the first, nor has he been the last artist interested in these computations (Atalay, 2004).

Robert Ricketts (1920-2003) was an American specialist in aesthetic and orthodontic surgery, who spent many studies on what he later patented as *golden divider*. In one of these studies, Ricketts conducts several measurements about the face on a number of female photographic models. In figure 4.7 we can observe the different points in the face used by Ricketts: the trichion  $T$  (the point identifying the hairline), the alar rim  $AL$  (the center of the curve on the outer edge of the nostril), the menton  $M$  (the lower border of the chin), the chilion  $CH$  (the lateral edge of the mouth), etc. (Atalay, 2004, p. 107, Figure 4.7 in p. 108).

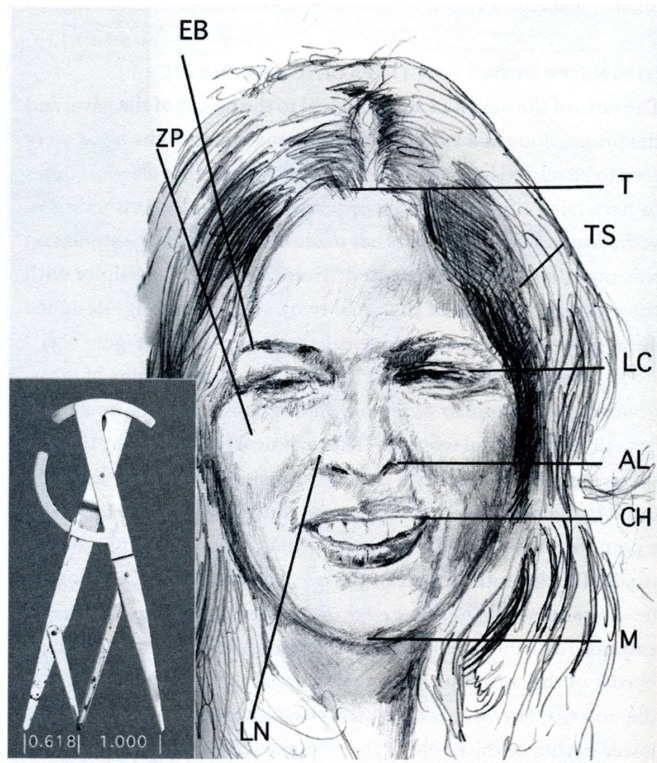


Figure 4.7: Sketch from Rochele Hirsch with Ricketts' points (Atalay, 2004, p. 108).

Ricketts obtained the following average results:

$$\begin{aligned} \overline{T - M} &= 144.3 \text{ mm}; & \overline{T - AL} &= 88.6 \text{ mm}; \\ \overline{AL - M} &= 54.5 \text{ mm}; & \overline{CH - M} &= 33.7 \text{ mm} \end{aligned}$$

It is interesting to note that the following ratio values approach very well to the *golden ratio*  $\varphi$ :

$$\frac{T - M}{T - AL} \simeq \frac{T - AL}{AL - M} \simeq \frac{AL - M}{CH - M} \simeq \varphi \quad (4.3)$$

## 4.6 *t*-test

Given a collection of data, the evaluation method for its analysis shall be accurate and enable the best exploitation of this data. The basic statistics of position and dispersion are given by the *mean* and the *variance*. The mean is the result of the sum of all given values  $x_i$  divided by the cardinality of the set and, the *variance* represents the average deviation between the variables  $x_i$  with their correspondent mean. If the value of the *variance* is low (resp. high), its dispersion is low (resp. high), i.e., the measurements are not (resp. are) spread from each other. (Brandt, 1998; Mosteller *et al.*, 1983)

$$\begin{aligned} \mathcal{A} &:= \{x_1, x_2, \dots, x_n\}; & \mathcal{A} \text{ is the set of data} \\ \bar{x} &:= \frac{\sum_{i=1}^n nx_i}{n}; & \bar{x} \text{ represents the mean} \\ \sigma &:= \frac{\sum_{i=1}^n n(\bar{x} - x_i)^2}{n}; & \sigma \text{ is the variance} \end{aligned} \quad (4.4)$$

What happens when we want to compare our data with a certain known hypothesis? That is, we have a collection of measurements and we want to know how accurate they are with respect to a preconceived value. These type of procedures are called *hypothesis testing*. In order to determine if a certain hypothesis (called the *null hypothesis*) is true or false we need to define the concept of *significance level*, since this is what can give an answer to our problem.

Suppose our *null hypothesis* is the value  $x_0$ ; if the probability of having our mean  $\bar{x}$  greater or equal than  $x_0$  is small enough, we can regard this occurrence to be improbable, i.e., its significance value is high and hence the hypothesis is rejected. Interestingly, the opposite does not give us any certainty, that is, if this probability cannot be bound by a very small number then we can only claim that our hypothesis “is not contradicted by the result of the sample.” (Brandt, 1998, p. 212) The test uses the following formulas:

$$\begin{aligned} t &= \frac{(\bar{x} - x_0)\sqrt{n}}{s_x} \\ s_x &= \frac{\sum_{i=1}^n (\bar{x} - x_i)^2}{n - 1}; & s_x \text{ is the sample standard deviation.} \end{aligned} \quad (4.5)$$

The value  $t$  represents the tolerance interval of our sample, that is, if the number obtained lies outside the interval given in table 4.6, we reject the null hypothesis. Table 4.6 shows the intervals in which our obtained value  $t$  would have no significance with either 90%, 95%, . . . of certainty. The first column in the left represents the degrees of freedom, which is defined by the total number of the

sample minus one ( $f = n - 1$ ), and the first row shows the different probabilities for each *significance level*.

$f$	90%	95%	97.5%	99%	99.5%	99.9%	99.95%
1	3.078	6.314	12.706	31.821	63.657	318.309	636.619
5	1.476	2.015	2.571	3.365	4.032	5.893	6.869
10	1.372	1.812	2.228	2.764	3.169	4.144	4.587
15	1.341	1.753	2.131	2.602	2.947	3.733	4.073
20	1.325	1.725	2.086	2.528	2.845	3.552	3.850
30	1.310	1.697	2.042	2.457	2.750	3.385	3.646
40	1.303	1.684	2.021	2.423	2.704	3.307	3.551
50	1.299	1.676	2.009	2.403	2.678	3.261	3.496
100	1.290	1.660	1.984	2.364	2.626	3.174	3.390
1000	1.282	1.646	1.962	2.330	2.581	3.098	3.300

Table 4.6:  $t$ -test values according to different probabilities and degrees of freedom (Brandt, 1998, p. 635).

How to interpret this table? Let us consider some examples:

1. Suppose we have our sample with 15 degrees of freedom. For a given hypothesis we obtain a  $t$ -value of  $t = 5.4$ . In the last column of row 15 we can see the range interval  $[-4.587, 4.587]$ . Our  $t$ -value is outside this range, which implies that we can reject our hypothesis with 99.95% of confidence. In this case, the significance level is very high.
2. If we suppose now that the result of our  $t$ -test is  $t = 1.6$ , then we can see that it lies outside the interval  $[-1.341, 1.341]$  but inside the following interval  $[-1.753, 1.753]$ . The decision we take for this case is completely subjective and it is due to the fact that we would like to have as much certainty as possible; the answer is then that we can reject the null hypothesis with 90% of confidence, but not higher. Though, if we would like to have a higher significance level we would not obtain further information on how our sample is behaving with respect to our given hypothesis.

# Chapter 5

## The Makonde Sculptors of Mozambique

*The objects of ethnomathematical study will always be mathematically unfamiliar - that is why we are interested in them.*

*(Willy Alangui & Bill Barton)*

### 5.1 Introduction

Mozambique is located in the southeast of Africa, between  $10^\circ$  and ca.  $25^\circ$  latitude, and ca.  $30^\circ$  and ca.  $40^\circ$  longitude, bordering with Swaziland and South Africa from the south, Zimbabwe, Zambia and Malawi from the west, Tanzania from the north and the Indian Ocean from the east. Until the arrival of Vasco da Gama in 1498, the land was inhabited by several Bantu groups who migrated from southwestern Africa; today, there are still over 20 ethnic groups living in Mozambique, but they are no longer as isolated as they were before. The Portuguese occupied, until the beginning of the twentieth century, just the coastal area of this country, having their most important settlements in Ilha de Moçambique, Angoche, Quelimane, Sofala, Chope and Tonga, all located between Beira and Nampula (see figure 5.1). Their main interest was the slave market and the export of gold and ivory. It was only after the Partition of Africa and the Wars of Resistance (ca. 1885-1913) that the colonization spread to the whole country, specially, to the inland (Isaacman & Isaacman, 1983; Henriksen, 1978).

By the end of the nineteenth century, the few education centers were provided by mission stations, mostly located in the south part of the country. After the complete occupation of the country, the Portuguese established their govern-



Figure 5.1: Map of Mozambique with its Provinces and Capitals.

ment and private schools in the urban centers; in the rural regions the missionary schools continued to develop. Unfortunately the educational system was vastly unequal: for the European children schooling was paralleled to that in Portugal, for the Mozambican children there existed the “education for adapting” which was called “rudimentary education” after 1956. Schools were divided into 4 years of primary instruction followed by the secondary technical or academic schools; for admission into this secondary school, children needed to pass a specific examination and only a few African students could reach this level, since their schooling was of poor caliber (Henriksen, 1978, pp. 143-148).

Mozambique is a very young country, like many others in Africa, and obtained its independence from Portugal on the 25th of June 1975 (the War of Independence started on the 25th of September 1964 in Chai, located in the Province of Cabo Delgado (see figure 5.1).<sup>1</sup> Since then, this country has been trying to catch up with other lusophone countries, particularly with respect to its political

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<sup>1</sup>Even though the War of Independence appears to have officially begun in 1964, it started much earlier and, due to this fact, there was a big massacre in Mueda, district of Cabo Delgado, on the 16th of June 1960 (Kacimi & Sulger, 2004).

stability and economical development. Before its independence, Mozambique was very isolated with respect to the rest of the world. In particular, technology is changing and developing every day, and the introduction of foreign technology produces a big perturbation in their own living habits and customs since the Mozambican people have not been able to accompany this process gradually.

Mozambican people usually call Africa to be their country and rarely use the name Mozambique. In my view, it is very important to highlight this fact since there are many cultures and ethnic groups, which sometimes have been divided by political borders, like the case of the Makonde people; these separations provoked different cultural changes on each side since they were being ruled and colonized by different countries. As a consequence, there are cultural differences within the Makonde. But, and above all this, Mozambicans come from Africa and live in Africa as they would say.

Between August and October 2008 I developed a field research in Maputo and Nampula (the capital of the Nampula province, having the particularity that it only borders with other Mozambican provinces (see figure 5.1). Because of this they have built the Military Academy here.). In Maputo, the capital located in the most southern province, I had the opportunity to meet important researchers in the area of ethnomathematics such as Paulus Gerdes, Marcos Cherinda and Abdulcarimo Ismael; during this first period I dedicated to collect relevant bibliographic sources and to learn from interesting and constructive discussions. I worked at the Informatics Center of the Pedagogical University (*Centro de Informática da Universidade Pedagógica*, CIUP) in the Lhanguene Campus and at the Center for Mozambican Studies and Ethnoscience of the Pedagogical University (*Centro de Estudos Moçambicanos e Etno-Ciências da Universidade Pedagógica*, CEMEC). In Nampula I undertook a fieldwork at the National Museum of Ethnology (*Museo de Etnologia*) of the University of Lúrio, where many Makonde sculptors are active and have a space to work and sell their pieces.

This chapter describes how the investigation has been pursued, starting with a description of the historical background, continuing with the hypotheses and finally presenting the collected data and their respective results, analyses, conclusions and limitations.

## 5.2 About the Makonde and their history

The Makonde Plateau is located between southern Tanzania and the most northern part of Mozambique. It is divided by the Rovuma river, which also constitutes the border between these two countries. The Makonde Plateau in Mozambique is located between the River Rovuma to the north, the River Lugenda to the west, the River Lúrio to the south, and the Indian Ocean to the east (see figure 5.2). Its biggest city is Mueda. According to oral tradition, the Makonde people arrived at this region about three centuries ago, when they were escaping the drought and tribal wars in the south of Niassa Lake. Unfortunately, there exists few documentation about the migration in Africa three to four hundred years ago; what can be affirmed is that migration had lasted until after colonization (Fouquer, 1972).

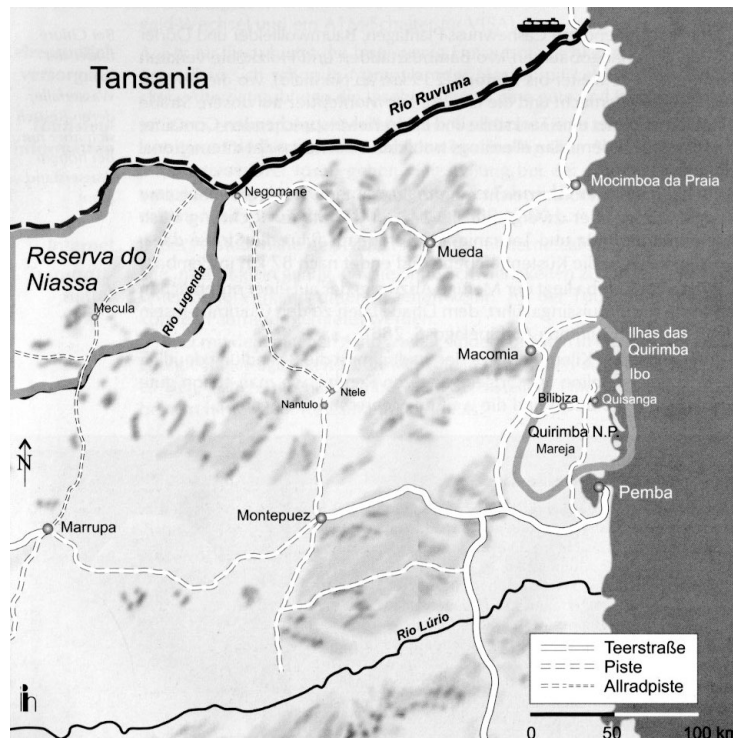


Figure 5.2: Map of Mueda's Plateau (picture scanned from Hupe & Vachal, 2008, p. 280).

According to their legends, the Makonde people prefer to live in plateaus without water and the women need to walk between five and twenty kilometers to collect it from a well and carry the clay jugs on their heads.<sup>2</sup> In their language, the

<sup>2</sup>According to one of the legends explaining the origin of Makonde people, they are forbidden to live near the waters, since there lies disease and death:

“[...] Daraufhin gingen sie [der Mensch und sein Weib] zusammen hinab zu den Wassern des Ruvuma, um sich zu waschen. Hier gebar das Weib ein Kind, welches jedoch nicht lebend zur Welt kam. Sie verliessen das Land und zogen über die Hochländer bis in das Tal des Mbemkurru,

word *makonde* (plural of *likonde*) stands for “fertile soil without water;” Makonde not only describes a geographic region, but also a person who carries this specific culture (Kacimi & Sulger, 2004).

The Makonde people have a cultural concept of nationality and not a racial concept or a concept of blood. As stated above, a person who carries the Makonde culture is Makonde; moreover, when a Makonde man marries a woman from another ethnic group, she will certainly become Makonde.<sup>3</sup> Inside, the Makonde’s society is matrilinear, i. e., the descendancy is uterine and, in this case, the leader of the family is usually an uncle, a brother or the eldest nephew of the mother. Nowadays, this is justified by the fact that Makonde fathers have the necessity to leave their family in search of a job; in Mozambique they usually go to the copper mines in Zambia and Transvaal.<sup>4</sup> Fouquer defines the Makonde as an old “decadent” form of society, in the sense that they have abandoned or lost their traditions and morals.<sup>5</sup> By considering this fact, the following question comes to light: to what extent can their present traditions be considered as traditions? For example, Kacimi & Sulger mentioned the puberty ritual as their most important ceremony (Kacimi & Sulger, 2004), but how old is this tradition? Where did it come from? How was it influenced, affected or even changed by the situation at certain times?. We shall return to these questions in the Analysis section, where

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*wo sie sich niederliessen. Dort gebar das Weib abermals ein Kind, das wiederum tot zur Welt kam. Daraufhin kehrten sie in die hochgelegene Buschlandschaft Mahuta zurück und dort wurde das dritte Kind geboren, welches nach der Geburt lebend und gesund blieb.”* (Adams, 1902, p. 41)  
“[...] [Der Stammvater, der Buschmensch] warnte seine Kinder, in die Täler und an die grossen Wasser zu ziehen, denn dort wohne die Krankheit und der Tod. Als Regel solle gelten, dass mindestens eine Stunde Weges sei von der Hütte bis zum Wasserplatze, [...]” (Adams, 1902, p. 42)

<sup>3</sup>Jorge Dias mentions that, for Makonde men it is a permanent concern the desire of having many women as he writes below:

*“Macondes olham para Macuas com sobrançeria, como povo que nunca temeram e que serviu de pasto às suas razias e incursões, para apanhar escravos. Tanto o desejo de ter muitas mulheres, que é uma preocupação dominante dos Macondes, como a necessidade de fazer escravos, para satisfazer as penas impostas em casos de crime de morte, em que era necessário dar um indivíduo em troca do morto, obrigavam a incursões em território macua.”* (Dias, 1964, pp. 79-80)

<sup>4</sup>in the case of the Tanzanian Makonde men, they usually go to Coconut Farms and Sisal Fields on the coast side.

<sup>5</sup>*“Statt ihnen [Afrikanische Gesellschaften] „primitive Haltungen“ zuzuschreiben, eine Formel, die Boris de Rackewitz prägte und dann selbst ablehnte, sollten wir vielleicht besser sagen, sie seien „entartete“ Formen sehr alter Gesellschaften, insoweit sie ihre Überlieferungen und sitten aufgaben oder verloren.”* (Fouquer, 1972, p. 37)

I'll present some possible answers.

Although some books have tried and described the characteristic Makonde physiognomy, the main characteristics were easily recognizable: mostly women, sometimes men as well, were tattooed in their face and some parts of the body, they had piercings in their upper lip, and they were used to sharpen their teeth (see figure 5.3).<sup>6</sup> These characteristics were used, on the one hand to make evident their ethnic roots and, on the other hand, to represent virtues; in the case of the tattoos they were said to have a symbolic value and the lip-piercing was considered as jewelry and also to have magical virtues (Fouquer, 1972, pp. 11 ff.). This was carried out until 1975, when the first independent government of Mozambique banned the practice of *scarification* (Kacimi & Sulger, 2004).<sup>7</sup>



Figure 5.3: Two Makonde women that were tattooed and pierced in their puberty (pictures taken by Martins Bernardo in 2008).

The Rovuma River became the border between two countries, Tanzania and Mozambique and with it, the Makonde people were also divided. As a cause of

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<sup>6</sup>Fouquer is very pejorative with respect to the way Makonde people used to characterize themselves:

“*Dieses Volk von Künstlern, Tänzern und Schöpfern von wunderbaren Formen erfand verschiedene Wege, sich häßlich zu machen: zugefeilte Zähne, um den Ruf des Kannibalismus zu bestätigen, Lippenpflocke, getragen von Frauen (früher auch von Männern), Tätowierungen, die Gesicht und Oberkörper bedeckten; [...]*” (Fouquer, 1972, p. 7)

Further on he no longer uses the word tattoo, but instead refers to it as scars:

“*Die Tätowierungen oder besser gesagt die Narben, welche Gesicht [...]*” (Fouquer, 1972, p. 11)

<sup>7</sup>The term scarification is the exact translation of the Portuguese word *escarificação* and its meaning is: “to make small cuts on an area of skin with a sharp knife.” (Longman Dict., 1993)

this division, they were exposed, affected and influenced, in different manners, by their respective colonizing countries. Moreover, development in the sense of building schools, hospitals and missions arrived much earlier in the Tanzanian territory, which had Germany as its first colonial power, causing differences in, e.g., initiation rituals and esthetical transmissions (Fouquer, 1972). The Mozambican Makonde people were, for longer time, faraway, and thus isolated, of the colonizing influences; hence, they were able to keep their traditions closer. It was only after the 1930's when the Portuguese arrived at the Mueda's Plateau;<sup>8</sup> after this they were converted to christianity by Dutch Montfort fathers.<sup>9</sup> Furthermore, Portugal, as a colonial power, is said to have developed its colonies less than the other colonial powers.

### 5.3 The Makonde and the Ebony Wood

The Makonde people believe in the divinity of their ancestors and they should be buried vertically after they die, in memory of their first mother, who came to life standing.<sup>10</sup> According to this legend, she originated from wood;<sup>11</sup> interestingly, about the years 1964 and 1970, Makonde men preferred to carve female sculptures.

Adams had already mentioned in his book that the Makonde people occupied

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<sup>8</sup>It is interesting to remark that there is a disagreement when it comes to determine the time when the Portuguese arrived at the Mueda Plateau. In fact, Kacimi & Sulger indicate the First World War, leading to question if there is a relationship between the existing War in Europe and the invasion towards inland in Mozambique. Based on my notes and interviews and on the book of Margot Dias, the Portuguese arrived on the date referred in the text (cf. appendix B and Dias, 1973).

<sup>9</sup>The Montfort Missionaries are a catholic community of priests and brothers that was founded in 1716 by St. Louis de Montfort (for more information on its doctrines, see Raja Rao, 2005).

<sup>10</sup>“*Der Stammvater, der Buschmensch, gab seinen Kindern das Gesetz, dass sie ihre Toten aufrecht begraben sollen zum Andenken an die erste Mutter, die aus Holz geschnitzt und aufrecht stehend zum Leben erwacht sei; [...]*” (Adams, 1902, p. 42)

<sup>11</sup>“*[...] Ihre Geburtslandschaft, Mahuta geheissen, sei auf der Südseite des Plateaus zum Ruvuma hin gelegen und nur mit dichtem Busch bestanden gewesen. Aus diesem Busche sei ein Mensch hervorgegangen, der sich niemals wusch und schor, der nur wenig ass und trank. Dieser ging aus und machte ein Menschenbildnis aus dem Holze eines Savannenbaumes, nahm es mit sich in seine Buschwohnung und stellte es dort aufrecht hin. Während der Nacht erwachte das Bildnis zum Leben und es war ein Weib.*” (Adams, 1902, p. 41)

“*Aus Holz kam durch den Mann ihre erste Mutter, und die Generationen lebten mit ihm.*” (Fouquer, 1972, p. 27)

themselves with the production of different wood carving pieces such as chairs, wood masks and walking-sticks. They exchanged these pieces for clay jars and pots from the neighbors, but some feminine figures could often be found in their own huts.<sup>12</sup> To Fouquer, sculptors were trained with the art of speculation, abstraction and synthesis.<sup>13</sup>

In contrast to the interpretations made above, Kacimi & Sulger and Margot Dias had pointed out that Makonde men needed to earn money, and this provoked a leaving aside of their creativity, since they have to produce as many pieces as possible, those that are strongly demanded.<sup>14</sup> The greatest stimulus in producing sculptures for trading started around the 1930's, with the arrival of Portuguese and missionaries at the Mueda's Plateau; they began to order different pieces, from religious until political "eminences,"<sup>15</sup> to the Makonde people. This can be seen as an introduction of the classical European style into their traditional one; in the present days one may find a large amount of nativity sets during the Christmas season. The pieces used to be carved with a soft wood and in order to make them more valuable or expensive, the sculptors started to use *pau-preto* (ebony wood,

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<sup>12</sup>To Adams, the wood carving occupation was naturally considered to be rather spiritual and not simply functional:

"[...] beschäftigen sich die Makonde auch mit Holzschnitzerei in Stühlen, Spazierstöcken, Handgriffen, Tabakdosen, Holzmasken und Bildnissen, höchst wahrscheinlich eine angeerbte Kunstfertigkeit ihres Stammvaters. Sie benutzen hierzu das feste dunkle Ebenholz [...] Die Erzeugnisse ihrer Kunst tauschen sie gegen Töpferarbeiten der in den lehmigen Niederungen wohnenden Nachbarn um. Sehr häufig findet man Holzbildnisse einer weiblichen Gestalt in ihren Hütten stehen und man ist geneigt, dieselben für eine Art Hauspenaten oder Götzenbilder zu halten; doch dienen dieselben allem Anschein nach nur zur Erinnerung an die Erschaffung ihrer ersten Mutter, wie die Sage verkündet." (Adams, 1902, p. 44)

<sup>13</sup>It should be remembered that both authors, Adams and Fouquer, were priests who had spent time in Mozambique working in the missions for the evangelization of the people, and they hence searched for spiritual meanings when they referred to the art of wood carving.

"Man muß die leitenden Gefühle des Bildhauers verstehen. Er hat das lebende und heilige Material gewählt, für ihn ist es Kommunikationsmittel mit anderen und vor allem mit den Vorfahren und der unsichtbaren Welt." (Fouquer, 1972, p. 28)

Even though the author sometimes refers to the Makonde people as a lower culture, he is able to acknowledge their ability of developing art, particularly because it enables men to connect with the *world of God*.

<sup>14</sup>"[...] camponeses que obtêm o seu ganha-pão com pequenas obras vendidas aos turistas. Com esse tipo de obras, os makondes mostram a sua renomada habilidade no ofício mas reprimem, muitas vezes, sua criatividade artística." (Kacimi & Sulger, 2004, pp. 10-11)

<sup>15</sup>Some examples of "eminences" were Jesus and the former Portuguese dictator António de Oliveira Salazar.

*Diospyros ebenum*) and *pau-rosa* (*Swartzia spp.*). With the increase of tourism in Africa, in the 1960's, there was also an increase in the sculpture's price and, as a consequence, an increase in the number of sculptors which, unfortunately as Margot Dias describes, brought a decrease in the quality of their pieces.<sup>16</sup>

There exist only Makonde men developing the art of carving; women have too many obligations such as household, taking care of children and pottery, leaving no time for other activities. According to the studies made by Breutz, sculptures had mainly a religious purpose and these are not the concern of women (Breutz, 1971, p. 154). As Raum expressed: "women, who since paleolithic times form one of the most common subjects of art, only rarely create art objects." (Raum, 1966, p. 6)

The Makonde sculptors have learned sculpting from their masters, usually an elder person, e.g., uncle or brother-in-law, who had instructed them in this art. As apprentices, they start learning and practicing mostly with busts and therefore it is quite easy to find some that are not well done (Kacimi & Sulger, 2004). Masters commonly teach one type of sculpture and, while the apprentice is trying to reproduce it, he continues with showing further techniques such as, e.g., resizing the arms of a woman. Once the apprentice is ready to go on his own, he becomes independent of his master and can produce or even create whatever his imagination allows.<sup>17</sup> He will then be acknowledged as a master by his community.

Some sculptors would keep producing only the type of sculpture they have learned, others will become autodidactic and teach themselves how to create other types and, furthermore, how to create new styles and hence develop new techniques. Faces and expressions are the most complicated to carve and, therefore, represent a proof of experience and highest qualification. In view of Kacimi & Sulger, there exists a similarity between Makonde sculptures and some paintings of Hieronymus Bosch and Pieter Brueghel, which were renaissanceist painters, in the sense that both have created grotesque human representations as well as human-animal forms; they also described the first as "geometrical figures" which is nearly the first bibliographic evidence on the use or interpretation of mathe-

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<sup>16</sup> "[...] *corresponderam os artistas com a fabricação de peças dos mesmos motivos que tiveram mais venda, em séries duplicadas e, naturalmente, cada vez mais mal trabalhadas. O negociante encomendava o que lhe dava mais lucro.*" (Dias, 1973, pp. 23-24)

<sup>17</sup> I must say that it is not common to see new creations nowadays, and this situation has been the same for some years, as Margot Dias explained: "A difusão é muito mais frequente do que a inovação, ao contrário do que geralmente se julga." (Dias, 1973, p. 15)

mathematical knowledge in the art of carving.<sup>18</sup>

The different types of sculptures found in the market are described in the two following sections.

### 5.3.1 Ujamaa

As we see in figures 5.4, these types of sculptures consist of carving the wood in such a way that keeps the column shape of the bole. The *ujamaa* is a human tower where not only men and women are climbing one another, but also children. Each person has a determined task or role to fulfill in her or his community, that, in this case, is the one consisting of all people in this human tower.

The concept of *ujamaa* used by the sculptors is inspired in the visions of Julius Nyerere (Tanzania's first president), who attempted to create a new type of village, where solidarity was to become the foundation of the new African society (Kacimi & Sulger, 2004, p. 24); it encloses familiar organization, ancestry, community consciousness, and the concept of an "African socialist" society.<sup>19</sup> The word *jamaa* comes from the Swahili and means family or familiar sense. There are two hypotheses, given by Margot Dias, on how this style arose:

- 1) as a transformation of the elephant's tooth that existed in other regions of Africa (e.g. Benin, Congo) and was brought to Makonde people by Europeans who had ordered them or,
- 2) as an intuition or simply by messing around with the bole and experimenting the possible outcomes. There exist more examples of such a similar construct in Cameroon, the Indians from North America and even Naïve Art was developed in this way. (Dias, 1973)

According to Kacimi & Sulger, the bole is carved from the bottom to the top;<sup>20</sup> according to my observations the *ujamaa* is started from the top and goes down, as a spiral, to the bottom or basis of the bole. There are two types of *ujamaa* sculptures:

compact: *imongo* is a Makonde term that stands for strength, energy and vigor, and it could be used to refer to this type of pieces. In this case, the surface of the bole is carved on the outside, in highrelief, preserving the annulus

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<sup>18</sup>“[...] *desenhos geométricos* [...]” (Kacimi & Sulger, 2004, p. 30)

<sup>19</sup>“[...] *igualdade (relativa) e aproveitamento comum dos bens* [...]” (Dias, 1973, p. 11)

<sup>20</sup>“*O escultor trabalha o Ujamaa de baixo pra cima.*” (Kacimi & Sulger, 2004, p. 53)



Figure 5.4: The left picture shows a compact *ujamaa* (picture taken from Kammerer-Grothaus, 1991, p. 72). The two following images to the right correspond to non-compact *ujamaa*, the most popular nowadays (2008).

of the branch compact and covered, as the central axis of the group. This style is called by the sculptors *ujamaa in relief*.

non-compact: in this case, the bole column is opened and uncovered. The figures must be carved in all angles since there is no main branch, but an *air*

*column*.<sup>21</sup> This style is called *perforated ujamaa* by the sculptors.

### 5.3.2 Shetani

These sculptures consist of grotesque human representations and human-animal forms (see figure 5.5), as already mentioned above. This has also been considered to be Modern Makonde Art by many authors, such as Kacimi & Sulger and Stout, it is the Makonde Art that appeared after the 1960's (Kacimi & Sulger, 2004; Stout, 1966).

The term *mashatani*, plural of *shetani*, refers to the various spirits of the Makonde cosmogony. The origin of this word (commonly translated as Satan or devil) came from the Hebrew and was adopted in the Ethiopian language; it later went to the Arabs and the Koran, and was finally adapted to the Swahili language. For the Mozambican Makonde people there exists no mythological figure representing Satan, but they believe in spirits of the dead, bad spirits and the spirits of animals.<sup>22</sup> The spirit of an anonymous dead person is called *mahoka*, the spirits of good dead people are called *machinamu* (*lichinamu* is the singular form) and the bad spirits are called *machatwani* (*lichatwani* is the singular form). Interestingly, the word *lichinamu* is also used to refer to “wood statuette.” Based on this, Margot Dias expressed her conviction that Makonde sculptures had emerged from the need of having visible images to make cults to their forefathers (Dias, 1973, p. 18). As already stated, the Mozambican Makonde people remained isolated until the 1930's and this can explain why they have no christian concept of Satan.

According to Mr. Mohammed Peera, a salesman, the *shetani* appeared in the year 1953 when Samaki, a sculptor from Mueda's District in Mozambique, brought a sculpture with very interesting shapes; it was also then, when they have started to use the tree bark to create different effects:

“[...] one of the earliest pieces I remember in this genre was a mutilated face of a spirit holding a telephone. I remarked to the artist that a Makonde figure with a telephone did not look right. The artist said he would not make such a piece again, but was clearly very angry.” (cit. Mohammed Peera, quoted from Dias, 1973, p. 26)

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<sup>21</sup>The precise word used in the text is *Luftsäule* (Grohs, 1971, p. 285).

<sup>22</sup>As Margot Dias describes, the forest's demons receive a different name, depending on the region in High Zambezi: e.g. *Sikulukobuzuka* in Subiya, *Muendandjangoli* in Luyi, *Kaendikamo* in Mbunda, *Chiruwi* in Nyanja and *Chitowe* in Yao (Dias, 1973, p. 19).



Figure 5.5: Two different *shetani* sculptures (Kammerer-Grothaus, 1991, pp. 71; 77).

The *shetani* pieces are fantastic, grotesque, unreal and surreal; they have been produced with an infinite freedom and originality. According to Stout, it was the use of hallucinogen drugs which enabled the sculptors to produce this type of images (Dias, 1973, cit. Anthony Stout, quoted from). But this does not make sense since the pipes appearing in the sculptures are of the narghile type,<sup>23</sup> and are smoked with tobacco. The Makonde people commonly consume alcoholic drinks to obtain an euphoria and drunkenness state.<sup>24</sup> It is difficult to give a precise reason of why sculptors had started to develop this new type of carving but, as Margot Dias stated, it has probably to do with the effect that such pieces caused among tourists, the most important buyers of wood sculptures.<sup>25</sup>

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<sup>23</sup>Narghile is a Persian word used in many languages to define a water pipe. It can be smoked with tobacco or herbal fruits

<sup>24</sup>By the end of my stay in Nampula, I was invited by Martins Bernardo to spend some time with Makonde women from his neighborhood. They drank *cabanga*, which is a fermentation of cornmeal, sugar and water.

<sup>25</sup>“*Através dos cuidados nas entrevistas de Elisabeth Grohs com os escultores, também podemos ver que ela conhece o perigo (a própria experiência na investigação no campo nos mostrou isso muitas vezes) que, com poucas palavras de alguém, ou com uma pergunta sugestiva, os Africanos percebem o que se gostava de ouvir e apanham imediatamente a idéia para contar as*

She also defined this new style to be “Makonde Modern Art,” and it must have arrived, due to colonizing influence, earlier in Tanzania than in Mozambique.

### 5.3.3 Sculpture in relief

This type of sculpture is also called *sculpture in high relief* since, what remains from the bole is its center. This style contains busts, human and animal shapes. The first is, as already stated, the starting point for an apprentice who wants to become a master and, moreover, I would say it is what they can do best.<sup>26</sup>

Among the most popular pieces we have women (see figure 5.6) which are either carved as bust (including the breasts), or they are standing carrying their baby, and sometimes accompanied by their children; Maasai figures, inspired in this ethnic group, who dress and hold their hair in a very special way (see figure 5.7, left); and Ethiopian persons that, according to the sculptors, represent the personification of hunger (see figure 5.7, right). It was fascinating to have noticed that, between November and December there is a large number of christian images, in particular, nativity sets that are especially produced with *pau-rosa*.<sup>27</sup>

The sculptures in high relief are considered to belong to “Pre-Modern Makonde Art” and, according to Margot Dias, they belong to the period before tourists and salesmen had started to show interest in the *ujamaa* and *shetani* styles (Dias, 1973). The most impressive examples of *sculptures in high relief* are the 2 figures in the portico of the Museum of Ethnology in Nampula; these 2 were made by two Makonde sculptors, but the original design was conceived in 1958 by the Portuguese architect Mário de Oliveira. This opens the question of whether such demonstration did not influence and motivate the Makonde carvers to start producing more of these pieces; the interest of the architect could have led the sculptors to generalize the interest of European people, in particular tourists, at that time.

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*histórias desejadas. Elisabeth Grohs foi muito cuidadosa e persistente em esclarecer este ponto e recebeu algumas confissões de escultores que são de grande interesse: «Todos acederam que não esculpem espíritos porque o seu mundo imaginativo seja dominado por eles, mas porque consideravam esta evolução de estilo como o mais alto grau da sua arte, o que demonstrava a procura.»*” (Dias, 1973, p. 28)

<sup>26</sup>The term best, used in this context, refers to the fact that most of the pieces for sale are of this type and it is very easy to find many of them with fine and accurate carved faces.

<sup>27</sup>I did not have the opportunity to see many nativity sets in the shelves, for sale, but I saw how they started to produce them, almost in series.



Figure 5.6: Two examples of women sculptures: the left image represents a full body sculptures and the right image is a bust (2008).

### 5.3.4 Masks - Mapiko

These sculptures are masks consisting either of the facial side, or they cover completely the head and some part of the bust (see figure 5.8). As we have suggested before, probably the first motivations Makonde men had to carve wood was the making of masks for ritual purpose or for the personification of ancestors for adoration and contemplation.<sup>28</sup> In particular, the Puberty Ritual is one of their most important ceremonies that still takes place in some communities and, for this reason, they still are creating masks that shall never be for sale, i. e., some pieces cannot be sold due to their spiritual meaning.

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<sup>28</sup>It is interesting to point out that H. Kammerer-Grothaus claims that the production of masks were given to men as a way to counterbalance the power or role of the mothers, i. e., the relevance of being a woman:

“[...] *Maskenschnitzen ist Tätigkeit der Männer und eine Art Gegengewicht zur Macht der Mütter.*” (Kammerer-Grothaus, 1991, p. 24)



Figure 5.7: Examples of Maasai and Ethiopian sculptures, usually sold as couples (pictures taken by me in 2008).



Figure 5.8: Two examples of masks, the left consisting only from the facial side and the right is a “head-mask” (left: picture taken by me in 2008, right: Povo Maconde, 1963).

The *shetani* masks are traditionally produced by the Tanzanian Makonde people and the *mapiko* masks from the Mozambican Makonde people. They started to be produced for sale purposes since the sculptors noticed a high interest other people had to buy or obtain pieces of this type. Among the sculptures that

are for sale, we can find male, female and animal-like masks.

## 5.4 Artist or Artisan

As already presented and stated above, many styles, shapes and forms of carving can be found, but they are mainly reproduced and repeated not only by different sculptors, but also by the same one. This leads to the question of to what extent is a Makonde sculptor an artist and/or artisan. I would like to present some view points that have already been presented and discussed regarding this question.

Before we start, it is important to remark that the same debate was also an issue in the history of the Western culture; in a dictionary of philosophical terms and concepts, the Greek word *techne* has been translated to art, artisanry, skill, ability and knowledge (Precht & Burkard, 1996, p. 604). Since 1813, history of art was considered a discipline (Precht & Burkard, 1996, p. 325); from that moment art started to become representative of a culture and its development. Moreover, the term *genius* became important after the seventeenth century in France and England; within the framework of aesthetics, a genius is the one who can create a piece of art using an innovative performance (Precht & Burkard, 1996, p. 205).

Since the beginning of the twentieth century, artists have questioned whether maybe art and its artistic techniques have not been exhausted, i. e., there remain no variations nor innovations possible; Benjamin spoke of an end of the auratic art due to technical reproducibility and commercialization.<sup>29</sup> Moreover, he claimed that artwork has always been reproducible; what has been done by humankind can always be copied or reproduced. As explained previously and as Benjamin stated, masters have given exercises to their art students, consisting of reproducing some pieces (Benjamin, 1955, p. 11). This issue has been discussed in many different cultures, and it has become a debate in the African culture due to the cultural changes and the influences of the Western culture.

According to Elimo Njau (Kenyan painter and director of Kibo Art Gallery in 1966 in Kilimanjaro, Tanzania), Makonde sculptors are “shock-absorber,” probably alluding to their ability to materialize the spiritual connections and visions through the art of carving. But, is this artistic activity stimulated by European

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<sup>29</sup>“*W. Benjamin prophezeit ein Ende der auratischen Kunst durch technische Reproduzierbarkeit und Verkommerzialisierung.*” (Precht & Burkard, 1996, p. 324)

interests and influences? Many people have referred to this activity as “tourist art”, “folk art”, “souvenir art”, “primitive art”, “unsophisticated art” and to be studied as “anthropological data” or “a minor branch of Western Art.” Njau stressed the need of East African governments to encourage the development of indigenous art, by buying them for exhibition purposes in their own country and, furthermore, copyrighting them to avoid copies (Stout, 1966, foreword).

In my opinion, there is clearly an external influence affecting the development of Makonde art since many sculptors are dedicated to the production in series of pieces that are preferred by the tourists; they need to maintain a certain salary in order to look after their families. It is very questionable to claim that a sculptor, who is only able to reproduce copies should also be acknowledged as an artist.

As Stout observed, the production in series of sculptures might have led to a better control of lines, and attention to proportions and details; the reproductions become more accurate. There has been a paradox of the “Modern Makonde Sculpture:” it should be a *curio fare* but, as previously explained, it is not.<sup>30</sup> Moreover, originality could provoke an unnecessary marketing problem; the artist cannot know in advance whether his creativity will be accepted by the ones giving him the sustenance. As a conclusion, any contact with a market or a different culture has tended to limit or pervert the Makonde creativity (Stout, 1966, pp. 8,11).

Grohs also discussed this dilemma and, according to her, there exist two tendencies: the first has considered ebony sculptures as “commercial art,” and the second has accounted Makonde art as a highly valued sequel of the art of carving. Both of them have been able to find arguments that validate their theory, making it even more difficult to establish Makonde sculpture as a specific art or artisanry. The arrival of the Portuguese and their interest in the wood sculptures might have played a very important role in the further development of the sculptors (Grohs, 1971, p. 274). For example, a makonde man would not carve small animals to the members of his community, these are clearly objects that represent the tourists’ interest and demand; the sculptor wants to sell and earn his living.

In a more general context, Breutz stressed the importance of wood carving within the African culture; he claimed that Africans “rarely invent anything,

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<sup>30</sup>The term *curio fare* is common among traders and retailers; it alludes to objects that are rare and, hence, valuable in their costs. Some examples can be ebony-sculptures, as already referred to in the text, basketry from the Sona Culture in Angola and jewelry or ornaments from the Pataxós in Brazil.

they adjust all acculturation to their needs and style.” (Breutz, 1971, p. 152) To him, African people have a great talent for sculpting, even in places where this profession is not traditional (Breutz, 1971, p. 153). Moreover, Breutz argues that their pieces have no great sense of originality and explains that a sculptor would not call himself to be an artist:

“African sculpture is in style the expression of a typical mentality. This occurs [...] in the sense of a certain surrounding of social, spiritual, mental and climatic factors. [...] In good pieces of sculpture the African style and their feelings are expressed as a by-product, because the purpose of their creativity endeavor is not intended to be artistic. That may be partly the reason why the designs are schematic.”

“The artist seldom considers himself to be an artist as such because his work is carried out for other purposes and he is more a wood cutter in the sense of a craftsman. Wood carvers often do not know that they have an artistic talent, they just learn their trade in their family [...]” (Breutz, 1971, pp. 153-154)

This immediately opens the question: did the European culture affect or influence how Makonde sculptors call their profession? They commonly use the term *master* when they refer to a person who is able to produce very good pieces, particularly the facial features need to be precise and accurate. If the concept of artist does not exist in a given culture, it will be meaningless as long as it does not change the way they carve. But, in my opinion, from the moment they had realized that this could affect the way they deal and sell their pieces, they have adopted this term, and even though remain masters, at least among themselves. This does, by no means, imply that the Makonde sculptor is not self-critic and also a critic with respect to his colleagues, as Raum explained:

“Of course, the artist, even in Africa is capable of viewing his own work critically. He scrutinizes his work carefully as he creates it.” (Raum, 1966, p. 8)

“There may not be a word for this sort of self-criticism but African artists state that while at work they must from time to time “think,” and think deeply.” (Raum, 1966, p. 8)

“Even though the professional art critic is absent in African society, there are in all African languages words for approval and disapproval, concepts

of beauty in man, woman and artefacts, an idea of the fitness of things.”  
(Raum, 1966, p. 9)

What the Makonde culture is producing nowadays has nothing to do with what they produced before the first contact with Western culture, christianization and islamization; “African art has not been static in the past” and these influences have been absorbed in an own typical African style and, together with the “desire for new patterns, new techniques, new objects of art” changes in their art have happened (Raum, 1966, p. 9). For example, most of the wood pieces carved prior to the colonial era were masks.

Unfortunately these changes have, in some way, molded African art; they diminished the traditional, tribal art and increased the production of *souvenir industry* and *burgeoning art*. The new Makonde sculptors are not only working for their consumers, who are mainly European, but they are also developing Western carving techniques. They have redefined symmetry, aesthetic, beauty and harmony according to their consumers’ taste, leading to a new stereotyped Makonde art (Raum, 1966, p. 10).

It is a pity to see that, after the 1930’s and the emergence of the wood carving industry, “the carver seldom takes the trouble to make good pieces [...]” (Breutz, 1971, p. 159) Unfortunately, they seem to have no other choice.

In my opinion, there are two main factors affecting the way Makonde sculptors produce their art or artisanry: what do dealers and tourists buy in present days (sometimes depending on the time of the year), and how much can they earn.<sup>31</sup> These two generate a chain reaction:

- i. Some sculptors live in small villages and go to the city to sell their pieces to dealers who usually offer very low prices per piece, but they buy wholesale.
- ii. Dealers and sculptors sell their pieces to tourists or other customers; many bargain over the prices resulting in a sale for much lower value.
- iii. Dealers and sculptors are unsatisfied since they are not earning enough.
- iv. The low prices inhibit the creativity of sculptors and push them to produce as many pieces as possible, so they can guarantee a minimum wage.

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<sup>31</sup>Martins Bernardo commented on this: “*Com pressa o artista não pode fazer coisas tão elaboradas porque isso tomaria mais tempo e eles não têm tempo se precisam vender para ganhar dinheiro.*”

Of course there exist genuine Makonde artists but not all of them are artists, some just produce woodcraft for a living. Even Martins Bernardo commented to me that some apprentices would spend the minimum time with a master, just so they can learn how to carve one type of sculpture, abandon their apprenticeship, and go to earn money on their own.<sup>32</sup>

The problem is how can we then define a genuine artist? Is an artist producing what we, as Western culture, call a piece of art? Or is an artist creating something that is coming from his own culture and techniques?

## 5.5 Hypothesis

I proceeded this research with, first, an ethnographic approach and, second, an ethnological ethnomathematical analysis. The questions in which I will focus during my study are:

The main questions I had were:

- 1) Do Makonde sculptors use calculations to determine human proportions while they carve? Are their computations comparable to those given by the (Western) idealized human proportions?
- 2) Is it possible to find golden sections within their final sculptures, even though there might be no prior knowledge of this term as such? Do Makonde sculptors have a concept of beauty?
- 3) Are Makonde sculptors artists or artisans? Could this difference be related to the idealized concept of beauty in their sculptures?

## 5.6 Data Collection - Sculptures

The research was divided into two periods: the first, which took place in Maputo, was focused on collecting many bibliographic information that has been used along this chapter. The second period, and longest one, constituted of pursuing the fieldwork at the *Museo de Etnologia* in Nampula. There I worked together with four different sculptors, and observed them carve different pieces, mostly human representations.

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<sup>32</sup>“*Tem aprendizes que aprendem a fazer uma peça só e já abandonam o mestre porque querem ganhar dinheiro.*” (Martins Bernardo)

Martins Bernardo was born in Aldeia Itamba, District of Nangade in Cabo Delgado. He is 31 years old, has been living in Nampula for 12 years and, since his arrival, works at the museum; he learned to carve for 1 year when he was 18 years old, and his master was his brother in law. The method used for him to learn was symmetry: he received one sculpture which had one half carved and had to reproduce the other half. Sometimes clients order him replicas, i.e., they bring pictures of other pieces and want to have them performed in ebony wood (see figure 5.9 as an example); for Martins it is easier to create something for himself than to copy.



Figure 5.9: This is an example of an ordered sculpture: the buyer brings a picture of what s/he wants and the sculptor needs to reproduce it. Note that he used *pau-rosa*, as to be more similar to the skin color (2008).

Pakholo Laza is 41 years old; his master was his elder brother when he was 22 years old. He comes from the Aldeia Peme, District of Mueda in Cabo Delgado. He has lived in Nampula for 20 years now.

Júlio Carlos is 28 years old and works since 10 years in the Museum. He comes from the District of Mocimboa da Praia in Cabo Delgado and learned, in 1998, to carve with his uncle Kunkenda who has passed away.

Eduardo Patrício Namembe also comes from the District of Mocimboa da Praia in Cabo Delgado. He lives in Nampula since 1982 and has been working since one year at the Museum. He became a sculptor in 1990 when he learned with the master Capamba, who was the father of some of his friends.

There are many young boys who also come to the courtyard where the sculp-

tors work; Martins told me they are apprentices and, therefore, spend most of the time sandpapering the sculptures that need to be smooth for the final polishing.

During their work, they will use the following tools: measuring tape (though most of the time they use the palm size or other pieces to measure), handsaw, *anchô* (name used to refer to ax), wood chisels, *coiva* (this is also a wood chisel, but it is curved), knife, file and *batedor* (translated to batter) (see figure 5.10).



Figure 5.10: From left to right: *anchô*, knife, three different wood chisels, three different *coivas* and handsaw. From up to down: *batedor* and file (2008).

### 5.6.1 *Mulher* by Martins Bernardo

This sculpture constituted of a standing woman carrying her baby and accompanied by her two other children.

When I asked him how long he needs to make one piece of ca. 20cm he answered “3 days and then I can work on the details.”

The first steps Martins took to start with the sculpture were: to measure the bole with his palms (2 palms long), to measure the width of the base with his thumb (exactly 1 thumb long) and to saw it until black wood powder comes out (= measure reference), to remove the external layer of the trunk, i. e., the black part is the only one left leaving the base on the top to “protect it.” (see figures 5.11)

He then started delineating the head; there was no movement alluding some measurement. He estimated the height of the arm and the position of the baby (see figure 5.12). The legs turned out to be flexed, which led me to think that there was improvisation. He knows that the leg is longer than the body (he



Figure 5.11: Left: the rough ebony wood of two palms long. Right: the black inner part and the base (2008).

pointed at the torso). He started by measuring the length from the foot to the knee, going up to the buttocks, and finishing with the upper part of the body. Along the procedure of delimiting the parts of the body he was always rotating the bole, keeping the position of the base fixed.

Later, Martins continued by carving deeper since he wanted to achieve the level of the first child.<sup>33</sup> He started to delineate the head and went down marking the arm and finally the leg, which also happened to be bent. The last child did also end up having flexed legs.

He carved and removed the wood from the middle part of the legs. It was in this moment that Martins had realized that the head was too big and he had to reduce it further more.

To make the fingers and the hand, he started by delineating the thumbs and then measured the size of the hand according to it;<sup>34</sup> it could happen that the pinky finger turns thicker than normal; if this is the case he will simply remove the excess. To measure the size of the feet, he used the lower leg as a length reference. The girl holding the hoe had only 3 visible toes.<sup>35</sup>

<sup>33</sup>“*Apanhar o próprio nível do menino.*” (Martins Bernardo)

<sup>34</sup>“*porque não pode ser do mesmo tamanho que esse (apontando o dedão).*” (Martins Bernardo)

<sup>35</sup>When I asked him, why not 2 only, Martins’ answer was: “*Porque se eu faço 2 fica um*



Figure 5.12: From left to right: the roughly delineated bole and a more detailed image of the torso of the woman with the baby (2008).

For the design of the faces, Martins started by marking the mouth, first measuring the chin, and then going to the inferior lip. He followed by marking the nostrils, then the superior lip, and finally he drew the eyes.<sup>36</sup> The ears position were already visible from the beginning of the carving procedure, and they are very important since the eyes need to be at the same height as them (see figure 5.13).<sup>37</sup>

The last phase consisted in making the hair. When I asked Martins how many of “these” (chignons) would fit in the woman’s hairstyle, he answered that he computes and measures while carving (see figure 5.13).<sup>38</sup>

Symmetries: when Martins marked the position of the ears he did it first in one side, and then placed the bole such that the head is against his stomach and he could draw an imaginary line with his eyes from one side to the other, from above. When he was making the breasts, he drew a line in the middle and then

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*espaço mais grande.”*

<sup>36</sup>I asked him how he measured the size of the forehead and Martins’ answer was: “*Ah, eu calculei porque se eu colocasse aqui (aponta um lugar) ia ficar curto e não ia ser pessoa então eu sei que tem que terminar aí, senão aqui fica curto demais.*”

<sup>37</sup>“... para quando eu faço os olhos têm que ficar na mesma altura porque se ficar embaixo não fica bem. Olhos e orelhas ficam na mesma altura.” (Martins Bernardo)

<sup>38</sup>“*Como sabe para saber quantos “desses” têm? Você sabe quantos vão ficar?* (Me)  
 “*Não, isso eu não sei ainda, isso eu vou calculando e medindo [...]*” (Martins Bernardo)



Figure 5.13: From left to right: an imaginary line drawn from the ear to the eye and a the procedure of carving the hair (2008).

reproduced one side in the other, just like the effect of a mirror. In many parts, such as the back of the skirt, the torso, the face and the back he would always carve one side and then reproduce it in the other.

### Personal Observations

Every time Martins was coming back from a break he would look at the sculpture turning it 180° in one direction and then in the other.

During the hours I spent with him, he was also having conversations with other persons who come and go. In one of these conversations he was asked when would his wedding be to what he answered: “2000... 2026;” Ana (Martins’s niece) spent one day with us, she was asked for her age, and her answer was: she clapped her hands one time and then showed 4 fingers.

### 5.6.2 *Senhora* by Arcanjo Bachela

Arcanjo Bachela is a Makua master, one of the exceptions among sculptors since it is a Makonde tradition as previously explained in this chapter. I met him at the sunday-market and we arranged to meet again so that I could follow 2 sculptures he would carve for 2 different persons. At the market he explained to me how he would carve the sculpture named *Senhora*.

The procedure was the following: cut the bole, remove the white wood peel,

start with the head (measures will be made with their hands or fingers; 1 palm = 20 cm), mark the body parts, start carving (always from the top to the bottom), conclude with the face (to keep symmetries, calculation is done mentally).

Such a sculpture can be finished within 2 days, but it depends on the mood of the artist; in one month he could produce up to 25 pieces.

### Personal Observations

Unfortunately, the next time I met Arcanjo Bachela he did not agree to proceed with our previous agreement. After a long debate, I decided to abandon the idea of working with him because I was not willing to pay what he wanted to receive for having me looking at his work.

### 5.6.3 *Macacos* by Martins Bernardo

The goal here was to carve the *Monkeys see/hear/speak no evil* set constituted of three monkeys, the first covering the eyes with its forepaws, the second covering the ears and the third the snout. The Makonde sculptors have developed a fourth monkey, the *monkey does no evil*, hence Martins' objective was to make the *Monkeys see/hear/speak/do no evil* sculpture set.

In order to measure the size of each piece, Martins used one sculpture from the shop. He criticized the quality of it since the monkey had no tale, no ears, no hindpaws, and hence it did not look realistic (see figure 5.14).



Figure 5.14: From left to right: the unrealistic monkey and the crack in the bole (2008).

Because monkeys have a very short neck, Martins considered different proportions to make the first rough divisions in the bole; these divisions were always based on observations, the Makonde sculptors have no table with “standard measures and proportions,”<sup>39</sup> they use observation and rotation.

<sup>39</sup>In fact, when I asked Martins about the size of the fore- and hindpaws, his answer was

When he started delineating the body parts, the order was completely arbitrary. He needed to be careful since it is very common that the trunk has cracks in the middle (see figure 5.14). Unfortunately, one part of the forepaws broke but Martins told me he can glue it again in the end.

He used two reference axes while carving: the first one was his left arm and the second is where the bole was placed. He rotated the piece with respect to the latter axis in order to carve the wood.

Symmetries: Martins used the bole-axis as a mirror-axis, he carved one side of the monkey and then “reflected” it on the other side. Interestingly, he did not look directly at this imaginary axis but he rotated from one side to the other in order to keep them symmetric, which means that he was indeed using this line.<sup>40</sup>

## Personal Observations

It seemed to be much more difficult to carve pieces when they are smaller. As Martins also commented, it is difficult to manipulate and hold the figure in different positions. In the case of the monkeys he used a bigger bole as a support between his legs (see figure 5.15). This bole turned out to be much more useful since, e.g., when Martins was sharpening a scraping-tool, he placed it in a tiny hole he’s done in the bigger wood trunk.

### 5.6.4 *Likhomba* - Mask by Pakholo Laza

The goal of Pakholo was to carve a mask of a Makonde woman’s face and for that he needed to halve transversally the tree trunk. One big advantage was that he did not need to be careful with the cracks that are usually found in the core of the bole since he removed this part away in order to get the shape of a proper mask; this was his starting point.

Once Pakholo established the borders in the back side, he used projection in order to compare them and see how they fit in a plane (see figure 5.16). After this was done, he started to furrow the back with the curved wood chisel; the depth was measured with respect to the curvature of the wood.

He began to delineate the face from the eyes, more precisely from the lower part and continued with the nose. Later on, I asked him how he had measured

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somehow confusing: “*o braço eu medi aqui porque eu sei que o macaco tem a parte mais comprida do corpo que as costelas.*” (Martins Bernardo pointed at the back part of the shoulders). Probably, what he intended to say was that the longest part of the monkeys is its forepaws.

<sup>40</sup>“*A linha é quando eu começo de um lado e daí eu controlo.*” (Martins Bernardo)



Figure 5.15: This image shows that the methods for holding the piece can become more difficult when they get smaller (2008).

the position of the mouth and he placed his index finger between it and the nose; the distance between them was exactly that of a *distal phalanx*.<sup>41</sup> To open the eyes from the back side, he placed his index finger in the back and his thumb in the front to determine where to furrow. In the case of the mouth, he put the mask in profile and, through observations, determined the position of the mouth from behind.

The lines of the hair were done easily since it was the position of the wood chisel, placed perpendicularly with respect to the mask, what determined how to follow the line and the interval between them; near the ears he carved elastic bands which made me ask him how did he follow the line of the braids. His answer was quite interesting: “I’m taking the line from here until there.”<sup>42</sup>

The tattoos preserved a symmetry with respect to the face, i. e., he carved 2 lines in one side and then reproduced them in the other and so on. He did not complete one side and reproduced it in the other at once, but he carved them little by little going from one side to the other.

Symmetries: when Pakholo carved the hair, in the middle part, he started from the outside and went towards the middle, making one by one in each side

<sup>41</sup>The *distal phalanx* is the terminal limb bone located at the tip of the finger.

<sup>42</sup>“*Estou a levar a linha daqui prali.*” (Pakholo Laza)



Figure 5.16: From left to right: Pakholo observing the piece in perspective, and delineating the hair symmetrically (2008).

(see figure 5.17). For the tattoos in the face, he proceeded similarly, carving 2 lines in the right side, and then repeating the same in the other side.



Figure 5.17: This figure shows how the hair is carved from outside to the inside or middle (2008).

### Personal Observations

Pakholo explained to me that the word *Likhomba* comes from the Makonde people of Mueda. He has 2 different batters, made from different wood types; the

lightest one is for carving the inner parts and the dark one “has a weight that makes it suitable for the outer parts”.<sup>43</sup>

### 5.6.5 *Ujamaa-Família* by Júlio Carlos

The goal of Júlio Carlos was to carve a *ujamaa* sculpture.

Once the bole was cut, Júlio started carving from the top of the sculpture. He carved the head of the father and went along in a spiral form carving the children (see figure 5.18). At the stage when he had carved 3 children and the head of the father I asked him how many children were going to be at the end in the whole piece. His answer was 15; it turned out to be 6 children, plus the head of the father and the mother.

Most of the children were carrying something, either in their heads or in their hands. I tried to ask Júlio how he placed the children and the objects and, after some misunderstandings, he finally answered “it is imagination, it is all in my mind.”

Once he has achieved the middle of the bole, he marked the base of the sculpture and defined the position of the mother. The mother had a similar height with respect to the children. Júlio explained to me that her size is comparable with that of the children because she stays with them and works in the *machamba*,<sup>44</sup> and the father has to leave the family in search of a job (if the family is from Cabo Delgado, he will most probably migrate to Tanzania and produce cloths).

Before he started carving the faces, Júlio “peeled” the complete sculpture, i. e., he “cleaned” it turning the surface smoother. The faces were carved following the same standards: he sized the chin, marked the nostrils and started to furrow around the nose’s position (see figure 5.18). Once the nose was done he carved the eyes and the forehead, finishing with the delineation of the lips and mouth. If there was some object covering the chin, Júlio started the faces from the eyes.

### Personal Observations

When I asked him about the positions of the children along the bole, his answer was not completely uninfluenced by how I had presented the question. In his first answer he tried to explain me what type of objects the children were carrying, and so I had to reformulate the question asking why did he put them

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<sup>43</sup>Pakholo Laza: “*tem um peso que é para os lugares de fora*”

<sup>44</sup>*Machamba* are the fields where there are plantations of, e.g., sugarcane, cashews, tomatoes



Figure 5.18: From left to right: the first part, the top, of the ujamaa has been carved; Júlio carving, and the first marks for the facial features (2008).

there, if it was improvisation, and he answered with a “yes.” I was convinced that he had not understood my question so I reformulated it one more time: “how do you compute the positions where you will put the children and the objects?” and then he said: “this is imagination, it is all in my head.”<sup>45</sup>

The sculptors commented to me that in Tanzania there are also Makonde people producing sculptures. Apparently there exists no ebony wood there, and they use a wood with a brown color. Life is supposed to be much cheaper and so are the prices of sculptures.

### 5.6.6 Interview with Eduardo Patrício Namembe

This is the story Eduardo told me about the Makonde Art Gallery in the *Museo de Etnologia* in Nampula (my translation of the transcribed interview; see appendix B for the extensive interview):

“The Makonde Art Gallery started in 1975, the year of independence [...] At that time, 2 persons worked in it, one of them being Master Dbanga, the same artist who carved, in 1956, the sculptures placed at the Museum’s porch. But in that period, Makonde art was used for rituals, it was an art made by means of myths [...] The Portuguese colonists, after their arrival in the region, noticed

<sup>45</sup>“*Como você calcula as posições para ir pondo as crianças e as coisas?*” (Me)  
 “*Isso é imaginação, está tudo na cabeça.*” (Júlio Carlos)

how this art was extremely creative, full with innovation, esthetics and diverse shapes to represent their spirits [...] It was with the Portuguese missionaries that Makonde art became marketable, unfortunately not inside Mozambique; the great interest comes from Europe [...] The pieces produced at that time were of shetani type and, due to the interest from abroad, the sculptors felt encouraged to create other figures and not stay static; it was when the djaman type appeared [...]

Djaman is a familiar ensemble; it represents the everyday life of the African people [...] African life is full of sacrifices, vulnerability and agriculture of subsistence [...] With the development of Makonde art, critics, studios and philosophers of art realized that it was an art with a high exponent in the Sub-Saharan Africa; it was an “odd art” [...] <sup>46</sup> Unfortunately, nowadays Makonde art has lost its relevance because of the lack of responsibility; our market is too weak, it does not allow us to live but only to survive [...] The Makonde people are producing artisanry and no longer art: they repeat the same piece  $n$ -times and a piece of art is something that cannot be copied [...] We are no longer allowed to be creative, we have to invest our time in dispatching as many pieces as possible [...]

The Makonde people are a Bantu folk who migrated from the Region of the Great Lakes [...] <sup>47</sup> They settled in the North of Mozambique because there exist a dense equatorial forest which could not be trespassed by the slave captors [...] The Makonde people carry their culture via oral transmission and the books that have been written are from the 1950’s and later, and the authors are missionaries [...] The Makonde folks have carried the art of carving since their origins and it derived from the *mapiko* [...] <sup>48</sup>

In the African culture, women are working more than men [...] The art of sculptures is for men, since women have to take charge of producing domestic utensils with burned clay [...] There existed women sculptors, but they disappeared because they did not know how to take care of the children simultaneously [...]

My Master taught me one type of figure, a woman carrying something on her

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<sup>46</sup>What Eduardo exactly said was: *arte ímpar*. This is a term that I have not heard before and, clearly, with a literal translation it loses its meaning, since odd has a negative connotation in English, but in Portuguese it can be used as a synonym for unique.

<sup>47</sup>The Great Lakes are located in Eastern Africa, covering the region surrounding the Lakes Kivu, Tanganyica and Victoria. Today, this region is divided into the following countries: Kenya, Uganda, Rwanda, Burundi and Tanzania.

<sup>48</sup>Recall that *mapiko* is the Northmozambican Makonde word used for mask.

head (either a clay pot or a bundle of fruits or vegetables) and, with time, I was developing new techniques and gaining mastery in art [...] The artist picks his images from the society, as he is a creative and dynamic member of it [...] The prices will be established according to the quality and time invested in carving a specific sculpture [...] Sometimes it needs to be renegotiated, because of the actual economical situation [...]"<sup>49</sup>

## Personal Observations

With my interview, Eduardo wanted to transmit the difficulties Makonde sculptors are experiencing in creating different types of sculptures due to the lack of interest the people in Mozambique show, and to the insisting renegotiations foreign clients do to lower the initial prices. My first intention was to obtain more information on how exactly an apprentice learns from a master who instructs him for a certain amount of time.

I decided to interview Eduardo because he used to come to the place where I was working and made comments on how the techniques used had been developed or how elaborated the sculpture was becoming. The moment I started recording him, the information I collected was insinuating the difficulty to trespass their art beyond Mozambican borders and how important this would be for their development since, to his considerations, the biggest markets for art are Europe, Asia and America; I was coming from Europe to work with them, why not telling all this to me?

## 5.7 Data Analysis

The first part of the analysis used the data obtained from the human figures and the second part used the facial features. Due to precision, the *t*-test was only used in the second part; I will come back to this point at the end.

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<sup>49</sup>Unfortunately, Makonde sculptures are not being properly valued among tourists. They keep trying to lower the prices given because they think sculptors are cheating. This is, in my opinion, far from being true!

### 5.7.1 Fitting Le Corbusier's modulator to Makonde Sculptures

The first step was to draw a model of the modulator which could later be scaled, in order to be able to adjust it to the size of the figures that will be analyzed; the scale used in our case has been given by the values of the first column in table 4.4, chapter 4 (p. 125). Recall that the most important reference point for our purposes is the navel.<sup>50</sup> We will call it the midpoint since it is exactly where the *modulator* is cut in two squares. Note that it is in now the half of a person's height, it is the half of the height with the arms raised. The fitting that we see in figure 5.19 as obtained after the adjustment followed these steps:<sup>51</sup>

- i. Position the midpoint of the *modulator* in the navel. In most cases, the navel has not been carved. We use the height of the elbow since it is the same height of the navel.
- ii. Having the midpoint fixed, it becomes the first reference point for scaling the *modulator* according to the size of the sculpture; the second reference point will be the feet; if the feet are looking ahead, I followed Dürer's design for finding the point (see chapter 4, figure 4.6).
- iii. Now that our model has been scaled to the size of the sculpture we can make a reflection of the arm which is not bended with respect to the line of the shoulders. Our *modulator sculpture* is completed.

As we see, the first three figures (figures 5.19(a), 5.19(b) and 5.19(c)) matched best to Le Corbusier's *modulator*, although, in all of them, the arm did not reach the height of 226 cm. Nonetheless, and in my opinion, they can still be considered to be very accurate, since we know that the sculptors never use more than their hands and fingers to do any kind of measurement. Interestingly, the first sculpture's height, figure 5.19(a), is about 160 cm in real size; this could lead us to conclude that, because of the proximity with the actual height of a person, it becomes easier to deal with the proportions since there is no need in scaling them. On the other hand, the following two figures (figures 5.19(b) and 5.19(c)), which represent a Maasai man and woman respectively, have the same average

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<sup>50</sup>This is not new since we already saw in the previous chapter 4 the importance of the navel for all different authors who were pursuing research in human proportions.

<sup>51</sup>A high resolution of some of these pictures may be found in appendix B. All of them are in digital copy in the DVD attached at the end of the thesis.

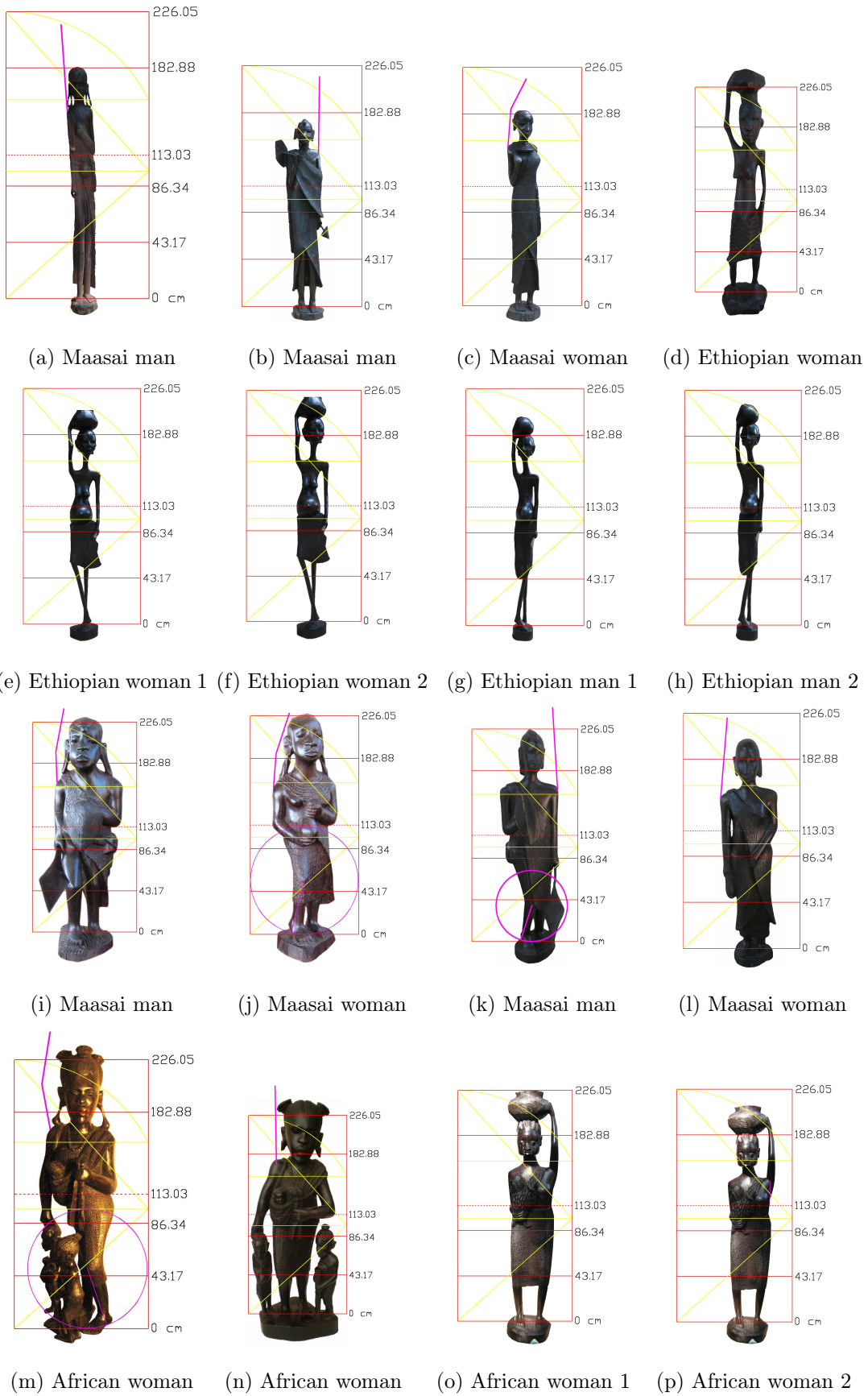


Figure 5.19: Fitting Le Corbusier's *modulor* to the sculptures.

size as the other sculptures (they are not higher than 50 cm). It is hence not possible for us to conclude that, due to the size of the sculpture they could be better proportioned.<sup>52</sup>

Figures 5.19(e) and 5.19(f) (respectively figures 5.19(g) and 5.19(h)) represent the same sculpture of an Ethiopian man (respectively woman) which has been fitted twice to the *modulor*. The reason why I did this in these particular cases was because their navel has been carved, but it does not coincide with the height of the elbow; nonetheless it seems to me that the midpoint of the *modulor* could “suit” both positions, i.e., the elbow and the navel. As we see, figures 5.19(e) and 5.19(g) give a better match with respect to the *modulor*, except that the arms do not touch the bottom height of 226 cm. But we have fixed the navel to be the midpoint and, in this case, we do not find a good proportion (see figures 5.19(f) and 5.19(h)). The Ethiopian woman in figure 5.19(d) could not fit to the *modulor* using the navel as the midpoint; the *modulor’s* scale would have to be smaller than the one we have presented, which means that the height of 182,88 cm, that intends to represent the human height, would appear to be below the shoulders.

Figure 5.19(i) until figure 5.19(o) all show a similar result: the navel represents the exact midpoint in which the body could be cut into two equal halves. In this sense, the navel may be seen as an explicit midpoint, but it does not coincide with the midpoint defined in the *modulor* since, in this latter case, it would halve the total height from the feet until the end of the raised arm. My claim is that this is the symmetry that sculptors apply when they carve human figures; unfortunately there are not sufficient results that can lead us to mathematically generalize this claim.

In both figures 5.19(o) and 5.19(p) we have established the position of the navel using the elbow, in the first image with the right arm and in the second with the left arm. As we clearly observe, there is no matching with respect to the lengths of the arms since, in the second case, the navel should almost be at the same height as the breasts (see figure 5.19(p)). Figures 5.19(d), 5.19(e) and 5.19(g) lead to the same conclusion; the best match for the navel’s position is with respect to the arm that is placed next to the body and not the one that is raised since they do not have the same length.

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<sup>52</sup>*Better proportioned* must be clearly understood as compared strictly to the *modulor’s* proportions (Le Corbusier, 1954).

## 5.7.2 Comparison of Dürer's and Makonde proportions

We have seen that Makonde sculptors tend to halve the human figure exactly at the navel, i.e.,  $\frac{NH'}{NH} = 1$ . Thus, it could be suggested that the values given by Dürer's proportions in table 4.5 of chapter 4 are more suitable to the Makonde sculptures than those of Le Corbusier's *modulor*, since they are greater than  $1 - \varphi$ . But these values oscillate between 0.65 and ca. 0.74, which is nearer to  $1 - \varphi$  than to the value of 1.

## 5.7.3 Facial Features and the Golden Section

Following the model from figure 4.7 presented in the previous chapter 4 (see page 126), we shall evaluate and analyze a selection of 32 pictures of faces (figures 5.20 and 5.21).<sup>53</sup> In order to be able to obtain the results in table 5.1, and figures 5.20 and 5.21, I proceeded with the following steps:

- i. Draw the lines marking the beginning of the forehead, the eyes, the nose, the mouth and the chin.
- ii. Draw a perpendicular line passing through the midpoint of the inner canthal distance.<sup>54</sup>
- iii. Measure the distances from the chin to the forehead ( $TE$ ), from the chin to the nose ( $NA$ ) and from the chin to the mouth ( $BO$ ) (see table 5.1).

From Equation 4.3 in the previous chapter 4, we obtain the following relations for the golden ratio  $\varphi$ :

$$\frac{TE}{TE - NA} = \frac{TE - NA}{NA} = \frac{NA}{BO} = \varphi \quad (5.1)$$

In order to compute the  $t$ -test we need first to calculate the means  $\bar{x}_1 = \frac{TE}{TE - NA}$ ,  $\bar{x}_2 = \frac{TE - NA}{NA}$  and  $\bar{x}_3 = \frac{NA}{BO}$  of the values given in the last three rows of table 5.1. The degrees of freedom is 31. The next table 5.2 presents the results for the means, standard deviations and one-sample  $t$ -tests obtained by taking  $\bar{x}_i - \varphi = \bar{x}_i - \frac{1 + \sqrt{5}}{2}$ ,  $i = 1, 2, 3$  as the null hypothesis, i.e., the perfect matching should be when the mean equals the golden ratio  $\varphi$ .

<sup>53</sup>A high resolution of some of these pictures may be found in appendix B. All of them are in digital copy in the DVD attached at the end of the thesis.

<sup>54</sup>canthus is the corner of each side of the eye, formed by the junction of the upper and lower lids.

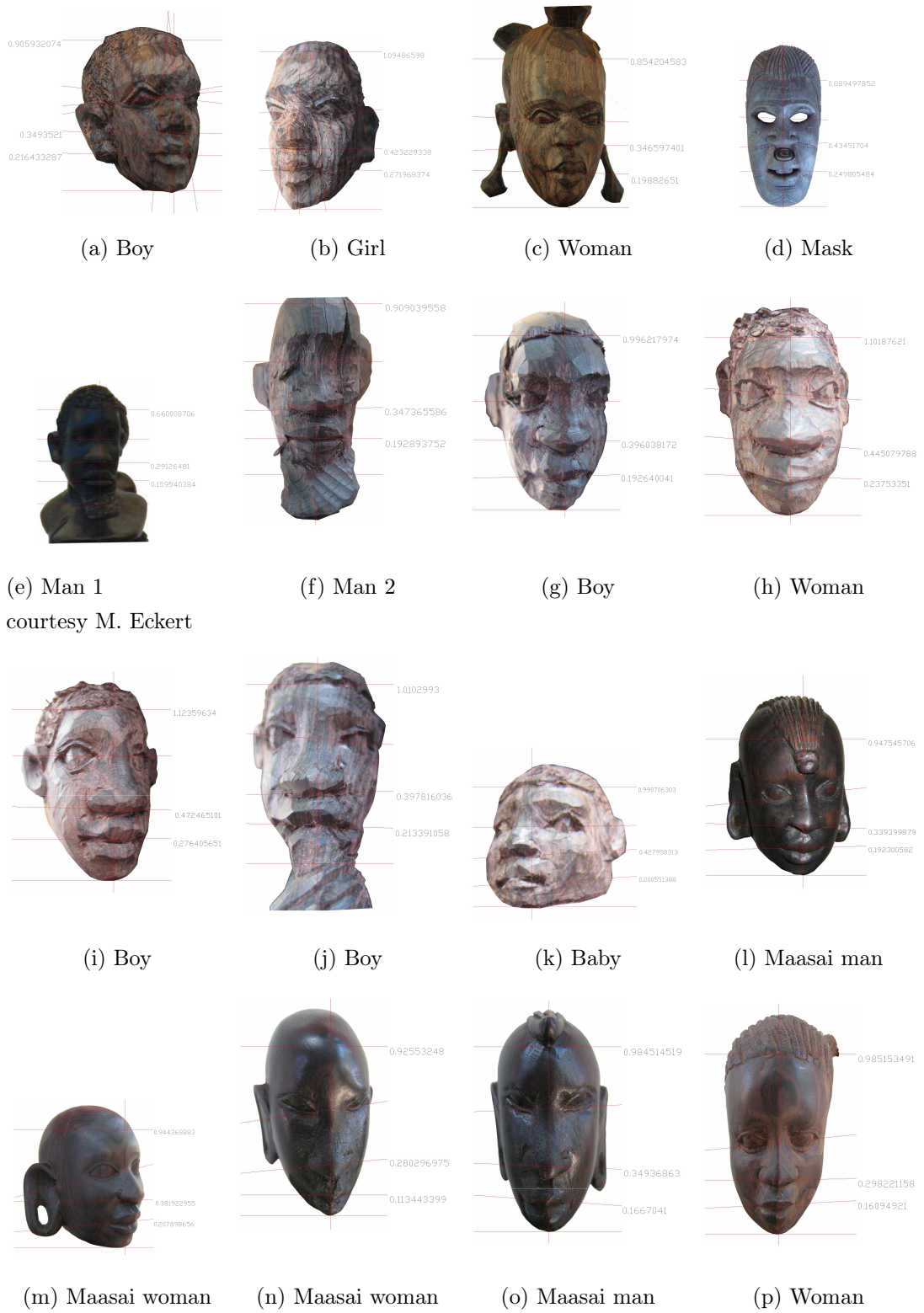


Figure 5.20: Facial features processed with AutoCAD<sup>®</sup>, first part.



Figure 5.21: Facial features processed with AutoCAD<sup>®</sup> second part.

IMG	TE	NA	BO	TE-NA	TE/(TE-NA)	(TE-NA)/NA	NA/BO
Boy	0.90593	0.34935	0.21643	0.55658	1.62768	1.59318	1.61413
Girl	1.09487	0.42323	0.27197	0.67164	1.63015	1.58693	1.55617
Woman	0.85420	0.34660	0.19883	0.50761	1.68281	1.46454	1.74322
Mask	0.88950	0.43452	0.24981	0.45498	1.95502	1.04710	1.73942
Man 1	0.66001	0.29126	0.15954	0.36874	1.78988	1.26601	1.82565
Man 2	0.90904	0.34737	0.19289	0.56167	1.61845	1.61695	1.80081
Boy	0.99622	0.39604	0.19264	0.60018	1.65987	1.51546	2.05585
Woman	1.10188	0.44508	0.23753	0.65680	1.67765	1.47568	1.87376
Boy	1.12360	0.47247	0.27641	0.65113	1.72561	1.37816	1.70932
Boy	1.01030	0.39782	0.21339	0.61248	1.64951	1.53961	1.86426
Baby	0.99071	0.42796	0.20055	0.56275	1.76048	1.31496	2.13391
Maasai man	0.94755	0.33940	0.19230	0.60815	1.55809	1.79183	1.76494
Maasai Woman	0.94437	0.38192	0.20790	0.56245	1.67904	1.47267	1.83706
Maasai Woman	0.92553	0.28030	0.11344	0.64524	1.43441	2.30197	2.47081
Maasai Man	0.98451	0.34937	0.16670	0.63515	1.55006	1.81798	2.09574
Woman	0.98515	0.29822	0.16095	0.68693	1.43413	2.30343	1.85289
Woman	1.11402	0.44774	0.25815	0.66628	1.67199	1.48811	1.73440
Man	1.10785	0.41024	0.24853	0.69761	1.58806	1.70051	1.65063
Maasai Woman	1.07597	0.39934	0.20625	0.67662	1.59020	1.69433	1.93617
Maasai Man	1.19414	0.49910	0.23705	0.69505	1.71808	1.39261	2.10542
Woman	1.21739	0.50949	0.23645	0.70790	1.71972	1.38942	2.15473
Woman	1.29736	0.46696	0.24359	0.83040	1.56233	1.77832	1.91697
Maasai Woman	1.29104	0.37755	0.20688	0.91349	1.41330	2.41954	1.82493
Maasai Man	1.10191	0.38652	0.19784	0.71540	1.54028	1.85089	1.95364
Chess Piece	0.75802	0.28111	0.17488	0.47691	1.58946	1.69648	1.60746
Chess Piece	0.78770	0.28388	0.14670	0.50383	1.56344	1.77480	1.93506
Chess Piece	0.55797	0.22078	0.12901	0.33719	1.65475	1.52729	1.71137
Chess Piece	0.64100	0.26301	0.13947	0.37799	1.69582	1.43715	1.88585
Chess Piece	0.65941	0.24108	0.11918	0.41834	1.57628	1.73528	2.02287
Girl	0.97231	0.45225	0.21108	0.52006	1.86960	1.14995	2.14258
Girl	1.07040	0.40984	0.17874	0.66056	1.62045	1.61175	2.29296
Ethiopian Woman	0.99856	0.37941	0.17388	0.61915	1.61279	1.63187	2.18199
Ethiopian Man	0.99643	0.38987	0.17986	0.60657	1.64274	1.55583	2.16764

Table 5.1: This table contains the values obtained by calculating the distances between the different points of the face (the computations were obtained with AutoCAD<sup>®</sup>).

	$\frac{TE}{TE-NA}$	$\frac{TE-NA}{NA}$	$\frac{NA}{BO}$
Mean $\bar{x}_i$	1.63824644	1.6157760	1.9140188
Standard Deviation	0.1124368	0.2986213	0.2146197
One-sample t-test	1.032684	-0.04344	7.9224

Table 5.2: Statistical Results for the  $t$ -test computed with respect to the facial features.

As we can observe, the result for the  $t$ -test in the last case ( $NA/BO$ ) allows us to assure, with 99% of confidence (Table I.9, Brandt, 1998, p. 635), that sculptors do not compute the golden section between the distances from chin to nose and from chin to mouth. In the first two cases, the null hypothesis cannot be rejected. The  $t$ -test does not give further information on the validity of these results in any of the confidence levels until 90%, but we can compare the means and arrive to some conclusions.

The mean  $\bar{x}_2$  computed for the case  $\frac{TE-NA}{NA}$  differs from the golden ratio  $\varphi$  in the third decimal place, i.e.,  $|\bar{x}_2 - \varphi| = 0,002\dots$ ; for  $\bar{x}_1 = \frac{TE}{TE-NA}$  the difference

is  $|\overline{x_1} - \varphi| = 0,02\dots$

As I verified, there are no measuring tools among the Makonde sculptors and thus, these are, in my opinion, very good approximations to the value of the golden ratio. According to these last 2 results, the short nose would represent the golden section of the straight line drawn from the chin until the forehead to the Makonde sculptors.

## 5.8 Conclusions

We know now that Makonde sculptors use only their hands as a tool for measuring lengths. During the manipulation and working with ebony wood, the movements show that their ability to determine sizes and proportions is based on pure observation which is, in my opinion, very much related and connected to experience. Many carvers learn this profession by reproducing one side in the other half of the bole.

The difference between the proportions determined by Le Corbusier compared to Albrecht Dürer are not essentially big when compared to the proportions used by the Makonde sculptors. But, both Dürer and the Makonde sculptors do not intend to idealize the human body. In this sense they could be considered to be similar, although their numerical values differ.

In fact, Makonde sculptures representing persons usually put them within a very real and concrete situation in life. Either the woman is going to the *machamba* to work and her children are accompanying her, or a community is working very solidly united. They want to represent themselves in the sculptures.

Regarding the facial features, the results presented in the previous section 5.7 show that it is possible to find the proportions related to the golden section: in the ratio between the distances from the short nose until the forehead and from the chin until the short nose, and in the ratio between the distances from the chin until the forehead and from the short nose until the forehead.

This suggests that up to a certain scale, that is, that of sculpting a face and, especially a woman's face, Makonde men attempt to encounter an ideal for beauty. This ideal is represented in the image of their first mother, this woman who has originated from ebony wood (see section 5.3). Furthermore, very seldom we find a sculpture of a woman in lying. These two evidences suggest that their inspiration for achieving a beauty as it has been idealized by the golden ratio comes from the rituals in which they divine their ancestors.

Furthermore, masks constitute the first sculptures created by the Makonde people for the realization of rituals. These masks, as we have seen, have the function of representing bad and good spirits during these ceremonies. And these good spirits are precisely those corresponding to the Makonde ancestors, including their first mother. The facial features have been thus idealized since the beginnings of Makonde art.

As a profession, we cannot generalize and call all Makonde sculptors to be artists. But we know by now that those sculptors who achieve to reproduce the so called idealized facial features will be acknowledged as a master among his community. And to us, this means that these Makonde masters are artists. These artists are those who are able to reach a spiritual level in which they encounter their first mother and are able to bring her back to reality by sculpting her facial image.

I would like to finish by presenting the “reward” I received from one Makonde sculptor, Martins Bernardo. He invited me to his community to get acquainted with the Makonde women living there. I had the opportunity to spend a whole day with them and it was fascinating. And I am sure that I was able to experience this because I showed so much respect and admiration to him, to his people and to his profession.

### **5.8.1 Limitations**

I had to overcome some difficulties during the first period of my research. One of these was related to the fact of me being from the opposite gender. At first, they did not seem to feel so comfortable with this, as I was the only woman in their working environment. And this environment consists only of men, women are not allowed to become sculptor. Fortunately, it lasted a short period and they finally showed their respect and friendship towards me.

A monetary aspect was that I could only undertake the complete research thanks to some friends that decided to buy ebony wood pieces. In this way, I could arrange with the Makonde sculptors that they would carve these pieces with the condition while I am present observing. I do think that without these “art patrons,” it would have been much more difficult to obtain so much information.



# Chapter 6

## The *teuto*-Brazilians of Friburgo, Brazil

*H: Ah, matemática nunca foi muito o forte meu, viu.*

*A: Mas aqui vocês tão fazendo matemática todos os dias!*

*H: É que não dá pra perceber.*

*(Hedinho Ambrust & Andrea V. Rohrer)*

### 6.1 Introduction

Brazil is the largest country in South America with a population of ca. 170 million. It is divided into 26 states and one federal district, being Brasília its capital (see figure 6.1). The state of São Paulo is the most populated with ca. 37 million people, representing ca. 21,7% of the whole country, and its surface corresponds to ca. 248209 km<sup>2</sup>. Campinas, located approximately 100 km north west of the city of São Paulo, corresponds to the second most populated city in the state with almost one million inhabitants.<sup>1</sup>

Brazil was discovered by the Portuguese Pedro Álvares Cabral in 1500; it remained a Portuguese colony until its independence in 1822. It has thus adopted the Portuguese as its official language. After the independence, many non-Portuguese Europeans had immigrated to Brazil.

The first Germans to arrive at São Paulo were brought by the general consul of Russia, George von Langsdorff, a German medical practitioner. In the same year of independence, he had obtained an authorization from José Bonifácio de

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<sup>1</sup>The exact figures provided by the IBGE (*Instituto Brasileiro de Geografia e Estatística*) in its census in 2000 are: population of Brazil = 169590693; population of São Paulo = 36969476; population of Campinas = 968172; and population of São Paulo city = 10405867 (IBGE, 2001, p. 45).



Figure 6.1: A political map of Brazil with its states and bordering countries in the south American continent.

Andrade e Silva, owner of the *Fazenda Mandioca* (Manioc manor) located in Rio de Janeiro, to bring immigrants to work in his rural property. Twenty German families were subsidized by von Langsdorff, and boarded the ship “Doris” arriving at the Guanabara Bay in Rio de Janeiro in 1824.

This first migration proved to be very successful, and until the end of the nineteenth century many Germans had immigrated. The peak of this immigration process was during the second half of that century. By the 1930s there were about eight thousand Germans living in the state of São Paulo (Kahle, 1937, p. 29; Miranda, 2005; von Simson, 1999, 1997, pp. 63-65).

Among the reasons for the emigration from Europe to the Americas we found a report from 1852, written by the district administrator of the rural village of Bernkastel (140 km south of Bonn, in Prussia) who explained that the production of goods was failing in its attempt to increase according to the growth rate of population, a fact that would eventually cause acquisition and nourishment difficulties among the members of the working classes. Already in 1846, 633 persons had emigrated either to USA or Brazil, and he predicted that these figures would go in crescendo since the incomes would no longer suffice to supply families according to their high standards (MoZ, 2007). The shortage of cultivable

lands and the inheritance rules were diminishing the possibilities of producing enough provisions for personal and commercial purposes, industries were going in recession since they were no longer able to provide the established incomes, and the pressure to pay high tithe and taxes started to provoke great dissatisfaction in lower income classes. Altogether these causes generated one of the greatest immigrations from Germany to Brazil, during the nineteenth century (MoZ, 2007; von Simson, 1997, p. 66).

Although abolition of slavery was officially signed on May 13th 1888, already between the years 1840 and 1880, a series of intense debates and liberal movements sought to democratize and build a new republic in Brazil, purging all remaining connections to the Portuguese monarchy. Many members of these movements were owners of coffee plantations, belonging to a so called “coffee-elite,” were against slavery and had started to properly hire laborers, paying them salaries. By 1855 there lived two thousand Germans and Swiss-Germans in the state of São Paulo; one of the crucial figures of this liberal movement was a senator named Nicolau de Campos Vergueiro who, in a partnership with the owner of the *Fazenda Sete Quedas* (*Sete Quedas* manor, see figure 6.2 and figure 6.4 for its geographic location), brought, in 1856, 112 German families to work in the fields (Di Francesco, 2007, p. 25; dos Santos Bezerra, 2002, pp. 69ff.; Leite, 2006; Fortes, 2003).

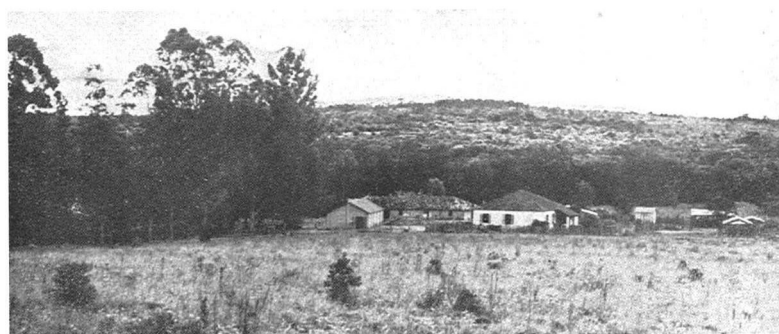


Figure 6.2: A picture of the *Fazenda Sete Quedas*, owed by senator Vergueiro. (Weizinger, 1935, picture 125)

Once the immigrants had evened up their debts with the landowners, they were able to save money and move away; some of them decided to buy land lots in the nearby region and dedicate them to the cultivation of coffee, potato, beans, etc. (von Simson, 1997). According to Oberacker, the German settlers achieved an important improvement for the development of agriculture in Brazil: due to their industriousness in agronomy they were able to increase the supplies for the urban areas, reinforcing the economical development of the nation (Oberacker

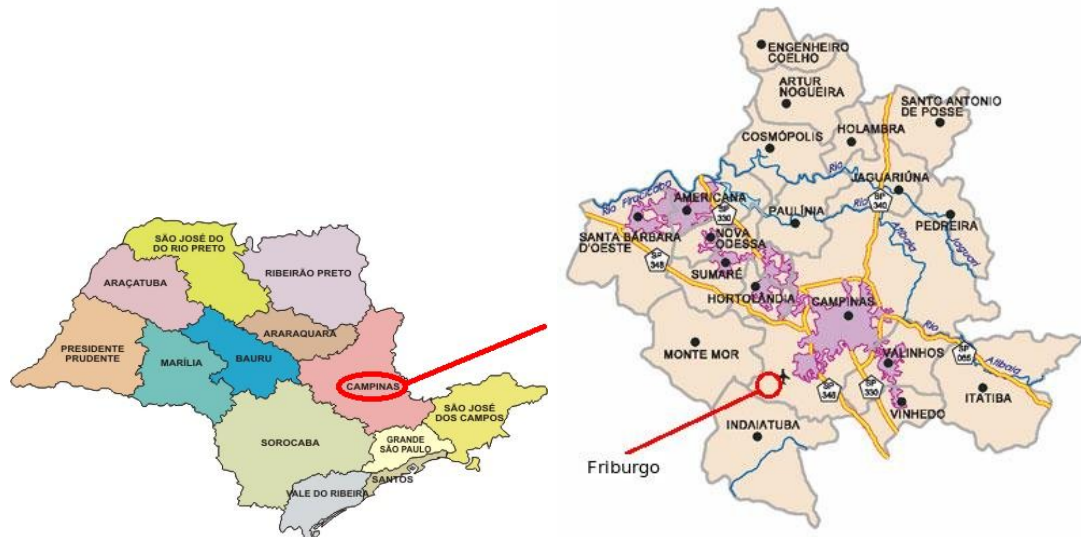


Figure 6.3: Left: a map of São Paulo where the region of Campias is indicated. Right: A map of Campinas. The red circle indicates the approximate location of the district of Friburgo.

Jr., 1968, pp. 285-286).

Eight families among these 112 had settled, between the years 1864 and 1877, in a rural region situated in the southwest of Campinas and north of Indaiatuba (ca. 22° 59' South and 47° 11' West, see figure 6.4). They were immigrants from the German regions of Rhenish Palatinate (midwest Germany) and Schleswig-Holstein (northernmost Germany), and from the canton of Bern in the German Switzerland. In 1879 the district of Friedburg, later called Friburgo, was founded and a school was opened this same year in October (see appendix C, section C.1 or Guebel, 1937, p. 2).

The integration process of this and other German colonies into the Brazilian culture was long and problematic. Two reasons can be pointed out: the first was the geographic location of these colonies, nearly always in the jungle or in not yet populated regions. As a consequence, the German immigrants felt the need of building a school where they could educate their children. These schools had been established with German curricula, and were, for a long period of time, the mainstay for the transmission of the German traditions and identity, difficulting the integration process (Schubring, 2003, p. 14).

Between October 2007 and January 2008 I undertook a field research in Friburgo. There I worked with the family Ambrust, one of the first families to arrive at this region. They, nowadays, live from the cultivation and and commercialization of grapes of the type *niagara*. Another component of this research was pursued in Campinas, at the Center of Local History (*Centro de Memória*, CMU) of the University of Campinas (Unicamp), where I could digitize the text-

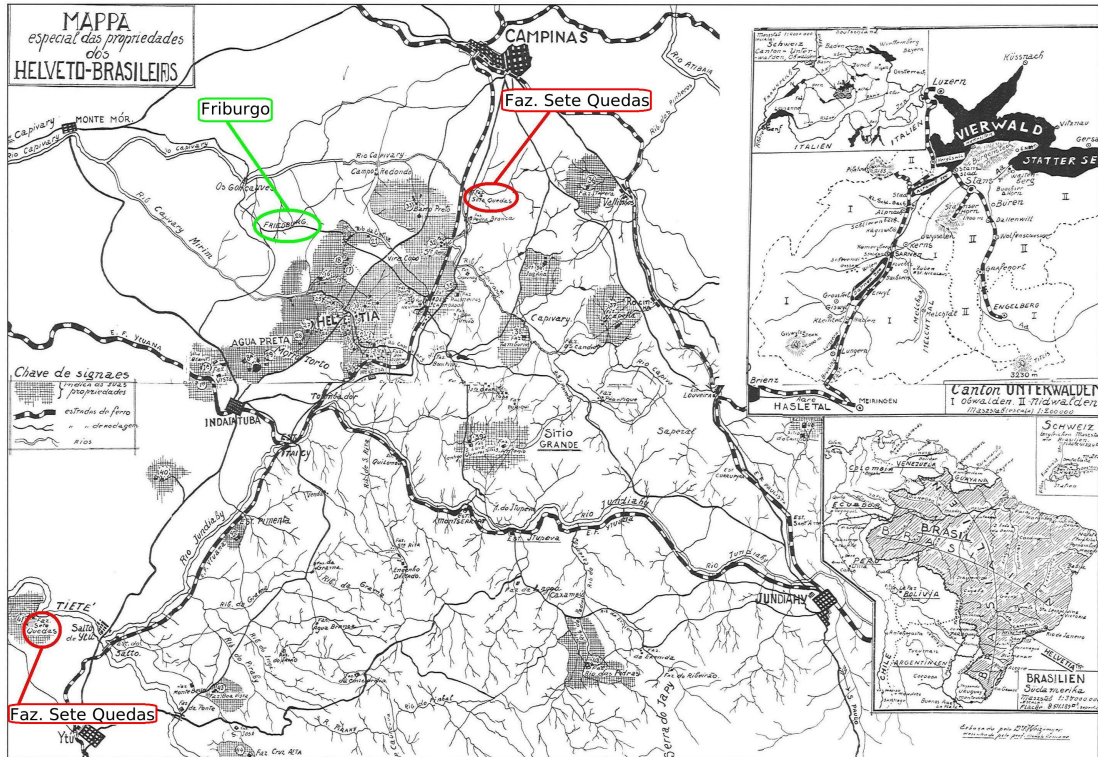


Figure 6.4: A map of *Comunidade Helvetia* and surroundings, where the location of Friburgo can be recognized. The red circles mark 2 two land lots of the *Fazenda Sete Quedas* and the green circle marks the location of Friburgo (Weizinger, 1935, picture 153).

books of mathematics that had been used in the school of Friburgo until the first quarter of the twentieth century.<sup>2</sup> I also had the opportunity to spend valuable time working personally with my co-adviser, Eduardo Sebastiani Ferreira.

In this chapter I shall describe how the investigation developed, starting with a description of the historical background, continuing with the hypotheses, and finishing with a presentation of the collected data, its respective analyses and conclusions.

## 6.2 The Foundation of Friburgo - Historical Facts

In 1937, Richard Guebel published, in a German journal called *Der Volksdeutsche* (The Ethnic German), an account of Friburgo: a small rural settlement

<sup>2</sup>In Friburgo, many books were spoiled due to the high level of humidity in the air, a common climatic situation in Campinas. For this reason, they were moved to the CMU since there they could be kept in better conditions. I received a formal authorization from the members of the School Society of Friburgo (*Sociedade Escolar do Bairro Friburgo*, SEB-Friburgo) allowing me to access and evaluate the information required for my research (see appendix C).

that was formed between the years 1864 and 1877.<sup>3</sup> The first settler was Friedrich Thamerus who had arrived in Brazil in 1851, coming from Rhenish Palatinate; he was followed by the brothers Nikolaus and Samuel Krähenbühl, Swiss-Germans from the canton of Bern, and later by the families Steffen, Jührs, Klemendt, Armbrust, Quitzau and Wulf from Schleswig-Holstein (See appendix C, section C.1 or Guebel, 1937, p. 2). Friburgo remains a peasant district where the family working is predominant, that is, each generation assumes the responsibility of the productive lands and continues with the family business (dos Santos Bezerra, 2006, p. 134).

These families and many others had arrived between 1840 and 1859 when senator Vergueiro had signed a partnership with the owners of the *Fazenda Ibicaba* and *Fazenda Sete Quedas*, in which was agreed to bring immigrants and hire them as laborers. The costs for it were to be covered by the same owners of the lands. With this, the immigrants had an initial debt with their employers, which was cancelled after a certain period of time they spent working as laborers. As described in the previous section, Vergueiro was against slavery policies and attempted to encourage an increase in the salaried class. It was not easy to compete against the slave laborers and, for this reason, Vergueiro had proposed this system of immigration conditioned to an initial debt. Thus, the immigrant was obliged to stay in contract until the total debt was liquidated (Fortes, 2003, p. 9).

During the first years, the settlers of Friburgo had to overcome many difficulties, most of all due to the inadequate transport routes, which continue to be in very bad conditions. Later, with the appearance of bigger and heavier means of transportation, such as trucks and tractors, they could transport their products easier.

These families were dedicated to the cultivation of potatoes. The sacks needed to be transported to the city several times in the week, and they were sold in the streets to private consumers. In the following years, they started to produce fruits and the economic and living situations had meliorated (see appendix C, section C.1 or Guebel, 1937, p. 2). Until 1929, these families were growing coffee as main production followed by potatoes, corn, beans and rice; some families raised dairy cows, swines and hens (von Simson, 1997, p. 69).

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<sup>3</sup>Maria Kahle stated in her book *Deutsche Heimat in Brasilien* that Friburgo was founded in 1858 (Kahle, 1937, p. 61). If Thamerus arrived in Brazil in 1851 it would not have been possible to pay the debts to the manor lord within 7 years, in most of the cases the families lived in the manor lands for at least ten years and up to twenty years (von Simson, 1997, p. 68).

By the end of the 1920s they decided to build a church; until then they had received the visit of the pastor of Campinas, who came to minister, every fifteen days, in the school building, constructed in 1879 (see section 6.2.1 below). Thanks to the financial support they had received from the German Protestant congregation of São Paulo and other Brazilian states, as well as voluntary donations, they could inaugurate their Protestant church, ministered by the pastor of Campinas, who came one Sunday a month to celebrate the service in 1934, despite the economical crisis and the steep fall in the coffee price (see figure 6.5, and von Simson, 1997, pp. 72-72).

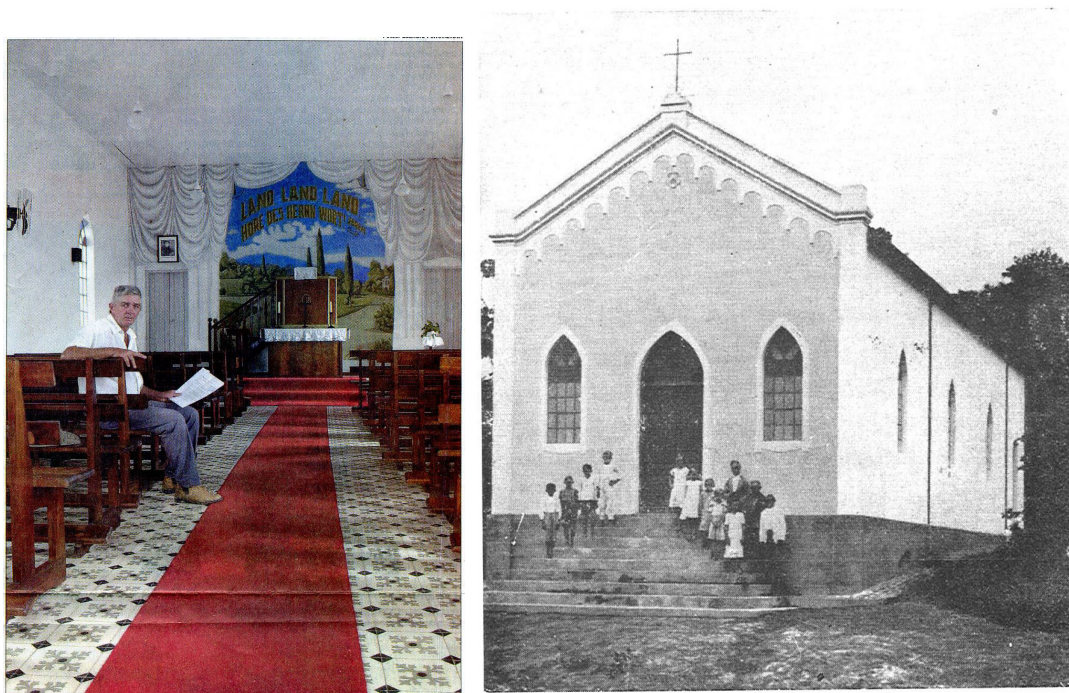


Figure 6.5: Pictures of the church of Friburgo, from inside and outside (left: Leite, 2006; right: Leite, 2006; Weizinger, 1935, picture 60).

It is interesting to note that the cemetery was built much earlier than the church itself, in 1886. With the death of some relatives, they had realized that the transport of the corpses to the Protestant cemetery in Campinas, located at about 20 km of Friburgo, was too exhausting as it had to be carried out by foot. Due to this fact, the community members took the decision, in December 1881, of constructing a Protestant cemetery in Friburgo. Until the cemetery was officially opened, they had to overcome a long struggle with the Catholic church, the dominant religion in Brazil, and the Municipality of Campinas (*Câmara Municipal de Campinas*) to obtain, respectively, the sanctification and the authorization for construction (see figure 6.6; von Simson, 1997, pp. 7071).

Guebel had depicted an interesting report of the life within this community



Figure 6.6: Pictures of the cemetery of Friburgo (2007).

for the readers in Germany; one negative aspect to him was the remote geographic location that did not enable the sons of the peasants to stay with them after they married. This was a cause for the newer generations to move to other towns and cities where, sometimes, they could not find German schools nor Protestant churches (see appendix C, section C.1 or Guebel, 1937, p. 3). With this emigration, the *teuto*-Brazilians of Friburgo started to lose their German identity and traditions.

In the early 1990s, the community of Friburgo decided to reconstruct and redefine their identity and traditions. The members of the School Society of Friburgo (*Sociedade Escolar do Bairro Friburgo*, SEB-Friburgo) searched for help in some universities in Campinas, and hoped that they could help with this process of retracing their identity and culture. The strong relationship these families have with their land (soil, earth) encouraged them to bring back the traditional peasant feasts and dances from the Germany of the nineteenth century, especially from those regions where their descendants came from (see figure 6.7). According to von Simson, the reconstruction of the identity is not related to a nostalgic enthusiasm or a static appreciation of the past, it is about understanding the present days through an exhaustive analysis of the past (von Simson, 2000, pp. 91;103).

### 6.2.1 The School of Friburgo

Once the families had settled in Friburgo, almost the first concern to arrive was that of giving education to their children; by that time, the German secondary school in Campinas already existed, but these peasants had no means to bring their children to the city. In 1878, the School Society of Friburgo (*Sociedade Escolar do Bairro Friburgo*) was founded with the following members: Henrique



Figure 6.7: Pictures of a pinboard with the events in Friburgo and a mural of the Neuschwanstein castle, which is actually located in the most southern Germany (2007).

Ströh, Samuel Krähenbühl, Reinaldo Steffen, Hans Steffen, Luiz Steffen, Nikolaus Krähenbühl and Otto Fahl (Augusti & Falleiros Braga, 1996, slide 4). They assumed the responsibility of building a school for the community and, with their own hands, completed the construction of the school building and of a house for the teacher, who was supposed to arrive directly from Germany (see figures 6.8 and 6.9). On October sixth of 1879, the elementary school was inaugurated with 16 children and the teacher Mr. Augusto Höhne (see appendix C, section C.1 or Guebel, 1937, p. 2.; Rueda *et al.*, 1996, p. 41).



Figure 6.8: The school of Friburgo, nowadays used as a recreational center. (2007).

At the beginning, the school building was the gathering center not only for children, but also for the settlers to share religious, cultural and political meetings (dos Santos Bezerra, 2006, p. 135). For example, it was during one of these meetings, on December 26th 1881, that the idea of building a cemetery for the community was suggested and approved (see section 6.2 above).

Unfortunately it was not easy to keep the school on the run; the remote geographic location of the district and the school of Friburgo, and the incapacity of paying a good salary often discouraged teachers. Finally, Nikolaus Krähenbühl

decided to assume the position; the community agreed that he was qualified to take charge of the education of their children since he had completed a secondary school level (*Gymnasium*) in his home country. He taught for almost ten years, until 1894 (Rueda *et al.*, 1996, p. 41). Other difficulty was presented by Maria Kahle:

“In most of the time, the children of the settlers visit the school only three and at most four years, sometimes it is sufficient for the parents if they go only single year. If there is much work to do in the fields, the children need to stay at home and help. It may happen that some children visit the school only ten or fifteen days in a whole month.”<sup>4</sup>

Meanwhile, In December 1896, the law 489 entitled “Obligation of teaching the national language” had been promulgated. The government of the state of São Paulo was aware of the existence of private schools linked to other ethnic groups.<sup>5</sup>

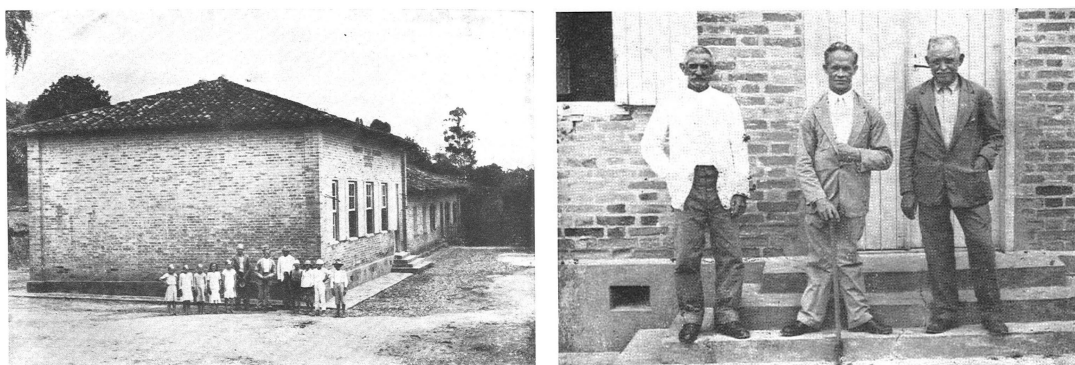


Figure 6.9: On the left hand side, a picture of the school of Friburgo. On the right hand side, the local authorities of Friburgo by 1923 posing at the porch of the school: Johannes Krähenbühl (church president, left), Richard Guebel (school teacher, middle) and Wilhelm Steffen (school president, right) (Weizinger, 1935, pictures 59;61).

On the other side of the ocean, in the German territory the Association for Germanism Abroad (*Verein für das Deutschtum in Ausland*, VDA, first called *Allgemeiner Deutscher Schulverein*) had been founded in 1881, with the purpose of encouraging the boost of the German language, culture and traditions. The role

<sup>4</sup>My translation of:

“*Meistens besuchen die Kolonistenkinder in den kleineren Siedlungen ihre Schule nur drei, höchstens vier Jahre, zuweilen genügt den Eltern aber auch schon ein einziges Jahr. Wenn es auf den Feldern viel Arbeit gibt, bleiben die Kinder aus. Es kommt vor, daß Kinder im Laufe des Monats nur zehn oder fünfzehn Tage die Schule besuchen.*” (Kahle, 1937, p. 37)

<sup>5</sup>The law 489 was promulgated by Campos Salles and its original title was *Obrigatoredade do ensino da lingua nacional* (dos Santos Bezerra, 2002, pp. 164-165).

of this association was decisive in reinforcing the position taken by the German colonies against the process of integration promoted by the Brazilian government (Schubring, 2003, pp. 15-16).

By 1895, procedures for the application of subsidies were started; the Ministry of Foreign Affairs (*Auswärtiges Amt*, AA), which had relations with the VDA, had, in 1900, systematized the payment of such subsidies to single schools. But it were not only these payments what maintained the cultural relations between Germany and the German schools in Brazil; they, furthermore, received imported school material, and some schools had attempted to contract teachers from Germany (Schubring, 2003, pp. 22 ff.).

On October 25th 1917, after Brazil had declared war against the German Empire, all German schools in the Brazilian territory were obliged to close. They were reopened after the end of the World War I, but the school situation was no longer the same as that prior to the War since the educational system had been nationalized. Nonetheless, the rejection of the integration policy among the now descendants of German immigrants, and so called *teuto*-Brazilians, was even higher.

The school in Friburgo had managed to reopen on February 1st 1918, before the war's end (dos Santos Bezerra, 2006, p. 138). In Guebel's terms, the closure of the school was associated with the rise of the hatred of the Germanism, practiced by the settlers, coming from the national government authorities that were in disagreement with the non-teaching of the national language. By the time of the publication, he had explained that it was forbidden by law to give lessons in a foreign language (see appendix C, section C.1 or Guebel, 1937, p. 2).

One other reform in public education was promulgated in Brazil, in December 1920 by Washington Luis: teaching in the national language was mandatory, particularly in private schools. In December 1925, another law 2095 was signed by the central government. It stated that the teaching of Portuguese language and of Brazilian history and geography were to be taught by Brazilian or Portuguese teachers.

Likely, the school had hired by 1919 two teachers for the school, the German Max Greger and the Swiss-Brazilian Edgar Forster, in order to avoid conflicts with the Brazilian policies (see appendix C, section. C.1 or Guebel, 1937, p. 3; dos Santos Bezerra, 2006, pp. 137-138). Since November 1919, Richard Guebel had been the teacher of the school of Friburgo; in his article, he brought out the fevered debated issues with teaching in German and/or Portuguese language (see

appendix C, section C.1 or Guebel, 1937).

Later, the school of Friburgo was supervised by the Educational Secretariat of the State (*Secretaria de Educação do Estado*):

“[The school of.] Friburgo was initially Protestant. After it started to be supervised by the Educational Secretariat of the State (*Secretaria de Educação do Estado*), it was obliged to receive Brazilian children, kids of the rural workers who also lived in the proximities of Friburgo, having both Catholic and Protestant.”<sup>6</sup>

## 6.3 Hypothesis

At the CMU-Unicamp, I proceeded with a historical approach to my ethno-mathematical research. In the grape fields of the Amburst family in Friburgo I developed an ethnographic and ethnological approach. Both will be described in the following section. I will propose a set of questions in which I should focus through my study.

The main questions I had were:

- 1) Among the textbooks of mathematics kept for conservation reasons at the CMU-Unicamp, how many of them were imported or brought from Germany? How many were edited by *teuto*-Brazilian publishers? Is there a considerable difference in the teaching methods used during the same period of time by German schools (*Volksschule*)? Is it possible to recognize a “frozen”, in Gerdes’ term, German school mathematics of the 1860s in the 1930s *teuto*-Brazilian school mathematics, in particular with respect to the use of unit systems?
- 2) Which mathematical tools are used in the process of growing grapes? Can they be classified as: knowledge obtained in school, knowledge acquired in practice, knowledge transferred through oral tradition?

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<sup>6</sup>My translation of:

“[A escola de] Friburgo era de início luterana. Depois que passou a ser fiscalizada pela Secretaria de Educação do Estado, foi obrigada a receber alunos brasileiros filhos dos trabalhadores rurais das proximidades se tornando assim, paritária, ou seja contava tanto com evangélicos quanto com católicos.” (dos Santos Bezerra, 2006, p. 70)

## 6.4 Data Collection

### 6.4.1 Textbooks - Centro de Memória, Unicamp

With the consent of the School Society of Friburgo (*Sociedade Escolar do Bairro Friburgo*, see appendix C, section C.2) I was able to access the school material stored at the CMU-Unicamp. This material had been brought from the school in Friburgo due to two reasons: the first was the bad state of some of the textbooks and school notebooks. Secondly, the SEB-Friburgo has no adequate conditions for keeping old school material.

The following table consists of the textbooks I digitized at the CMU-Unicamp. They have been categorized by title, author, publisher, year of publication. This latter and the language of the book determines the order of listing. The complete digitized versions of these books may be found in the attached media (DVD, see back cover).

Title	Author	Publisher	Year
<i>Aufgaben für das praktische Rechnen, zum Gebrauch in den Volksschulen</i>	Ed. Trieschmann	Fr. Wortmann, Schwelm	1891
<i>Das verbundene Kopf- und Zifferrechnen für ein- und zweiklassige Volksschulen</i>	Fr. Guth	Adolf Bonz & Comp., Stuttgart	1892
<i>Geometrische Rechenaufgaben für die Oberklasse der Volks- und Bürgerschule sowie für Fortbildungsschulen und Seminarvorbereitungsanstalten</i>	Dr. C. Kehr	E. F. Thienemann, Gotha	1894
<i>Rechenbuch für deutsch-brasilianische Volks-Schulen</i>	Chr. Kleikamp	Verlag des Verfassers, Porto Alegre	1898 <sup>7</sup>
<i>Praktische Rechenschule in vier Heften für deutsche Schulen in Brasilien</i>	Otto Büchler	Rotermund und Co., São Leopoldo, Rio Grande do Sul	1932
<i>Guia do Medidor de Terrenos ou Regras Practicas para avaliar a Superficie das Terras segundo o Novo Systema</i>	F. Teixeira da Silva	Imprensa da Universidade, Coimbra	1861
<i>Curso Theorico e Practico de Pedagogia</i>	J. J. Rapet	Liv. Chardron, de Lello & Irmão, Porto	1897
<i>Chave da Algebra Elementar</i>	Antonio Trajano	Typ. Leuzinger, Rio de Janeiro	1897
<i>Educação: Terceira Conferencia Nacional de Educação.</i> Vol. VI, No. 3		Orgão da Directoria Geral de Instrução Publica e da Sociedade de Educação de São Paulo	1929
<i>Mensário de Orientação Pedagógica na Escola e no Lar: Infância e Juventude</i>	Renato Americano (editor)		1936

Table 6.1: List of all books that the school of Friburgo has stored at CMU-Unicamp. The first 5 books are textbooks in mathematics in German language. The last 5 are in Portuguese and on different subjects.

Table 6.1 shows that the books in German were all textbooks in mathematics. Among the books in Portuguese we have: one text book in mathematics, three books have the term pedagogy in the main title, and one book that refers to, according to its title, the measuring procedures of land lots. The textbooks in German language will be those used for the further analysis in section 6.5; for this reason I will present their detailed contents below. Following the same chronological order as in table 6.1, we have:

**Aufgaben für das praktische Rechnen** (Trieschmann, 1891).

I. Der Zahlenraum von 1 bis 1000.

1. Zählen (Numerieren).
2. Zusammenzählen (Addieren).
3. Abziehen (Subtrahieren).
4. Vervielfältigen (Multiplizieren).
5. Teilen und Enthaltensein (Dividieren).

II. Der unbegrenzte Zahlenraum.

1. Numerieren.
2. Zusammenzählen (Addieren).
3. Abziehen (Subtrahieren).
4. Vervielfältigen (Multiplizieren).
5. Teilen und Enthaltensein (Dividieren).
6. Vermischte Aufgaben.

Anhang

- Die römischen Zahlzeichen.
- Übungstafel.
- Das kleine Einmaleins.

**Geometrische Rechenaufgaben** (Kehr, 1894).

I. Längenberechnungen.

- Gerade Linien.
- Kreislinien.

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<sup>7</sup>In the edition I digitized of Kleikamp's book there appeared no year of publication. I obtained this information from Kreutz' book (cf. Kreutz, 1994, p.86).

## II. Flächenberechnungen.

- Die Parallelogramme.
- Berechnung der Dreiecke.
  - A. Berechnung des Flächeninhalts der Dreiecke.
  - B. Berechnung der Seiten im Dreiecke.
    - a) Im rechtwinkligen Dreiecke.
    - b) Im gleichseitigen Dreiecke.
    - c) Im gleichschenkligen Dreiecke.
    - d) Im rechtwinklig-gleichschenkligen Dreiecke.
    - e) Im ungleichseitigen Dreiecke.
- Trapez und Trapezoid.
- Berechnung des Flächengehaltes regelmäßiger Vielecke.
- Berechnung des Flächengehaltes unregelmäßiger Vielecke.
- Die Kreisfläche.
- Die Ellipse.
- Kreisabschnitt und Kreisbogenabschnitt.

## III. Körperberechnungen.

- Das Prisma.
- Der Zylinder.
- Die Pyramide und der Pyramidenstumpf.
- Der Kegel und der Kegelstumpf.
- Die Kugel.

### Rechenbuch (Kleikamp, 1898)

#### I. Der Zahlenraum von 1 bis 10.

- A. Zuzählen.
- B. Abziehen.
- C. Malnehmen.
- D. Enthaltensein und Teilen.

#### II. Der Zahlenraum von 1 bis 20.

- A. Zuzählen und Abziehen.
- B. Malnehmen.
- C. Enthaltensein und Teilen.
  - I. Ohne Reste.
  - II. Mit Resten.

III. Der Zahlenraum von 1-100. 1. und 2. Teil.

- A. Bilden und Zerlegen zweistelliger Zahlen.
- B. Zuzählen.
- C. Abzählen.
- D. Malnehmen.
- E. Enthaltensein und Teilen.

IV. Der Zahlenraum von 1-10 000.

- A. Bilden der Zahlen.
- B. Zusammenzählen, Addieren - Addition.
- C. Abziehen, Subtrahieren - Subtraktion.
- D. Vervielfältigen, Multiplizieren - Multiplikation.
- E. Teilen, Dividieren - Division.

V. Einführung in die Bruchform.

- Das kleine Einmaleins.
- Verzeichnis der im Hefte vorkommenden Abkürzungen der Maße und Gewichte.

**Praktische Rechenschule in vier Heften 3. Heft** (Büchler, 1932).

- Regeldetri.

A. Kopfrechnen

- Schluß von der Einheit auf die Mehrheit.
- Schluß von der Mehrheit auf die Mehrheit.
- Schluß von der Mehrheit auf die Einheit.
- Schluß von der Mehrheit auf die Mehrheit. (Rechenvorteile.)

B. Schriftlich.

1. Regeldetri mit geraden Verhältnissen.
  - a) Aufgaben mit ganzen Zahlen.
  - b) Aufgaben mit gemeinen Brüchen.
  - c) Aufgaben mit Dezimalbrüchen.
2. Regeldetri mit umgekehrten Verhältnissen.
3. Zusammengesetzte Regeldetri.

- Allgemeine Prozentrechnung.

1. Berechnung des Prozentbetrages.
2. Berechnung der Prozentzahl.

- Zinsrechnung.
  1. Berechnung der Zinsen.
    - A. Kopfrechnen.
      - Benutzung von Rechenvorteile.
      - Eingekleidete Aufgaben fürs Kopfrechnen.
    - B. Schriftlich.
      - Vermischte Aufgaben.
      - Schuldschein und Hypothek.
  2. Berechnung des Kapitals.
    - A. Kopfrechnen.
    - B. Schriftlich.
  3. Der Zinsfuß wird gesucht.
  4. Die Zeit wird gesucht.
- Rabattrechnung.
  - A. Kopfrechnen.
  - B. Schriftlich.
- Erweiterung der Rabatt-Rechnung.
  - Berechnung der Prozentzahl.
  - Berechnung der Zeit der Vorauszahlung.
  - Brutto, Netto, Tara.
- Gewinn- und Verlustrechnung.
  - A. Kopfrechnen.
  - B. Schriftlich.
    1. Ohne Prozentangaben.
    2. Berechnung der Prozentzahl des Gewinnes oder Verlustes.
- Mischungsrechnung.
  1. Der mittlere Preis wird gesucht. (Durchschnittsrechnung.)
  2. Der Preis einer Sorte wird gesucht.
- Teilungs- oder Verhältnis-Rechnung.
  1. Arithmetische Teilungsverhältnisse.
  2. Geometrische Teilungsverhältnisse.
  3. Gesellschaftsrechnung.
- Das Geld.
  - Geldwährung und Arten des Geldes.
  - Umrechnungen mit dem Auslande.
- Münzen, Maße und Gewichte.

The first book, printed in Germany, introduced the basic arithmetic operations. The second book, also printed in Germany, consisted of the computations of length, surface and volume. The third book belongs to the first of these collection that was printed in Brazil. According to Mauro, it consisted of a series of 2 books, being this the first of them. The last book, printed in Brazil as well and authored by Büchler, was focused on the so called *bürgerliches Rechnen*, that is, the calculations necessary for the everyday life. It consisted of a series of 4 books, this being the third.

### 6.4.2 Interviews in Friburgo

The information presented in this section was collected during the days I had spent with Hedinho Ambrust in Friburgo. I have gathered them while walking, conversing and interviewing with him. The complete transcriptions in Portuguese may be found in Appendix C. All texts and sentences have been translated by me.

Hedinho is a producer of grapes, which is why many technical terms taken from the disciplines of agriculture and agronomy will appear throughout the following report. I will give a short description of those terms I have used:

Crop growing is a synonym for cultivation; the term crop itself is the outcome product of a certain plant, e.g., a vegetable, a grain or a fruit. In German: *Anbau* or *Kultivierung*, and in Portuguese: *cultivo* or *cultura*.

Breed refers to the type or class of a certain plant. In German: *Sorte*, and in Portuguese: *variedade*.

Topography is the study of the shapes and features of the soil.

Stem refers to the main part of a plant. In German: *Baumstamm*, and in Portuguese: *caule*.

Rootstock is the stem of a plant that will serve as the roots of a new coming plant. In German: *Wurzelstock*, and in Portuguese: *porta-enxerto* or *cavalo*.

Scion is a living part of a plant that will be grafted in the rootstock; determining thus the breed. In German: *Ableger* or *Edelreis*, and in Portuguese: *enxerto*.

Lop off is the procedure consisting of cutting the plant up to its main stem; in the coming season it will grow again. In German: *abästen* or *beschneiden*, and in Portuguese: *podar*.

## Family Ambrust - History

Hedio (Hedinho), Carlos and Edson Ambrust administrate the land of their parents, Albrecht and Enides; Hedinho lives in the land house with the parents, and is the in charge of administrating the lands, plantations and everything related to it. The name of the company is *Sítio Mirim* which could be translated to English as *Small Land* (see figure 6.10). His family belongs to one of the founders of Friburgo; their last name used to be Armbrust but it changed to Ambrust due to a typing mistake at the register office.



Figure 6.10: The wrapping used in some boxes with the name of Hedinho's small business (2007).

The Ambrust family has owned the land where they live for more than 130 years. His grandfather was the owner of more than 100 *alqueires*, as Carlos informed to me; 1 *alqueire* equals 24200 m<sup>2</sup>, so the land summed up to (2,42 · 10<sup>4</sup>) m<sup>2</sup> or, in hectare, 2,42 ha. Today, Hedinho and his brothers have ca. 7 *alqueires* invested to the cultivation of grapevines; inheritance, land distribution and sales have reduced and divided several lots throughout the family.

The first crop growing in the lands of the Ambrust family were potatoes, corn and beans. And the first producer was Hedinho's great-grandfather. When I asked him if it would be possible that his descendants had used growing techniques that they had imported from Germany, he was not sure about the answer but he tended to hold this for improbable as modernization has so far provoked major changes in the labor work, enabling the use of machinery instead of physical work.

The cultivation of grapes was started by Hedinho's father and grandfather, around the year 1973. They started with five thousand stems. Today, it totals up to seventy thousand grapevine plants spread in an area of approximately 7 *alqueires*. The only breed he and his brothers cultivate is called *niagara*, one of the most popular in Brazil and the only in the region; they only produce wine

grapes for personal consumption.

Prior to the grape plantations, Albrecht and his father had cultivated tomatoes for at least four years, in the 1960s; according to Carlos, tomatoes crop growing are beautiful and very profitable, but it demands too much attention and hard work as it damages the soil and brings many plagues to it.

## **Cultivating *niagara* grapes**

### **Dividing the lands**

As Hedinho stated, his cultivation of grapes uses 7 *alqueires* of surface, distributed in 3 land lots, summing a total of seventy thousand stems. Each *alqueire* is divided into 2 blocks, totaling 14 blocks of grapes. Each block is constituted by streets and stem-lines, and around these blocks there are land roads of 5 m wide, where trucks can drive and be loaded with the crops, otherwise they would need to be transported by foot.<sup>8</sup> The distance between the streets is approximately 1,7- 1,8 m, and the distance between the stems is 80 cm; these cannot be reduced, otherwise the plants would be too near from each other disabling the circulation of air.

The size and shape of the blocks change according to the topography of the land, nonetheless Carlos computed an average of 3500 stems per block; Hedinho is accustomed to plant at most 75 stems in one stem-line, but it is possible to have narrower or wider streets with 50 and up to 150 grapevines. Hedinho holds that having long streets is tiring and disadvantageous because the person working in it needs to be standing for longer time. Nonetheless this number depends and varies according to how the amount of surface is optimized for its arable use.

The grapevines are held on the top by three wires that have been stretched out throughout the stakes of the stem-line, drawing a triangle. Hedinho explained to me that they used to be positioned in one plane and that they later realized that by putting the wires in a *hat-shape* the sprouts were able to move to opposite directions, enabling more incidence of sun and ventilation, thus helping in the coloration of the grapes.

During the time when the land was divided and belonging to the members of the family, there existed no construction of fences in the borders of the land lots as they did not see this as necessary. After the lots were sold to different

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<sup>8</sup>The name of the roads between blocks are called in Portuguese *carreador*, which means a land road for cars.



Figure 6.11: Some parts of the land lots of Hedinho with grapevines planted. (Pictures taken by me.)

families, it required such fences.

It may happen that a land road crosses these borders and this demands the construction of a farm gate. In some cases, building a *mata-burro* becomes more practical: a *mata-burro* consists of digging a squared hole in the road and covering it with wooden beams such that, the gap left between these beams equals their width. The main idea is that cars and trucks can cross this, but not animals: for this reason the gaps left open will not be as wide as the width of a normal car wheel. Hence, it avoids the invasion of cattle from other producers and, at the same time, it keeps the road open. It once happened to Hedinho, that one of his plantations was invaded by an ox cattle; fortunately, his neighbor and owner of the cattle payed for the damages caused.

The contour lines consist of gutters about the blocks and streets; depending on the topography, they are dug in order to avoid erosion and crumblings in the soil. Hedinho claimed that these contour lines are mostly needed in inclined lands. The purpose of a contour line is to create an artificial channel for the rain waters to flow and not destroy the plantations. As Hedinho said: “it is like a sewer.”<sup>9</sup> The distance between these lines varies from 100 to 200 m.

A neighbor of Hedinho built a golf course in his land. He commented to me that these lands used to be very productive but now they had been misused and are no longer arable. I asked him if it had been so because of the lawn used for playing golf, but he denied and explained that the relief and topography of the soil had been modified and that these modifications cause erosion in the earth.

One of the parcels Hedinho counts in his crop growing is in another part of Friburgo, nearer to the school; the owner is another person and Hedinho has been

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<sup>9</sup>My translation of:

“É, é uma valeta que vai servir de um tipo de um esgoto, pra água de chuva.” (See appendix. C)

renting it for four years now. In this lot, the streets are wider and constitute of ca. 90 stems, and the total number of blocks is equal to four; he predicted about six thousand boxes of 5 kg for the 2007 harvest. The disadvantage of allocating parcels is that you have no rights to manipulate the soil as you conveniently estimate, said Hedinho. In this case, there is one tree standing in the middle of a block attracting birds that feed the grapes and destroy the bunches.

### **Growing, cropping and nesting grapes**

Before starting with the cultivation of grapevines, it is necessary to locate the blocks and determine their surface; a block can be primarily understood as a city block, it consists of stem-lines, streets and land roads that surround it. The streets are marked and the stakes are rammed around the block, in each stem-line, and, along these lines, every 5 stems. The wires are stretched out from one end to the other, and strips of reusable plastic are fixed in one of the wires, marking the future position of each grapevine.

Normally, one stake is rammed every four stems but, in order to reduce costs as the stakes are very expensive, Hedinho has added one grapevine. For ten thousand stems he requires ca. 1000-1200 stakes; each stake has a cost of R\$ 4,5 to R\$ 5 and the best ones may top R\$ 10. Good stakes last the whole 20 years; they are usually injected and treated with copper sulfate. If they have not been treated, they will last only half of this time, i. e., ten years.

The following procedure is to plant the rootstock which is normally a sour variety of grapes but very good at taking roots. This stock is planted in August and needs to grow for one year; after this year, the rootstock is grafted with the scion which is inserted such that ca. 15-20 cm remains outside the surface and 10 cm is put inside the stock and covered with earth. This is the variety of grapes that will be produced. Hedinho concluded: “the first crop occurs two years after the rootstock has been planted.”<sup>10</sup> According to him, it is not convenient to graft long scions because they run the risk of drying. After approximately ten years, the grafts can no longer be recognized nor are they visible to the naked eye (see figure 6.12).

The taste of the grapes vary from year to year; this is measured according to the amount of sugar, called *brix*. A good brix happens when the cold and, later, the dry seasons arrive at the appropriate time of the year. If it rains too much

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<sup>10</sup>My translation of:

“Então são 2 anos, desde que planta até você ter a primeira colheita.” (See appendix C)



Figure 6.12: The first image shows how the rootstock has been cut in half in order to be grafted. The second image up presents a scion that has already grown and become a proper plant. As the image down indicates, the procedure of inserting the scion in the rootstock becomes unrecognizable (2007).

during September and October, the grapes become more watery. As Hedinho explained, it is thanks to the dry season that the grapes retain sugar, they retain energy. The brix also depends on the type of soil; according to Hedinho, the land in Friburgo, i.e. the one he rents, is sandier and hence the grapes are not as sweet as they are in his own lands.

Each sprout can develop two to three grape bunches; as Hedinho explained, if there are only two they become big bunches, and if there are three one of them will be small. Sometimes, the small bunches are small because they have dropped load. Hedinho calls these bunches of second class; they are normally placed in small boxes since the big bunches would not fit in them. They appear four months (120 days) prior to the crop season; they also come up before the leaves.

The task of the leaves is to protect the grape bunches from the sun since, if they are directly exposed, they lose their intensive purple color which is turned into a reddish one. The grapes are covered with something that could be com-

pared to dust, but they call it *wax*. It is, as Hedinho says, the *charm* of the grape; for this reason it is not good to touch them, too many times, with the fingers because they lose this wax and hence their charm; when cropping the bunches, you need only use the fingertips. The hat-shape effect, produced with the wires, helps the bunches stay under the shade created by the leaves.



Figure 6.13: On the left hand side we can appreciate the wax of the grapes and how it has been removed with the fingertips. On the right hand side, we see how the leaves shade to the grape bunches (2007).

The grapevines last 20 years, just as the stakes do. After this time, Hedinho removes them and start cultivating corn; it is a very good plantation to re-feed the soil with nutrients, as he said. This procedure is called *crop rotation* and it lasts from three to four years. It is very important to let the earth rest and be stirred, otherwise it becomes too hard.

Every second street is covered with fodder; this helps keeping the earth moist, especially during the dry season in September. The fodder is spread during the months of February and March.

The grapevines are cropped between November and January; they will rest until July. Between mid-July until mid-September they are lopped off almost until the main trunk. This process is followed in such a way that the crop season should start in November and finish in January. The prediction of the crops may have a shift of ten days; this shift depends on how long was the dry season.

Laborers use either wooden baskets or thick wooden boxes to crop. If they are cropping with the thick wooden boxes, the grape bunches are immediately accommodated in two layers, so that they will be touched only one time only with the hands (see figure 6.14). The grape bunches are cropped by streets and Hedinho considers unfortunate that they do not ripe simultaneously, even though they had been lopped off in the same period of time. He concluded by saying that sometimes this leads to losses in the sales.



Figure 6.14: These are boxes Hedinho uses to crop in the field. On the left hand side, we can appreciate how the bunches are accommodated (2007).

If the harvest is proceeded with the wooden baskets, the grape bunches are transported to the warehouse where they will be filled in other boxes. Among these boxes, there are two types: those made of cardboard and those made of wood (see figure 6.15). In the case of the wooden boxes, there are boxes made of thick wood that are not for sale, i.e., Hedinho's clients need to return the boxes for the next order; and there are thin wooden boxes that are included in the sale's price. The cardboard boxes can be filled with up to 1,5 kg and the wooden boxes with up to 5 kg. Some boxes have cover; these are commonly requested by buyers that need to travel long distances with them, e.g., to Goiás.<sup>11</sup>



Figure 6.15: On the left hand side we see the baskets that had been transported to the warehouse. The grape bunches will be moved to the cardboard boxes on the right hand side (2007).

Furthermore, different grape bunches will be filled into different boxes: the small bunches go into the small boxes of 1,5 kg and, analogously, the big bunches go into the big boxes of 5 kg. According to Hedinho, bigger grape bunches are better. When the grape bunches are filled in the boxes, the smallest bunches come on the bottom and the big ones on the top, always resulting in 2 layers

<sup>11</sup>The distance between Friburgo and any city or town in the state of Goiás is at least 1000 km.

and giving a good appearance. The advantage of cropping the grape bunches in the baskets and later bringing them to the warehouse is that the bunches can be selected; the small ones go in one basket and the big ones in another.

When I asked Hedinho how do they know that the boxes are weighing exactly 1,5 kg or 5 kg his answer was: “A box can only comprise this amount, and if you do not fill it you do not achieve the desired weight.”<sup>12</sup> I furthermore asked whether the boxes are weighed once they are filled to what he answered: “It is not possible to do that. But if you hold a box of, e.g., 5 kg, shake it and the grapes shake inside, then you know that there is not enough grapes in it.”<sup>13</sup>

Both the cardboard and thin wooden boxes need to be filled in the warehouse; if it has rained one day before the crop, the grapes need to be dried with an air compressor because they may, otherwise, spoil and damage the boxes, most particularly those of cardboard. Hedinho claims this procedure to be disadvantageous since it demands more time, more labor, and the grapes are easily damaged as they are touched 3 times with the hands before they finally enter in a box. If it rains too much during the crop season, e.g., two or three days consecutively, the demand of labor raises considerably as the number of ripe grape bunches increase and they need to be cropped and sold before they spoil.

Cardboard boxes are usually sold to street sellers, who prefer to carry smaller boxes; it is not only easier to transport them to the traffic lights in the streets but,<sup>14</sup> as Hedinho said, it is more probable that a person sitting in her/his car will buy small boxes for personal consumption; he exemplifies it by saying that “a family with two or three members will not buy a 5 kg box.”<sup>15</sup> The 5 kg wooden boxes are normally sold to supermarkets or big fresh market sellers.

The first day I was there, we worked almost the whole time in the warehouse,

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<sup>12</sup>My translation of:

“*É porque a caixa num comporta mais que cinco, entendeu? [...] E se você não encher um pouquinho, bem cheio não dá o peso que eles pedem, né.*” (See appendix C)

<sup>13</sup>My translation of:

“*Não, não. Não tem como. [...] por exemplo, se você vai pegar uma caixa que não tem cinco quilos, você vai... quer ver, você vai pegar, você vai chacoalhar ela assim, a uva vai chacoalhar dentro. Então você já sabe que tá faltando uva dentro.*” (See appendix C)

<sup>14</sup>It has become very common to observe street sellers, entertainers, beggars and even windshield cleaners in industrializing countries such as Brazil: their aim is to earn or receive some money from the drivers that are waiting until the red light turns green.

<sup>15</sup>My translation of:

“*Porque às vezes uma, por exemplo, tem uma família tem duas, três pessoas ele não vai comprar uma caixa de cinco quilos.*” (See appendix C)

filling 1,5 kg cardboard boxes. Hedinho had to sell that day one thousand cardboard boxes of grapes. They were filled and piled up; as he said, he needed 100 piles of ten boxes each.

### **Selling grapes and Administrating the lands and laborers**

The small cardboard boxes are sold for R\$ 2,6; Hedinho presumes that they will be sold for R\$ 5 in the streets. He manages to sell the 5 kg boxes for R\$ 8 to R\$ 9 to his clients from Minas Gerais, whereas the CEASA (*Centrais de Abastecimento de Campinas* - Supplies Center of Campinas) pays only R\$ 6,5 to R\$ 7 per box. The price and the use of boxes vary according to the size of the grape bunches, and to what the buyer determines for her/his convenience.

Hedinho receives periodically the visit of an agronomist; as a member of National Brazilian Assistance Service for Small Businesses (*Serviço Brasileiro de Apoio às Micro e Pequenas Empresas*, SEBRAE), he has the right to get advise from an agriculture specialist every thirty to forty days. This service has existed for approximately ten years; Hedinho's father and grandfather could not take use of it. Hedinho is also a member of the rural trade union of Indaiatuba (*Sindicato Rural de Indaiatuba*); he must, in this case, pay an annuity for it and, in exchange, he receives all kinds of guidance and help regarding the accounting of his laborers, e.g., emission of wage receipts and tax computations.

Hedinho has eight laborers under sharecropping contracts working in his plantations, that is they receive , e.g., two blocks to administrate and the earnings need to be shared with the owner of the land, in this case Hedinho. They earn a normal salary and all social compensations: "they are all registered."<sup>16</sup> The workers have the right to live with her/his family in small houses in the land, and do not pay any rent nor water and electricity costs.

Hedinho and his brother Carlos agreed that tomatoes production is the best in ensuring a high income rate; but the problem with cultivating tomatoes is that the soil creates a lot of pests and fungi. They also agreed that the traditional cultivation in the family had been the potatoes; unfortunately, this production expanded too much in the region and small producers like the Ambrust started to disappear.

Hedinho and his brothers produced potatoes until 1997; they were able to earn a lot until 1994 and, between 1995 and 1997, they suffered an enormous

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<sup>16</sup>My translation of:

"*Mas eles são empregados né, eu pago, são registrados mesmo.*" (See appendix. C)

and violent loss that obliged them to withdraw the potatoes production. They then tried to recover from their losses by cultivating tomatoes and beans but it happened to be unsuccessful and another failure. Finally, in 1997, Hedinho had to declare bankrupt. Since then, they have been mainly dedicated to the cultivation of grapes; as they say, it does not make you rich but it guarantees economical stability in a long term future.

Nowadays, productions commonly depend on the trade arrangements made beforehand and Hedinho estimates the “spontaneous” commercialization as being very difficult.

Lands may be rented under two type of contracts: in the first type, the tenant pays a rent that corresponds to a percentage of his earnings. In the second type, the rent price is a fixed amount. For example, in the case of grapes the amount corresponds to 10% of the earnings: “If I crop 100 boxes, 10 belong to the land owner.”<sup>17</sup> Hedinho also rents twenty *alqueires* for the cultivation of corn; in this case the monthly amount has been fixed and agreed to R\$ 1500.

I asked Hedinho which one he thinks is better but, as he said, it depends. The advantage of paying a percentage is that, if you have no crop, you do not pay any rent. In other cases, e.g. the potatoes production, it is more convenient to pay a fixed amount since the 10% would correspond to a much higher amount.

## 6.5 Data Analysis

This section is divided into two parts: in the first of them I will present the analysis of the German textbooks used in the school of Friburgo, and in the second part I will descriptively analyze the interviews and notes obtained during the fieldwork in Friburgo.

### 6.5.1 Textbooks in Brazil and Germany

The schools established by the German settlers in Brazil used to be, for several decades, very elementary institutions, equipped with few didactical material and poorly prepared teachers. While schools situated in towns gradually developed to include more advanced learning, up to secondary education, schools in the rural areas continued to function at elementary levels. The textbooks used

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<sup>17</sup>My translation of:

“*Se eu colher dez, cem caixas, dez são do, vai pro proprietário.*” (See appendix. C)

had been either brought by chance with the immigrants or received as a donation from some institution in Germany, for instance the VDA. Therefore, some of the oldest textbooks used in the school of Friburgo do not correspond to the region from where the settlers were coming from.

Evidently, the textbooks sent from Germany were quite heterogeneous, given the existence of an enormous number of such books for elementary schools in the various German states. A growing dissatisfaction with these heterogeneous gifts, combined with an emerging cooperation between the *teuto*-Brazilian settlements led to the establishment of a proper schoolbook production in Brazil itself, and in German language.

It was in particular the publisher *Gráfica Rotermund* in São Leopoldo, located in Rio Grande do Sul, the most southern state of Brazil, founded in 1877, which succeeded in establishing textbooks for all the teaching subjects. The first *teuto*-Brazilian mathematics textbook, written by Christian Kleikamp, was not yet published by Rotermund but by Krahe & *Cia.*, in the nearby Porto Alegre. However, the next textbook series used in Friburgo was written by Otto Büchler and published by Rotermund. Rotermund's textbooks dominated the *teuto*-Brazilian production from about the 1910s onward. This publisher continues to exist until today.

The collection of schoolbooks in the CMU-Unicamp (Center of Local History, see 6.1) shows that in the school of Friburgo some of the incoherent donations from Germany were used until the 1890s. From the late 1890s on, they stuck to the *teuto*-Brazilian publications.

## **History, Evolution and Changes of Measure Systems**

The units of weights and measures constitute a fundamental knowledge for the functioning of the most basic elements of a society: trade and commerce. At the same time, they constitute a type of mathematics that is of general use for all: an elementary mathematics needed for the everyday life situations, called *bürgerliches Rechnen* in German. Despite this universality, it used to be a highly dispersed knowledge due to the existence of an own unit system in almost every local community, which were based on different stipulations of the units of length, sometimes depending on the object or material, and likewise for weights, surfaces, volumes etc. Hence, traditional elementary arithmetic textbooks had to provide extensive instruction in the transformations of one such complex system of units into another.

It was the French Revolution which had accomplished, besides the political, another highly fundamental social revolution: the unification of *poids et mesures*, of weights and measures. The creation of the metric system was introduced in the entire territory of France, and it established a rational system for all sub-units: the decimal system. Although it was made obligatory, this revolution proved the inertia and resistance of social systems: it took decades until the metric system was actually exercised in France. The situation outside France was even more complicated as it also depended on political constellations. At first, the metric system was enthusiastically received by scientists, and disseminated in Europe (except Britain) after the First International Scientific Conference, held in Paris between 1798 and 1799, where the exact determination of the meter was established. But after the defeat of the Napoleonic system in Europe and the political Restoration, most European states continued with or returned to their own non-metric traditional systems. In Germany, for instance, the length unit was the *Fuß* (feet), measured however differently in the various German states.

This was the situation and the knowledge the settlers had of applied arithmetics when they emigrated from Germany in the 1860s since the metric system was officially implemented in 1872 (Haustein, 2001, p. 269).

In Brazil, the metric system was legally introduced in 1862, with the law 1.157. According to historical documentation, it was officially implemented ten years later, in 1872 (Haustein, 2001, p. 265; Dias, 1998).

Both Kleikamp's and Büchler's books had included tables with the metric and traditional Brazilian unit systems. Table 6.2 (page 204) in Kleikamp's book introduces only the units used in the exercises. Büchler's book presented the traditional Brazilian measure units (table 6.3, page 205) **and** the metric system (table 6.4, page 206).

Furthermore, table 6.5 (page 207) provides a table which shows the evidence that some of the traditional Brazilian units continued to be used until at least 1925 (Brockhaus, 1925), thus ignoring the implementation of the metric system in 1872.

Table in Kleikamp (1898)		
Abbreviation	Name	Equivalence to metric units
arr	arroba	1 arr = 15 kg
bra	braça	1 bra = 2 m 20 cm
cm	Centimeter	100 cm = 1 m
Dtz	Dutzend	1 Dtz = 12 Stück
g	Gramm	1000 g = 1 kg
hl	Hektoliter	1 hl = 100 l
kg	Kilogramm oder Kilo	1 kg = 1000 g
l	Liter	
leg	legua	1 leg = 3000 bra = 6600 m
m	Meter	1 m = 100 cm
med	medida	1 med = 4 Flaschen
pal	palmo	1 pal = 22 cm
pat	patacca	1 pat = 320 rs
	Pipa	1 pipa = 480 l = 180 med
rs	Réis	100 rs = 1 tostão; 1000 rs = 1 Milréis
tost	tostão	1 tost = 100 rs; 10 tost = 1\$000 rs
vint	vintem	1 vint = 20 rs
\$	Milréis	1\$ = 1000rs

Table 6.2: Table of abbreviations of some metric and non-metric units, including their respective transformations into the metric system, presented in Kleikamp's book (1898).

<b>Special Brazilian non-metric units in Büchler 1932</b>		
Abbreviation	Name	Equivalence to metric units
Measures of length		
pal	palmo	1 pal = 22 cm = 8 Zoll
	Fuss	1 Fuss = 32 cm = 11 Zoll
	Vara	1 Vara = 1,10 m = 5 Palmos
bra	Braça	1 bra = 2 m 20 cm = 2 Varas = 10 pal
	Quadra	1 Quadra = 60 Braças
leg	Legua	1 leg = 3000 bra = 6600 m
	Covado (Elle)	1 Covado = 68 cm
Measures of surface		
qpal	Quadratpalmo	1 qpal = 484 cm
qbra	Quadratbraça	1 qbra = 4,84 qm
qleg	Quadratlegua	1 qleg = 43560000 qm
Measures of capacity		
	Tonelada	1 Tonelada = 2 Pipas = 960 l
	Pipa	1 Pipa = 180 Medidas = 480 l
med	medida	1 med = 4 Flaschen = 2,66 l
	Alqueire	1 Alqueire = 36 l
	Quarto	1 Quarto = 9 l
Measures of weight		
	Quintal	1 Quintal = 4 Arrobas
arr	Arroba	1 arr = 15 kg (= 14,689 kg)
Currency		
	conto de reis	1 conto de reis = 1:000\$000 = 1000 Milreis
\$	Milréis	1\$000 = 1000rs
pat	patacca	1 pat = 16 vint = 320 rs
tost	tostão	1 tost = 100 rs
vint	vintem	1 vint = 20 rs

Table 6.3: Table of abbreviations of Brazilian measure units and their respective transformations into the metric system, presented in Büchler's book (1932).

Table of metric system in Büchler (1932)					
Abbreviation	Name	Equivalence	Abbreviation	Name	Equivalence
Currency					
\$	Milreis	1\$000 = 1000 Reis (Rs.)	qkm	Quadratkilometer	1 qkm = 100 ha
Measures of length					
km	Kilometer	1 km = 1000 m	ha	Hektar	1 ha = 100 a
m	Meter	1 m = 10 dm	a	Ar	1 a = 100 qm
dm	Dezimeter	1 dm = 10 cm	qm	Quadratmeter	1 qm = 100 qdm
cm	Zentimeter	1 cm = 10 mm; 1 m = 100 cm	qdm	Quadratdezimeter	1 qdm = 100 qcm
mm	Milimeter	1 m = 1000 mm	qcm	Quadratzentimeter	1 qm = 10000 qcm
Measures of weight					
t	Tonne	1 t = 1000 kg	qmm	Quadratmillimeter	1 qcm = 100 qmm
Measures of volume					
dz	Doppelzentner	1 dz = 100 kg	cbm	Kubikmeter	1 cbm = 1000 cdm = 1000 l
ztr	Zentner	1 ztr = 50 kg	cdm	Kubikdezimeter	1 cdm = 1000 ccm
kg	Kilogramm	1 kg = 10 hg	ccm	Kubikzentimeter	1 ccm = 1000 cmm; 1000 ccm = 1 l
pfd	Pfund	1 pfd = 500 g	cmm	Kubikmillimeter	1 cbm = 1000000 cmm
hg	Hektogramm	1 hg = 100 g	hl	Hektoliter	1 hl = 100 l
g	Gramm	1 kg = 1000 g	sch	Scheffel	1 sch = 50 l
mg	Milligramm	1 g = 1000 mg	l	Liter	
			ml	Milliliter	1 l = 1000000 ml

Table 6.4: Table of abbreviations and descriptions of the metric units, presented in Büchler's book (1932).

Länder	Geldeinheit	Längenmaße	Flächenmaße	Körpermaße	Gewichte
	RM 1)	m	a	l	g
Spanien	1 Peseta = 100 Centimos	M	M	M	M
Tschechoslow.	1 Krone = 100 Heller	M	M	M	M
Türkei	1 Piaster (Grusch) = 40 Para, 100 Piaster = 1 türk. Pfund	M 1 Pik Halibi	M	M	M 1 Kantar = 44 Oken. 1 Oka
Ungarn	1 Krone = 100 Heller	M	M	M	M
II. Amerika					
Argentinische Republik	1 Peso = 100 Centavos	1 Vara = 3 Pies	Legua cuadrada	1 Taneza = 3 Almudes	1 Libra = 2 Marcos
Brasilien	1 Milreis = 1000 Reis (Einzahl: Real)	M 1 Pe 1 Legua	M	M 1 Alqueire 1 Pipa = 180 Medidas	M 1 Arratel (128 = 1 Quintal) 459
Kanada	M 1 Peso (Dollar) = 100 Centavos	M 1 Varo 1 Legua 1 Vara	wie Großbritannien M 1 Hacienda = 20 Cuadere 1 Topo	M 1 Fanega 1 Arroba 1 Fanega	M 1 Libra (25 = 1 Arroba, 100 = 1 Quintal) 1 Arroba
Mexiko	1 Sol = 100 Centavos = 10 Dineros	1 Yard = 3 Feet (1 Foot = 12 Inches)	1 Acre 1 Township	1 Bushel = 8 Gallons (1 Gallon = 4 Quarts zu 2 Pints zu 4 Gills)	1 Pound Avoir du pois = 16 Unzen 1 Hundredweight (Zentner) = Troygewicht
Peru	1 Dollar = 100 Cents	1 Mile	M 1 Méu (100 = 1 King)	M 1 Tschhi = 10 Tschhing Getreide u. Flüssigkeit, gewöhnl. nach Gewicht	M 1 Pikul (Tan) zu 100 Kätts (Kin)
Ver. Staaten	1 Tael oder Liang zu 10 Maces zu 100 Cash (Käsch)	M 1 Jin = 10 Tschhi 1 Li	1 Sch zu 30 Tsjubo	M 1 Tschhi = 10 Tschhing Getreide u. Flüssigkeiten nach Gewicht	Mehoder Monneh Kätti 1 Tael 1 Kwan
III. Asien	1 Yen = 100 Sen	1 Ri = 36 Tschhe 1 Hat (Cubit) 1 Kob = 1000 engl. Fathom	Biggah	1 Schoo 1 Koku	3,78 3,757 933,105
China	1 Rupie = 16 Annas	1 Voet 1 Paal	1 Yonke = 4 Beuwes	1 Kan	846,700 61,500
Japan	wie Niederlande	1 Arschin (Göös) 1 Farsang = 6000 Zer	1 Dscherib	nach Gewicht	2938 4,59
Indien (britisch)	1 Kran = 50 Dinar	M 1 Pik = Beledi 1 Malackah oder Malagha	M 1 Feddan	M 1 Ardeb = 6 Webeh.	M Oka (33 = 1 Kantar). Rottel (100 = 1 Kantar)
Indien (niederländ.)	1 ägypt. Pfund = 100 Piaster				1295 444,730
Persien					
IV. Afrika					
Ägypten					
Südafrika					
Union					
V. Australien und Polynesien					

Maße und Gewichte des betreffenden Mutterlandes  
 Anmerkungen: 1) Fremde Geldeinheiten werden, wenn nichts anders vermerkt, mit der Reichsmark von 1925 (Berechnung nach den amtl. Umsatzsteuerrechnungssätzen für Mai 1925) verglichen. 2) Goldwert der schwed. Krone. 3) Berechnung nach dem Goldfrank. 4) 8,47 Goldröbel = 1 lb. 5) Fiktionaler Goldwert 2 Peso = 1 Doll. 6) 10 Sol = 1 lb. 7) Nur (Gewichts- und Rechnungseinheit, von verschiedenem Wert. 8) 1 Rupie = 2 Schilling. 9) 1 ägypt. Pfund = 10 Schilling 6 1/4 Pence.

Längenmaße	Flächenmaße	Körpermaße	Gewichte
Kilometer . . . 1 km = 1000 m	Kubikmeter . . . 1 cbm = 1000 cbdm	Hektoliter . . . 1 hl = 100 l	Tonne . . . 1 t = 1000 kg
Meter . . . 1 m = 10 dm	Hektar . . . 1 ha = 100 a	Dekaliter . . . 1 dal = 10 l	Meterzentner . . . 1 q = 100 kg
Dezimeter . . . 1 dm = 10 cm	Kubikdezimeter 1 cbdm = 1000 cbcm	Liter . . . 1 l = 10 dl	Kilogramm . . . 1 kg = 1000 g
Zentimeter . . . 1 cm = 10 mm	Ar . . . 1 a = 100 qm	Deziliter . . . 1 dl = 10 cl	Gramm . . . 1 g = 10 dg
Millimeter . . . 1 mm = 1000 µ	Quadratmeter . . . 1 qm = 100 qdm	Zentiliter . . . 1 cl = 10 ml	Dezigramm . . . 1 dg = 10 cgr
Mikron . . . 1 µ = 1000 µµ	Quadratdezimeter 1 qdm = 100 qdm	Milliliter . . . 1 ml = 10 l	Zentigramm . . . 1 cg = 10 mg
Millimikron	Quadratmillimeter	Mikroliter	Milligramm . . . 1 mg = 10 µ
			Mikrogramm

Table 6.5: This table shows the different unit systems used in several countries, including Brazil (see red box) and its equivalences to the metric system (Brockhaus, 1925).

Some examples of the units in table 6.5 that continued to be used, thus “ignoring the law” are:

*pé*, in English feet. This was a unit used worldwide and diverse in every region.

*legua*, in English league. It was used in Brazil and Latin America for measuring lengths. It had a different value in each country, e.g., 1 L. = 4513 m in Chile, 1 L. = 5152 m in Argentina, and 1 L. = 5590 m in one part of Brazil (Kahnt & Knorr, 1987). According to Kleikamp’s table 6.2, 1 L. = 6600 m.

*alqueire*, a volume unit for either liquids or grains depending on the region. In Rio de Janeiro it was used for liquids and 1 A. = 11,864 l and in the state of Maranhão as well, but there 1 A. = 44,050 l. It was also used as a surface measure in Brazil and Portugal: 1 A. = 48400 m<sup>2</sup> and 1 A. = 24200 m<sup>2</sup>.

*quintal* was a unit for mass quantity. It was used in several countries from South America and Europe. For example, 1 Q. = 58,759 kg in Brazil, 1 Q. = 46,008 kg in Bolivia, 1 Q. = 40,793 kg in Marseille, and 1 Q. = 31,163 kg in Nizza, both in France (Kahnt & Knorr, 1987).

In Kleikamp’s book we are able to appreciate several exercises using the traditional Brazilian units. Some examples are:

32. *Wie viele patacca-Stücke sind gleich 10-Milscheine? (p. 22)*

40. *Wilhelm will einen Zaun von 81 braças Länge machen; nun hat er den neunten Teil davon fertig. Wie viele bra sind das und wie viele bra Zaun hat er noch zu machen? (p. 37)*

25. *Anna hat 560 rs, erhält aber noch 2 tost und 4 vint geschenkt. Wieviel Geld hat sie? (p. 53)*

35. *In seine Sparbüchse wirft Karl nach und nach: 2 vint, 3 pat, 1\$540 rs, 2 tost, 2 pat, 3\$460 rs, 500 rs, 160 rs, 700 rs und 1\$800 rs. Wieviel hat Karl gespart? - Davon giebt er 8\$760 rs aus. Wieviel hat er noch? (p. 62)*

3. *João kaufte in der Venda für 2\$400 Kaffee und für 1 pat Nägel. Er bezahlte mit einem 5\$-Schein. Wieviel bekam er heraus? (p. 63)*

Kleikamp’s book was first printed in 1898 and had, according to Mauro, a last edition in 1914 (Mauro, 2005, p. 171). This suggests that the traditional measure system had been further practiced by the *teuto*-Brazilians until 1914.

In Büchler’s book from 1932 no exercises using the Brazilian traditional units were found, even though a table with their transformations into the metric system had been attached to it, suggesting that these units were not completely

obsolete. Büchler's school material represented, in this sense, a modernization in the mathematics curriculum since it attempted to introduce the new metric system, so that the newer generations would get accustomed to it.

Furthermore, table 6.3 shows two units that had also corresponded to the traditional German measure system, these are *Fuß* (feet, F.) and *Elle* (cubit, E.). These two units belong to the eldest measure systems. *Fuß* was given by measuring a human foot from the heel until the tiptoe. *Elle* corresponded to the length of the forearm. Their measures were hence very different depending on the country and on the region within that country (Kahnt & Knorr, 1987).

For example, 1 F. = 0,31385 m in Prussia (from 1816) and 1 F. = 0,318385 m in Anhalt (northwest of Germany) (Kahnt & Knorr, 1987, p. 98). These two values are similar to the *teuto*-Brazilian *Fuß*: 1 F. = 0,32 m (see table 6.3).

In Brazil, *Elle* was called *covado* and it was equal to: 1 E. = 68 cm (see table 6.3). In Germany, it had different values according to the respective town, e.g., 1 E. = 68,02 cm in Aachen (west Germany, bordering with Belgium and the Netherlands) and 1 *lange* E. = 68,77 cm in Hamburg (Kahnt & Knorr, 1987, p. 81). As we see, these values almost coincide with the one given in Brazil.

Furthermore, table 6.5 shows that some traditional Brazilian units were still in use by 1925 (Brockhaus, 1925). Their transformation into the metric system does not always coincide to that of the values given by Büchler (or Kleikamp):

$$\begin{array}{ll}
 1 \text{ Pe} = 1 \text{ Fuß} = 0,33 \text{ m}; & 1 \text{ Fuß} = 32 \text{ cm} = 0,32 \text{ m} \\
 1 \text{ Legua} = 6687 \text{ m}; & 1 \text{ Legua} = 6600 \text{ m} \\
 1 \text{ Alqueire} = 40 \text{ l}; & 1 \text{ Alqueire} = 36 \text{ l} \\
 1 \text{ Pipa} = 500 \text{ l}; & 1 \text{ Pipa} = 480 \text{ l} \\
 1 \text{ Quintal} = 128 \text{ Arratel}; & 1 \text{ Quintal} = 4 \text{ Arroba} \\
 = 128 \cdot 0,459 \text{ kg} & = 4 \cdot 14,689 \text{ kg} \\
 = 58.752 \text{ kg} & = 58.756 \text{ kg}
 \end{array}$$

The left hand side represents the values given in table 6.5 (1925) and the right hand side shows those given in Büchler's table 6.3 (1932). The only value that seems to coincide is the one given by *Quintal*, a measure of weight.

## Comparison between German and Brazilian exercises in mathematics

In order to be able to determine how different or similar was the mathematics curriculum in the *teuto*-Brazilian school of Friburgo compared to that in the *Volksschule* in Germany, a parallel between books and some exercises will be established in this section. The type of exercises chosen for comparison will be

those related to the methods of calculation necessary for the everyday life.

Table 6.1 shows that the first three books were printed in Germany (Schwelm, Stuttgart and Gotha) and the following two in the south of Brazil (Porto Alegre and Rio Grande do Sul). The books that will be used for this analysis are: *Aufgaben für das praktische Rechnen* (Trieschmann, 1891), *Geometrische Rechenaufgaben* (Kehr, 1894), *Rechenbuch* (Kleikamp, 1898) and *Praktische Rechenschule* (Büchler, 1932).<sup>18</sup>

The books selected to represent the German side are showed in the following table 6.6.

Title	Author	Publisher	Year
<i>Anleitung zum Rechenunterrichte in der Volksschule</i>	A. Büttner	Ferdinand Hirt & Sohn, Leipzig	1882
<i>Die Elemente der Buchstabenrechnung und Algebra. Für den Schul- und Selbstunterricht</i>	A. Büttner	Stubenrauchschen Buchhandlung, Berlin	1886
<i>Rechenaufgaben für mehrklassige Schulen</i>	A. Büttner & E. Kirchhoff	Ferdinand Hirt & Sohn, Leipzig	1895
<i>A. Büttners Anleitung für den Rechen- und Raumlehre-Unterricht in der Volksschule</i>	A. Büttner & O. Teichmann	Ferdinand Hirt & Sohn, Leipzig	1932

Table 6.6: List of the textbooks used in *Volksschulen* in Germany, selected from Büttner's collection.

As one observes, all books are authored by just one person, Adolf Büttner (1827-1907). In fact, he and his textbooks for arithmetic were chosen as the measuring “unit” for the comparisons, since they constitute a constant and a variable at the same time: a constant, since Büttner's textbooks for primary schooling were so enormously successful that they were re-edited again and again, during his lifetime and even many decades after his death. It continued through such diverse periods as the Weimar Republic, the Nazi-regime, and after World War II in the Federal Republic, until even the 1960s. And they present a variable

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<sup>18</sup>The book *Das verbundene Kopf- und Zifferrechnen* (Guth, 1892) will not be considered since its contents show the introduction of the basic arithmetic operations and, even though there might be exercises with applications to the everyday life, these are referred to the German educational system. It is sufficient to comparatively analyze two books printed in Germany, as this comparison will allow us to a better evaluation of the development and/or continuity in the teaching and learning of both countries.

since these booklets, first published in the late 1860s in eastern Prussia, not only expanded to wider regions, but also became differentiated. This differentiation occurred according to a growing number of regional editions, hence adapting to local and regional contexts, and also according to the grade of development of primary schools, in particular in rural regions. They thus became highly indispensable for *einfache Schulverhältnisse*, i.e., schools with just one or two grades, combining several ages of pupils, or for well established primary schools with up to seven or eight grades. And the textbook series adapted always according to changes in the syllabi, in didactical and methodological conceptions.

Büttner had pursued a career in several *Lehrerseminare*, hence he was a teacher educator for primary schools. He produced many textbooks, not only for mathematics, in use in the *Volksschulen* in Germany until after World War II. Moreover, Otto Büchler, author of the book *Praktische Rechenschule* (see table 6.1) had been a student of Büttner's (Mauro, 2005, p. 131-132). Germany has been a very decentralized country and, even so, Büttner's legacy had been used nationwide; for this reason we have considered him to be a good reference for the mathematics education and instruction in the Germany of that time.

Büttner had become a teacher after attending the *Lehrerseminar* in Neuzelle, Brandenburg, between the years 1845 and 1847. He acted as *Dozent* in this same *Lehrerseminar* and in Droyßig, Sachsen. Between 1855 and 1859 he had worked in the *Lehrerseminar* in Moers, North Rhine-Westphalia, where he was also the director of the *Übungsschule*. Thereafter, he became *Dozent* of the *Lehrerseminar* in Bütow, Pommern and finally, in 1882, he had moved to the *Lehrerseminar* in Marienburg, Westpreußen where he retired as *Oberlehrer* (Mauro, 2005, pp. 131-132).<sup>19</sup>

In this analysis, the procedure for comparison consisted of choosing, for each book used in Friburgo, a parallel German one to which it will be confronted. The selection of the books has been selected according to year of publication and similarity of contents.

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<sup>19</sup>The terms *Lehrerseminar*, *Dozent*, *Oberlehrer* and *Übungsschule* are very specific to the German school system and, therefore, difficult to translate. We have already used these terms when we described, in chapter 1, section 1.1.1, Fettweis' career.

Aufgaben für das praktische Rechnen (Trieschmann, 1891)

This book is divided into two main chapters: the first introducing the numeration from 1 until 1000, and the second the infinite number range. Each chapter is again divided into 5 sections: counting and the basic arithmetic operations, i.e., addition, subtraction, multiplication and division. It consists only of exercises, and the first three or four of each chapter are presented with solutions.

Die Elemente der Buchstabenrechnung und Algebra (Büttner, 1886)

The complete title, as shown in table 6.6, indicates that this book is used for school and self-instruction. For this reason, it is mainly focused on the extensive explanations of its contents, presenting fewer exercises at the end of each lesson. The first chapter introduces the basic arithmetic operations: addition, subtraction, multiplication and division.

Both books were printed in Germany, nonetheless we will be able to see that its contents have different intentions and are probably designed for different school grades. The following examples present obviously the same currency and measure units:  $\mathcal{M}$  - denotes the early German mark -,  $\mathcal{P}$  - abbreviates *Pfennig* (penny) -, and the metric system is denoted with the same symbols as today. The following examples of exercises have been selected:

19. Ein Beamter bezieht monatlich 60[90]  $\mathcal{M}$  Gehalt, wieviel demnach in 5, 6, 8, 9, 10, 11, 12 Monaten? (p. 25)

26) Ein Arbeiter verdient täglich  $\mathbf{a}$   $\mathcal{M}$ ; wieviel verdient er in 1 Woche? wieviel in  $\mathbf{m}$  Tagen? (p. 8)

63. Jemand nimmt jährlich ein 941 [1091]  $\mathcal{M}$  und giebt monatlich aus 52 [57]  $\mathcal{M}$ . a) W. v. beträgt die jährliche Ersparnis? W. v. wird er jährlich ersparen, wenn er wöchentlich b) 7  $\mathcal{M}$ , c) 12  $\mathcal{M}$  ausgiebt? (p. 7)

27) Von  $\mathbf{a}$  Arbeitern verdient jeder monatlich  $\mathbf{b}$   $\mathcal{M}$ , und sie geben zusammen monatlich  $\mathbf{c}$   $\mathcal{M}$  aus. Wieviel ersparen alle in  $\mathbf{d}$  Monaten? (p. 8)

36. 4 [5] hl Wein kosten 320  $\mathcal{M}$ , wie teuer ist 1 hl? (p. 12)

62) Beweise den Satz: Wenn  $\mathbf{a}$  hl  $\mathbf{b}$   $\mathcal{M}$  kosten, so kostet 1 l  $\frac{\mathbf{b}}{\mathbf{a}}$   $\mathcal{P}$ . (p. 14)

54. 194 ha Land kosten 101268 [54126]  $\mathcal{M}$ ; wie teuer kommt 1 ha? (p. 30)

From these three examples, we notice that Büttner's book presented abstract exercises, using symbols instead of numbers. In the case of Trieschmann's book, the exercises contain concrete numbers and quantities. Even though the type of calculations required to solve them are similar, it is clear that the left hand side is dealing with real life situations, whereas the right hand side have abstract quantities that may be replaced with real concrete values. In conclusion, these books have different degrees of difficulty, that of Büttner presenting a higher degree of difficulty.

<p><i>Eine Kuh gibt durchschnittlich wöchentlich 54 l Milch. Wie groß ist der jährliche Nutzen dieser Kuh, wenn 1 l Milch mit 15 <math>\mathcal{P}</math> berechnet wird (71, p. 31)</i></p>	<p><i>In Bordeaux kostet 1 hl Wein a Frank; wieviel <math>\mathcal{P}</math> in Deutschland, wenn 10 Frank = 8 <math>\mathcal{M}</math> sind? (24, p. 31)</i></p>
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The equivalence between  $\mathcal{P}$  and  $\mathcal{M}$  is:  $1 \mathcal{M} = 100 \mathcal{P}$ . At first, both exercises may seem very different: the first is asking for the annual income of the milk sales, given the weekly milk production and the price for each liter. The second exercise is asking for the price in German currency of 1 hl given the price in French currency and the currency exchange between them. They are both solvable by the same calculation procedure: on the left hand side, there are three relations that need to be put together,  $1 \text{ week} = 54 \text{ l}$ ,  $1 \text{ l} = 15 \mathcal{P}$  and  $1 \text{ year} = 52 \text{ weeks}$ . On the right hand side too, and the three relations are:  $1 \text{ hl} = \text{a Frank}$ ,  $10 \text{ Frank} = 8 \mathcal{M}$  and  $1 \mathcal{M} = 100 \mathcal{P}$ .

92. Im Jahre 1865 sollen aus fremden Ländern in Amerika eingewandert sein und in Newyork die Küste betreten haben: 82454 Deutsche, 70338 Irländer, 27649 Engländer, 3961 Schotten, 2512 Schweizer, 2494 Schweden, 2045 Franzosen, 729 Holländer, 727 Dänen, 594 Italiener und 1530 Russen, Spanier und Portugiesen. W. v. zusammen? (Trieschmann, 1891, p. 19)

48. W. v. Deutsche wanderten im Jahre 1865 in Amerika mehr ein als a) Irländer, b) Engländer u. s. w.? (Siehe Aufgabe 92 auf Seite 19) (Trieschmann, 1891, p. 22)

7) Zur Auffindung des Ostertermines im Verlaufe unseres Jahrhunderts hat der berühmte Mathematiker Gauß folgende Formeln gegeben: Bezeichnet  $n$  das laufende Jahr unseres Jahrhunderts (z. B. 79 für das Jahr 1879), bedeuten ferner  $a$ ,  $b$ ,  $c$ ,  $d$  und  $e$  die Reste der Divisionen  $(n + 14) : 19$ ,  $n : 4$ ,  $(n + 1) : 7$ ,  $(19a + 23) : 30$  und  $2(b + 2c + 3d + 2) : 7$ , so trifft der Ostersonntag auf den  $(22 + d + e)$ ten März, oder den  $(d + e) - 9$ ten April. Berechne nach vorstehenden Formeln das Osterfest für die nächsten Jahre! (Büttner, 1886, p. 30)

These last two examples have no relation between each other, but they are worthwhile to be presented. The exercises on the left hand side were introduced in the sections of addition and, respectively, subtraction. We see in them how the occurring events at that time were integrated into the mathematics teaching since they contextualize the situation of immigration and, with it, children were also becoming aware that the highest migration movement was occurring in Germany.

The exercise on the right hand side deserves, to my consideration, a special attention as it presents an abstract formula that attempts to compute the exact date of the religious commemoration corresponding to Easter. By knowing how to manipulate these formulas, children and other persons were able to calculate the Easter holidays beforehand.

### Geometrische Rechenaufgaben

(Kehr, 1894)

This book is divided into 3 chapters, each of them presenting the calculations of, respectively, lines (1 dimensional areas), surfaces (2 dimensional areas), and solids (3 dimensional areas). In the first chapter, straight and circular lines are introduced, followed by the second chapter with parallelograms, triangles, trapezoids, regular and irregular polygons, circles and ellipses, and finishing with the third chapter containing prisms, cylinders, pyramids, cones and spheres.

### Anleitung zum Rechenunterrichte

(Büttner, 1882)

This book is methodic, that is, it is a guide for the teaching of mathematics in the classroom. It is divided into chapters according to each school grade, going from the first until the eighth; the last chapter, i.e., the eighth grade has a section dedicated to the computation of areas: lines, surfaces and solids.

Again, both books were printed in Germany, thus the exercises will probably use the same unit systems. Kehr's book is just focused on the topic of introducing the calculations of areas. Büttner's book is addressed to teachers and can be used for all school grades, from the first until the eighth. In both books, the subject of geometric areas is not introduced until the higher school grades: *Oberklasse* and *Achte Stufe*, respectively. Some examples of the exercises are:

22. *Ein Ackerstück ist 36 m breit.*  
a) *Wie viel Furchen liegen nebeneinander, wenn jede 0,15 m breit ist?* b)  
*Welchen Weg haben die Pferde beim Pflügen durchschritten, wenn das Ackerstück 95 m lang ist?* (p. 3)

*Wie lang ist der Weg, den die Pferde beim Umpflügen von 1 ha Land zurücklegen, wenn die Furchen 25 cm breit sind?* (p. 235)

The equivalences between the different units are:  $100 \text{ cm} = 1 \text{ m}$  and  $1 \text{ ha} = 10000 \text{ m}^2$ . Both exercises ask: given a surface, how long do horses plough if the furrow has a certain width. After transforming the units, the solution is given by determining how many times the furrow fits in the width of the area, and then multiplying this number with the length of this area

42. Zwei Gärten haben gleichen Flächeninhalt, jeder 90,2500 qm. Der eine hat aber die Form eines Rechtecks, dessen höhe 10,50 m beträgt, der andere die Form eines Quadrates. Haben bei gleichem Flächengehalte beide auch gleich viel laufende m Zaun und, wenn nicht, wie groß ist der Unterschied? (p. 12)

Ein rechtwinkl. Stück Land von 225 m Länge und 112,5 m Breite soll in der Breite 37,5 m verlieren. Wieviel muß es länger werden, wenn der Flächeninhalt derselbe bleiben soll? (p. 237)

11. Wie viel l Wasser faßt ein kreisrunder Maischbottich von 4,80 m Durchmesser und 1,96 m Höhe? (p. 37)

Wieviel cbm enthält ein Baumstamm von 5 m Länge, wenn der mittlere Durchmesser 30 cm beträgt? (p. 240)

The equivalence between  $\text{cbm} = \text{m}^3$  (cubic meter) and liter is  $1000 \text{ l} = 1 \text{ cbm}$ . Both problems are essentially the same, to determine the volume of a certain conic or cylindric solid.

31. Wenn der Durchmesser der Erde zu 1719 geographischen Meilen und die Entfernung derselben von der Sonne zu 19776000 Meilen angenommen wird: a) Wie viel Erdkörper ließen sich dann in gerade Linie zwischen der Erde und Sonne aufstellen? b) Wie lange würde eine Kanonenkugel von der Erde bis zur Sonne fliegen, wenn deren Geschwindigkeit zu 690 m in der Stunde angenommen wird und die geographische Meile = 7404,40 m ist? (Kehr, 1894; p. 4)

This exercise, presented in Kehr's book, is fascinating since it introduces another unit system, namely the geographic mile. Its equivalence to m is given in the exercise itself, being 1 geographische Meile = 7404,40 m. Not only had the exercise required the distance between the earth and the sun in "earth units" but, furthermore, the "time distance" was also asked to be calculated.

**Rechenbuch** (Kleikamp, 1898)

There are four chapters divided according to the range of numbers that are introduced: from 1 to 10, from 1 to 20, from 1 to 100, and from 1 to 10000. In each chapter, the basic arithmetic operations are presented: addition, subtraction, multiplication and division. The last section (from 1 to 10000) has included an introduction to fractions. This book was the first of a series of 2.

**Rechenaufgaben** (Büttner & Kirchoff, 1895)

The book is divided into five chapters: the first, numeration, includes counting, reading and writing until 1000, followed by the introduction of the numbers until 10000 and until 1 million. The following chapters introduce the basic arithmetic operations: numeration, addition, subtraction, multiplication, division. It finishes with a chapter presenting mixed exercises.

This is the first example of a book used in the school of Friburgo that was printed in Brazil in German language. Only one chapter of Kleikamp's book can be used for comparing it with that of Büttner's: that with numeration from 1 until 10000. Kleikamp included at the end of the book a table of the abbreviations and their values used along the book (see table 6.2, page 204). The following selected exercises will prove to be very interesting:

35. *In seine Sparbüchse wirft Karl nach und nach: 2 vint, 3 pat, 1\$540 rs, 2 tost, 2 pat, 3\$460 rs, 500 rs, 160 rs, 700 rs und 1\$800 rs. Wieviel hat Karl gespart? - Davon giebt er 8\$760 rs aus. Wieviel hat er noch?* (p. 62)

31) *Ein Knabe hat in seiner Sparbüchse ein Funfzigpfennigstück und 4 Zwanzigpfennigstücke; wieviel  $\mathcal{R}$  besitzt er?* (p. 6)

We see on the left hand side an exercise that will prove the child's ability in manipulating the different "sub-"currencies in which the Brazilian currency was divided. By the values given in table 6.2 we note that these equivalences are not established as in a metric system. In the case of the exercise on the right hand side, the currency in Germany was no longer non-metric, which may be interpreted as a simplification in the calculations.

24. *Wieviel verdient jemand in  $\frac{1}{4}$  Jahr, wenn er jährlich a) 920\$, b) 1000\$, c) 1800\$, d) 2180\$, e) 2340\$ verdient?* (p. 75)

104) *Eine Familie braucht in  $\frac{3}{4}$  Jahren 1125  $\mathcal{M}$ ; wieviel macht es monatlich?* (p. 25)

It is important to note that in these exercises all results will be given by integer numbers: on the left hand side we see that all numbers are divisible by 4. On the right hand side, 1125  $\mathcal{M}$  represents the amount earned in 9 months ( $= \frac{3}{4}$  of a year) and 9 divides 1125, resulting in an integer number as well.

<p>3. João kaufte in der Venda für 2\$400 Kaffee und für 1 pat Nägel. Er bezahlte mit einem 5\$-Schein. Wieviel bekam er heraus? (p. 63)</p>	<p>45) Ein Knabe kauft ein Lesebuch für 80 <math>\mathcal{P}</math> und eine Tafel für 30 <math>\mathcal{P}</math>; wieviel bekommt er von 2 <math>\mathcal{M}</math> zurück (p. 12)</p>
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Although the currencies used in both exercises are different as they belong to either Brazil or, respectively, Germany, both exercises demand first a conversion of the “sub-”currencies. As stated above, this was much more complicated in Brazil since the equivalences between them were non-metric. In the case of the German currency, we know already that  $100 \mathcal{P} = 1 \mathcal{M}$ .

<p>5. 40 Pferde kosten 3 Contos. Was kostet eins? (p. 77)</p>	<p>61) 3 Pferde kosten 1644 <math>\mathcal{M}</math>; wieviel kostet eins durchschnittlich? (p. 24)</p>
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The “sub-”currency *Contos* was not introduced in Kleikamp’s abbreviation table, even though it was used. Büchler’s book see table 6.3, gave us this equivalence, being  $1 \text{ Conto} = 1000\$ = 1000000 \text{ rs}$ . The exercise on the left would prove to be more complicated than the one on the right hand side if it had to be computed in different “sub-”currencies, and not only in rs.

It is interesting to note that Büttner’s proposed exercise on the right hand side asks for the averaged price of one horse. He is assuming that not all horses are equally priced, thus introducing a more concrete and real situation into the classroom.

<p>4. Wieviel rs sind <math>\frac{1}{2}, \frac{1}{4}, \frac{1}{5}, \frac{1}{8}, \frac{1}{10}, \frac{1}{20}, \frac{1}{100}</math> \$? (p. 80)</p>	<p>121) Wieviel <math>\mathcal{P}</math> sind <math>\frac{1}{5} \mathcal{M}?</math> <math>\frac{2}{5} \mathcal{M}?</math> <math>\frac{1}{10} \mathcal{M}?</math> <math>\frac{3}{10} \mathcal{M}?</math> <math>\frac{3}{4} \mathcal{M}?</math> (p. 15)</p>
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Again, this division always result in integer numbers: 2, 4, 5, 8, 10, 20, 100 all divide 1000000, and 4, 5, 10 divide 100.

<p>20. Im Jahre 1824 kamen die ersten deutschen Kolonisten nach Rio Grande do Sul. Wie viele Jahre sind seitdem vergangen? (Kleikamp, 1898, p. 66)</p>	
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This last exercise is fascinating because of its formulation: the question was how many years have passed since the first settlers arrived at Rio Grande do Sul in 1824. It is completely contextualized in the history of German immigration into Brazil and hence impossible to find an equivalent to such an exercise in Germany.

The final analysis will be able to provide us some answers to the questions proposed in section 6.3. For this reason I have expanded the number of examples so that we get a better overview of their contents.

**Praktische Rechenschule** (Büchler, 1932)

This book corresponds to the third of a series of four. It is focused on the *bürgerliche Rechnungsarten* (calculation types used in the everyday life) in their simple form. It is divided into 8 main chapters as following: *Regeldetri* (rule of three), *Prozentrechnung* (percentage calculation), *Zinsrechnung* (interest calculation), *Rabattrechnung* (discount calculation), *Gewinn- und Verlustrechnung* (profit and loss calculations), *Mischungsrechnung* (rule of alligation), *Teilungs- oder Verhältnisrechnung* (ratio calculation) and *Das Geld* (the money or currency).

This book was part of a series of 4 books, being this one the third of them.

**A. Büttners Anleitung für den Rechen- und Raumlehre-Unterricht**

(Büttner & Kirchhoff, 1932)

This book corresponds to the fourth of a series of five. It is a book to be used by teachers, hence there appear not many exercises in it. The book is to be used for the seventh and eighth school grades. In chapter III of this book, we find the *bürgerliche Rechnungsarten* which is divided as following: *Schlußrechnung* (rule of three), *Zeitrechnung* (calculation of times), *Durchschnittsrechnung* (average calculation), *Prozentrechnung* (percentage calculation), *Warenrechnung* (commercial invoice), *Zinsrechnung* (interest calculation), *Verhältnisrechnung* (ratio calculation) and *Mischungsrechnung* (rule of alligation). In chapter IV there is one section named *Reich und Staat* (empire and state) in which a subsection called *Münzrechnung* is found.

The distribution of both books is very similar as well as the names given for the different sections and/or chapters. In Büchler's book we also find a table with the equivalences between the Brazilian measures and the metric units (see table 6.3 in page 205).

<p>22) 3 kg kosten 600 Rs. Wieviel kosten 6, 9, 12, 15 usw. kg? (p. 7)</p> <p>92) Für 189\$000 erhält man <math>33\frac{3}{4}</math> m Tuch. Wie teuer sind <math>67\frac{1}{4}</math> m? (p. 11)</p>	<p>1. Beispiel: Ein Stück Tuch von 24 m Länge kostet 345 <math>\mathcal{R}\mathcal{M}</math>. Wir kaufen 7 m von dem Tuch. (p. 58)</p>
<p>56) 40 Arbeiter machen 75 m einer Arbeit. Wieviel machen 8 Arbeiter? (p. 9)</p> <p>116) 21 Arbeiter bauen ein Haus in 30 Tagen. Wie lange haben dann 12 Arbeiter daran zu tun? (p. 13)</p>	<p>2. Beispiel: 3 Maurer arbeiten an einer Mauer 16 Tage. Die Arbeit wird von 4 Maurern fertiggestellt. (p. 58)</p>

These examples are presented for exercising the rule of three. As we see, they are very similar in their formulation and also in the unit system they use, except that the currency must obviously be different.

<p>20) Zum Bau eines Hauses wurden 25400 Backsteine angefahren, von denen <math>5\frac{1}{2}\%</math> durch Bruch unbrauchbar wurden. Wieviel Stück blieben brauchbar? (p. 21)</p>	<p>b) Vermindere 350 <math>\mathcal{R}\mathcal{M}</math> um 16%. (p. 68)</p>
<p>17) Kaffee verliert durch das Brennen <math>12\frac{1}{2}\%</math> von seinem Gewichte. Wieviel beträgt hiernach der Gewichtsverlust an: a) 20 kg, b) 145 kg, c) 16,6 kg, d) 0,750 kg? (p. 21)</p>	<p>d) Beispiel: Rindfleisch verliert beim Kochen 15% seines Gewichts. Die Mutter kauft für eine Festlichkeit <math>4\frac{1}{2}</math> kg. (p. 73)</p>
<p>35) Eine Stadt von 16250 Seelen hatte in 2 Jahren 455 Einwohner weniger. Wieviel % betrug die Verminderung? (p. 23)</p>	<p>I.a) Von 50 Schülern einer Klasse fehlten wegen Masern 30, von 40 Kindern einer anderen Klasse 28. (p. 70)</p>

These examples also prove to be very similar. Note that now it is no more important that the divisions must result in integer numbers; the pupils which were learning these lessons had learned fractions in their first years.

<p>18) Wieviel Zinsen trugen 200\$ zu 8% vom 1. April 1910 bis 1. Oktober 1912? (p. 27)</p>	<p>5) Wieviel Zinsen bringen 85 <math>\mathcal{R}\mathcal{M}</math> zu 3% in 7 Monaten? (p. 92)</p>
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15) Wie groß ist das Kapital, das zu  $3\frac{1}{3}\%$  in 1 Jahre, 8 Monaten und 24 Tagen 109\$200 Zinsen bringt? (p. 37)

19) Welches Kapital bringt a) zu 4% in  $\frac{1}{4}$  J. 360  $\mathcal{R}\mathcal{M}$  Zinsen? b) zu  $3\frac{1}{2}\%$  täglich 2,80  $\mathcal{R}\mathcal{M}$  Zinsen? (p. 94)

17) Zu wieviel % müssen 43:200\$ ausgeliehen werden, um davon täglich a) 6\$; b) 5\$100; c) 4\$200 Zinsen einzunehmen? (p. 41)

13) Zu wieviel % sind 750  $\mathcal{R}\mathcal{M}$  ausgeliehen, wenn sie vierteljährlich 6,25  $\mathcal{R}\mathcal{M}$  Zinsen bringen? (p. 93)

15) In welcher Zeit bringen 1:000\$ zu demselben Zinsfuße ebensoviel Zinsen, wie 1:250\$ in einem Jahre? (p. 45)

21) In welcher Zeit bringen 200  $\mathcal{R}\mathcal{M}$  zu 5% a) 70  $\mathcal{R}\mathcal{M}$ , b) 5  $\mathcal{R}\mathcal{M}$  Zinsen? (p. 95)

The four examples above show the different exercise types regarding the calculations of interest, capital and rate of interest.

4) Eine Rechnung wurde unter Abzug von 118\$ Rabatt mit 2:832\$ bar bezahlt. Wieviel % Rabatt waren abgezogen worden? (p. 50)

b)2) Anton will eine Uhr kaufen. Der Uhrmacher berechnet sie gegen bar mit 42  $\mathcal{R}\mathcal{M}$ ; andernfalls beträgt der Preis 48  $\mathcal{R}\mathcal{M}$ . (Kaufe gegen Barzahlung!) (p. 87)

3) Ein Kaufmann erhält eine Kiste Ware. Das Bruttogewicht beträgt 150 kg, die Tara wird mit 6% berechnet. Wieviel beträgt das Nettogewicht? (p. 53)

2) Ein Faß mit Petroleum wiegt 3,20 Ztr. Die Tara beträgt 20%. (p. 86)

30) Eine Ware mußte, da sie beschädigt war, mit einem Verluste von 2\$400 für 87\$600 verkauft werden. Wieviel % wurden verloren? (p. 57)

5) H. hat 1 m Tuch mit 6,25  $\mathcal{R}\mathcal{M}$  eingekauft und sieht sich genötigt, es mit 5,75  $\mathcal{R}\mathcal{M}$  zu verkaufen. (p. 82)

In the second column of exercises, we see that the unit of Ztr has been introduced. Ztr is the abbreviation of *Zentner* and 1 Ztr = 50 kg. Except for the currencies, we have been able to note in the presented examples that the units are more standardized than in the case of the exercises presented in the book of Kleikamp.

<p>17) 180 l Wein wurden mit 30 l Wasser vermischt und das l dieser Mischung für 1\$200 verkauft. Wie teuer war 1 l des ungemischten Weines? (p. 60)</p>	<p>1) Unter <math>\frac{1}{2}</math> hl Bier gießt eine Hausfrau 30 l Wasser und berechnet, daß ihr das Liter des Hausbieres 25 <math>\mathcal{R}</math> kostet. Wie teuer ist 1 hl Bier? (p. 117)</p>
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In these examples we note that real life contexts had changed for the *teuto-Brazilians*. Germany is well known for its beer production, and this is not the case in Brazil. Furthermore, wine has not been a specialty in this country but it is nonetheless produced in smaller quantities.

<p>1) Wieviel \$ gilt 1 Pfd zum Kurs von 12 d; <math>12\frac{1}{2}</math> d; <math>13\frac{1}{4}</math> d; <math>14\frac{1}{8}</math> d? (p. 71)</p>	<p>f) A. kauft in Wien 120 m Tuch, das m zu 19 Schilling. Der Eingangszoll beträgt 27 <math>\mathcal{R}</math>. Wieviel <math>\mathcal{R}</math> kostet 1 m? (p. 179)</p>
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These last two exercises are interesting since they introduce other currencies and propose problems that transform these currencies to the local currency. On the left hand side, the exercise proposed by Büchler deals with Pfd which is the abbreviation of *Pfund* and represents the British pound. The pound was divided, at least for this exercise, in 20 shillings (sh), and each shilling was again divided into 12 pence (d). So, 1 pound = 240 d. In the case of the exercise presented by Büttner, on the right hand side, the Schilling is the Austrian currency and the exchange value was approximated to 1  $\mathcal{R}$  = 2 Schilling.

### 6.5.2 Ethnomathematical Analysis of Interviews

The method for analyzing the interviews is descriptive ethnographic; several ethnomathematical knowledge are followed and concluded from the information obtained during the fieldwork, and they are described below.

Not only Hedinho, but probably the agronomists of the state of São Paulo use the scale unit of *alqueires* for measuring large surfaces. The relation between one *alqueire* and *hectare* or  $m^2$  varies, in Brazil, depending on the region where it is being used. For example, in the state of São Paulo it equals 2,42 ha and in the state of Minas Gerais, the northern border state of São Paulo, it equals 4,84 ha.

There is an interesting observation that appears in the book *Guia do Medidor de Terrenos* (Teixera da Silva, 1861) itemized in the list of digitized books on page 186: the book's function was to re-educate surveyors in Portugal, introducing the metric system to them. As it is explained in the foreword, different

regions in Portugal were using different units for measuring surfaces, and the national administration seemed to have started to doubt whether surveyors were performing their profession correctly by using the correct measuring tools. In order to avoid any kind of misunderstandings, the authorities decided to introduce the metric system nationwide, and hence landowners were in the position of being able to check and compare the measures obtained. Most interestingly is that the unit *alqueire* appears in the book, and it does neither equal those used in São Paulo nor in Minas Gerais. Furthermore, it had different values according to the region where it was being used, e.g. 836,352 m<sup>2</sup> in Benavente, Coruche, Samora, Salvaterra and Vallada, and 1650 m<sup>2</sup> in Tras-os-Montes (see figures 6.16, 6.17).



**TABELLA**

**Tabella de redução dos moios e alqueires das Lesirias<sup>1</sup> a ares seu multiplo e submultiplo, suppondo o alqueire egual a 836<sup>m</sup>2,352 (17:280 palmos quadrados.)**

Medidas de Superficie	Em metros quadrados	Hectares	Ares	Centiares	Observações
Alqueire de terra	836,352	”	8	36	<p>Em Tras-os-Montes usa-se de um alqueire para medida de superficie que regula por 1650<sup>m</sup>2 (mil passos quadrados) ou 16,5 ares.</p> <p>No Funchal o alqueire, medida de superficie, mede 25 ou 30 canas quadradas, variando a cana, de 5<sup>m</sup>,5 (25 palmos portuguezes) a 5<sup>m</sup>,7 (25 palmos que dizem inglezes). Os alqueires da terra serão:</p> <p>— medido por 25 canas —                      — (palmo portuguez) —                      — alqueire 7,56 ares —                      — medido por 25 canas —                      — (palmo dicto inglez) —                      — alqueire 8,12 ares —                      — medido por 30 canas —                      — (palmo portuguez) —                      — alqueire 9,07 ares —                      — medido por 30 canas —                      — (palmo dicto inglez) —                      — alqueire 9,75 ares —</p> <p>Estes, como os alqueires de Tras-os-Montes, não consta que se compoñham em moios.</p>
2	1672,704	”	16	73	
3	2509,056	”	25	9	
4	3345,408	”	33	45	
5	4181,760	”	41	82	
sacco	5018,112	”	50	18	
7	5854,464	”	58	54	
8	6690,816	”	66	91	
9	7527,168	”	75	27	
10	8363,52	”	83	64	
15	12545,28	1	25	45	
20	16727,04	1	67	27	
Meio moio	25090,56	2	50	91	
Moio	50181,12	5	1	81	

<sup>1</sup> Usa-se d'esta medida nos campos de Benavente, Coruche, Samora, Salvaterra e Vallada. Nos campos da Gollegã, de Almeirim, de Santarem, do Cartaxo e da Chamusca ha outra medida especial o *hastil*, de que se falla em separado.

Figure 6.17: Digital copy of the table with the equivalence measures of the *alqueire* unit in the book *Guia do Medidor de Terrenos* (pictures taken by me).

Hedinho computed 1000 stems planted in one *alqueire*; the information he used for this computation is the one he has at hand, that is 70000 grapevines distributed in an area of 7 *alqueires*. He could not determine with certainty

how many blocks may fit in each *alqueire*; but his brother Carlos was able to estimate an average of 3500 stems per block, which could give almost 3 blocks per unit of *alqueire*. But, as Hedinho claimed, it is not easy to determine this number because the land roads are built in between disabling arable land and, furthermore, the size of the blocks are strongly depending on the topography of the land. This latter fact needs also to be considered as a boundary condition when the use of arable land is optimized.

In contrast to this, some measures may be and, indeed, have been fixed after a limited number of optimizations. It is the case of the distances between grapevines and that between stem-lines, being respectively 80 cm and ca. 170-180 cm. The number of stems between the stakes has also been fixed to 5 and, although the number of stems per line will depend on the independent variable “topography of the land”, Hedinho was able to give a very good approximation of 75 since he has experienced the advantages this quantity brings.

The cultivation of grapevines started in 1973, by Hedinho’s father and grandfather, with 5000 stems. Even though, Hedinho and his brothers admitted that the family tradition has been the potatoes production, in the mid 1990s it provoked so many losses that they decided to abandon this traditional family business. In spite of the awareness they have regarding the differences in profit, that of potatoes being much higher, they decided to go for what can bring economical stability in a long term future; they are no longer willing to take the risks they did before. For this reason is that the number of grapevines increased from 5000 to 70000 within 34 years.

Furthermore, Hedinho explained to me that this cultivation is perennial, crop rotation happens every 20 years. It is interesting to note that the term perennial, outside the agricultural context, means something that lasts forever; when referring to plants, it means to last for more than two years. The following quotes from Cox *et al.* (2006) confirms Hedinho’s assertion on long term sustainability:

“[...] perennial plant communities store [...], maintain better soil and water quality, and manage nutrients more conservately than do annual communities [...]

Because annual crops are more sensitive than perennials to conditions in the soil’s topmost layer and have a shorter growing season in which to adapt to stresses, they are more detrimentally affected by temperature increases [...]” (Cox *et al.*, 2006, pp. 649-650)

Thus, Hedinho knows, and it is also what he expressed that, in a long term,

perennial plants are sustainable and generate enough incomes. The problem with the crops of potatoes and tomatoes seemed to have also been related to the uncertainty of not knowing whether they would grow properly, or the conditions would be appropriate. Without being able to control these factors, Hedinho and his brothers decided to take no further risks, as I have already stated above.

The use of wires to hold the sprouts of the grapevines represent another ethnomathematical knowledge; as Hedinho explained to me, he and his employees observed that, by putting three wires such that they draw a triangle the *hat-shape* could be obtained, and this causes the effect that the leaves spread even more generating shade that lasts the whole day. They know that the leaves will appear after the bunches and, for some time, it is important that they have a greater incidence of sun; but from a certain point on, they require more shade than sunlight.

It is very interesting to remark that the term *hat-shape* I have used as my own interpretation and translation to *manjedoura* is not at all the literal translation of this latter term. *Manjedoura* is translated into English as manger, that is, it is a long open container in which food for cattle or horses is placed. Why would the position of the wires have the shape of a manger? If we observe and compare both figures in figure 6.18, we can see that the wires sustained by the stakes can represent the same shape as the upper part of a manger. Once the leaves rise, the whole picture resembles a manger filled with fodder; another way of looking at this picture is considering the wires to be the frame and the leaves the essential material of the hat.

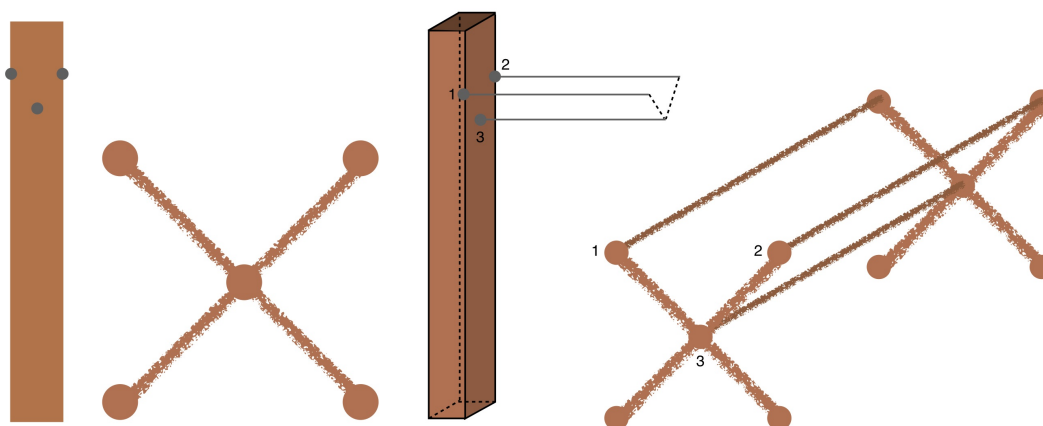


Figure 6.18: On the left hand side we see the 2-d triangle formed in both, the distribution of the wires and the manger. On the right hand side both objects are drawn in perspective, presenting the same “effect” (triangles 123).

The contour lines will be scoured only if the topography of the land demands it, once again this latter is the boundary condition; Hedinho knows this and in some cases, instead of proceeding with the contour lines, it is sufficient to cover the stem-lines with fodder. As he said, this does not only help fixing the soil, but it also keeps the moist in it for the grapevines to survive during the dry seasons; which is why the stem-lines are always covered with fodder.

Hedinho knows that the grape bunches appear 4 months or 120 days prior to the crop season, and he uses this as an advantage to predict not only the exact cropping seasons but also to compute his yearly profit. The fact of knowing that from each sprout there will rise 2 or 3 bunches, being at least one small, would also allow him to compute a profit prediction already when the sprouts come up.

Hedinho explained to me the term *brix* as a measuring unit for the level of sugar; he seemed to clearly associate sugar as a synonym for energy, i.e., the grapes will consume more energy if the dry seasons are enough dry, and so they will produce more sugar and lose more water. The greatest advantage is that the prices can be raised because sweet grapes are good grapes, and good grapes are allowed to be expensive.

Regarding the type of boxes used, Hedinho knows that his clients have different resale purposes, and this conditions which boxes will be used. The choice of types of boxes is limited because Hedinho knows beforehand who will buy his crops; moreover, he explained to me that it is no longer possible to have crop growings without prior negotiations.

The prices are determined according to the size of the boxes and the general quality of the grapes, as already stated above. But the relation price-weight is not linear and, as Hedinho claimed, small boxes are more convenient for the sale. One 1,5 kg box costs R\$ 2,6 and one 5 kg box may cost from R\$ 6,5-7 to R\$ 8-9:  $(3 \cdot 1,5 + 0,5) \text{ kg} = \text{R } \$3 \cdot 2,6 + \frac{0,5 \cdot 2,6}{1,5} = \text{R\$ } 8,67$ , which is, in almost every case, more than the price of a 5 kg box; this without considering the quality of the grape bunches measured with respect to their size. Hedinho explained that the big bunches touched one time only with the fingertips are the best and the big boxes contain most of these bunches, so the price should be obviously higher.

The time consumed to fill the boxes is very high and they may spend up to one complete working day filling 1000 boxes of 1,5 kg. This makes the process of verifying their weights with a scale almost impossible, and for this reason they have developed a method of verification that consists of shaking the box and if the grape bunches are able to shake, they know the weight has not yet been

achieved. In the easiest cases, they can notice with naked eye that the box is not full because there are too many gaps between the bunches.

Finally, Hedinho had experience allocating land lots using the two systems explained above. As he said, there exist no unique solution for this question, and this will always depend on the cultivation purposes that are planned.

## 6.6 Conclusions

From table 6.1 in page 186 we are able to conclude that three textbooks in mathematics had been printed in Germany, and two in Brazil. Among these *teuto*-Brazilian book, the first was authored by Kleikamp and first printed in 1898, having up to a fourth edition in 1914. One year later, in 1915, a new text book from Büchler was introduced and printed, in total, twelve times until 1933 (Mauro, 2005). In other regions, the *teuto*-Brazilian books were used for even a longer period.

The parallel between the *teuto*-Brazilian and German textbooks has showed that mathematical contents and formulation of exercises were very similar. In particular, both Büchler's and Büttner's books from 1932 differed only in the currency used in each of the two countries.

On the contrary, and although the general formulation and presentation of contents and exercises in Kleikamp's and Büttner's book (respectively, 1898 and 1895) were similar, Kleikamp's material had continued using and practicing the traditional Brazilian unit system until, most probably, 1914 whereas Germany had already introduced the metric system into the classroom.

In fact, as we have seen above, the law substituting the traditional Brazilian measure units with the metric system had been officially signed in 1862. The *teuto*-Brazilians of Friburgo continued to use some of these traditional units down to the present day. Hedinho Ambrust counted the amount of surface he has with grapevine plantations in *alqueire*, a unit that, on the one hand, has proved to be non-metric and, on the other hand, referred to different measures according to the region where it was being used.

Furthermore, table 6.3, 6.2 as well as 6.5 show that the *alqueire* was used as a unit for measuring volumes. Kahnt & Knorr (1987) defines the *alqueire* to be both, a measure of volume and of surface; but in this case  $1 \text{ alqueire} = 48400 \text{ m}^2$ , which is not equal to the use Hedinho gives to it (to Hedinho,  $1 \text{ alqueire} = 24200 \text{ m}^2$ ).

Table 6.5 shows that the measures of surfaces had been standardized to the metric system by 1925. On the contrary, table 6.3 indicates that the traditional Brazilian measure units of surfaces were still in use, at least among the *teuto*-Brazilians of Friburgo. This may be seen as another evidence of the fact that these settlers had lived partially isolated from the Brazilian culture and that, although they were “enculturating”, this process was still very slow.

Finally, if we take into account that the Germans, who founded Friburgo, had emigrated from Germany at a time when the metric system had not been yet established, it could have been easier to them to deal once more with non-metric system, that is, with units that are not divided into tenths, hundreds and so forth. In fact, the units of *Fuss* and *Elle* can be found in the 1932 table 6.3 (p. 205) in Büchler’s book. We have seen that those units were also used all over Germany and had different values according to the region. This suggests that, although the values for some equivalent units and the unit itself were not the same, the “frozen” mathematical knowledge of the *teuto*-Brazilians of Friburgo was precisely these methods for calculating different units that are not, in general, divisible by tenths, hundreds and so on.

To complete these conclusions, let us now turn to the interviews with Hedinho Ambrust. We were able to recognize many mathematical tools used in the everyday activities that are related to the growing of grapevines:

Time calculations. Hedinho needs to be constantly computing the harvest season and the times for cropping each different block.

Optimizations. The distribution of blocks thorough the land lots must be such that it takes advantage of as much arable land as possible. The costs of production need also be optimized, e.g., the amount of stakes in a stem-line and the width of a street.

Weighing. Boxes are not weighed, they are shaken. By doing this, Hedinho is able to predict the approximate weight of the box without having to use a weighing machine. This furthermore optimizes the amount of working hours.

Geometry. We have been able to realize that the triangles produced by the wires are associated to a manger. It does not matter how it has been called, the fact is that the geometric figure is the same, that is, the outcome is a triangle.

These ethnomathematical knowledge has been learned and practiced by Hedinho through oral tradition since he has inherited the business of his father. On the other hand, it is also based on practice, and on the experience he and his brother have collected throughout the years they have been dedicated to this business.

There is one part of this knowledge that could be acknowledged as what is learnt in school. I would like to suggest that, in this case, the “academic” knowledge was not introduced in school, but by the agronomist who comes to the field and transmits his knowledge. For example, between 5 grape stems there should be a stake. Hedinho has learned this and yet manipulated to his own convenience. Hence, an exact differentiation between these types of knowledge become difficult.

I would like to finish by commenting that Hedinho was most impressed when he had heard that I was writing my Ph.D. thesis in mathematics and could not understand why I was working with him. He furthermore said that he has never been good at mathematics. I reacted to that sentence and responded that it was not true since he was using mathematics in all the daily activities he was showing to me. He then answered: “yes, but we don’t know.”

### **6.6.1 Limitations**

I experienced great difficulties to pursue this fieldwork since I had to go to Friburgo and introduce myself on my own. My first encounter was with the Schäfer family and, at that time, they had insinuated that they were very busy with their activities and could not help me any further.

Some weeks later I could participate in a lunch the community of Friburgo had organized to collect money for the maintenance of the cemetery. I arrived very early and helped the women in the kitchen, and later I was helping in the sale of cookies and sweets.

It was then when I had the opportunity to introduce myself to the members of the *Sociedade Escolar do Bairro Friburgo*. The next step came much faster and easier. One week later I was working together with Hedinho.

Another difficulty I had to overcome was the geographic location of Friburgo: it is very isolated and faraway from the city and the public transportation. Luckily, Hedinho was very helpful and always picked me up with his car at the final bus stops.



# Chapter 7

## Final Conclusions

We have been able to show that ethnomathematical research has existed since at least 1929, when Fettweis' Ph.D. thesis was published as a book. His research and legacy represents a revealing aspect within the history of ethnomathematics as its existence had so far been dated 1985 on, the year of creation of ISGEm (International Study Group on Ethnomathematics). Fettweis was not the only scholar pursuing research on ethnomathematics at that time, but he certainly was the first to bring it into the academic level.

The contributions made by Fettweis and other scholars who developed research on the cultural aspects of mathematics and who opened the debate on the universality of mathematics have been of great importance for the constitution of ethnomathematics, although they had not, until now, received the acknowledgement they deserve. They have constituted the *pre-paradigm* period, as defined by Kuhn, since they had pursued their research isolated from each other.

The conceptualization of ethnomathematics has proved to be difficult due to, on the one hand, the fact that this discipline used not to regard mathematics as being universal, and even less as platonic. For an ethnomathematician, mathematics belongs to what the humankind has constructed throughout its history. On the other hand, it has been attempted to consolidate ethnomathematics as being a theory, following the standards of the so called exact sciences.

Ethnomathematics must be regarded as demanding other standards than just those given by the exact sciences. More than questioning the effect that societies and cultures have to the development of all types of knowledge that may interpreted as being mathematical, ethnomathematics and its practice oriented research assures that such cultural and social conditions will achieve to change and affect the course of the evolution and development of mathematics.

This cultural and social awareness embedded in the ethnomathematical research has strongly suggested the need for a conceptualization within a wider scope, one that embraces disciplines from both “cultures” of sciences, the exact and the social. It is precisely under this assumption that we presented in our research a new approach to ethnomathematics, one that joins these two sciences and, at the same time, does not invalidate their separated theories. This is achieved by considering a supplementary interdisciplinary approach as it has been defined.

Throughout this study we have been able to realize that it is not possible to study the ethnomathematics of a given culture without considering its identity, i.e., its modes of living, habits, traditions etc. The disciplines from the social sciences provide us with the necessary tools to consistently evaluate data according to the values embedded in a specific society. Furthermore, how we enter a certain society may be attributed with some level of perturbation, and we need to be able to adapt and confront with it.

On the other hand, mathematics, mathematics education and history of mathematics allow us to specify our range of research. Thus, ethnomathematics studies ethnomathematical knowledge, but this interpretation is clearly based on what has been agreed upon academic mathematics, its history and education.

Both applied researches developed in this study have also proved the necessity of combining the exact and the social sciences.

The research pursued in Mozambique has showed that the idealization of beauty given by the mathematical definition of the golden ratio represents an idealization in the Makonde culture as well. The beauty represented in the face of a woman attempts to remind their first mother, that is, the first woman of its culture. This mathematical knowledge as well as other concepts such as symmetry, projection, tools for measuring are orally transmitted from master to student, thus belonging to the oral tradition of this culture, in particular of this sub-culture of Makonde sculptors.

A Makonde sculptor achieves the status of *master* when he has proved the ability of concretizing the abstract feminine facial beauty, representing it in a sculpture. It is this master who will be acknowledged to be an artist since he is able to go beyond what he has learned in practice, and enters imagination. The uniqueness in Makonde art is precisely this ability to convert to wood what is practiced by their people in deities rituals.

Finally, the research undertaken in Brazil has showed the existence of a

“frozen” mathematics among the *teuto*-Brazilians of Friburgo. The use of measuring units that are not divided into tenths, hundreds and so on has been practiced worldwide. Those systems have proved to be much more complicated since they do not deal with the counting in decimals.

In the Germany of the 1860s such traditional units were used in every region and differed from region to region. When the immigrants had arrived in Brazil they had to learn the Brazilian units, which can be seen as being comparable to those in Germany since they were also not based in a decimal system. Although the law obliging the use of the, in France, established metric system, the *teuto*-Brazilian textbooks proved that the old traditional units continued to be practiced, at least until the 1930s.

The members of the community of Friburgo have showed that the ethnomathematical knowledge they had acquired to develop a certain activity is transmitted orally. Together with inheriting a business or certain responsibilities within the family, their ethnomathematical knowledge used for the continuity of such businesses are then obtained through such a process of oral transmission.

Our work suggests that the practice-oriented research in ethnomathematics studies, in a great deal, how knowledge is transmitted orally. Sometimes many terms that have been scientifically defined are practiced by the peoples, but they are not aware of their names. It is thus, that the procedures used to solve problems in the everyday life and activities may not be immediately understood or interpreted as mathematics, but they are indeed. And for such studies it seems fundamental to have the tools provided by the social sciences to concurrently evaluate the cultural context.

Hence, ethnomathematics results from these confluences between the disciplines of mathematics, mathematics education and history of mathematics, and those of cultural anthropology, ethnology, ethnography and ethnosience.



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(PA-Fettweis) Excerpts from *Personalakte - Ewald Fettweis*, *Signatur*: BR PE 7847,  
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# Appendix A

## Personalakte - Ewald Fettweis

The following information was obtained from *Signatur*: BR PE 7847, *Aktenzeichen*: R3M-3-02-1900/09 filed at the *Landesarchiv Nordrhein-Westfalen*.

### Personal Information

Dr. Ewald Fettweis, geb. 23. Juli 1881, gestorben 24. Juli 1967

Ruhestand ab Oktober 1948

Personalblatt A (Pädagogische Akademie) von 11.07.1946 Aachen:

- Dr. Phil. Universität Bonn am 15.06.1927

- Dienstzeit: Winter 1916/17 - Frühjahr 1918 als Nachrichtentruppen

### Transcription of his Doctorate certificate:

“Zeugnisabschrift

Die Philosophische Fakultät der Rheinischen Friedrich-Wilhelms-Universität zu Bonn verleiht auf Grund der als “sehr gut” befundenen Schrift “Das Rechnen der Naturvölker” und der “sehr gut” bestandenen mündlichen Prüfung in Pädagogik, Philosophie und Mathematik dem Verfasser der Schrift Ewald Fettweis aus Eupen die Würde und die Rechte eines Doktors der Philosophie.

Gegeben zu Bonn am 15. Juni 1927

Unter dem Rektorat des Professors der evangelischen Theologie

Dr. Johannes Meinold

Unter dem Dekanat des Professors der deutsch. u. niederl. Phil.

Dr. Theodor Frings”

## Sons

Söhne: Günter Fettweis, geb 17. November 1924; Ewald Fettweis, geb. 1. Dezember 1926.

## Exchanged letter with the *Kulturminister*

Teil des Schreibens von Dr. Fettweis an die Frau Kultusminister vom 20. September 1948:

“2.) *Ich habe mich in der Nazizeit weil ich nicht der Partei angehörte schwerer Demütigung unterziehen müssen und habe durch den Krieg mein ganzes Hab und Gut verloren, [..]*”

“23. Sept. 1948

1.) *Herrn Professor Dr. Ewald Fettweis*

*Aachen*

*Pädagogische Akademie*

*Auf Ihr an die Frau Kultusminister persönlich gerichtetes Schreiben vom 20.9.48 bedauere ich, Ihnen mitteilen zu müssen, dass die von Ihnen beantragte Verlängerung Ihrer Dienstzeit aus personalpolitischen Gründen nicht möglich ist. Die beamtenrechtlichen Bestimmungen über die Zuruhesetzung nach Erreichung der Altersgrenze sind allgemein bekannt, so dass es nicht üblich ist, bevorstehende Pensionierungen wegen Erreichen der Altersgrenze vorher anzukünden. Eine abermalige Hinausschiebung Ihrer Zuruhesetzung ist aus Erwägungen personeller Art nicht mehr angängig.”*

Seine Personalakte ging bis zum 1932 und erst ab 1945 wieder weiter bis er starb.

“Anlage zu meinem Gesuch vom 8.11.48

3.) *Ich habe der Partei nicht angehört und ihr immer feindlich gegenübergestanden. Ich habe die Nazi-Ideologie nicht nur in wissenschaftlichen Zeitschriften unter persönlicher Gefahr bekämpft sondern auch jüdische und halbjüdische Schüler sowie andere Verfolgte des Naziregimes persönlich in Schutz genommen. Meine sämtlichen Schüler kannten meine Einstellung.”*

Am 8.12.1948 erhielt er die Zusage von Kultusminister zur weiteren Tätigkeit als nebenamtlicher Dozent an der Pädagogischen Akademie, Aachen

# Appendix B

## Field Notes: Museum of Ethnology - Nampula, Mozambique

The first part of this appendix consists of the full data collection and interview. The second part presents some of the pictures used for the data analysis in section 5.7 in a better resolution and a bigger size.

### B.1 Written collected data

This section includes the complete field notes I collected during the field research. It also includes the complete transcription of the interview I made with one of the sculptors, Eduardo.

**Martins Bernardo - *Mulher***

**5/9/2008**

Maconde- Aldeia Itamba, Distrito de Nangade, Cabo Delgado- 12 anos em Nampula.

“Mais fácil fazer coisa própria do que cópia. Demora 3 dias e logo só faltam os detalhes. Perna é mais comprida do que o corpo. joelho → nádegas → tronco”

Ferramentas usadas:

- fita metro para medir a madeira
- serrote
- anchô (a linha da base é feita com anchô e é a primeira coisa a ser marcada)
- formão (diversos tamanhos)

- coiva (ferro curvo para partes curvas)
- faca para limar

**6/9/2008**

- 1) mede a madeira com palmos (2 palmos)
- 2) base medida com dedo polegar longitudinal à madeira para determinar a altura dela. A profundidade da base (tem de chegar até o interior negro) é controlada olhando o farelo da madeira que vai saindo durante a serragem
- 3) tirar a casca exterior até chegar ao interior preto com o anchô. A base fica pra cima para “protegê-la” e vai sendo feito de cima pra baixo. O tronco não tem diferença em dificuldade se é girado ao longo. Tira uma linha para chegar à camada preta e logo começa a picar transversalmente e tira pedaços inteiros (mais fácil)

**Observações:** há uma tendência em fazer pés grandes quando eles fazem cópias. As cópias são geralmente de fotografias que são entregues pelas pessoas que encomendam. É mais fácil fazer figuras de pessoas brancas ou negras? De acordo com Geraldo é mais fácil desenhar um branco.

- 3) Para tirar as últimas farpas da casca ele continua usando o anchô. Ele começa a esculpir a partir de onde vai a cabeça. Ele olhou e começou a marcar a cabeça. Como ele mediu? Não houve nenhum movimento físico, foi só olhando.
- 4) Mediu a altura do braço e de onde vai ficar o bebê até ele ficar sem o anchô e então começou a esculpir a cabeça.
- 5) Acredito que há improvisação. As pernas estão semi-flexionadas. Ele vai marcando sempre com o anchô, e enquanto ele está marcando ele vai girando a madeira (ele sempre segura ela pela cabeça ou pela base).

**Conversa externa:** *preocupação geral: trabalho dos camponeses.*

Modo em que Martins aprendeu a esculpir: no começo ele recebia o trabalho feito numa metade e ele tinha que reproduzir o outro lado (simetria).

- 6) Furos na orelha. De um lado ele faz uma “entrada”. Ele coloca a peça na posição horizontal (com a cabeça na barriga) para seguir com a simetria e

fazer o buraco do outro lado. Para completar o buraco, continua por trás; para o primeiro, ele olha com respeito ao da frente. Para o segundo, ele segue a simetria da parte de trás.

Para desenhar o peito (parte de cima), ele esculpe novamente uma linha na metade e logo faz os lados.

## 8/9/2008

Formar menino do lado da mãe:

- talhar a figura exterior (sempre levanta a escultura e vai olhando de um lado e do outro)
- talhando mais profundo para “apanhar o próprio nível do menino”. Atravessar o tronco para que o menino e a mãe não estejam grudados. (De acordo com o que eu entendi, para ter uma figura em 3-d e poder esculpir em todas as direções)
- usam 2 “formões” diferentes

Quando ele já pode atravessar o menino por todos os lados, começa a fazê-lo a partir da cabeça (dá a forma inicial e logo passa a marca pelo final do rosto e faz o pescoço.

Seguinte passo: “fazer” (= demarcar com o formão) o braço e descer até a perna.

Tanto a mãe quanto o filho têm uma perna semi-flexionada. Quando vai talhar uma parte como saia-traseira, torso, rosto, costas ele começa da metade pra fora e logo volta à metade pra ir pro outro lado (simetria). O menino ficou “delineado” e agora ele voltou com a mulher.

Está começando com o outro menino (que vai ser uma menina) que está na frente da mãe. O menino está do lado. Colocou a mão em volta da menina para sentir a profundidade em ambos os lados (é a primeira vez que ele faz isso, normalmente ele baseia-se no que vê de um lado e do outro, mas de frente e não de lado). O buraco já está aberto e agora ele olha através desse. Os pés também já estão desenhados. A perna mais exposta em cada uma das 3 figuras da escultura está semi-flexionada. Demarcar os pés na base. Com muita atenção ele olha, praticamente, em todos os ângulos para observar os tamanhos. Mede o tamanho dos pés com respeito ao da perna que, de acordo ao mesmo Martins, saiu um pouco curta.

Ele deixa um pedaço de madeira segurando a menina, para quando ele bater nela não partir. Esse pedaço vem da capulana da mãe, mas termina antes. E ele prefere deixar as peças juntas até a menina estar terminada, senão ela parte ao bater.

O preço da peça vai ser decidido no final, quando a obra estiver pronta. Isso vai ser medido de acordo à qualidade do resultado final.

Rotações: (desenho)

**Prestar atenção:** onde fica a base? sempre embaixo da perna direita ou em direção aos pés? direção da rotação quando observa-se (provavelmente vaivém), mas mais importante é quando a peça está sendo localizada.

**18/9/2008**

Martins: 31 anos- aprendeu com 18 (o cunhado ensinou; cunhado trabalha na revenda de esculturas em Maputo)

Para separar as pernas da mulher, ele marcou primeiro a saia (arbitrariamente) e logo começou a esculpir a partir das pernas para poder desenhá-las pra dentro também. Logo de separadas as 2 pernas, ele começa a polir-as para que não fiquem tão grossas. Com a escultura na mão esquerda e a base apoiada nas suas pernas, ele observa-a enquanto vai rotando-a. Diz que está calculando a medida das partes da perna com respeito ao tronco e põe medidas de palmas da mão; para que não fique desproporcional (muito curta ou muito comprida). E ele destaca o fato da cabeça estar grande demais e que vai ter que diminuir.

Começou a vestir a mulher com uma capulana no torso e, pra saber qual altura seguir com respeito à parte dianteira, ele simplesmente olha na frente e logo atrás e logo na frente e logo bate.

*Conversa entre 2 pessoas: “de que tamanho?”; “2 palmos”; “quanto?”; “70 paus”*

Quando ele vai começar depois de um recreio, ele olha a escultura e vai dando uma volta “completa” (180° pra um lado e 180° pro outro).

Lixa de ferro (popseco?) para que a peça fique sem ondas quando for a hora de lixar com a lixa de papel.

O tamanho da mão é medido de acordo ao dedão (“porque não pode ser do mesmo tamanho que esse (apontando o dedão) dedo”. Se o formão for muito grande para a parte onde ele quer chegar, então tem que usar um pequeno. Pode usar o formão grande mas neste caso a posição dele fica paralela ao corpo (o corpo dele). No caso do formão pequeno vai perpendicular (como ele disse “vai

atravessado”).

**19/9/2008**

Na perna dos meninos ele usa uma faca para “talhar” porque com o formão e o batedor parece que não alcança: “Tem que usar a faca para diminuir e chegar a nível (porque o formão já não chega)”.

Para medir o tamanho do pé e dos dedos do pé, ele usa como referencia o tamanho da perna (mas indica com o dedo desde o joelho pra baixo). No menino com a enxada na mão que está em cima de um dos pés, vai ficar somente 3 dedos pra fora. Porque não 2? “Porque se eu faço 2 fica um espaço mais grande”.

A faca está sendo usada com muita frequência agora que o trabalho está muito mais avançado. Antes, quando as feições ainda estavam sendo feitas ele só usava o formão.

Quando ele fez os dedos da mão que segura a capulana, o dedo mindinho ficou muito grosso (ele começou a fazer os dedos desde o indicador até o mindinho), ou seja que ele não mediu o que tinha na mão e dividiu por 4 dedos senão que mediu a grossura dos dedos e o que sobrou ele tirou.

Está fazendo o rosto do primeiro menino (o que tem a “chuinca” nas mãos). Ele começa pela boca; lábios inferiores e logo os buracos do nariz pra continuar com os lábios superiores e daí os olhos.

Como você mediu a testa?

“Ah, eu calculei porque se eu colocasse aqui (aponta um lugar) ia ficar curto e não ia ser pessoa então eu sei que tem que terminar aí, senão aqui fica curto demais.”

As orelhas ficaram semi-marcadas desde o começo da obra (praticamente).

Fazer o cabelo com a coiva.

Para começar com a boca o que é medido primeiro é o queixo.

*Mata-bixo do dia: apas*

As orelhas jogam algum papel?

“Sim, para quando eu faço os olhos têm que ficar na mesma altura porque se ficar embaixo não fica bem. Olhos e orelhas ficam na mesma altura” (ele toca o seu próprio rosto).

*de acordo ao Martins, os aprendizes são os meninos que estão lixando e fazendo a fase final da escultura*

**20/9/2008**

O cabelo da mulher foi uma decisão pessoal. Como ele começou de um jeito, tem que seguir assim (“não pode ser diferente”).

*“quando vai ser o seu casamento?”; “2 mil e... 2 mil e 26”*

Como faz para saber quantos “desses” (losango dos coques) têm? Você sabe quantos vão ficar?

*“Não, isso eu não sei ainda, isso eu vou calculando e medindo...”*

O estampado da capulana não segue uma direção única, senão várias pela dificuldade de poder chegar a alguns lugares no corpo da mulher.

*perguntaram a Ana (sobrinha de Martins) quantos anos ela tem e a resposta foi uma batida de palmas e logo ela mostrou 4 dedos. Ou seja, bater palmas 1 vez representa 10 porque são 2 mãos (ou não?!).*

*Eduardo diz: “bordar o cabelo é uma técnica de ponta”*

A última etapa do trabalho é o raspado para ficar mais lisa e depois poder lixar. Faz-se com o raspador.

Martins: “Com pressa o artista não pode fazer coisas tão elaboradas porque isso tomaria mais tempo e eles não têm tempo se precisam vender para ganhar dinheiro.”

## **Arcanjo Bachela (mestre macua) - At the Market**

**7/9/2008**

Nome da escultura: SENHORA

Senhora camponesa voltando da machamba que vai buscar água na volta do trabalho.

1. Cortar o pau
2. Tirar a casca branca, deixa parte preta
3. Começar a obra com a cabeça.  
Usam centímetros do dedo/mão (1 palma = 20 cm).  
*“Imaginação pessoal acerta as coisas”*
4. Marcam partes do corpo (todas) e logo começam a talhar: sempre de cima pra baixo.  
anchô, escóbulo (?- não há fotos)

## 5. Rosto: “não é preciso copiar”

Faz cálculo mental para manter simetria no rosto

- onde termina a cabeça
- olhos
- ... por último a boca

“Senhora” pode acabar em 2 dias mas depende do estado do artista (acordou bom faz mais, acordou adoecido faz menos)

1 mes = ca. 25 peças

Tem que ter mestre para ser escultor. Não é possível fazer ou ser sem aprender.

Telefones: 827064554 → Fabião Plinton (B. Namicopo); 842827760 → Pachela (B. Namicopo)

## Martins Bernardo - *Macacos*

21/9/2008

Para medir o tamanho dos macacos ele usa outro como referência (ver foto).

Como mediu o tamanho dos braços e pernas?

“O braço eu medi aqui (ver foto) porque eu sei que o macaco tem a parte mais comprida do corpo que as costas” (ele aponta a parte de trás dos seus ombros). A medida é da cabeça até os braços e pela parte de trás dos braços até pernas.

“É mais fácil trabalhar com peça grande porque pequena é mais difícil de segurar.”

*Martins aprendeu durante 1 ano a fazer esculturas.*

Macaco que ele usou como referência está mal feito (observação de Martins) porque tem rabo curto, não tem orelha e não tem pé. Ele vai fazer um “macaco verdadeiro”.

“Tem aprendizes que aprendem a fazer uma peça só e já abandonam o mestre porque querem ganhar dinheiro.”

Para fazer os espaços entre os braços e as pernas, ele fez primeiro os das 2 pernas e logo de um braço e depois do outro (completo). Estamos fazendo o macaco que não ouve!!!

Braço direito quebrou porque a madeira está rachada (normal no interior dela). Mas ele vai colar depois. Para diminuir o braço quebrado ele vai colar e depois passar o raspador.

Está afiando o raspador e para segurá-lo contra a madeira que usa de suporte, ele fez um pequeno buraco nela para que o raspador esteja fixo.

Segundo macaco começou pelo rabo e depois subiu até a cabeça e mediu o tamanho do tronco até a cabeça (mas tudo isso só é feito na base de observação, rotando a peça; ele nunca usa alguma referência como sistema para medir).

Quando ele usa a enxada, a posição do braço com a ferramenta fica mais ou menos no mesmo lugar; é a peça que vai se movendo (pra frente e pra trás, e também girando em todos os sentidos).

Quando ele faz os braços e as pernas (a primeira silhueta) ele vai olhando de um lado e logo do outro pra ir preservando certa simetria; mas ele não olha de frente. Olha de uma lado, olha do outro e logo continua.

Ele disse: “a linha é quando eu começo de um lado e daí eu controlo”. Isso no caso faz pensar que ele sim olha pra frente.

É o macaco que não vê. Desta vez ele não começou por um lado separando as extremidades, mas ele foi fazendo um lado e o outro revezando. Ou seja, que é completamente arbitrário e não tem nada a ver com alguma medida a seguir porque as medidas já foram estabelecidas desde antes.

**26/9/2008**

Faltam 2 macacos.

O serrote está torto e, para endireitar ele coloca-lo perpendicular ao seu corpo para poder ver em longitudinal com seus olhos.

Hoje ele começou pelas pernas, marcou-as e agora está marcando a cabeça.

**Pakolo Laza - Máscara (*Likhomba*)**

**29/9/2008**

Pakolo tem 41 anos e com 22 anos aprendeu a fazer esculturas com o mestre que era seu irmão mais velho. Ele vem da província de Cabo Delgado, Aldeia Peme no distrito de Mueda. Já faz 20 anos que ele mora em Nampula.

- usa a enxada com muito mais cuidado em comparação com Martins.
- ele cortou o tronco em 2 metades e a que ele está usando tinha uma rachadura-buraco no meio que é o que vai se transformar na parte de trás da máscara (eu não perguntei mas já dá pra ver isso)

- sulcando a parte de trás com uma coiva ele vai olhando a profundidade dela comparando com o lado dianteiro. A parte de trás é a primeira a ser talhada porque depois ele vai ter que abrir os olhos e a boca. A coiva é o que permite “aprofundar” (a coiva foi feita por ele, não é original). A profundidade é medida com respeito à curvatura da madeira.
- desenhou a beira da parte de trás
- para igualar os lados da parte de trás, ele usa “projeção” e olha longitudinalmente para ver o quanto é uma “linha reta”.
- o rosto ele começou a partir da parte de onde começa o nariz, isto é, (desenho).  
Mentira! Ele começou pela demarcação dos olhos, por baixo.  
Para começar ele mediu com o dedo para ver onde ficariam os olhos. Mais pra baixo fica a boca e pra cima vai ser a parte do cabelo.

*Explicação: likhomba é palavra Maconde de Mueda*

O olho já tem 1 dedão de profundidade e a sensação é de que ainda falta muito pra sair do outro lado. Profundidade é como a primeira parte do dedo mindinho e a altura completa são mais ou menos 2 partes do mindinho, mas onde está o olho é de se supor que já está mais profundo na parte traseira porque ele já sulcou aí.

O batedor mais claro é para os lugares de dentro e o escuro “tem um peso que é para os lugares de fora”.

Eu perguntei como ele tinha medido pra fazer a boca e ele me indicou o dedo indicador e colocou-no desde o nariz e justo onde está a juntura é onde ele começou a boca para os lábios.

**1/10/2008**

*Dia nacional dos idosos*

*FANAKALOKU = linguagem usada nas minas da África do Sul*

- \* A escultura final não é tão alta como o tamanho original porque ele vai sulcando pra dentro e então vai tirando o que fica sobrando em volta.
- \* Abrir o olho por trás. Como sabe onde tem que fazer atrás? Pega com os dedos polegar e indicador de um lado (atrás) e do outro (frente) respectivamente.

- \* Para abrir a boca por trás ele olha simplesmente a máscara de perfil e mede onde tem que ir parar a boca. Olha na frente e talha atrás.

*Entrou uma lasquinha de madeira no olho dele e ele tirou com um papel dobrado em espiral*

Para fazer o cabelo, o próprio ferro (quando ele coloca em vertical) é que vai indicar onde ele tem que começar a fazer.

*Água quente não queima casa.*

Na metade da parte do cabelo ele está fazendo as linhas de fora pra dentro, uma de cada lado até chegar ao centro (à metade).

“Estou a levar a linha daqui prali” (quando ele me explica como passar as tranças por baixo dos “rabos” que ele fez.

**2/10/2008**

Tatuagem: 2 linhas do lado direito e pra repetir o outro lado, ele vai fazendo pedacinho por pedacinho olhando sempre o lado anterior.

**Júlio Carlos - *Djaman (Família)***

**4/10/2008**

*Dia da Paz Moçambicana*

Júlio Carlos tem 28 anos e trabalha há 10 anos no museu. É de Cabo Delgado, Distrito de Mocimboa da Praia e em 1998 aprendeu a fazer esculturas com o seu tio Kunkenda que já faleceu.

- \* começa por cima, pela cabeça do que vai ser o pai. Enquanto ele vai talhando a madeira, ele vai agregando as orelhas ao mesmo tempo (só no pai; mas não, por exemplo, o nariz)
- \* tem de 1 lado a cabeça de 1 menino e 1 menino que está bem em cima e agora ele está começando do outro lado (aparentemente o trabalho vai desde cima rotando pra baixo)

*Ele acha que vai ter 15 crianças na obra completa*

**6/10/2008**

Eu perguntei se ele pode me explicar como é que ele vai colocando os meninos e as coisas que eles carregam. Ele respondeu dizendo o que são as coisas que

eles carregam (são bagagem). Logo eu perguntei porque ele as punha, se ele ia improvisando. Ele me disse “sim”, mas parece que não entendeu a pergunta direito, então eu perguntei como ele calculava as posições para ir pondo as crianças e as coisas e ele me disse: “isso é imaginação, está tudo na cabeça”.

**7/10/2008**

*Mukunha e Akunha são palavras macuas para referir-se ao branco. Hoje tirei uma lasca de madeira de um dos olhos de Júlio*

A madeira já está talhada aproximadamente até a metade e ele agora marcou a base porque quer fazer a mãe (suposição: ele está calculando quantas crianças ele pode pôr antes de fazer a mãe). Agora ele mexeu o formão de cima pra baixo.

Capinar. A mãe tem um tamanho relativamente normal com respeito às crianças porque ela fica com eles, cuidando deles e vai pra machamba de manhã pra capinar. O homem tem a cabeça grande para criar todos os filhos. Ele é de Cabo Delgado e “naquela época” o pai viaja pra Tanzânia pra trabalhar “fazendo roupa” (fazer as capulanas ou fazer o dinheiro para a roupa?) e está longe.

**9/10/2008**

Terminar as partes que ainda não estão esculpidas, furar (fazer os buracos correspondentes) e logo “cascar” (que significa “limpar” e deixar as figuras mais lisas) e finalmente pôr caras e daí lixar.

No espaço que sobra consegue sair uma criança só. “2? Nada, uma só”.

*Hoje foi dia de mata-bichar com os escultores. Chima (carapata de milho) com um refogado de peixe seco*

**10/10/2008**

### Caras

PAI: começou pelo lábio inferior (o pai tem um cavanhaque) e logo ele marcou o limite da boca pra fazê-la. (lembre que ele vai tirando em volta pra dar a forma) O que ele marcou na verdade como “lábio superior” era de verdade o nariz. Por enquanto ele não marcou nada do olho, mas dá pra perceber onde eles vão estar porque já está afundado.

MENINO: (de cima pra baixo) ele está fazendo que nem antes, marca o lábio inferior, logo a parte de baixo do nariz e agora está desenhando o nariz. Uma vez

desenhado o nariz, desocupou a testa e logo começou a fazer os buracos para os olhos até que agora está marcando-os.

MENINO (EMBAIXO DO PAI): segue igual como antes.

MENINA (EMBAIXO DO PAI): o mesmo procedimento.

### **11/10/2008**

Para fazer os rostos ele segue sempre o mesmo procedimento.

Na Tanzânia também habitam Macondes que também fazem esculturas, não há pau-preto e usam uma madeira de cor castanha. De acordo é informação lá a vida é muito mais barata e as esculturas também.

### **12/10/2008**

O menino que está ajoelhado, ele começou pelos olhos e logo marcou a linha do nariz.

*Desde 1973 até 1992 havia uma base de Macondes em Rapale dos antigos combatentes. Naquela época o comboio pra Cuamba saía cada 2 semanas. A RENAMO tirava as linhas do trem. Quando o trem chegava, os mestres tinham que começar a construir de novo.*

O menino que está ajoelhado tem um chifre na boca e usa como instrumento musical.

O nenê ele também começou pelos olhos. Aparentemente quando tem alguma coisa tampando o queixo, ele começa por cima.

## **B.2 Interview Transcript**

### **3/10/2008**

Cabo Delgado, Distrito de Mocimboa da Praia. Está desde 1982 em Nampula e trabalhando no museu desde o ano passado. É escultor desde 1990 e aprendeu com 16 anos do mestre Capamba (pai dos amigos).

**A:** Andrea

**E:** Eduardo

**A:** Pronto. É... conta pra mim o que você sabe hum, sobre como começa a a aquele grupo de escultores que está atrás do museu. Quando que começaram a, quando formou a galeria de arte Maconde atrás do museu?

**E:** Bom, a galeria de arte Maconde começou em Nampula, começou em 1975 com o ano da independência.

**A:** Hum hum.

**E:** Aquela galeria, antes trabalhavam 2 pessoas, não eram muitas pessoas, eram poucas pessoas que trabalhavam ali. Por exemplo, o mestre Dbanga aquele, o homem que fez aquelas obras que estão ali em frente logo do Museu de Etnologia de Nampula. Ele chegou aqui em Nampula em 1956, trabalhou aquelas, fez aquelas obras e depois deixou. Porque antigamente a arte, a arte Maconde era feita pra ritos de iniciação, era uma arte escura, uma arte que as pessoas faziam através de mitos, utilizava mais a metodologia.

**A:** Hum hum.

**E:** Depois quando os colonos portugueses, quando chegaram aqui viram que a arte, a arte que eles tinham tinha uma super criatividade, uma grande inovação. Eles viram que também dentro da arte tinha muita estática e muitas muitas formas de eles de apresentar segundo o seu espírito, segundo as suas mentalidades, segundo o seu conceito, como é que eles definiam a vida no cotidiano, como é que eles encaravam algumas situações que eles não conseguiam interpretar outros fenômenos naturais, como eles... Então eles levavam aquela madeira, faziam ali algumas obras, umas estatuetas chamadas shatani, shatani que essa palavra deriva de lá da Tanzânia e que significa demônio. Por que que eles baseavam-se nessa fase de demônio? Não era demônio, aquilo era uma forma de não conseguir interpretar algumas filosofias que os africanos têm. Então baseavam-se naquilo, limitavam-se e não sabiam interpretar aqueles, aquelas o que que. Alguns sonhos, eles colocavam, eles diziam que isso aqui pronto vamos dizer que isso aqui essa está né, é diabo.

**A:** Hum hum.

**E:** É diabo. Porque eles não tinham outra saída senão essa. Então com o andar do tempo a arte foi crescendo e as coisas foram saindo, os missionários portugueses que cá chegaram nos anos 40 viram que afinal de contas essa arte é uma arte que tem um mercado mas o mercado não é aqui dentro do Moçambique. Um um, como é que, um arqueólogo que trabalhava na Tanzânia na Tanzânia, ele descobriu que essas artes são artes que podem mudar a vida e o ambiente de um sítio depois de ser expostas. Pronto dali ele levou aquelas artes e foi experimentar na Europa e viu que tinha muita saída. Então ele já quando veio organizou grupo de pessoas, outros que faziam surrealismo, outros que faziam realismo. Realismo que é imitar algumas estátuas feitas de, religiosas, estátuas religiosas. Então

surrealismo eram os mitos shatani. O tempo foi-se, foi andando, foram também descobrindo que não, em vez de nós ficarmos estáticos nós temos que ser pessoas de longo percurso. Andar muito tempo. Basearam-se em fazer aquelas obras de arte como uma forma de ganhar sustento porque eles não podiam levar as obras de arte daqui da África para a Europa depois não render nada. Foram lá vendendo e as obras lá começaram a ter uma saída muito, muito elevada. Dali a situação não parou perto, já pro lado dos artistas, os antigos os nossos mestres já começaram a criar novas, novas obras de arte. Já chegou-se a se criar o djaman. O djaman, já não se fazia o djaman furado, não, era um djaman em relevo. Não se conseguia furar e pesava muito.

**A:** Djaman é o que?

**E:** Djaman é um conjunto familiar. Essa palavra também deriva de lá da Tanzânia é um conjunto familiar. Djaman, por exemplo, uma sociedade um povo. Depois de, na obra de djaman pode-se pôr lá muitas coisas, pode-se pôr lá os mitos, os mitos de shatani, podem pôr pessoas a trabalharem, pessoas com lenha, pessoas enquanto levam caixas de banana, pessoas enquanto estão a construir uma casa, pessoas num funeral. Quer dizer, aquela aquele todo cotidiano da vida das pessoas quanto aqui na África como se vive aqui, porque a vida africana não é uma vida de super excelência. é uma vida de muito sacrifício, de muita vulnerancia, de muita agricultura de subsistência, não é aquela agricultura mecanizada como, como aconteceu lá na Europa nos anos da revolução. Então aquela fase de que eles já apanhavam o rumo do desenvolvimento da arte, os os mais entendidos na arte, os críticos, os estudiosos, os filósofos, os grandes os grandes especialistas da arte foram estudando que a arte, foram ver que a arte, a arte africana e a arte Maconde é uma arte que tem um expoente muito elevado na África, na África Subsahariana por exemplo, na África Central, é uma arte ímpar. Levaram aquelas obras de arte, foram expor em alguns sítios lá da Europa, por exemplo na galeria na galeria internacional da França encontram-se lá obras de arte dos velhos que já não estão, que já não se encontram entre nós. Então aquela coisa toda foram vendo ao final de contas que essa arte é uma arte lucrativa, começaram já, já os homens também começaram a chegar até a modernidade, onde nos encontrou-nos. E nós pela sua parte, pegamos a arte deles e dissemos não, essa arte aqui nós temos que mudar, temos que mudar, temos que fazer um lado mais positivo desta arte, desta arte pra que? A arte já ultimamente, está a apanhar um fracasso por causa, do que? Não há muita responsabilidade. Porque que essa muita responsabilidade não aparece? Não aparece porque, por causa do

mercado, o nosso mercado é muito fraco. é um mercado que não me deixa viver, é um mercado que só que, só pra sobrevivência. Agora, quando isso acontece, tem aparecido fraco acabamento, fraca criatividade, não há aquela inovação, as pessoas só fazem obras de artesanato, então em vez de arte, saem das obras de arte vão para as obras de artesanato. O que é uma obra de artesanato e o que é uma obra de arte? Aqui tem uma diferença: obra de artesanato é aquela que uma pessoa faz uma mais  $n$  vezes repetindo a mesma figura até, podem ter mil figuras, dois mil, duas mil figuras conforme do número, enquanto obra de arte e obra que não se copia, não é fácil eu como artista obra que eu fiz no mes passado, pegar a mesma, copiar tal e qual. Há grande diferença. Os críticos logo dizem que aquilo não estava bem, e pior se a obra sair fora do país. A obra, essa obra não está bem, essa obra está assim. Então daí que nós cá em Nampula, em Moçambique, a arte está pendente, está pendente por causa de que? Do nosso mercado.

**A:** Hum.

**E:** é muito fraco, não nos conduz até lá. Não deixa nós com aquela satisfação espiritual, com aquela satisfação da alma pronto eu sou artista, se eu faço uma obra de arte eu vou ganhar tanto, vou ter o meu alimento, vou ter o sítio onde eu posso me acolher, um lugar onde eu posso me deitar, dormir é vontade, ficar relaxado. Isso promove muita desgraça nos artistas e agora, os artistas que existem agora só pautam pela despachar as obras e só. Não há uma criatividade, não há uma obra nova, não há obra nova.

**A:** Por isso que tem tanta, tem tantas figuras Massai, da Etiópia?

**E:** Sim, sim, sim. Por exemplo, essas figuras são figuras que é artesanato, isso e artesanato não e arte não. Isso é artesanato. Daí que nós ficamos, ficamos muito assim não bem mesmo com aquela, com aquela ponderância da alma por causa de fazer obra de arte.

**A:** Quando é que foi, porque você falou pra mim que tem, que vocês usam muitas palavras que vem da Tanzânia. A cultura Maconde vem de Tanzânia? Ou vem de onde?

**E:** Não não, a cultura Maconde não vem da Tanzânia. Nós somos um povo Bantu.

**A:** Um povo o que?

**E:** Bantu, nós somos um povo Bantu. Através daquelas migrações que existiram nos tempos que eu já nem sei quando começou a história, a história que reza essas coisas. Nós saímos duma, duma povoação mas muito minoritária da África que saiu dos montes não é, não saiu dos montes Namule não. Esse povo saia dos grandes lagos, foram emigrando, foram emigrando, chegaram, passaram uma

parte do lado da da do deserto de Kalahari, desceram um bocado assim pra a Zâmbia, outra parte do Zimbabwe, outra parte da Angola, quer dizer essas partes, então o povo Maconde foi se espalhando com os seus hábitos e costumes. Quando chegaram no norte do Moçambique já passando pela Tanzânia, só passando pela Tanzânia, não vieram da Tanzânia. Foram aquelas migrações, coisas complicadíssimas dos tempos lá ido que eu agora não sei dizer, só a história que reza essas coisas. Eles foram se fixar no norte do Moçambique. Se fixaram-se no norte do Moçambique. Porque que se fixaram no norte do Moçambique? Eles fixaram-se no norte do Moçambique pra evitar o movimento de captura de escravos. Hoje lá no norte do Moçambique dizem que existem matas, existem florestas densas equatoriais que os capturadores dos escravos não conseguiam penetrar até lá no fundo. Daí eles foram se espalhando, assim com sua cultura, com sua arte, com seus costumes, os seus rituais, quer dizer todo aquele conjunto de coisas culturais que eles levavam não abandonaram, não deixaram por trás, levaram consigo.

**A:** E, a cultura de fazer esculturas existiu sempre na, na arte Maconde?

**E:** Existiu, sim sim.

**A:** Ou houve uma época que não...

**E:** Não, não não. Ela existiu, eles levavam consigo tudo o que fazia parte da tradição. Porque? Dos ritos de iniciação, eles foram se adaptando algumas coisas que outras já se esqueceram porque os povos Macondes não eram povos estudiosos, eram povos ágrafos.

**A:** Hum hum.

**E:** Não tinham nada de escrever, não escreviam nada. Eles usavam mais oratura, não usaram literatura. Eles usaram oratura, foram utilizando oraturas até os dias de hoje, nós não temos nenhum livro que nos diz que pronto que esse livro... Se existe, podem existir dos tempos dos anos 50 mas escritos por missionários. Mas um livro base que diz que a cultura Maconde é isto, não existe. Só de boca em boca, até nos dias moderno até os dias de hoje. Daí que os povos Maconde não escreviam mas levavam consigo as esculturas. Pronto, foram desenvolvendo aquilo como atividade normal não faziam daquilo o comércio, não faziam daquilo o comércio, faziam pra danças de mulheres chamado mhuali(?), danças, ritos de iniciação do homem chamado likhumbe(?). Eles foram fazendo essas coisas mas através do mapiko. onde nasceu arte de escultura? nasceu no mapiko, eles basearam-se no mapiko. do mapiko surgiram então muitas dessas artes porque na vida real dos Macondes, eles são muito artísticos e eles conheceram uma imensa estática de arte. Eles não dormem nas esteiras, não. Fazem umas camas de

cambala, assim fios sobrecruzados, eles dormem ali porque, evitando o que? Cobras não sei quanto, então até uma esteira, uma esteira feita por um Maconde é uma esteira com muita estática. é, pilão por exemplo, é um pilão com muita estática. O, como que eu posso dizer, algumas armadilhas são coisas com muita estática. Então quando aquilo encontrasse pessoas com mais sentido de estática, eles mudavam e faziam daquilo ali uma coisa luxo, até que fazendo um pilão ou utensílios domésticos em geral não dá pra você ver outros, não dá pra pôr, não dá pra ver...(00:15:19)

**A:** Hum, você da outra vez tinha me dito que a a arte de escultura era uma tarefa que os homens realizavam. Então só são os homens que podem fazer as esculturas, ou as mulheres também poderiam fazer esculturas mas elas não realizam essa tarefa?

**E:** As mulheres elas não realizam porque andam muito ocupadas através da cozinha. é assim, o povo africano quem trabalha mais são as mulheres. Na vida real, os homens são pessoas que trabalham e completam o trabalho das mulheres, mas aqui o trabalho da escultura, das artes na cultura Maconde está dividido. As mulheres fazem os utensílios domésticos, algumas panelas, tigelas, pratos. Mas de que? De barro, barro já queimado, que aquilo usa-se há muito tempo. Também panelas pra levar ao poço elas não usam tambores como a modernidade diz, mostra agora. Elas usam o barro para fazer os seus utensílios domésticos. Nos anos 50, 40 por lá em diante, eles os homens só se dedicavam a essas artes a de esculpir. Existiram mulheres sim que eram escultoras, mas desapareceram com o andar do tempo por causa de não saber como cuidar das crianças. Porque a arte, essa arte aqui, a arte Maconde requer muita criatividade, muita paciência e leva muito tempo, muito tempo e leva muito tempo pra fazer esse tipo de arte, um dia inteiro uma pessoa pode sentar só levanta quando vai a casa de banho, só levanta que é pra apanhar um pequeno pequeno-almoço, ou um almoço, ao jantar só depois que estiver cansado. Agora uma mulher que tem a vida domestica, que tem os, as suas formas de como cuidar das crianças, quer dizer, esse todo processo não não permitia com que as mulheres fossem também escultoras. Daí que as mulheres baseavam-se na cozinha e é isso. é isso, é assim, até isso levou, até nos tempos modernos que só as mulh... os homens é que fazem a arte de esculpir. Não é que as mulheres não sabem, a mulher sabe. A mulher ajuda na machamba, ir ao campo, buscar alguma mandioca, cuidar do milho. Enquanto os homens baseavam-se na arte, faziam os mapikos, faziam algumas obras de arte que até agora algumas obras de arte já não existem no mercado. só alguém pode ter em

casa dele ou só um grupo de especialistas que comprou nos anos 40 e guardou e estão no museu e não se vende, nem a leilão nem nada. Outras artes já são patrimônio cultural, são patrimônio cultural e daí que nem se vendem.

**A:** Também tem peças no museu né?

**E:** Tem, o museu grande cá em Nampula tem obras lá que não se vendem. Tem nem pra tirar fotos não dá. São obras conservadas pela lei, a lei é que protege aquelas obras. E nem podem ser copiadas, aliás não copiada, são obras de arte que não sai de copiar. Sai uma outra coisa, daí cria transforma-se. Na no mercado do, dentro do país também não sai esse tipo de obra.

**A:** Então as mulheres, as mulheres são as pessoas que fazem, constroem painéis de barro e aqueles é... não sei como é que chama, pra recolher água qual é...

**E:** Sim sim sim, como é que é aquilo, moringa de barro. Chama-se moringa de barro, aquelas painéis grandes.

**A:** São elas que fazem? Os homens, eles não trabalham com barro?

**E:** Não não não, os homens não trabalham.

**A:** Porque não?

**E:** Os homens não trabalham porque têm a outra ocupação. Os homens trabalham mais a madeira os homens dedicam-se mais na arte das madeiras.

**A:** O pilão são os homens que fazem ou as mulheres?

**E:** Os homens é que fazem, os homens é que fazem o pilão e entregam às mulheres. Os piladores, os pilões fazem até pentes pra o uso doméstico da casa. Sim. E um pilão feito na arte Maconde pode levar 50 anos, pode levar 50 anos (00:20:26). Aquilo não se estraga não se faz nada.

**A:** E a escultura de pau-preto também não estraga ou pode estragar?

**E:** Não não não, a madeira é muito rígida. Só pode mudar de cor mas se não estar bem conservada, ela muda de cor sim. E pior se pintar muda de cor. Agora, se não pintar e deixar no original, conservar num sítio onde não passa muito sol, onde não passa muita humidade, aquela obra de arte fica intacta fica como veio sim. Não muda nada, ela fica como está, como veio. E é isso que obra, esta arte aqui tem muita encomenda (00:21:08). Só o que acontece, há muita negligência, essa obras de arte aqui em Moçambique há muita negligência, há uma coisa que, não sei agora são os dirigentes, às vezes que é o governo. Mas o governo não digo que não, mas alguns dirigentes que querem que essa arte aqui fica extinta aqui em Moçambique. Porque eles não se interessam pela arte, só querem vir falar conosco muitas vezes são os jornalistas. E os jornalistas eles sabem ali recolher a informação e publicar e não se dão por isso, não se dão por nada como é que

está a desenvolver. Os tal dos dirigentes vêm a nós como pessoas que, pronto, pessoas da segunda da terceira mão. Enquanto a arte, a obra de arte é uma obra, é uma atividade é um trabalho, é um serviço. Aquilo bem organizado pode tirar pessoas da grande pobreza, da grande miséria em que o povo moçambicano está. é, um exemplo, eu não vou aqui orgulhar-me, eu vivo da arte. Eu fiz o meu nível medio, mas eu vivo da arte. Eu não tenho outra atividade senão a arte. Agora, porque que o governo não arranja mecanismos pra nós termos um mercado na Europa? Porque o problema daqui é no mercado, na Europa. Quando o governo organizar um mercado bom na Europa, nós vamos passar a ter, a meter até divisas no país, porque obra de arte não há de sair aqui de Moçambique assim de qualquer maneira não, mas como quando uma pessoa rouba, de qualquer maneira não. Aquilo tem os seus custos, tem os seus valores, paga-se por isso. Daí que o governo ficam logo a nos ignorar (00:23:09), não ligam pra nós, falam nada, ou não falam, falam disparates, falam coisas desnecessárias, coisas sem cabimento. Quando eles querem, vêm ali, qualquer altura, quer dizer há uma desorganização autêntica e que desmoraliza-nos. Então nós fica, sem saber como fazer. Quando vamos pra lá eles, quando vamos estar com eles eles não dizem nada, não tem tempo pra nos atender, deixa-nos é sorte. Existe outro grupo de pessoas que só querem o fruto do trabalho mas não ir trabalhar, agora assim não querem não tem interesse. Não pedimos, não pedimos bilhões de dólares ou bilhões de euros pra eles nos darem, não. Nós pedimos só a moralização deles de serem no terreno, vierem falar conosco sobre alguma solução. Só, não é muita coisa. E é isso que está a acontecer, estamos assim a andar de um lado pra outro sem saber como sair desse cubículo. Mas pronto, esta arte vai vencer a arte é quem vence aqui. Porque os que já viram, os grandes livros as grandes exposições lá da das Europas, das Américas da Ásia, eles estão a descobrir que esta arte aqui afinal de contas sai de um sítio assim. Pessoalmente eles descem até o terreno, falam conosco e daí estão a abrir algumas valas por onde vai passar essa arte. E nós estamos atentos, estamos atentos. Qualquer dia esta arte terá um valor. é difícil encontrar um escultor com uma bicicleta, o que é uma bicicleta? Um meio de transporte que, pronto, que é o da última classe que artista não tem. Nem que esse artista fosse bom de esculpir (?; 00:25:34), nem que esse artista fosse um criativo da primeira qualidade não tem. Porque? Porque o mercado, o nosso mercado não deixa. E quando chegam algumas delegações que vem estudar esta arte, se encontram uma pessoa de má fé, diz que isso aqui não existe que aqui não encontra-se aqui. Só lá tem umas 2 pessoas lá que estão desorganizadas, que estão a andar lá. Quer

dizer eles estão a privar os conhecimentos nossos, nos deixam é sorte, privam os outros conhecimentos; quando alguém, as pessoas saem a gente vem aqui conosco como é que vocês estão a viver. Impedem eles pra não chegar até a nós. Essas são algumas formas que estamos a viver na modernidade, enquanto do outro lado da Tanzânia não é assim, as coisas são bem claras.

**A:** Na Tanzânia?

**E:** Na Tanzânia as coisas são bem claras, estão bem clarificadas. é bem normal sair um grupo de pessoas vão pra lá, vão pra Alemanha, vão pra Itália vão pra Nova Zelândia, vão pra outros países, Holanda, Dinamarca, Suíça, Portugal. Esses países lá na Europa, vão a desenvolver esta arte. Mas aqui em Moçambique, tu não experimentas vir aqui com uma quantidade, que eu quero comprar uma quantidade de arte eles não te deixam sair com aquela mercadoria. Nem mesmo você pagando eles não te deixam sair. Quer dizer, essa parte não está estudada, não está estudada e não querem que as pessoas estudam quando saírem. Quando vêm, só prometem e esquece, esquece. Mas a vitória é da arte, a arte vai vencer. A arte vai vencer. Nem mesmo com garras e dentes, isso aí tem de acabar. Nesse tempo que levaram-nas de sair vamos sair, sair vamos sair. é sentimental, encontrar um artista a viver na miséria total, sem saber como sair. Mas os artistas existem, eles existem, eles trabalham, eles são muito trabalhadores, eles são pessoas que se aplicam. De 1 a 30 o artista aplica-se, artista cria, só faz obras. Aquelas obras dele sai, são obras só que... ele nem escreve nada o que fez, como é que produziu, não sabe. O artista virou hoje, quantas obras você produziu durante o ano passado, não diz, não escreveu em nenhum sítio. Não tem tempo de ir é escola, porque que não tem tempo de ir é escola? Dinheiro não chega pra pagar a escola, sustentar os filhos, não sei o que. Os que vão, vão por amor dos estudos. Há pessoas aleijadas apaixonadas no amor da escola. Essa gente vão a escola, essas vão a escola. Mas não são muitos, aqui em Nampula não chegam 10 os que tem nível medio, não chegam 10.

**A:** Dos escultores que estão ali trás?

**E:** Não chegam 10 (00:29:20). Se formos a fazer um inquérito mesmo profundo, poucos é que sabem escrever, poucos é que sabem escrever. Poucos é que sabem falar a língua portuguesa corretamente, sem sobressaltos. Os outros só sabem falar em talão assim desorganizado, que não leva a lugar nenhum. Mas uma linguagem mesmo propriamente clássica, é difícil, difícil é. Mas pronto, a arte existe, existe a arte e pronto, existem os que estão apaixonados na arte. Tudo bem.

**A:** Quando você aprendeu a fazer escultura, o seu mestre, ele te ensinou a fazer

uma figura ou ele te ensinou uma técnica?

**E:** Ele ensinou-me uma figura, ensinou-me uma figura e as técnicas foram aparecendo com o andar do meu domínio da arte. Ele ensinou-me uma figura, uma senhora carregada de, de que? De uma panela de barro com um cacho de bananas. Outra era com uma enxada carregada de uma trouxa cheia de melancias ou, como é que é, alguns frutos, alguns vegetais, quer dizer são coisas que ele me ensinou... Agora, o tempo foi ditando o que que era eu, através de algumas experiências, através de alguns workshops (!), através de alguns, de algumas figuras que eu fui vendo, através de alguns passos assim. Então aquilo foi levando avante.

**A:** Você aprendeu por conta própria então, ou foi ele, não foi ele que ensinou?

**E:** Não não, é que são outras coisas que ele me ensinou.

**A:** Por exemplo, como você, pra você medir o tamanho da cabeça da mulher, ou do braço, ou o tamanho do nenê, o tamanho das crianças. Isso foi você que foi aprendendo, o mestre não ensina isso?

**E:** Sim isso são técnicas. Não não não, o mestre ensina no princípio como se diminui um braço, e o artista é um ser criativo, o artista não é um ser estático. O artista cria aquilo que ele vê. O artista não está fora da sociedade, o artista está dentro da sociedade. Então, através da sociedade é dali onde ele tira as suas imagens, gravam de onde grava pra se fazer. Agora isso está se desmoronando, porque já não há motivação pra tal, não há motivação. Mas agora, mas pronto, quem aprendeu quem sabe morre sabendo, né. E, quem sabe quer saber mais. O saber não ocupa espaço, nem lugar. O saber não é como a física de 2 corpos não podem ocupar o mesmo espaço no mesmo tempo, não. O saber é uma coisa ampla, uma coisa que vai se extraindo até. Então o saber do artista é tal e qual o saber dum cientista, dum, por exemplo, arqueólogo, dum técnico, do mecânico, daqueles que fazem novas coisas. Então o saber do artista é tal e qual, ao saber desses homens que eu andei aqui a mencionar. E é daí que o artista ganha o seu conhecimento através dessas coisas.

**A:** E o seu mestre, ele vendia também a arte que ele fazia ou não?

**E:** Ele vendia, ele vendia.

**A:** E ele... existe alguma regra pra avaliar as peças, pra dizer “essa peça custa tanto porque usou tanta madeira e porque consumiu tanto tempo”, ou vocês... você, o seu mestre falou pra você como dar os preços às peças ou foi você mesmo que escolheu e não depende do tamanho da peça mas... como é que você...?

**E:** Bom, isso é variado, depende de como a obra está. Pode-se vender uma obra grande a um preço muito pequeno. Pode se vender uma peça pequena a um

preço muito elevado. Depende do tipo de arte que se aplicou naquela obra. Pode se fazer uma peça pequena e vender só a um preço muito elevado, é o tipo do acabamento que o artista usou ali naquela obra. é o tipo do tempo, aquilo estipula o tempo, estipula-se. Isso já na fase onde os clientes já aparecem. Por exemplo, eu não posso vender uma obra muito caro enquanto eu não tenho o que comer na minha casa. Ele aparece e eu tenho essa obra que ele gosta, ele gosta da obra, eu ponho o preço atrás, ele vira a obra vê o preço “epa, eu aqui esse preço não tenho. Eu tenho aqui 1000 (mili!) ou eu tenho aqui 700”. Aquele dinheiro que ele tem, aquele dinheiro que ele está a dizer é aquele que você deve levar, porque se você não leva há de dormir com fome e isso não é vantagem. Quer dizer, já está a perder, então são aqueles efeitos, aqueles fenômenos que vêm a dizer que a obra de arte está a perder a sua credibilidade por causa do nosso mercado. Uma pessoa pode vender uma obra de arte a um preço ínfimo, porque tem que comer, não pode morrer de fome enquanto está a trabalhar. Como é que ele vai viver, se aquela obra de arte não vendeu? Como que é de ir fazer uma obra? Não há maneira. Daí então vende a qualquer preço. Mas num sítio onde se compra bem as obras de arte, e daí onde não se nega os dinheiros. Não, mas também essa minha obra de arte foi muito estudada, teve muita criatividade, fiz muita inovação, então eu não quero que seja assim vendida. Eu quero que vocês, se você quiser essa obra de arte dem-me esse preço, se não quer deixa. Daí então...

(interrupção do garçom que veio perguntar se nós queremos almoçar; feijoada de porco é o prato do dia e Eduardo pediu um)

**E:** é isso Andrea, nós estamos a viver aqui em Moçambique através da arte mas, não nos rende, não rende. Por exemplo eu, qualquer dia posso abandonar a arte porque não me dá vantagsubsubsectionas não irem como eu quero, eu deixo a arte. Posso trabalhar na administração, posso traba... posso ser professor, posso ser uma outra coisa, posso ser qualquer coisa mas não, não na arte. Mas não deixando de ir visitar as artes, mas não me aplicar na arte, porque? A arte pra mim não tem vantagem.

**A:** E como é que, porque que vocês vão... tem muita gente, bom, os Macondes são de Cabo Delgado, não é? A maioria dos Macondes moram em Cabo Delgado. E porque vocês vêm à Nampula?

**E:** Não, nós viemos em Nampula porque na hora da independência, sobre a unidade nacional, todos se espalhamos. Há uma mistura, há Macondes que estão no Maputo, na Beira, que estão no Quelimane, que estão em diferentes cantos daqui do país. Então aquela coisa levou-nos quase, por exemplo eu vivi primeiro

no Maputo em 1982 com o meu pai, minha mãe, saímos de lá, viemos cá, fomos lá em 76, saímos lá de Maputo em 1982 e viemos cá em Nampula. Aqui eu comecei com os meus estudos primários, fui estudando, estudando, abandonei, meti-me na arte porque não tinha como sustentar os meus filhos. Dali, eu fui vivendo, fui vivendo, fui vivendo, encontrei os meus colegas. Se você quer sustentar os seus estudos, não pode vender na rua, não vende nada, tem a madeira, a madeira está muito barata, a obra você vende a um dinheiro muito, um bocado elevado. Eu tive que tirar a camisola dos estudos, pus a camisola da arte, fui aprendendo, fui aprendendo, eu vi que não. Afinal das contas faltava-me alguma ciência, faltava-me uma cientificação das coisas. Abandonei. Tive que parar de fazer a arte e matricular-me na escola pra estudar. E fui a estudar, fui estudando, fui estudando até nos dias de hoje. Já estou carregado, já tenho o meu nível medio, já não tenho problemas assim.

(interrupção do garçom que trouxe o almoço do Eduardo e para pedir refresco)

**E:** é isso Andrea, as coisas não estão a andar nada bem. Não estar a andar nada bem, eu sinto muito quando isso acontece a nós. Mas não temos outra saída, não temos como sair, não temos como sair.

**A:** E você tem filhos?

**E:** Eu tenho um filho.

**A:** E você quer que ele aprenda também a fazer a arte Maconde ou não?

**E:** Não não, não preciso. O meu filho não precisa aprender a arte Maconde. Não precisa porque é, é um sofrimento muito grande. Não sei, se as coisas mudarem futuramente, posso ensinar mas não como um artista, não. Se ele quiser, quer dizer, o dom de uma pessoa não se proíbe. Se ele quiser pode ser um artista, mas eu não deixo porque não é fácil viver como artista. Eu preferia lutar para que ele pelo menos faça a universidade, mas uma outra coisa diferente daquilo que sou eu pai.

(garçom traz o refresco)

### B.3 Enlarged Pictures

I have selected some examples of the pictures presented in section 5.7 to present them here in a larger format, for a better appreciation. All pictures, including these may be found in the DVD-ROM attached at the back cover.

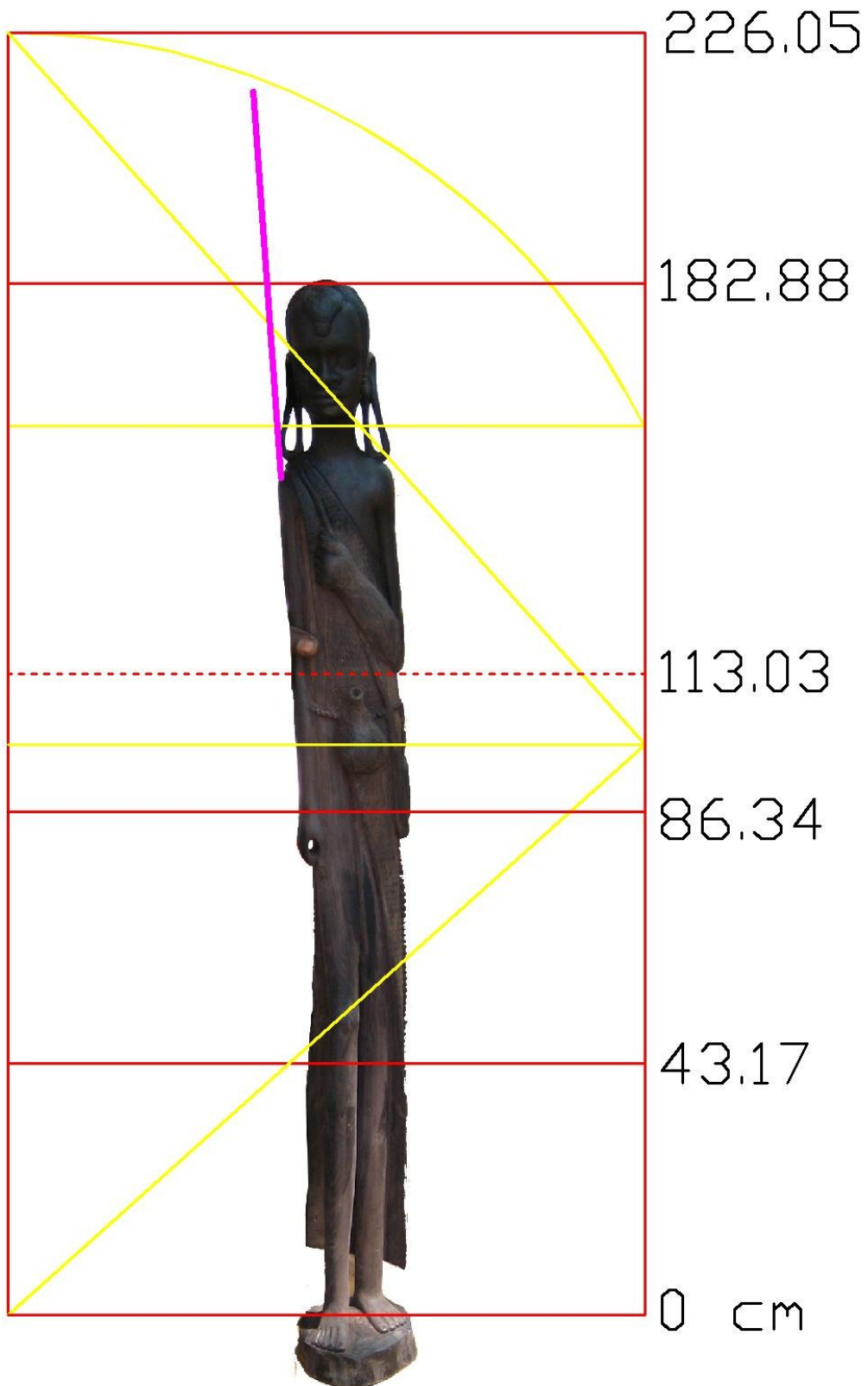


Figure B.1: Example of the *modulor* of a Maasai man.

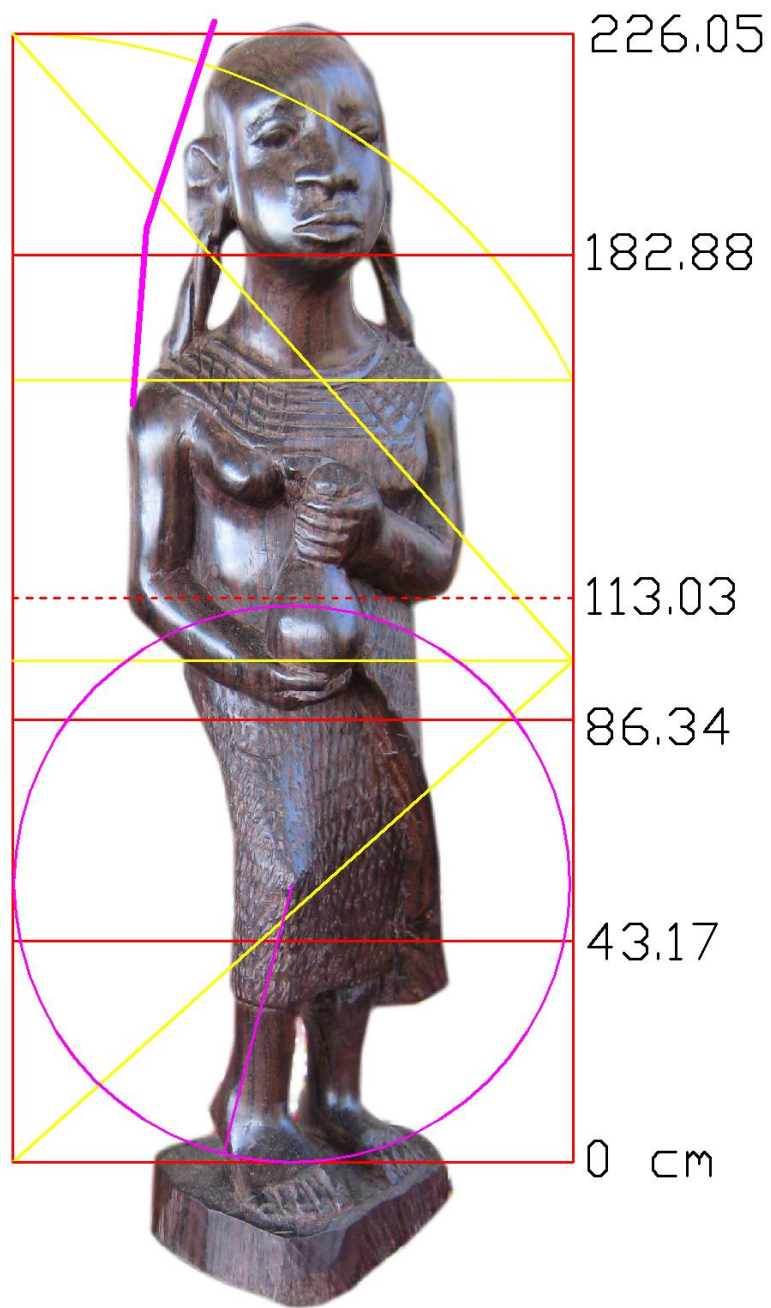


Figure B.2: Example of the *modulor* of Maasai woman.

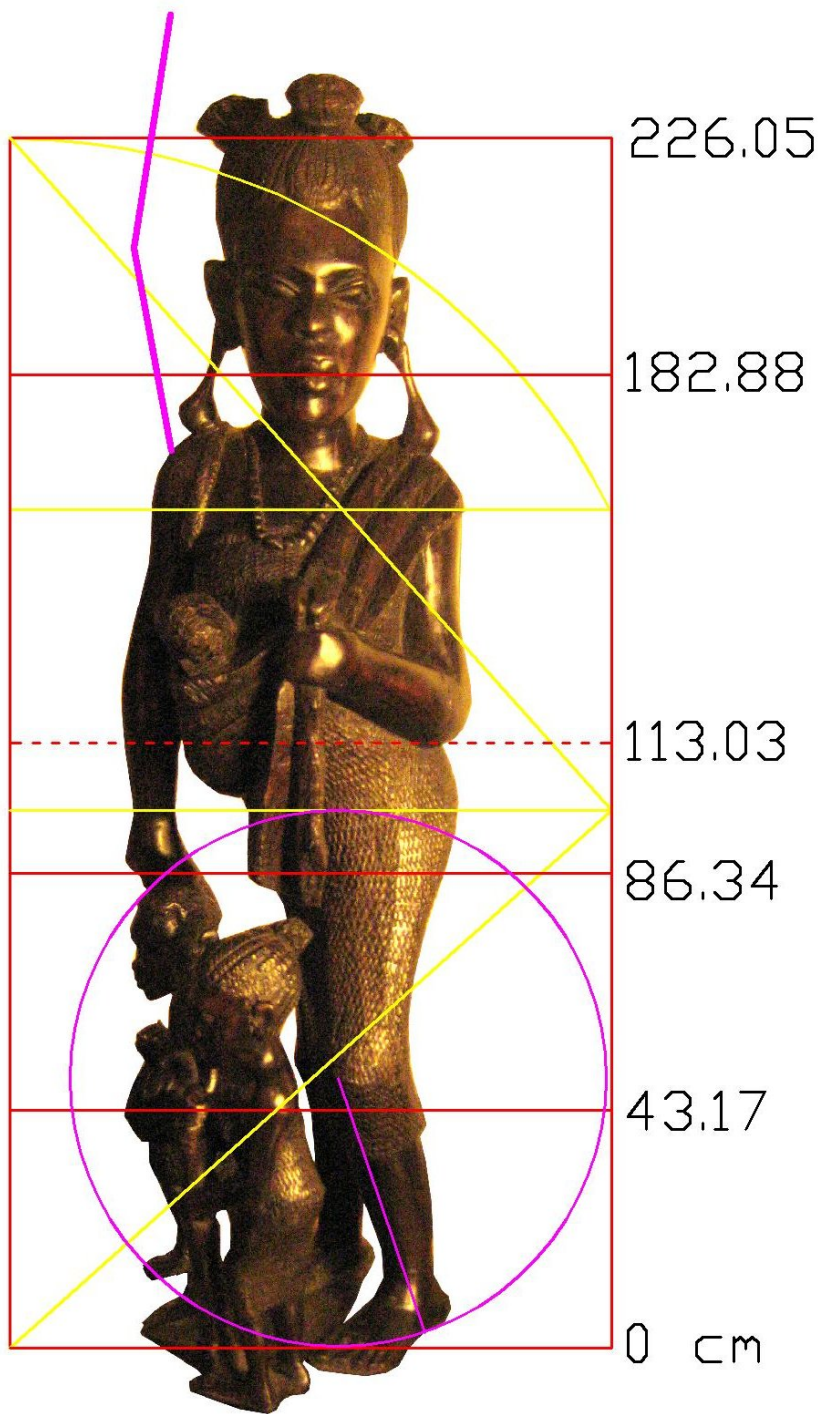


Figure B.3: Example of the *modulor* of a woman.

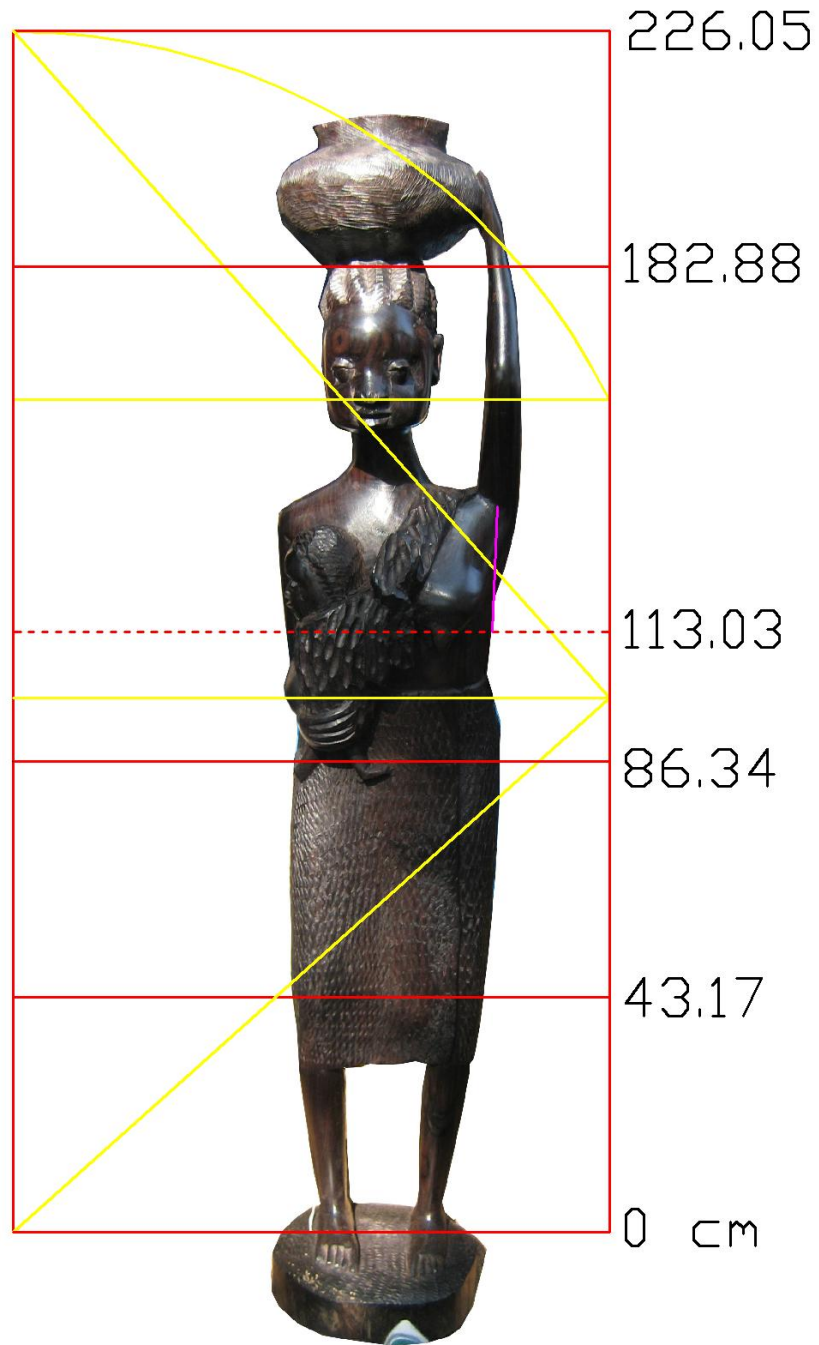


Figure B.4: Example of the *modulor* of a woman.



Figure B.5: Examples of the computations proceeded in the facial features of a boy and a woman.



Figure B.6: Examples of the computations proceeded in the facial features of two women. Note that the last woman has very inaccurate features.



# Appendix C

## Field Notes: *Centro de Memória,* Unicamp, and Friburgo, Campinas - Brazil

### C.1 Transcription of the article *Friedburg* by Richard Guebel

The Article Friedburg, written by Richard Guebel, was published in the magazine *Der Volksdeutsche: das Blatt d. Volksbundes für das Deutschtum im Ausland*, in 1937. (Guebel, 1937) Below is a transcription of it since the original had been written using old German script style.

Die kleine Bauernsiedlung Friedburg im brasilianischen Staate Sao Paulo entstand in den Jahren 1864-77. Der erste deutsche Ansiedler war der schon 1851 aus der Rheinpfalz eingewanderte Friedrich Thamerus. Ihm folgten nach wenigen Jahren die beiden Brüder Nikolaus und Samuel Krähenbühl, Deutschschweizer, gebürtig aus dem Kanton Bern. Danach machten sich in den Jahren 1870-77 mehrere Schleswig-holsteiner hier ansässig, die Familien Steffen, Jührs, Klemendt, Armbrust, Quitzau und Wulf, nach welchen etliche Jahre später die Familienväter Ulitzka, Albrecht, Schröder, Dobner und Skupien kamen.

Die Siedler waren durch Vertrag mit einem brasilianischen Kaffeeplanta- genbesitzer nach Brasilien gekommen. Bis zum Jahr 1876 hatten sie sich durch Fleiß und Sparsamkeit soviel erübrigt, um sich hier in Friedburg eigenen Grundbe- sitz erwerben zu können. In den ersten Jahren hatten die Ansiedler große Schwierigkeiten zu überwinden, wie es auf Neuland immer der Fall ist. Eines der größten Hin-

dernisse war, und ist z. Z. noch heute, die Unzulänglichkeit der Verkehrswege. Jetzt, da die geernteten Erzeugnisse im Lastauto zur Stadt geschafft werden, erzählen die Söhne der alten Kolonien noch gern von den beschwerlichen, manchmal abenteuerlichen Stadtreisen, die in den ersten 20 Jahren ein oder mehrere Male in der Woche gemacht werden mußten. Bald nach Mitternacht wurde aufgestanden, die in großen Rebledertaschen befindlichen Kartoffelsäcke den störrischen Maultieren an die Tragsättel gehängt, und dann ging es auf der schlechten, durch Gräben und Morast beinahe unpassierbaren Landstraße zur Stadt, die erst nach Sonnenaufgang erreicht wurde. Oft kam es vor, daß die Tiere scheuten oder im Gedränge zwischen hohen Böschungen ihre Last abwarfen und querfeldein durch Busch und Dickicht ausrissen. Wenn man endlich in der Stadt angekommen war, folgte das mühselige Straße-auf-und-ab-ziehen, um die Produkte im kleinen zu verkaufen. Sehr häufig kam es dann vor, daß nach langem, vergeblichen Bemühen die Waren noch bei einem Geschäftsmann eingestellt werden mußten.

Doch brachten alle Beschwerden die zähe Arbeitskraft der Bauern nicht zum Erlahmen. Nach etlichen Jahren zeigten sich die Früchte des ausdauernden Fleißes: die Wirtschaftslage besserte sich.

Aber eine andere ernste Frage bereitete ihnen Sorgen, nämlich der Schulunterricht für die heranwachsenden Kinder. Zwar war schon damals die noch jetzt bestehende Deutsche Vereinsschule in Campinas gegründet und in Betrieb, aber den Siedlern fehlten die Mittel, um ihre Kinder in der Stadt unterzubringen. Schließlich legten sie selber Hand ans Werk zum Bau des eigenen Schulhauses und der Lehrerwohnung. Am 6. Oktober 1879 erfüllte sich der Friedburger Bauern heißester Wunsch: die Schule konnte in Betrieb gesetzt werden. Seither, d. h. in 57 Jahren, ist auch der Unterricht nicht unterbrochen worden, mit Ausnahme von drei Monaten im Weltkriege, als die Wogen des Deutschenhasses bis herüber ins friedliche, entlegene Friedburg brandeten und die Schule wegen angeblich ungenügender Pflege der Landessprache von den Behörden geschlossen wurde.

überhaupt wird der fremdsprachige Unterricht von der Staatsregierung gehemmt, und zwar erstens durch das Gesetz, welches verbietet, Kinder unter zehn Jahren anders als in der Landessprache zu unterrichten, und zweitens dadurch, daß der Unterricht in den Fächern Landessprache, brasilianische Geschichte und Erdkunde von keinem Ausländer, selbst wenn er die portugiesische Sprache vollkommen beherrscht, erteilt werden darf.

Wenn von der Friedburger Schule die Rede ist, müssen wir dankbar des schon vorher genannten Ansiedlers Nikolaus Krähenbühl, eines Deutschschweiz-

ers, gedenken, welcher vor etwa 20 Jahren verstorben ist. Dieser übernahm, um der Unannehmlichkeit des häufigen Lehrerwechsels und der daraus sich ergebenden Unterbrechung des Unterrichts zu steuern, selbst die Schule und leitete sie treu und segensreich ununterbrochen über zehn Jahre unter Zurückstellung seiner eigenen wirtschaftlichen Belange, denn der Schulverein konnte ihm nur eine geringe Entschädigung bieten.

Auch heute noch wird die deutsche Sprache und Sitte gepflegt wie zu Großvaters Zeiten, hauptsächlich dank dem Wirken der Schule und dem treuen Zusammenhalten im Verein. Unrühmliche Ausnahmen gibt es selbstredend auch hier, wie z. B. in einigen Familien, die - zu verständnislos aber zu träge - selbst im Hause und im Verkehr mit den Kindern sich der Landessprache bedienen. Dieses unentwegte Festhalten am Deutschtum haben die Friedburger vor drei Jahren wieder bewiesen, indem sie den Bau einer eigenen Kirche beschlossen und durchführten. Zwar erhoben sich gegen den Kirchbau selbst innerhalb der Gemeinde ernste Bedenken angesichts des Umstandes, daß diese nur über eine kleine Mitgliederzahl und geringen Kassenbestand verfügt und die Bauunkosten zum größten Teil durch freiwillige Spenden gedeckt werden mußten. Aber es muß dankbar anerkannt werden: Friedburg berief nicht vergeblich den Opfersinn und die Gebefreudigkeit der deutsch-evangelischen Gemeinden im Staate S. Paulo und anderer Staaten. Von allen Seiten wurde wirksam unterstützt, so daß das Kirchlein halb fertiggestellt werden konnte und der Gemeinde nur eine verhältnismäßig leichte Schuldenlast verblieb. Kirchlich betreut wird Friedburg von dem Pfarrer der deutschen Gemeinde Campinas, welcher an einem Sonntag im Monat zur Gottesdienstfeier hinkommt.

Wirtschaftlich erfreut sich die Siedlung eines mäßigen Wohlstandes, da auf dem fast durchweg fruchtbaren Boden alle einheimischen Kulturpflanzen angebaut werden können. Sehr bedauerlich ist es jedoch, daß es der Siedlung an Ausdehnungsraum fehlt. Friedburg ist ein langer, schmaler Landstreifen, der von allen Seiten von unfruchtbarem Kamp eingengt ist. Die Bauernsöhne können daher nach ihrer Verheiratung nicht auf dem elterlichen Grundbesitz bleiben, sondern müssen sich anderwärts Land erwerben, manchmal an Orten, wo ihnen Schule und Gottesdienste in deutscher Sprache nicht zugänglich sind und ihre Kinder dadurch dem deutschen Volkstum verlorengehen. Der Landesverband Deutscher Lehrer und der Gustav-Adolf-Verein bemühen sich zwar, durch Schulgründungen und Entsendung von Reisepredigern diesem Übel nach Möglichkeit abzuhelpfen, doch kommt diese aufopfernde Betreuung selbstredend mehr den in geschlossenen

Siedlungen ansässigen Volksgenossen zugute.

## C.2 Request and Authorization for the Development of the Field Research in Friburgo and at the *Centro de Memória* of Unicamp

### Request

The following corresponds to the letter I presented to the *Sociedade Escolar do Bairro Friburgo* requesting the access of the material stored in the *Centro de Memória*, as well as the opportunity to work and develop a study on cultivating grapevines.

#### 1. Apresentação

Meu nome é Andrea Rohrer. Sou de origem alemã, mas nasci em Campinas. Meu pai era Hermann Rohrer, um alemão da região sul da Alemanha, chamada Bavaria. Ele foi professor de Estatística na Unicamp e faleceu, a causa de um acidente, no ano 1995. Fiz a minha graduação em Física na Universidade de Chile, em Santiago de Chile. Há 5 anos moro na Alemanha. Fiz meus estudos de Mestrado em Matemática na Universidade de Munique e já tem 1 ano e 7 meses que estou fazendo o meu doutorado na Universidade de Bielefeld, onde moro. Tenho 2 orientadores para a minha tese. O primeiro é o Dr. Gert Schubring que está na Universidade de Bielefeld e o segundo é o Prof. Eduardo Sebastiani que trabalhou na Unicamp e agora está aposentado. O meu trabalho de doutorado trata-se, a grosso modo, de Etnomatemática. Para mim, Etnomatemática significa como diferentes culturas, comunidades ou etnias desenvolvem a Matemática de acordo com os seus conhecimentos, necessidades e entorno, tanto social e cultural como também com respeito ao meio ambiente e condições climáticas.

#### 2. Iniciativa

Prof. Sebastiani conheceu o bairro de Friburgo graças à uma reportagem que apareceu no Correio Popular com respeito a ampliação do aeroporto de Viracopos. Naquela época ele comentou que no bairro de vocês havia, aparentemente, um trabalho voltado à agricultura, mas não tínhamos maiores conhecimentos sobre isso. Por volta de abril deste ano, ele mencionou que a Professora Olga von Simson, do Centro de Memória da Unicamp, já tinha realizado varias entrevistas com alguns dos moradores de Friburgo e que eu poderia obter alguma informação com ela sobre a vida no bairro de vocês. Entrei em contato com ela e a resposta

foi positiva para eu vir para o Brasil e trabalhar um pouco em conjunto com ela e poder acessar aos seus trabalhos. Profa. Olga têm sido bastante atenciosa comigo e através dela pude acessar o material didático que vocês tinham na Escola de Friburgo, e também li algumas entrevistas realizadas onde se falava sobre o funcionamento da escola e dos professores que houveram aí. Além disso, já deve fazer quase 1 mes que vim para Friburgo visitar o sr. Gerson Schaeffer e dona Zélia. Eles foram bastante atenciosos comigo e me levaram para conhecer o complexo onde está a escola, igreja e um monumento em homenagem aos fundadores do bairro Friburgo. Eu tentei falar sobre o meu projeto de trabalho, mas devo confessar que não fui muito clara ao respeito. O sr. Gerson me fez a proposta de vir para Friburgo para o Almoço do Cemitério e assim conhecer as outras pessoas que, apesar de já não morarem em Friburgo, tem um laço direto com este bairro. Foi o sr. Gerson que me disse que criava gado e que havia uma ou duas famílias que plantavam uva. Logo após eu conversei com o prof. Sebastiani, e ele me ajudou a construir a seguinte proposta que quero fazer à vocês:

### **3. Proposta**

Gostaria de consultar à vocês se me dariam a autorização para estudar os livros antigos de matemática que eram usados na escola, já que a Profa. Olga me disse que esse material só está na guarda, e não na posse, do Centro de Memória. Além disso, gostaria de poder realizar outro trabalho em conjunto com vocês e que seria em relação às plantações de uva. Eu desconheço completamente o que se deve fazer num sítio ou roça para poder plantar uvas. O Único que eu sei são alguns nomes dos métodos e passos a ser realizados durante uma plantação de uva, que seriam: curva de níveis, medida de terreno, estimativa de colheita, influência da lua, quantas mudas de planta podem ser colocadas em cada linha, distância entre linhas, adubo, comercialização (encaixotar, cortar), qualidades de uva, altura de parreira entre outras coisas. A minha idéia é a seguinte: acompanhá-los no trabalho feito dia a dia nas plantações, mas sem impedir o trabalho de vocês. Muito pelo contrário, gostaria de poder observar tudo o que vocês tem a realizar para assim poder aprender os métodos utilizados, realizar consultas ao respeito e, quem sabe, poder ser duas mãos à mais para ajudá-los. Gostaria também de saber como vocês aprenderam a realizar todo o trabalho, quer dizer, se foi um ensino oral entregue de geração em geração, se vocês aprenderam a fazer isso na escola, ou se foi outro tipo de formação profissional.

### **4. Limitação**

Há 1 semana atrás ia ser realizado o Almoço do Cemitério, mas não foi

possível a causa do trânsito na estrada. Isso me fez perceber que eu também tenho uma limitação. Infelizmente não tenho carro nem carteira de motorista. Dona Zélia e o sr. Gerson se ofereceram gentilmente ir me buscar no Terminal Vida Nova, na primeira visita que fiz em Friburgo. Para o dia do almoço, dona Zélia mais uma vez com muita gentileza e boa vontade disse que estaria trabalhando, preparando o almoço, mas que tentaria dar um jeito de ir me buscar se eu chegasse por volta das 9 horas da manhã. Mas, finalmente eu não posso dispensar de uma pessoa que vá me levar e me buscar todos os dias necessários, no caso de uma aceitação e boa recepção do projeto que estou apresentando. É por isso que eu gostaria de consultar se seria possível morar (alugar) em alguma casa dentro do mesmo bairro de Friburgo.

## Authorization

Figure C.1 is a copy of the authorization given by the *Sociedade Escolar do Bairro Friburgo* to access the material stored in the *Centro de Memória*.

**SOCIEDADE ESCOLAR DO BAIRRO FRIBURGO**

FUNDADA EM 1879 - CNPJ - 08.941.456/0001-68

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CAIXA POSTAL - 208 - INDAIATUBA

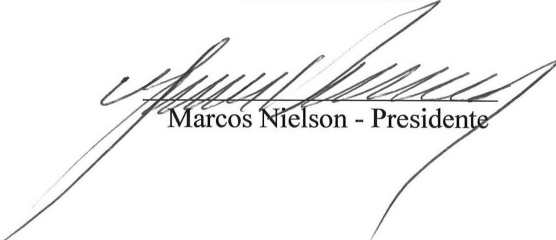
CEP- 13.330-970

Campinas, 22 de Novembro de 2007

Ao  
Centro de Memória da Unicamp  
At. Dr.<sup>a</sup> Olga von Simson

Eu Marcos Nielson presidente da Sociedade Escolar do Bairro Friburgo autorizo a senhorita Andréa Rohrer a pesquisar os documentos desta Sociedade, que se encontram arquivados no Centro de Memória, visando a conclusão de seu projeto de doutorado referente à imigração alemã para o Brasil.

Atenciosamente



Marcos Nielson - Presidente

Figure C.1: Copy of the authorization given by the *Sociedade Escolar do Bairro Friburgo*.

## C.3 Interview Transcripts

13-12-07 - Interview number 1

**A:** Andrea

**H:** Hedinho

**L:** Lucas

**H:** Esse é o meu sobrinho Lucas, filho do Edson. (Other voices in the background.)

**A:** Oi, bom dia.

**L:** Bom dia. (Other voices in the background.)

**A:** Ah, esses caixotes de madeira também... aqueles que estão aí são de cinco quilos?

**H:** Não, esse é de dois... é de um quilo e meio.

**A:** Esse é de um quilo e meio, esse aqui é de cinco?

**H:** Essa aqui são as cestas na verdade que a gente colhe lá pra trazer pra cá pra embalar. Porque aqui essa uva nós estamos colocando...

**A:** (interrupts) Ah! Tá certo, tá certo. Isso aqui vocês usam pra levar pra, pra fazer a colheita.

**H:** Essas caixa por exemplo pra mim são pra uva. Essas são de cinco quilo.

**A:** As de madeirinha.

**H:** De madeira. Isso aqui já é uma caixa fechada, vai papel aí que geralmente o pessoal compra pra viajar longe, pra Goiás essas coisa. Aí vai nessas caixa. Mas a maioria sai nisso aqui ó,<sup>1</sup> nessa embalagem aqui, que é a caixa aberta. Que é o mesmo peso daquela ali, só que aqui não vai papel, não vai nada e a mão de obra é bem menos. Porque pra aquela lá eu tenho que fazer o mesmo sistema que isso aqui, tenho que colher lá trazer pra cá e embalar, quer dizer eu pego no cacho três vezes e isso estraga, né?! Agora esse aqui não, esse aqui eu levo lá eu colho do pé direto aqui dentro...

**A:** (interrupts) Ah tá.

**H:** (continues) e vou ajustando conforme preciso.<sup>2</sup> Então isso aqui pega na uva uma vez só e já colho direto do pé e vai aqui dentro. E aqueles mineiro que eu falei pra você...

**A:** (interrupts) Aí essas vocês usam pra passar pra...

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<sup>1</sup> Ó is Portuguese slang that comes from *olhar*, so it is the imperative form *olha* in slang version.

<sup>2</sup> *ajustar* comes from *jeito* and it refers to, in this particular sentence, put the grapes inside the boxes without leaving any free space between them.

**H:** Pra essa caixinha pequena.

**A:** Pra caixinha pequena.

**H:** Porque esses cacho de uva aqui, eles são tudo cacho pequeno, ou seja, você não tem como pôr uva grande, cacho grande ali ó, ó. São tudo pequenininho. Né, que a gente chama de uva de...de...de segunda e tal. E os cacho maior vai nas outras caixa.

**A:** Hum hum.<sup>3</sup>

**H:** Então esse aqui é o que cabe ali, é o que a gente consegue botar ali, né.

**A:** E ele, ele vem assim na árvore?

**H:** É, ele dá assim na...no pé ali, como você viu.

**A:** É bem pequeno mesmo.

**H:** É esse...é, às vezes é cacho que não, como que a gente fala, não cresce tanto ou derruba carga coisa assim. (Radio music.)

**A:** Isso aqui que você (not understandable; ca. 00:02:37), isso aqui vai direto, né?

**H:** É. (Voices in the back and radio music.) Essa caixa depois, ela tem a tampa... .

**A:** (interrupts) Aí isso vai embalado.

**H:** (continues)...que tá ali no fundo é a tampa que vai em cima dela, é pregada aqui, vai um papel branco. É outro tipo de embalagem né, e esse é o rótulo nosso.

**A:** Sítio Mirim?

**H:** Sítio Mirim...Só que essa é uma embalagem que tá aos pouco tá acabando, não não tão usando muito mais. No entanto a gente fez essa aqui que já vendemos bastante, mas não tá saindo, saiu pouco dela. A que tá saindo muito é essa aqui, as caixinha de papelão (not understandable; ca. 00:03:35)

**A:** Essa daqui sai mais porque é mais fácil de levar.

**H:** Mais fácil de levar, e é mais fácil, por exemplo, pra eles vender. Que é mais fácil vender o...por exemplo, pra essa mineirada que carrega pra vender na rua, eles vende uma caixinha dessas...

**A:** (interrupts) É mais fácil de ficar carregando também.

**H:** É, eles vendem uma caixinha dessas por exemplo cinco reais. Eles pagam aqui pra mim dois e sessenta. Mas lá eles vendem a cinco, sei lá até quanto, né.

**A:** Hum hum.

**H:** E pra eles venderem na rua é melhor. Porque às vezes uma, por exemplo, tem uma família tem duas, três pessoas ele não vai comprar uma caixa de cinco quilos.

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<sup>3</sup>*Hum hum* is used to affirm or confirm what has been said.

**A:** Não não.

**H:** Vai comprar uma de um quilo e meio de uva.

**A:** Ou talvez comprar as de cinco, de repente tem que dividir em saquinho aí também é mais trabalho pra eles.

**H:** Então eles levam muito é isso aqui, essas embalagem de papelão. E existe essa caixinha de madeira, que nem essas aqui. Aí ela vai rótulo, vai tudo também, no mesmo sistema de... igual essa só que é pequena. Mas aí ela dá muita mão de obra, então a gente (not understandable; ca. 00:04:39, engine starts)

**A:** E esse é o tipo da uva, uva niagara?

**H:** É, isso, uva niagara. Que é essa uva aqui.

**A:** Então é a única que você, que vocês tem aqui no sítio inteiro?

**H:** É, só dessa...

**A:** (interrupts) Só dessa.

**H:** Nossa região só produz esse tipo de uva. As outras uva, itália, rubi, benitaka que são aquelas uva grandona que você come ela, né. Aquela não vai aqui, não produz aqui. Essa aí produz só em outras regiões.

**A:** Aí o senhor disse que esse sítio inteiro que vocês tem aqui, já tem há cento e trinta anos.

**H:** É, até um pouquinho até mais eu acho sim. Mas é pelo menos nessa faixa. Ó por exemplo...

**A:** (interrupts) Mas há quanto tempo vocês plantam?

**H:** Uva?

**A:** Uva.

**H:** Nós plantamos uva... ah... setenta e três pra cá. De mil novecentos e setenta e três pra cá. Dá o que? Trinta e, 2003...

**A:** (interrupts) É mais de trinta. trinta e quatro anos.

**H:** Trinta e quatro anos que a gente tem uva todo ano, sempre tem.

**A:** Hum hum.

**H:** Nunca deixamos de...

**A:** (interrupts) E o senhor começou então a plantar com seu irmão? Ou com seu pai?

**H:** Quem começou a plantar foi meu avô com o meu pai.

**A:** Ah!

**H:** Eles que começaram é eu nem... depois que a gente... eu era criança. Olha esse caixote aqui é o que vai, que eles levam também.

**A:** Esse é de cinco quilos?

**H:** É. Isso são as caixa maior, tá vendo, são caixa grande.

**A:** Até que tá molhado mesmo, né?

**H:** É, elas tão tudo molhada.

**A:** E como é que, como é que vocês sabem que tem cinco quilos?

**H:** É porque a caixa num comporta mais que cinco, entendeu?

**A:** Hum hum

**H:** E se você não encher um pouquinho, bem cheio não dá o peso que eles pedem, né.

**A:** Mas vocês não vão passando assim balança por... tipo caixa por caixa pra pra...

**H:** (interrupts) Não, não. Não tem como.

**A:** Então é, saber que tem cinco quilos é experiência?

**H:** É, é o, que ela não, também não cabe mais, não é, que cinco quilos de uva. É difícil caber muito mais.

**A:** E se tiver menos dá pra sentir a...

**H:** (interrupts) Dá, se eu não pegar, por exemplo, se você vai pegar uma caixa que não tem cinco quilos, você vai... quer ver, você vai pegar, você vai chacoalhar ela assim, a uva vai chacoalhar dentro. Então você já sabe que tá faltando uva dentro. E o próprio comprador, ele chega e no pegar ele já sabe também, né. Então é por experiência, não tem como você pesar. Por exemplo, esse caixote aqui, essa caixa tem um peso, essa aqui já tem outro porque elas são meio desigual no caso dessa aqui, né

**A:** É.

**H:** Agora aquelas mais nova lá, já tem um peso só. Até daria mas a gente, mas a gente não... já por experiência, na pratica não, não pesa.

**A:** E isso aqui, essa caixa aqui vocês já levam direto pra fazer a colheita?

**H:** É, essa leva, colho do pé direto aqui, como ela tá ali, tá vendo, né. Como ela tá aí, só vai parando embaixo do pé e já vai colhendo.

**A:** Essa planta é mamão?

**H:** É mamão.

**A:** É mamão.

**H:** Aqui do outro lado é milho. Ali é uma uva que tá mais nova, perto do milho ali também.

**A:** Ah! Isso que eu queria perguntar também. Como é que vocês... tem algum, algum procedimento pra replantação se vocês...

**H:** (interrupts) Da uva?

**A:** (continues) tiram uva e plantam outra coisa pra não. . .

**H:** (interrupts) É. . .

**A:** (continues, interrupts). . . destruir a terra?

**H:** (continues). . . por exemplo, essa quadra aqui de terra onde tem esse milho aqui, aqui teve uva por vinte anos plantado.

**A:** Vinte anos.

**H:** Vinte anos. Aí ela ficou velha, começa a morrer muito pé pro meio depois de uma certa idade dela. Aí você tem que renovar. Então aqui já fazem três anos que nós arrancamos a uva. E nós pretendemos plantar agora esse ano que é o cavalo dela, pra ela ser enxertada só no ano que vem, vai produzir só daqui dois anos, né.<sup>4</sup> Mas talvez ainda nem plante ainda esse ano, pra deixar a terra dá uma descansada um pouco mais. E a melhor coisa pra fazer rotação de cultura, que a gente chama, é o milho, porque o milho ele repõe nutriente pra terra. Ele repõe nitrogênio essas coisas, ele não é uma planta que suga, né, e que acaba com a terra. Pelo contrário, ele ajuda a manter equilibrar bem a terra. Pra rotação de cultura, milho, girassol essas coisas se tem melhor cor, né. Agora se você plantar feijão é pior, o feijão é uma planta que ele suga a terra, ele tira tudo que ela tem. Ele empobrece o solo. Já o milho não, o milho é uma planta que. . . que ele ajuda a recuperar.

**A:** Tá.

**H:** Né. Então aqui já é o terceiro ano que tá plantando milho de novo, né. Tira o milho, quando colhe em março, vai colher ele em março começo de abril. Aí a gente deixa, cresce mato fica aí e depois, né. Então a gente vai plantar ou esse ano e se não der esse ano pra plantar, talvez não planta e ano que vem vai plantar uva.

**A:** Aí quanto, mais ou menos o intervalo entre uma, uma tirada de uva e o milho fica quanto? quatro, cinco anos ou?

**H:** Ah uns três, quatro anos, no mínimo, no mínimo.

**A:** Três, quatro anos.

**H:** Porque você já repetir, por exemplo você arranca uma uva e já planta outra não vai, não vai ajudar muita coisa não. É bom sempre a terra dar uma descansada, dar uma. . . mexer bem ela, porque você vê ó, planta, né, ela fica aí ó. A terra fica dura, é forrada uma rua sim uma não, tá vendo tem capim numa rua, a outra é

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<sup>4</sup>*Cavalo* is the tree trunk; and *enxertar* is the action of making a graft (= *enxerto*), i. e., to insert a piece of living plant in a tree trunk.

terra, a outra...<sup>5</sup>

**A:** (interrupts) Ah é!

**H:** tem forragem, né. Isso por causa da época da seca, a gente faz isso pra.

**A:** E será que o preço do milho vai subir agora com o combustível alternativo?

**H:** Ah pode.

**A:** O senhor será que vai mudar de opinião e vai plantar mais milho em vez de uva?

**H:** Não, isso não muda muito na gente...

**A:** Então o capim que fica aí no meio é mais pra tentar adubar um pouco a terra ou o que?

**H:** Também aduba né, mas é mais pra reter a humidade mesmo.

**A:** Pra reter a humidade...

**H:** É, uma humidade que ela precisa em setembro (not understandable; ca. 00:11:33). Essa forragem na verdade a gente coloca agora em Fevereiro Fevereiro Março, quando a terra ainda tá bem húmida. Aí é, é colocado tudo.

**A:** Quantas pessoas trabalham aqui com o senhor?

**H:** Seis, sete, oito trabalham.

**A:** E eles ajudam, eles fazem safra, poda e encaixotamento?<sup>6</sup>

**H:** É, é. Mas eles são empregados né, eu pago, são registrados mesmo.

**A:** (Doing some observation in the field.) Aí tem uma...

**H:** Isso aí é passarinho que faz isso.

**A:** É tá um pouco húm-, molhadinho, né. Bom, tem umas gotinhas...

**H:** (interrupts) É, mas isso aí não interfere. A gente colhe, entendeu.

**A:** Será que as folhas tão aí pra proteger do sol também?

**H:** Isso é, você tem que deixar. Por exemplo, eu não posso arrancar essa folhas aqui, senão ela madura, ela...esses cachos tão maduro ó. Aqueles ali ainda tão amadurecendo, se ele fica no sol por exemplo, ele vai ficar com uma cor feia, vermelho, é... não vai ficar roxa como essa, entendeu.

**A:** Tá.

**H:** Porque a uva tem uma cera por cima dela, própria dela, entendeu. Ó.

**A:** Ah é.

**H:** Entendeu? E é esse que é o charme dela, né. Agora, se eu fico pegando muito nela, ela perde isso aqui. Aí a uva fica feia. Então eu tenho que tomar muito

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<sup>5</sup> *Capim* is the name given to several gramineous plants; it is also fodder.

<sup>6</sup> *Podar* is to cut the parts of a plant for them to acquire strength for growing more vitally and enriching the production.

cuidado na hora de colher, tem que colher só com as ponta dos dedos pra não, pra ela não perder isso ai. Que é uma proteção dela e ela fica bonita, né.

**A:** É porque, senão aqui os clientes não gostam já. . .

**H:** (interrupts) Não, não. Ela fica tudo lustrada, ela fica brilhando. Parece que você encerou ela e passou um pano, né, e fica feio. Lá em cima o que tem lá é igual aqui, é a mesma coisa, entendeu. Os pomar de uva são aqui , a maioria todos desse jeito.<sup>7</sup>

**A:** Então quan-, quanto que é a quantidade assim de terreno que o senhor tem separado pra. . .

**H:** (interrupts) Pra uva?

**A:** (continues) pra uva.

**H:** Quatro, cinco, dá mais ou menos uns sete alqueire de uva.

**A:** Quanto que era um alqueire? vinte e quatro mil. . .

**H:** (interrupts) Vinte e quatro mil e duzentos metros.<sup>8</sup>

**A:** Vinte e quatro mil e duzentos metros.

**H:** É. Um alqueire é vinte e quatro mil e duzentos. Então, eu tenho sete deles. Por exemplo, pra cada alqueire de uva, não, pra cada. . . é, fazer outra conta quer ver. . . dá mais. Meu irmão é que sabe certo, mas não. . . eu acho que é, cada hectare que, daí é dez mil metros cabe sete mil pés de uva.

**A:** Hum hum.

**H:** A gente tem ao todo, nós temos setenta mil pés.

**A & H:** Setenta mil.

**H:** É. Desse aqui.

**A:** Que é esse ai?

**H:** É. É esse aqui, é um pé ó. Sai daqui e vem e vai até aqui ó. Esse é um pé de uva, né.

**A:** Hum hum.

**H:** Entáo esse, nós temos setenta mil. . .

**A:** (interrupts) Aqui tem outro.

**H:** É, esse aqui já é outro e já encosta nele, tá vendo. O outro aqui já, já encosta aqui. A uva dá muita mão de obra, viu. Você tem que cuidar esses broto, tem que limpar tudo ele, amarrar em cima, amarrar no meio. Depois sempre tem que tá cortando essas pontas. . . (interruption)

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<sup>7</sup>*Pomar* is a piece of land where a farmer cultivates fruit trees.

<sup>8</sup>Not to cause any misunderstanding, *alqueire* is a measure system for surfaces and since the interview is done in a very colloquial language we do not say squared meters, but it is understood to be included.

**A:** É, tem que fazer essa aqui, né, o suporte pra ela.

**H:** Isso aqui você põe uma vez só e ele dura aí vinte anos, né?! Mas você tem que sempre, depois quando poda aqui embaixo, é que nem vai depois que colheu, aí a uva vai descansar e tal. Final de Julho, Agosto eu vou podar ela aqui, aí ela vai brotar aqui ó.

**A:** Mas esse galho aqui velho, ele fica?

**H:** Não, esse é o tronco dela.

**A:** Ele fica?

**H:** Esse fica, esse é. . .

**A:** E como é que, como que o senhor faz pra plantar. . . dá pra pegar de uma muda fazer outra, plantar outra ou não?

**H:** Não, é o seguinte: essas quadra aqui da frente foi feito isso. Por exemplo, pra mim plantar essa uva eu planto primeiro o cavalo dela, que é o suporte do enxerto, é o porta-enxerto que a gente chama, que é uma uva rústica, azeda que não tem comércio nem nada. A rolha dela é diferente, é o que, é o que dá o enraizamento dela. Aí então, eu planto ela, durante um ano aquilo cresce e tal, tudo. Ele só forma folha e galhos, só. Não dá uva, é muito difícil dar, e quando dá num presta.

**A:** Hum hum.

**H:** Aí quando chega em Agosto por exemplo, eu planto ela em. . . é. . . mais ou menos Agosto. Por exemplo, eu planto em Agosto desse ano, Agosto do ano que vem, depois de 1 ano é que eu vou enxertar ela.

### **13-12-07 - Interview number 2**

**A:** Andrea

**H:** Hedinho

**E:** Edson

**H:** (not understandable) e isso é totalmente gratuito. Se vem um agrônomo aqui é a mesma coisa, você vai no médico você tem que pagar a consulta.

**A:** Hum hum.

**H:** Um agrônomo não vem de graça aqui, me visitar. E o SEBRAE proporciona isso pros agricultores de maneira totalmente gratuita.<sup>9</sup> É o que ajuda muito a gente. Então a gente tem a visita dele, de um agrônomo a cada trinta, quarenta dias ele vem. Vem e anda toda a lavoura, fica com a gente, conversa e fala, explica

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<sup>9</sup>SEBRAE is the abbreviation of *Serviço Brasileiro de Apoio às micro e pequenas Empresas*, which is the Brazilian national service that supports small business.

e... geralmente é um agrônomo que trabalha nessa área, na área de fruta. Se eu quero, por exemplo, na área do milho, da batata que a gente planta também é um agrô-, é outro agrônomo que mexe com essa área, que entende dessa área. É que nem o médico, são várias especialidades.

**A:** É.

**H:** Né. Por exemplo, aqui já aconteceu de vim agrônomo que nunca viu um pé de uva na vida. Mas o cara é... vamos dizer, um Ph.D. em batata. Mas ele nem conhece uva. Então ele (not understandable; ca. 00:00:52), ele sabe né, mas não... ele não entende.

**A:** Não pode dar palpite.

**H:** Não pode, porque ele não sabe, né. É a mesma coisa que... um ginecologista querendo dar palpite num ortopedista.

**A:** É. Aí quando seu pai e seu avô começaram...

**H:** (interrupts) Isso não existia.

**A:** (continues)... eles dão aviso, ou... ou não existia antes?

**H:** Não, aquilo não existia. Isso tá tendo pra nós de uns dez anos pra cá.

**A:** Mas aí, o senhor avisou que tinha plantação aqui ou foram eles que chegaram?

**H:** Não, eles que vieram por meio do Sindicato Rural de Indaiatuba que indica, né, os produtor pra eles fazerem, pra eles ficarem ajudando. O que ajuda muito a gente é o Sindicato Rural, né. Eles têm toda a assessoria pra tudo esses agrônomos que... o Sindicato Rural...

**A:** (interrupts) Sindicato Rural é de Indaiatuba?

**H:** De Indaiatuba. Eles ajudam muito também. Por exemplo o Sindicato deu toda a assessoria pra mim na parte de... de contabilidade essas coisa de empregado, de ficha, de departamento de pessoal essas coisas é tudo com eles. Eles fazem tudo pra mim. Eu só rolava os tal de holerite pra pagar os funcionários, recolhimento das caixa eles fazem.<sup>10</sup> Quer dizer eu pago pra eles lá, mas eu não preciso estar correndo no banco ou pagar um escritório. Isso eles fazem gratuitamente pra gente. Eu pago assim uma anuidade do Sindicato minha, mas é, o valor é pequeno em relação a se eu for pagar um escritório pra cuidar das coisas pra eles.

**A:** É, é.

**H:** Aí eles fazem isso, fazem imposto de renda, fazem tudo...

**A:** É, pra todo empregado também fiquem bem em ordem com todos os papéis.

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<sup>10</sup> *Holerite* is a common word used in Brazil to refer to the document that contains the detailed monthly incomes.

**H:** Sim, sim. E dentro da lei né.

**A:** Tem aposentadoria depois. . .

**H:** Tudo, tudo. Registrado como qualquer outro funcionário.

**A:** E o, e eles moram aqui então dentro do sítio?

**H:** É. Eles moram aqui.

**A:** Mas eles não pagam aluguel ou como é que funciona?

**H:** Não não, não pagam nada. Não paga nem água, nem luz, nem aluguel nem nada. Não pagam nada.

**A:** Aí você fica responsável. (not understandable; ca. 00:02:37)

**H:** Isso é responsabilidade minha. Mas em si, o mais da uva. . .

**A:** Então o, o seu pai e seu avô começaram. . .

**H:** É.

**A:** E que eles . . . viram outros produtor.

**H:** Os produtor.

**A:** Que não tinha.

**H:** Que na época não existia uva aqui na região, não tinha.

**A:** E antes deles plantarem uva eles já tinham plantado alguma outra coisa?

**H:** É, a batata.

**A:** Era batata?

**H:** Batata, milho, feijão. . .

**A:** Também pra venda?

**H:** É, também. Sempre. A gente planta batata na verdade, desde os meus bisavô. Eles que quando vieram da Alemanha, a primeira coisa que eles fizeram aqui foi plantar batata.

**A:** Então provavelmente eles tenham, usam a mesma técnica que trouxeram da Alemanha, será que ainda?

**H:** É, hoje é diferente, porque hoje naquele tempo era tudo na mão, né, tudo manual. Hoje é tudo mecanizado. Por exemplo hoje, no caso da batata é tudo mecanizado. É pouco. . . tudo com trator, máquina. É diferente do que era naqueles tempo deles lá.

**A:** Hum hum.

**H:** Mas a gente continua plantando até hoje.

**A:** Aí, o sítio que o senhor falou. Um sítio com uva, com plantação de uva. . .

**H:** (interrupts) Outro com. . .

**A:** (interrupts and continues) dura uns vinte anos?

**H:** É, a lavoura dura uns vinte anos. É uma lavoura perene.

**A:** A lavoura dura vinte anos.

**H:** É, essa é uma lavoura perene, dura vinte anos.

**A:** Aí tem que tirar...

**H:** (interrupts) É, depois você vê que daí ela...

**A:** (interrupts and continues) pra alimentar o solo.

**H:** É, ela não começa a produzir mais, ela vai... dá cacho só pequeno. A gente no próprio pé vê essa fase dele. Aí você tem que arrancar tudo fora.

**A:** Hum hum. O gosto da uva varia muito ou ou?

**H:** De ano pra ano sim.

**A:** De ano pra ano.

**H:** Porque tem o brix que é o teor de açúcar dela, né. Esse ano por exemplo o teor de açúcar dela tá bom porque fez frio na época certa, deu a seca que a seca ajuda a... a acentuar bem o teor de açúcar dela. Se dá um ano muito chuvoso na, no Setembro Outubro, aí ela dá uma uva mais, vamos dizer, aguada, ela não tem tanto açúcar. Você vai chupar ela, você vai "ó, essa uva tá aguada"...

**A:** (interrupts) Hum hum.

**H:** (continues) vamos dizer. E hoje não, hoje você chupa e você vê que ela tá uma uva doce mesmo, bem doce. Então é, por causa da seca. Porque ela vai reter açúcar, ela vai reter energia pra ela, né.

**A:** Hum hum.

**H:** Por causa da seca isso, ela não gasta... em vez de ela gastar a energia dela não, ela retém pra ela. Por isso que daí aumenta o teor de açúcar do grão da uva. E aí varia né, tem anos que às vezes pode dar uma uva mais... assim com um teor mais baixo ou uma uva com o açúcar mais alto. Esse ano tá muito bom, a uva tá bem doce mesmo, com sabor de uva. Não tá com...

**A:** Bom, então essa parte aqui da... esse aqui fica...

**H:** (interrupts) Fica, isso aí fica.

**A:** Fica o tempo inteiro?

**H:** Fica o tempo inteiro. Isso a gente nunca mexe, né. ...

**A:** (interrupts) E como é que, como é que... porque que tem um triângulo aí?

**H:** É...

**A:** Ah, é pra segurar.

**H:** Isso, ele segura esses arames.

**A:** Pra segurar.

**H:** Por exemplo, antigamente se eu colocava esse arame, esse arame aqui ia aqui e um aqui. Então a uva era só amarrada reta.

**A:** Hum hum.

**H:** Entendeu? Esse arame tava no meio. E aí o que que a gente foi descobrindo com o tempo? Que se eu abrisse aqui dois arames e pusesse... isso aqui ó. Ó, esse broto amarrou pra cá, aquele broto amarrou pra lá. Ela dá mais incidência de sol aqui dentro e dá uma incidência melhor por exemplo, de ventilação, vento essas coisas. Então isso ajuda muito, o que que a gente descobriu, na coloração da uva.

**A:** Ah, na coloração...

**H:** (interrupts) Na coloração.

**A:** Não, não pra ter mais uva?

**H:** Não, não. Ajuda na coloração da uva. Aí a uva vai fazer o que? É, ela vai ter uma boa incidência de sol quando ela tá pequenininha, brotando. E depois quando ela já formou o cacho, que o cacho já tá formado... isso aqui ó, tá vendo ó, cai aqui por dentro e ele fica na sombra, aí ele dá uma coloração melhor. Porque se fosse só de um jeito aqui, ou ele pegava o sol da manhã ou o sol da tarde. Ele ia tomar sol de tudo jeito. E, dessa forma ele não toma tanto sol. Toma mas bem menos, é... diferente. Então aí...

**A:** (interrupts) É que aí fica meio um efeito meio chapéu, né?

**H:** Isso é, cobre e fica fresquinho ali pra elas que...

**A:** Então, antigamente só tinha um, um e um?

**H:** É, eram três arames.

**A:** Isso é o que seu pai e seu avô fizeram?

**H:** É, eram três arames só, né. Nisso a gente foi depois descobrindo, né, a gente bolou fizemos esse triangulinho pra passar o arame pra segurar, né. Pra abrir e fazer em forma de, a gente chama isso aqui em forma de manjedoura, né, porque ó...<sup>11</sup>

**A:** (interrupts) Manjedoura?

**H:** Uma manjedoura, a gente chama isso é... forma de manjedoura.

**A:** Aí quando, quando vem o milho que geralmente o que vocês replantam, plantam depois da, da lavoura é milho?

**H:** É, geralmente é.

**A:** Aí tira tudo isso aqui?

**H:** Tudo, aí tem que arrancar tudo, tira tudo, aí arranca tudo.

**A:** Quando vocês vão plantar de novo, como é que, como é que...

**H:** (interrupts) A gente planta...

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<sup>11</sup> *Manjedoura* is translated to rack.

**A:** (interrupts and continues) faz a. . .

**H:** (interrupts and continues) aí você vai e. . .

**A:** (interrupts and continues) a separação aqui, por exemplo dessa. . .

**H:** (interrupts) Hum hum, entendi.

**A:** (continues) dessa ruazinha? Distância entre. . .

**H:** (interrupts) Aí você vai marcar, né, com estaca, você demarca as quadras e assinala tudo no chão aonde vai os mourão da cabeceira, né.

**A:** Quanto tem geralmente uma. . .

**H:** (interrupts) Aqui entre uma rua e outra. . .

**A:** (interrupts) Porque aqui tem um final.

**H:** É, entre essa rua e aquela lá tem um metro e oitenta.

**A:** Um metro e oitenta.

**H:** E entre pé tem oitenta centímetros.

**A:** Oitenta centímetros. E isso é medido com respeito a que, ao acesso das pessoas pra fazer a colheita ou?

**H:** É, ele é. . . se eu plantar mais denso que isso, prejudica a produção dela.

**A:** Ah porque vai, vai ficar prejudicando o solo ou. . .

**H:** (interrupts) Não, é, também. E ela vai ficando muito, muito densa a plantação. E um plantação densa é. . .

**A:** (interrupts) Fica pouco espaço.

**H:** (continues). . . pouco espaço, dá pouca circulação de ar isso pra, daí não é bom. Então é o, o espaçamento correto dela é oiten. . . é um e oitenta. Ou até um e setenta de rua que dá pra fazer também, né.

**A:** Hum hum.

**H:** E oitenta entre pé, né.

**A:** E a, a quadra. . . o tamanho. . . qual que é o tamanho da quadra?

**H:** Ah, isso eu acho que pula. Por exemplo eu quero fazer uma rua com duzentos pé, uma rua com cinquenta pé. Aqui são rua, a gente usa cada rua dessas são setenta e cinco pé. É o que a gente costuma fazer. Então a gente já divide mais ou menos como tá feito naquelas ali na frente, ó, então setenta e cinco pé por rua, aí. . . E quando você planta, né, a gente geralmente coloca os mourão da cabeceira primeiro.<sup>12</sup>

**A:** O que que é o mourão?

**H:** O mourão é esse aqui, esse mourão aqui

**A:** Ah tá.

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<sup>12</sup>*Mourão* are the stakes that are put at the beginning of the streets where the wires are fixed

**H:** É igual ao da cabeceira. A gente coloca eles primeiro, né, primeira coisa antes de plantar. Coloca esses mourão e aí quando a gente vai plantar, fica um arame aqui desse mourão lá naquele da ponta. E esse arame tem as marca divididos é, entre oitenta centímetros cada um certinho a marca onde vai colocar. . .

**A:** (interrupts) A muda.

**H:** (continues). . . a muda de uva. Aí você planta uma rua, acabou de plantar muda pra outra, planta e assim você vai fazendo.

**A:** E as, as mudas de uva que vocês colocam são de outra quadra?

**H:** De outro lugar.

**A:** De outro lugar. E essa, essa numeração de oitenta centímetros e setenta e cinco pés por rua, porque foram aprendendo na prática ou foi o agrônomo que veio e. . . ?

**H:** Não, isso a gente vai na prática, né.

**A:** Na prática.

**H:** Por exemplo, rua muito comprida é muito cansativo pra gente que trabalha, né. Porque quando você vai desbrotar essas coisa, você fica muito tempo num lugar só. Tem que cuidar de broto por broto, não é. Por exemplo até eu cuidar de (not understandable; ca. 00:10:17) é demorado. Então você pega uma rua muito comprida e, fica muito tempo em pé e, também não é vantajoso.

**A:** Hum hum.

**H:** Né, e fica ruim. Por exemplo eu tô colhendo aqui no meio, eu tenho que levar a uva colhida lá na outra beirada, fica longe. Então você faz uma quadra um pouquinho mais compacta e não vai dar tanto problema, é melhor pra gente pra trabalhar. Mais que setenta e cinco pés aí é uma rua muito comprida e é ruim pra trabalhar, porque daí fica. . . você ir de uma extremidade na outra fica muito longe, né.

**A:** É, quando enche o caixote tem que sair. . .

**H:** (interrupts) É.

**A:** (continues). . . aí de repente ficar na metade do caminho.

**H:** Fica ruim.

**A:** A, a primeira safra que sai não é uva boa?

**H:** Não, é. A primeira já que sai é uva boa.

**A:** A primeira já que sai é boa?

**H:** É boa, a primeira. Mas isso é depois de dois anos de plantar que. . .

**A:** (interrupts) Ah, os primeiros dois anos não tem, não sai?

**H:** Não. Não, porque demora 1 ano pra você formar o porta-enxerto que é o

cavalo da uva. Demora 1 ano.

**A:** Demora 1 ano.

**H:** Aí você enxerta, ele vai brotar, vai crescer, aí você vai formar o pé da uva tudo. Aí você vai podar ele no outro ano, que daí é que ele vai dar uva. Então são 2 anos, desde que planta até você ter a primeira colheita. Dois anos.

**A:** Aí de ano pra ano. . . aí de ano pra ano vai pegando outro sabor a uva, dependendo do sol, da quantidade de chuva.

**H:** É, é. Isso influencia.

**A:** Hum hum. E essa uva aqui não tem nada a ver com produção de vinho?

**H:** Não, essa uva não é pra. . .

**A:** (interrupts) Não é pra produção de vinho.

**H:** Não, não. Essa uva é de mesa.

**A:** De mesa.

**H:** Até ela dá. . .

**A:** (interrupts) E era essa, essa aqui que vocês sortearam no bingo também?

**H:** É, foi daqui.

**A:** Foi daqui?

**H:** O forte do mercado da uva é agora, né. Esse, essa semana, semana que vem até o natal. Aqui é a melhor época pra vender uva. É uma fruta que a turma usa pro natal, então. . .

**A:** É, e pro ano novo tem que comer também. . .

**H:** É.

**A:** (continues) pra boa sorte. (laughings)

**H:** É, essas coisas aí. Então é nesse tempo que a gente procura tirar a colheita, trabalhar com ela nessa época.

**A:** Essa máquina é o que, é um?

**H:** É um compressor de ar. A gente usa ele pra fazer as caixa.

**A:** Ah tá.

**H:** Como essa uva tá muito molhada porque tomou muita chuva ontem, passa um ar nela pra dar um secada. Antes de botar nas caixinha de papelão, senão as caixinha de papelão desmancha, né. Vai molhar, ela desmancha.

**A:** É.

**H:** Então não tem jeito.

**A:** Então o senhor falou pra mim que vendia um caixote de cinco quilos pros mineiros por oito, nove reais?

**H:** É.

**A:** E o CEASA tava pedindo seis e cinquenta, sete?<sup>13</sup>

**H:** É, mais baixo.

**A:** Mais baixo.

**H:** Por exemplo, quatro caixinhas dessas aqui de papelão equivale a uma dessa aqui. Eu vendo ela mais barato, mas quatro caixinhas dela dá um peso de uma dessa, de uva, né.

**A:** E essa é dois e sessenta. Aí dá quatro vezes dois e sessenta. Fica mais que oito reais.

**H:** Se eu fosse...; e se eu fosse vender essa uva que ela é pequeninha naquela caixa lá, ou mesmo aqui, eles vão pagar quatro reais. Entendeu. Se eu fosse mandar pro CEASA né, tal, sairia muito mais barato. Então não compensa, eu colocar nessas caixa, então é por isso que a gente usa essa aqui.

**A:** Então o preço não é proporcional com o peso, mas?

**H:** Não, não. É pra o tipo da uva...

**A:** (interrupts) O tipo da uva.

**H:** (continues)... é o tamanho do cacho, né. Aí cada tamanho de uva é um preço diferente.

**A:** Mas aí, mas aí o tamanho tamanho do cacho assim; um cacho pequeno e um cacho grande, o sabor não muda?

**H:** Não.

**A:** É mais a apresentação?

**H:** Mais a apresentação. O sabor é o mesmo, é a mesma coisa.

**A:** O sabor é o mesmo. E a mesma, uma mesma planta pode dar cachos pequenos e grandes, geralmente?

**H:** Ele dá. Depende do broto, pode dar. No mesmo pé você vê cacho diferente, isso é normal. Tem no pé o cachinho pequeno e tem o cacho grande no mesmo pé junto. Ou às vezes acontece de ter só grande, e como acontece de dar só pequeno também. Isso acontece, mas no geral ele tem o pequeno, tem o grande. Cada broto dá dois três cachos de uva. Então geralmente, se dá dois eles são dois grandes, se dá três um é que fica pequeno. Um é que fica menor e os outros dois ficam maior, né. Cada brotinho da uva...

**A:** E quando sai o cacho já na planta, quanto que demora pra amadurecer?

**H:** Quatro meses.

**A:** Quatro meses?

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<sup>13</sup>CEASA (= Centrais de Abastecimento de Campinas S.A.) is the supplies center of Campinas.

**H:** Entre você podar ela, ela brotar, crescer, colher. Quatro meses. Cento e vinte dias

**A:** Quando sai... e ela fica, ela é bem verde no começo?

**H:** É.

**A:** Que nem essa cor aqui?

**H:** (not understandable; ca. 00:16:43) Ela é verde, até chegar nesse tom. O engraçado é que quando ela brota, a primeira coisa que você vê é o cacho. Ela solta primeiro o cacho, depois ela abre as folhas.

**A:** Olha!

**H:** Então quando você vê a produção...

**A:** (interrupts) Então ela pega um pouco de sol no começo?

**H:** É. Você já vê já a produção que vai dar já no comecinho. Quando tem um brotinho desse tamanho, você já sabe se vai colher uma uva boa.

**A:** E quando vocês, quando vocês começam a colheita agora, vocês começaram em, no final de Novembro, né?

**H:** É.

**A:** Quando vocês vão tirando o cacho, faz a caixa em cima pra colher pra Janeiro ou aí isso fica parado?

**H:** Não, ela para, aí ela para, aí ela fica parada.

**A:** E vocês, vocês separam as quadras de acordo com a temporada?

**H:** Isso é, a gente faz é... Nós podemos de Julho, da segunda quinzena de Julho até a primeira quinzena de Setembro. Então a gente faz uma escala de poda das quadras, por exemplo, essa quadra poda o dia tal a outra outro dia, pra que? Pra que eu comece a colher em Novembro e termine em Janeiro a colheita. E no mês de Dezembro, por exemplo, da segunda quinzena de Novembro até a primeira quinzena de Janeiro eu tenho uva todo dia. Todo dia eu colho uva daqui pra frente. Então é mais ou menos assim. Às vezes acontece de passar ano novo e já termina a colheita, porque ela pode adiantar, ela pode atrasar uma geração. Por exemplo, esse ano aqui ela adiantou em média dez dias, por causa da seca. Então ela adiantou, ela tá madurando mais rápido do que ano passado por exemplo que ela demorou mais pra madurar. Então uva que eu tinha podado pra colher na semana de natal, vai colher já agora. E a uva que tava pra colher na semana de ano novo, vai colher no natal. Então geralmente já ano novo eu não vou ter quase mais muita uva e no comecinho de Janeiro acaba.

**A:** Ah, então a safra vai acabar antes esse ano?

**H:** Vai acabar antes, vai acabar... porque ela adiantou em média dez, doze dias

do que seria o normal.

**A:** Hum hum.

**H:** Em vez de cento e vinte dias ela tá madurando em cento e dez, cento e oito dias de poda. Quer dizer desde a poda até agora, né. E às vezes ela atrasa aí ela dura uns cento e trinta, cento e trinta e cinco dias, já aconteceu também. Então varia, de ano pra ano o clima interfere muito. Ele faz essa variação de maturação dela adiantar e atrasar. E esse ano ela adiantou, e ela adiantou bastante, né.

(Machine noise and radio music in the background.)

**A:** Eu vou lá ver como é que ele segura a uva pra, pra não tirar a cera, né. É cera que chama o...?

**H:** Ah, a gente fala cera, né.

**E:** Sei lá como é que diz.

**H:** A gente chama de cera, né.

**A:** É, esse cacho aqui tá bem verde.

**E:** Ela é branca.

**H:** Essa é branca.

**A:** Ah, é branca?

**E:** Ela é doce também, do mesmo jeito. Só que no original a uva é assim. Isso daqui foi... como é que eu vou falar assim...

**H:** (interrupts) É, foi mudada, né.

**E:** (continues) foi mudada.

**H:** A uva niagara, o original dela era, seria branca.

**E:** Ela seria branca.

**A:** Ah tá.

**H:** Mas por outro tipo de... a turma vai modificando, né, a genética dela, aí conseguiu fazer rosar.

**E:** Tá ruim.

**H:** Hã?

**E:** Tá tudo molhado aqui.

**A:** Eu joga aqui?

**H:** Pode. Se você quiser chupar uva Andrea, fica à vontade.

**A:** (laughings)

**H:** Pode pegar e... ela tá mais do que lavada com tanta chuva que tomou isso aí.

**A:** Mas então a cor que tem, pegou da onde? É mutação ou?

**H:** É, foi mudança, vai mudando...

**E:** (interrupts) Mudou a genética no caso...

**H:** (interrupts and continues) mudaram a genética dela.

**E:** Porque ela era bem clarinha.

(Radio music, alarm clock and car noises in the background.)

**A:** Essas aí tão aí dentro porque?

**H:** Essas aí estraga, tá estragada.

**A:** Ah, tá estragada?

**H:** O pessoal derrubou, caiu no chão, então aí a gente joga. Isso aí vai pro lixo, vai na... Esse cacho, com certeza ele caiu no chão. Quando colheram lá, ele deve ter caído no chão aí... complicou.

**A:** Nossa, tinha muito tempo que eu não comia essa uva. Mm?

**H:** Tá super... Você falou daquela vez...

**A:** (interrupts) Posso tentar também?

**H:** Pode.

**A:** O que que você ia falar pra mim?

**H:** É... você falou que tava fazendo matemática?

**A:** Hum...

**H:** E a tese que você vai defender, por exemplo, por quê que no caso você veio procurar a gente no Friburgo? O que que levou isso, como é que é a historia? Onde que entrou a matemática juntar o que a gente como imigrante alemão aqui?

**A:** Então, o meu orientador na Unicamp, ele conheceu o trabalho da professora Olga...

**H:** Ahã!

**A:** Aí, aí bom, ele falou pra mim ver que... tem uma parte da matemática assim que é, que é um estudo novo que começaram a fazer que é a matemática que você acaba aprendendo mais no dia a dia do que na escola, né.

**H:** Hum hum.

**A:** Porque tem muita matemática que a gente acaba aprendendo assim na prática, por exemplo, aqui o que, que o senhor falava de, de colocar setenta e cinco plantas, é, setenta e cinco mudas por rua. Isso é matemática na verdade, né. Mas é uma coisa que você aprende com a prática, não é ninguém que ensina, que você vai na escola e que fala pra você tem que ter tantas, né.

**H:** Hum hum. Você é natural da onde?

**A:** Eu sou daqui de Campinas.

**H:** Daqui mesmo?

**A:** Hum hum. Mas o meu pai era alemão. Pega assim?

**H:** É.

**A:** Aí eu vim parar em Friburgo, bom, fiquei sabendo que o senhor plantava uva e eu vim parar aqui realmente pra, pra aprender como é que...

**H:** (interrupts) Aonde que entra a matemática no negócio?

**A:** É! É como é que vocês lidam com isso, né. Pra fazer, pra vender... pra vender, pra encaixotar, pra saber o peso, essas coisas, né.

**H:** Entendi, entendi. Isso depois, você vai defender uma tese, no caso, na universidade...

**A:** (interrupts) Vou. Na Alemanha.

**H:** (continues) na Alemanha.

**A:** É, é como eu falei pro senhor ali e pra, pras pessoas da sociedade que eu vou, eu vou mostrar também pra vocês, né, pra... Porque se eu não tiver a aprovação de vocês aí não adianta defender nada.

**H:** Geralmente no fundo a gente usa esses cachinho, esses menorzinho que nem você colocou aí. E daí, esses maior um pouco a gente usa pra pôr em cima.

**A:** Ah tá.

**H:** Pra... fica um pouco mais bonito. Que esse aqui não tem muito pra onde fugir com ela, por que ela é, é uma uva mais fina. Hum... fraquinha. Essa não é uma uva,

**E:** É uva.

**H:** Só uva.

**A:** (laughings)

**H:** Já chegou em, tem alguns anos atrás a gente perder isso aqui no pé, porque não tinha comércio pra ela.

**A:** Nossa!

**H:** Aí é prejuízo, né. E hoje não, hoje tem uma procura grande dessa uva, né. Por causa daquilo que eu falei. Enquanto o preço daquela fica cara, o cara compra uma dessa aqui, né.

**A:** Tá faltando, né?!

**H:** É, tá faltando um pouco. Por exemplo aqui ó. Esse aqui você tem que fazer assim, e encostar um pouco mais, e daí aqui caberia um, menor que um cacho, por exemplo isso aqui ó. Mais ou menos isso.

**A:** É, ficou melhor.

**H:** Essa aqui é uma caixa de um quilo e meio só, né.

**A:** O que a gente tá fazendo agora é tu... é pros mineiros.

**H:** É, é pra hoje. Temos que fazer mil desse aqui.

**A:** Nossa!

**H:** Ainda tem muito serviço, muito.

**A:** Hoje tá frio mesmo.

**H:** É, hoje tá com cara de inverno. . . Como é que chama a universidade que você estuda lá?

**A:** Universidade de Bielefeld, que é o nome da cidade também.

**H:** O nome da cidade?

**A:** É. Como se fosse uma Unicamp, que é a Universidade de Campinas, só que a Universidade de Bielefeld.

**H:** Ah tá.

**A:** Mas eu posso mostrar pro senhor depois. . .

**H:** E você tava aqui, você começou aqui na Unicamp?

**A:** Não, eu comecei lá.

**H:** Lá mesmo?

**A:** É, mas eu comecei lá porque o meu professor aqui da Unicamp, ele me apresentou o professor de lá.

**H:** Ah. E aí você. . .

**A:** É, e como eu já tava, eu tava morando em Munique. Aí eu já, eu só mudei de cidade, né.

**H:** Ah tá, entendi. Por exemplo, depois você se forma, você se forma em que? Matemática?

**A:** É, doutora em matemática.

**H:** Doutor em Matemática. Ai meu deus do céu, né.

**E:** Vai fazer o que?

**H:** Você é, por exemplo, em que área que você vai conseguir trabalhar depois?

**A:** É, na universidade.

**H:** Na universidade?

**A:** Na universidade.

**H:** Dar aula?

**A:** É, dar aula.

**H:** Ah, matemática nunca foi muito o forte meu, viu. Dentro do povo brasileiro, vai ser difícil achar um que gosta de matemática mesmo, né.

**A:** Mas aqui vocês tão fazendo matemática todos os dias!

**H:** É, mas. . .

**A:** É que não dá pra perceber, né?!

**H:** É.

**A:** Por exemplo, eu queria perguntar como é que vocês sabem quanto é que tem, porque vocês vão contando aí, né, os mil caixotes.

**H:** É, nós vai com dez de alto. Dez caixinha de alto... é assim.

**A:** dois, quatro seis, oito... é, tem dez.

**H:** É.

**A:** Aí tem que ser dez por dez.

**H:** É.

**A:** Não, dez por dez dá cem. Tem que ser... .

**H:** É cem. Dez por cem. Você tem que ter cem pilhas de dez aí pra dá os mil.

**A:** Nossa!

**H:** Nós chega lá. Até de tarde a gente chega.

**E:** Até de tarde meu filho. Agora mata essa curiosidade nossa, é bom morar na Alemanha?

**A:** É bom, é. Mas eu gosto mais do Brasil. Eu morei, eu morei aqui até os 13 anos de idade.

**H:** Aqui em Campinas?

**A:** Aqui em Campinas, é. Meu pai trabalhava na Unicamp, e depois meu pai morreu, e a gente foi morar no Chile com a minha mãe.

**H:** No Chile?

**A:** É, porque minha mãe é chilena.

**H:** Nossa, você já rodou bastante então.

**A:** (laughings) Já.

**E:** Mãe chilena com pai alemão.

**H:** Pucha vida!

#### **17-12-07 - Interview number 1**

**A: Andrea**

**H: Hedinho**

**H:** A sua autorização tá lá em casa.

**A:** Ah, brigada. Você trabalhou no final de semana?

**H:** Trabalhei no sábado, ontem só de manhã.

**A:** Tá.

**H:** O Jeremias trouxe aquele dia, só que ele veio à noite. Eu falei, “à noite você vai trazer”.

**A:** Ah, o dia que eu fui.

**H:** É, ele levou de noite.

**A:** Os mineiros já foram embora ou tão aí ainda?

**H:** Eles vão carregar hoje, de novo. Tem que colher pra eles.

**A:** Lá, no outro sítio em Friburgo também?

**H:** Não, lá ainda não. Eu vou acho que pra lá amanhã, pra colher lá. Depende do que fizer hoje na parte. . .

**A:** Aí já começaram a colher em parte nova ou vocês continuam na mesma. . .

**H:** (interrupts) A gente continua na mesma que a gente tava naquele dia que você foi lá.

**A:** Hum hum.

**H:** Eu acho que a gente deve terminar hoje. No final de semana não saiu muita coisa.

**A:** Não?

**H:** Não, o mercado deu uma parada. Tava vindo um dízimo tão bom, né?! De repente deu uma paradinha, depois tirou o pé, chovendo.<sup>14</sup> Mas essa semana, eu acho que a partir de hoje. . .

**A:** (interrupts) Ah, porque até sexta-feira com certeza, né?! Porque é a última semana antes do natal.

**H:** Não, eu já vou, eu vou até domingo. Até domingo nós vamos carregar.

**A:** Ah tá.

**H:** Nós vamos pegar até dia vinte e quatro, vinte e sete no máximo porque na verdade depois do natal é muito difícil pegar alguma coisa. Porque geralmente tem algumas sobras nos supermercados essas coisas, e ninguém também quer pegar uva. Só que essa semana a gente tem que tirar muita uva, madurou muito. Tá tudo maduro, maduro e tem que tirar. Não pode deixar. De repente começa a virar o tempo que nem aconteceu na semana passada e a coisa começa a complicar.

**A:** É. Mas aí o que que o senhor faz com as que sobram? Vende pra particular?

**H:** Geralmente a gente consegue tirar tudo, né?!

**A:** Ah tá.

**H:** Sobra muito pouco, mas. . .

**A:** Mas se a colheita for até fim de Janeiro. . .

**H:** É, mas eu acho que ela não vai não até fim de Janeiro, termina bem antes. Vai terminar bem antes. E o que eu falei, a uva adiantou. Ela deu uma boa adiantada. . .

**A:** Por causa do calor ou da chuva?

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<sup>14</sup>*Dímo* is the contribution to the church that corresponds to  $\frac{1}{10}$  of the harvesting

**H:** Não, da seca na época dela, né. Deu uma... ela adiantou um pouco. Ah mas isso não é ruim, isso é até bom. O duro é se ela atrasar um pouco, aí é complicado. Aí você quer tirar uva e não madura, né... conseguiu dar uma olhada naquele livro que...?

**A:** (interrupts) Eu vi, muito interessante! Muito inte-, tem algum jeito de comprar ele?

**H:** Olha Andrea...

**A:** Porque senão eu tava pensando fazer uma xerox do, do livro.

**H:** Teria que entrar em contato aí com a... com aqueles endereços em Campinas, que eu comprei deles.

**A:** Ah tá.

**H:** Seu Walter, por exemplo, ele é que tem... Se quiser é com eles

**A:** Nossa eu achei muito... As cartas são muito bonitas, porque contam também a historia do Brasil.

**H:** Que conta a época da...

**A:** Proclamação da república.

**H:** Até da guerra do Paraguai.

**A:** É.

**H:** Bem no mês...

**A:** (interrupts) Os barcos como eles chegaram... muito interessante!

**H:** Foi achado num,<sup>15</sup> lá num porão não sei aonde lá na casa lá em Suíça, tava lá dentro de um baú, e aí ficou guardado. Guardado pelo tempo na verdade.

**A:** É.

**H:** Tá fazendo um sol, meei como tava, meei lá.<sup>16</sup> Esse tempo tá tão maluco!

**A:** Eu tava até com receio hoje de manha, pensando que ia fazer frio que nem aquele dia.

**H:** É, não, hoje... agora tem ainda um pouquinho de sol, mas porém às 9 horas dá pra perceber.

**A:** Tem um mapa também no livro do, de Friburgo com o nome das famílias que escreveram.

**H:** Tem, ahã.

**A:** Aparece vocês também.

**H:** É.

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<sup>15</sup> *Num* is the liason of *em+um*.

<sup>16</sup> The verb *meiar* means to put in the middle or cut in half.

**A:** Ó, se você quiser eu gostaria que o senhor me levasse pra cima, pro outro lado do...

**H:** Ah não, nós vamos pra lá hoje.

**A:** Porque dá pra ver, dá pra ver... da quadra dá pra ver até um pedaço, né?! Porque depois deve ter mais.

**H:** Nós vamos, nós vamos lá pra cima hoje, porque tá colhendo lá em cima. Hoje eu não to trabalhando lá no galpão, não tem que fazer aquelas caixinhas que nós fizemos.

**A:** Ah, já terminaram de encaixotar pros mineiros?

**H:** É, terminamos naquele dia.

**A:** Ah tá.

**H:** Hoje é recolhimento do pé. A gente precisa colher dessa vez.

**A:** O senhor e seu irmão trabalham, também colhem?

**H:** É também.

**A:** É difícil passar por aqui.

**H:** Hã?

**A:** Tá ruim por aqui.

**H:** É. É terra, barro (not understandable; ca. 00:09:15).<sup>17</sup>

**17-12-07**

**Interview number 2**

**A: Andrea**

**H: Hedinho**

**C: Carlos**

**H:** Vou levar você lá no Friburgo pra você ver a nossa uva e pra ver a, a casa que tem lá.

**A:** Aí tem uma pequenininha.

**H:** Aquilo ali, geralmente ocorre no, quando, na ponta. Não, isso aí ele não, ele não vai...

**A:** Ah, não dá depois?

**H:** Ele dá, ele madura mas é uma uva que não, não tem como. Ela faz, por exemplo, se você corta as pontas dela, aí ela brota de novo e ela solta os cachos.

**A:** Mas essa aí será que vai ficar bonita depois?

**H:** Não, ela não fica, não. Essa aí depois, ela não (not understandable; ca. 00:00:41). Ela madura, até dá pra fazer uma geleia.

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<sup>17</sup>Hedinho is making comments about the country road where we were driving.

**A:** Então uma quadra tem setenta e cinco plantas por linha. Ou seja, são setenta e cinco plantas de comprimento, né, na verdade.

**H:** Isso.

**A:** E isso é medido de acordo a...

**H:** (interrupts) De acordo a... aqui você vai vendo. Por exemplo, essas quadras que aqui são diferentes do que a gente tem lá em cima, por causa do terreno, né, pra gente poder aproveitar o máximo da área da terra. Então pode ser que às vezes... mas na média geral...

**A:** (interrupts) Ah, quando a terra é mais rica tenta o, o que?

**H:** Não é que aqui por causa da posição do terreno, o jeito que é a te-, quer dizer não é... vamos dizer é cheio de canto, então você tem que aproveitar bem, senão não...

**A:** Ah. Acaba montando linhas com menos.

**H:** Menos, algumas menos, outras mais. Isso daí eu faço pra aproveitar bem a terra, né.

**A:** Quando vocês vão fazer uma quadra, vocês colocam os mourão em todas as linhas ou marcam primeiro só o quadrado?

**H:** Não, a gente marca primeiro, né, coloca umas caixinhas marcando onde vai ser os mourão da cabeceira. E aí depois, põe o mourão primeiro pra daí começar a plantar. Pelo menos os de fora a gente põe.

**A:** Aqui os das esquinas, tá certo.

**H:** Aí conta assim, cada cinco pé vai um mourão no meio.

**A:** Hum hum. Pra segurar o arame.

**H:** Porque o ideal seria, por exemplo um mourão a cada quatro pé, né. Sabe, segura bem a carga e tudo isso que pode dar, mas a gente vai tentando as vezes reduzir custo, porque o mourão tem um custo bem alto.

**A:** Hum hum.

**H:** Então a gente diminuiu, aumentou um pé pra diminuir um pouco mais o mourão e coisas assim. Por exemplo pra... pra dez mil pés de uva vai mais de mil e... vai mil e duzentos mourão, mais ou menos. E ele tem um custo de quatro e cinquenta, cinco reais cada mourão. E isso que é um mourão meio, vamos dizer assim, não muito forte. Se for pôr um mourão bom, ele passa de dez reais cada um.

**A:** Nossa. O mourão tem que ficar trocando cada quanto tempo, ou ele dura os vinte anos?

**H:** Não, ele dura, né. Se você colocar um mourão que é tratado, que ele é feito,

como é que você fala, de alto claro nele que eles injetam, esqueci como é que chama aquilo mesmo. É tipo de um sulfato de cobre que é injetado no mourão verde, né, quando ele é cortado.

**A:** Hum hum.

**H:** Daí ele dura vinte anos. Se você ter um mourão simples, ele só cortado sem tratamento nenhum, ele dura dez. Ele dura a metade, né.

**A:** Aí tem que trocar, né?

**H:** Tem que ir trocando conforme eles vão quebrando, a gente vai trocando. Aqui ó, essa uva aqui é. (not understandable; ca. 00:04:57)

**A:** Mas essa é mais nova.

**H:** Essa é nova, é o que eu vou explicar pra você. Lembra que eu falei pra você do enxerto?

**A:** Falou.

**H:** Isso aqui é um cavalo, esse é um porta enxerto. Entendeu? Olha aqui, esse é um enxerto que, vamos dizer assim, não vingou.<sup>18</sup> Aqui tá o tronco dele, ó.

**A:** Hum hum.

**H:** Né. Tá o barbante aqui ainda. Vou tentar tira ele... Esse é o barbante que foi amarrado, quer ver, ó!

**A:** Ah!

**H:** Ó o pedacinho do, ó, do galho que foi enxertado aqui. Esse aqui não vingou, esse ele não ligou, ele morreu. Né. O cavalo não, morreu o enxerto que não conseguiu sair. O cavalo tá aí. Ano que vem, ele pode ser re-enxertado, aí cavouca aqui, abaixa ele e enxerta ele mais dentro do chão, aí ele vai pegar. E aí, é isso aqui ó.

**A:** Esse aqui deu.

**H:** É, esse deu.

**A:** E aqui dá pra ver que essa parte é velha e essa é nova.

**H:** Aqui da terra você vê bem direitinho como é que... Que nem naquela do outro dia não dá pra ver porque já tem quase dez anos de enxerto, então não vai aparecer.

**A:** Essa aqui é nova, né?

**H:** É, essa aqui foi enxertada esse ano.

**A:** Ah, foi esse ano?

**H:** Esse ano.

**A:** Então não vai dar uva aqui?

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<sup>18</sup> *Vingar* means to develop, grow or to be successful

**H:** Vai, vai dar agora. Vai dar...

**A:** Ah, vai dar pra colheitar esse ano?

**H:** Vai... em maio. Ó, tá vendo, ó lá. Desculpa que eu não vi...

**A:** Não tem problema.

**H:** Ó, o cavalo. Aqui foi cortado como foi feito nesse aqui, ó, ta vendo. Aí tá, foi rachado, e aí foi posto aquele galhinho que nem eu expliquei pra você...

**A:** (interrupts) Hum hum.

**H:** (continues) aquele dia, que é esse aqui ó. Esse pedacinho aqui ó, ele foi enxertado aqui ó. Ó como que cresceu isso aqui tudo em volta.

**A:** Nossa!

**H:** Né, ele cobriu com a própria materia dele. Ó, esse é o barbante que tinha amarrando, né, pra ele ficar firme. Isso aqui ele apodrece, ele some, né, ele vai embora né, não fica aí. E, aí saiu, ele brotou, né, e já formou um pé novo de uva.

**A:** E porque que sai dessa cor aqui? Por que que fica diferente?

**H:** É verde, porque é o broto, aqui é o broto, né. Por isso que ele sai assim, ele vai brotar...

**A:** (interrupts) Ah, esse aqui é o... é o enxerto.

**H:** (interrupts and continues) esse é o ga-, é o enxerto, é. Ele brotou aqui na ponta...

**A:** (interrupts) É esse pedaço pequeno.

**H:** É, ele brotou aqui na ponta, ó. Foi crescendo, crescendo e formou o pé da uva, entendeu. Esse aqui é diferente daqueles ali, por exemplo, porque aqui foi feito de um pé, né, abriu dois. Ali a gente faz um só, aqui foi feito um pouco diferente. Nós abrimos dois, um pra lá e outro pra cá.

**A:** Ah, é que geralmente é só pra uma direção.

**H:** É, que é só pra um lado. Ó aqui, ó.

**A:** Esse aí não pegou.

**H:** Olha, esse não pegou também. Olha, tá vendo, esse aqui que foi colocado ali que é esse aqui. É esse aqui. Aí então, esse aqui foi formado, ele cresceu, veio aqui, né, cuidou, tratou dele. Agora tá com uns quinze, uns vinte dias ele foi podado. Foi cortado aqui ó, tá vendo. Cortou aqui aí ele brotou. Agora, nesse primeiro broto que sai ó, esse aqui é um cacho de uva. Esse já é um cacho de uva.

**A:** O que que é o cacho de uva?

**H:** Esse aqui, né. Esse é um cachinho de uva já.

**A:** Nossa!

**H:** Né, ó, o outro tá aqui.

**A:** E esse aí que começa a crescer?

**H:** É esse que forma o cacho, esse aqui é o cacho da uva. É esse aqui ó. Aí você tem tudo, esse processo aqui ó. Tem que limpar ela até, ela vai vim e ser amarrada aqui em cima.

**A:** Hum hum.

**H:** Né. Tem que tirar isso, ó. Isso aqui tem que ser tudo retirado. Esse galinhos, aquela forma, isso aqui tem que tirar tudo fora. Tem que limpar broto por broto até ele chegar aqui em cima. Ó ali, tem um broto grande. Tira essa folha, tira essa. Porque se elas ficarem aqui, elas encobrem o cacho, aí não pode Ó, esse é um cacho aqui, tira isso, tira isso e isso aqui também, aí esse, aí ele chegou aqui e dá pra amarrar. Então, é amarrado aqui. Aí você faz isso e corta a ponta aqui, ó.

**A:** Pra não crescer mais ou o que?

**H:** Pra não crescer mais.

**A:** Se corta a ponta não cresce mais.

**H:** Não, quer dizer, ele cresce aqui ó porque sobrou um brotinho aqui que a gente deixa, que vai dar só a ponta da uva mas isso aí ele demora até crescer tudo, aí né.

**A:** Hum hum. Essas partes é que tem que tirar?

**H:** É, isso aqui tem tudo que tirar fora. Porque isso aqui, na verdade, é um tipo de cipózinho, né, e ele vai se enrolando onde ele achar ele se enrola.

**A:** Hum hum.

**H:** E isso pra, depois que ele seca e a planta fica... é, já velha, vamos dizer, os broto fica velho como esses daqui assim. Ah, você não consegue mais tirar, ele fica muito duro.

**A:** Ah, é esse aqui não é? É esse aqui que enrola depois?

**H:** É ó, esse aqui é um por exemplo. Foi enrolado, ó, olha como é que ele fica. E é um... então você tem que tirar ele enquanto ele é novinho, assim que ele é mole e você corta com o dedo.

**A:** Hum hum.

**H:** Né, aí você vai tirando.

**A:** E isso tem que fazer o tempo inteiro, né, não é uma temporada que... .

**H:** É, não, isso aqui você faz até ela fica tudo prontinha amarrada aqui em cima. Aí depois é só, só essa vai crescer, essa ponta que tem aqui, né. Aí, você vai tirando conforme cresce, às vezes nem tira muito, deixa pra fazer mais sombra, depende. Aí depende muito, mas sempre tem que de vez em quando dar uma

cortada, senão ela vai crescendo, vai crescendo, né. Esse tipo de poda que a gente tem feito aqui, a gente chama de poda verde. Porque o pé tá inteirinho verde, cheio de folha, ele tá verde, né. Ele não tá ainda que nem aqueles tronco que já é seco, que a uva é já mais velha. Essa uva é nova, é a primeira vez que ela vai produzir.

**A:** Mas, poda verde também por causa da idade? Porque depois ela vai escurecer?

**H:** É, vai. Até o final do ano ela tá igual aquela outra.

**A:** Mas é rápido também, né?

**H:** É.

**A:** E esse aqui é a, a realimentação do solo?

**H:** É, isso é milho.

**A:** E milho vocês vendem também? Vende melhor que a uva ou não?

**H:** Depende. Não é melhor, milho é mais mercado pra granja, pra... frango essas coisas. Ó, aí eu não posso dizer porque eu não sei muito.

**A:** Hum hum. Bom dia.

**C:** Como passou o fim de semana?

**A:** Bem, e vocês?

**C:** Tudo bem.

**H:** Tá vendo.

**A:** Trabalhou também o senhor?

**C:** Quer dizer eu mesmo trabalhei pouco, mas eu vejo que tá colhendo uva, né. E eu já não trabalho mais nisso.

**A:** Hum hum.

**C:** Eu já tô mais velho, né. Por que? Eu não aguento mais, tô cansado já.

**A:** (laughings) E você?

**C:** Esse servião aqui ainda dá pra fazer, é um servião leve.

**H:** Eu tava mostrando pra ela, como que tinha que limpar broto por broto. Isso dá trabalho.

**A:** Aí vocês usam esse daqui mesmo pra, pra agarrar?

**H:** É, é não. Essa é uma máquina que a gente tem que amarra com essas fitas aqui, igual a esse aqui, como tá esse aqui. Ela é um tipo de grampeador grande, puxa a fita, você passa o broto e ele amarra aqui no arame. Que nem tá aqui, ó.

**A:** E o material não machuca a planta, não...?

**H:** Não! É plástico e... isso aqui é plástico reciclado, na verdade.

**A:** Hum hum.

**H:** E ele às vezes, lá em cima já, os nossos ponteiros já, soltou tudo.

**C:** O que eles tão fazendo agora ele é mais, mais degradável, né.

**H:** É

**C:** Esse aqui por exemplo, esse aqui não acaba nunca. Então, eles tão tentando fazer um negócio mais, mais... um produto que...

**H:** (interrupts) Esse talvez não é daquele lindo de plástico reciclável, agora esses aqui já são. Esses são, ele dura pouco, ele... o sol ele rressaca, racha e cai, pronto, some!

**C:** Esse aqui ele já desmancha mais fácil.

**H:** Mais fácil que os outros.

**A:** Você começou a trabalhar aqui quando, quando eles começaram, acho que foi ano setenta e três que o senhor me disse que foi?

**H:** Na época... é, eu trabalhava junto com o meu pai, naquela época.

**C:** É, na verdade a gente dividiu o sítio faz quanto?

**H:** Noventa e quatro.

**C:** Não, o que dividiu sítio faz mais... abriu a nossa sociedade foi em noventa e quatro. Porque antes...

**H:** (interrupts) Trabalhava todo mundo junto.

**C:** É, guardava e trabalhava junto. Depois de noventa e quatro a gente resolveu abrir, né, a sociedade, que daí eu e Edson e Hedinho assinamos, né. Então né, abrimos a sociedade e daí fiquei eu trabalhando separado dele, mas na verdade é tudo família. A propriedade já tem várias geração que tá na família. A medida que vai morrendo os mais velho vai dividindo, então vai diminuindo.

**H:** Virou uma chácara pra cada um.

**C:** Que nem o meu avô ele tinha mais de cem alqueires de terra.

**A:** Mais de cem? E quando começaram a plantar aqui, começaram assim, com uma quadra pequenininha ou foi já de vez?

**C:** O que uva?

**A:** É.

**C:** A uva começou com cinco mil pés.

**A:** Cinco mil pés.

**C:** Isso. E isso foi em setenta e um, setenta e dois por aí. Setenta e três, eu não me lembro bem.

**A:** Cinco mil pés dá uma quadra ou dá menos de uma quadra?

**H:** É mais ou menos que nem isso aqui, ó.

**C:** Geralmente uma quadra dá uns três mil e quinhentos pés. É uma quadra... é tem um pouquinho mais que isso aqui. Então a gente não conhecia, né. As

peessoas que conheciam uva bem falavam “planta, planta!”, né. E daí, eles vieram aqui e deram umas orientação pra gente e... não tem muito segredo não, planta do mesmo jeito. (not understandable; ca. 00:16:28)

**A:** Quanto tempo?

**C:** A gente plantou tomate desde sessenta e dois até setenta e seis. É uma lavoura muito bonita e gostosa, mas é muito trabalho.

**A:** É muito trabalho?

**C:** Só que, naquela época foi muito bom e a gente ganhou muito dinheiro também.

**A:** Hum hum.

**C:** A gente conseguiu sair naquela época foi com tomate. Só que, a gente também plantava cinquenta mil pé por ano. Então por exemplo, cinquenta mil pé aqui, e depois no ano seguinte você tem que ir mudando. Só que nós já tinha feito rodízio acho que três ou quatro vezes no sítio. E o sítio não é tão grande né, então praguejou muito a terra e tomate é muito perseguido por praga, né. Então ficou mais difícil de cuidar...

**A:** Nossa.

**C:** Né, aí gente parou com o tomate e viramos pra batata. Uva e batata.

**A:** estraga muito o solo o tomate? Também?

**C:** Não não, pelo o contrario...

**A:** (interrupts) É mais a praga?

**C:** Tomate ele é bom, tomate usa muito adubo, né. Você precisa colocar muito adubo, só que cria outras doenças de solo. Por exemplo, a puxadeira no caso que é um fungo, uma bactéria que dá e aquilo fica na terra, sabe.

**A:** Hum hum.

**C:** Então não adianta, nós planta ou daqui três quatro anos plantar, dá de novo. Então teve que parar por causa disso, né. Hoje se for plantar talvez não seja mais problema não, porque já faz tantos ano que a gente fez. Mas é, tem que fazer uma rotação, só adianta fazer uma rotação de cultura, plantar tomate, milho, brocal(?). Mas, sabe o que foi a produção começou a cair muito e achamos melhor parar. É, se você for mexer com a lavoura tradicional da família que é a batata, né. Só que...

**A:** Isso desde os tempos da primeira geração que chegou, né?

**C:** Ah, meu pai e meu avô sempre foram batateiro, só que nessa época que plantou tomate a gente não plantava batata. Você não tinha condições, não dava pra plantar. Aí também antigamente, no tempo do meu avô, do meu pai eles plantavam batata sem irrigação, né. Daí quando não chovia, já viu, né. A

produção é, negar tudo. Daí parou com tomate, daí a gente começou a fazer lavoura irrigada. A produção de lavoura que nem a batata é, não tem erro, né, a produção é violenta. Só que aumentou muito as lavoura no país inteiro, né. Mesmo batata era na nossa região na época de inverno, a região nossa aqui Campinas, aqui, Indaiatuba, Monte Mor essas cidades aí era região de batata. Hoje, planta batata no Brasil inteiro, né. E, naquele tempo quem plantava cinco alqueire de batata era um batateiro forte. quantos que tinha? Cento e cinquenta, duzentos produtor. . .

**A:** Nossa.

**C:** Então é, difícil.

**H:** Os pequeno vão sumindo e vai ficando só os grande, os mais fortes, né, por exemplo nesse caso e os pequenos vai desaparecendo.

**A:** É, é.

**H:** Na nossa região tinha o que, no tudo uns duzentos produtor de batata. Hoje se tiver. . .

**A:** Aqui?

**H:** É na região, aqui Indaiatuba, Monte Mor. Mas hoje se tiver cinco ou seis é muito.

**C:** Na época tinha pra vender também onde plantava bastante batata na região, Aqui na nossa região tinha mais ou menos aqui em Campinas, Capivari a Jundiaí, Monte Mor isso só na região nossa aqui. São Paulo mesmo CEASA, a gente tinha mais o que ceder devido a comprador de batata. Hoje só tem um.

**A:** Não vale a pena você plantar também, né.

**C:** É, não vale.

**H:** E que nem, por isso que eu falei pra você. A gente planta em parceria com quem vende. Porque não tem mais com quem comercializar. Então você tem que ter. . . se você plantar um negócio que não tem aonde for. . .

**A:** (interrupts) Tem que ter um comprador seguro.

**H:** (continues) tem que ter comprador seguro que vai comercializar a sua safra, senão você tá inteiro ralado. E aí a gente, por exemplo, no caso nosso, já tem uns três anos ou mais que a gente tá plantando em parceria com eles. Mas. . .

**C:** (interrupts) Por isso que tá conseguindo plantar.

**H:** É, por isso que consegue plantar ainda, porque senão a gente teria parado já.

**C:** É plantar batata, como é que eu falo. Em noventa e quatro foi justo quando a gente abriu a parceria que ganhou muito dinheiro com a batata naquele ano. Então eu comprei trator novo, irrigação, cano (not understandable; ca. 00:21:00).

Daí foi em noventa e cinco, noventa e seis e noventa e sete, os três anos que eu perdi dinheiro, mas perdi dinheiro pra valer. E com produção de mil e oitocentos, dois mil sacos de batata por alqueire. E deu prejuízo, mas prejuízo violento. Então eu não aguentei, sabe, e parei. Aí teve, teve umas lavoura de feijão e de tomate também. Uma puxa de uma produção boa também. Perdemos as três lavoura. Aí a gente quebrou, não teve como. Aí parei e só fiquei no cultivo de uva. A uva não se dá, não dá dinheiro pra gente ganhar dinheiro, entende. Dá pra viver, mas pelo menos não é uma lavoura cara que nem. . .

**A:** (interrupts) Também não é um trabalho tão cansativo?

**C:** É, também. Apesar que a lavoura de batata não é difícil de fazer. Hoje com as tecnologias não é difícil de fazer, né. Só que, ficou inviável, né. Muito cara a lavoura, muito cara. Tem que ter produção boa e preão bom, mas pra gente ganhar dinheiro aí é difícil. Não é fácil, é pesado. Quando acerta, aí é coisa boa. Em noventa e quatro, noventa e quatro a lavoura, a batata não tava nem tão boa pra arrancar ainda, tava machucando esfolando aos poucos, e ainda meio verde. Mesmo assim colhemos tudo. Isso é coisa de louco.

**H:** Vamos lá em cima?

**A:** Vamos, licença.

**C:** Tá, fica à vontade.

**H:** Olha aqui tá vendo, cheio de cavalo aqui. (external conversation; ca. 00:23:03) E aqui tinha uva formada, que foi plantada agora, né. A gente tira a raiz dela, aí ela brota de novo, tá vendo. Isso aqui demora um tempo até ele sumir desaparecer, por completo.

**A:** Mas, aqui já não sai o. . . se não cuidar dela. . .

**H:** Não, é só um cavalo. . . é um enxerto, uma raiz que ficou lá no fundo. Isso aí brota e, tenta sair de novo.

**A:** Tem um tamanho, tipo, mais ou menos certo assim pra fazer o corte no porta enxerto? E pra colocar o tamanho do cavalo também?

**H:** Tem, tem. Na altura do chão, uns dez centímetros do chão pra cima.

**A:** Que é o corte?

**H:** É o corte que daí que coloca o galhinho da. . .

**A:** Quanto que fica pra fora da, do porta-enxerto o galho?

**H:** Ah, uns vinte centímetros.

**A:** Vinte centímetros?

**H:** Quinze a vinte máximo. Na verdade é um galhinho assim, né. É esse aqui, né.

**A:** Hum hum.

**H:** Ele dá uma vista aqui e outra vista aqui, ó. Outra gema pra brotar.

**A:** Tá.

**H:** Geralmente nesses dois ele faz o brote aqui em cima, bem ali né. Cortou lá, foi essa parte foi colocada no cavalo, no porta-enxerto, né, e daí brotou aqui.

**A:** Aí fica dez centímetros pra dentro?

**H:** É.

**A:** E essa medida, é, como é que, como é que. . .

**H:** (interruptions) Como que eu vou fazer ela?

**A:** É.

**H:** É na pratica também, não tem como você tá ali medindo nem nada. Aquilo é de acordo, as vezes você pode achar, sei lá, uns cavalo mais grossos ou mais finos. Aí, se é um fino você tem que colocar um galhinho desse menor, aí você faz ele menor, aí é. Você acha um mais grosso, você coloca um mais grosso, aí fica maior. Então depende muito.

**A:** Mas se colocar mais comprido, ele cai ou não? Ou, também não faz diferença?

**H:** É que não é viável, né. Não é viável, porque daí ele tende a secar mais rápido.

**A:** Ah, ele seca mais rápido?

**H:** Ele seca rápido. E outra como é que você vai fazer um monte de terra pro alto? Não dá, então você tem que fazer ele baixinho. . .

**A:** (interruptions) Ah, porque você tem que tampar ele, é verdade.

**H:** Tem que cobrir ele de terra, senão não tem jeito.

**A:** Tem que cobrir os vinte centímetros, o galho inteiro tem que cobrir?

**H:** É, do chão, dos dez centímetros do porta-enxerto, mas o galhinho que você colocar vai dar isso aqui de altura.

**A:** É.

**H:** Aí você cobre e vai dar um. . . olha como é que tá aqui.

**A:** Tá. Esse. . .

**H:** Olha, pra cá. Tudo maduro!

**A:** Nossa.

**H:** Tá no ponto mesmo pra colher. Tá bem na hora.

**A:** Quantas quadras tem agora em total?

**H:** Ah, é complicado saber quantas quadras tem. Por exemplo aqui é do meu tio, ali embaixo. Essa parte aqui é dele, né. Então eu não cuido, é ele que cuida. Ele tem aí os meeiro dele. A nossa tá ali em cima.

**A:** Ali depois da do. . .

**H:** (interrupts) É, depois do milho ali. Mas aqui por exemplo, nosso tem: uma, duas, três, quatro, cinco, seis, sete, oito, nove, dez... onze, doze, treze, catorze quadras de uva.

**A:** O tamanho do sítio completo é quanto?

**H:** Aqui de tudo?

**A:** Não, onde estão as catorze?

**H:** Não, aqui é contando aqui com o Friburgo.

**A:** Ah tá.

**H:** Dá catorze.

**A:** E quanto que dá em tamanho de terreno?

**H:** De terreno?

**A:** É.

**H:** O terreno dá mais ou menos uns sete alqueire.

**A:** Sete alqueire.

**H:** É. E tem setenta mil pés de uva. Mais ou menos dez mil pés de uva por alqueire que tem. (not understandable; ca. 00:27:41). Em um alqueire você consegue plantar dez, onze mil pés de uva.

**A:** E em um alqueire, quantas quadras dá dentro? Duas, três?

**H:** Duas, depende do tamanho que você quiser fazer ela, né. Depende do tamanho.

**A:** Entre cada quadra tem um espaço pra rua mesmo...

**H:** (interrupts) Tem, isso mesmo

**A:** (continues)... que é pra passar carro.

**H:** É, é cinco metros que a gente coloca entre uma e outra.

**A:** Cinco metros.

**H:** Varreador que a gente chama.

**A:** Varreador?

**H:** Carreador! Carreador.

**A:** Carreador?

**H:** Olha, aqui a nossa uva pega lá de baixo e vem até... toda essa parte aqui.

**A:** E do outro lado é do... também é milho que é de vocês, né?

**H:** Não, lá é do vizinho. Ah também essa uva já colheu tudo, já limpou. Agora ela vai descansar.

**A:** E tem que podar depois?

**H:** Só em Junho, só em Julho.

**A:** Só em Julho?

**H:** Isso Julho, Agosto. É, você vai cortar aqui embaixo, né. E...

**A:** Ah, deixa ela pelada de novo a planta?

**H:** É, isso aqui vai cair tudo. Ela vai, com o tempo, lá por abril é maio, não tem mais uma folha. Aí...

**A:** (interrupts) Cai sozinho?

**H:** Cai sozinho. Aí fica só esse aqui. Só esses galhos aqui, né. É o periodo de dormência que ela vai...<sup>19</sup>

**A:** E, tem que tirar a, as folhas ou pode deixar pra adubar o...?

**H:** Não, isso não tem problema. Essas uvas que vão ficando pra três, isso aqui eles não passam, não fica passando e repassando, o que é que custa, senão perdemos. Se não caiu, vai estragando.

**A:** Minha prima tinha uva niagara em casa. Mas eu perguntei pra ela onde é que eles tinham comprado, e falaram que na rua mesmo. Vende aqui também em Indaiatuba?

**H:** Na rua?

**A:** É.

**H:** Ah, pode ser que sim. É, sempre tem.

**A:** Mas é de vocês?

**H:** Não, não é nossa.

**A:** essa aí tá pronta pra colher, olha.

**H:** Essa é de vinho.

**A:** É menor!

**H:** É, é diferente. Essa uva aqui ela é de vinho. É uva pra vinho.

**A:** E como é que ela chama?

**H:** (not understandable; ca. 00:31:39) Essa aqui você vai né, colher e vai fermentar. Olha a cor. A gente fazia vinho, fazia bastante, mas ele dá muita mão de obra...

**A:** (interrupts) Faziam vinho?

**H:** Fazia, nós sempre fez. Pro consumo próprio da gente.

**A:** E pra fazer vinho tem que tirar a polpa? Usa a cáscara ou usa tudo?

**H:** Não. Corta o cacho aqui e amassa tudo, né. Aí você amassa.

**A:** Mas põe uma maquina pra, pra amassar, ou como é que é?

**H:** Ah, aqui geralmente a gente amassa às vezes na mão.

**A:** Com o pé?

**H:** Não, com o pé nós nunca fizemos. Sempre com a mão. Porque é pouco, são só essas duas ruas aqui.

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<sup>19</sup>*Dormência* is the period of time when the plant is “sleeping” or “resting.”

**A:** Ah, só tem duas ruas de uva?

**H:** Só, só. Pra vinho é só essas duas aqui.

**A:** Mas vocês já não fazem mais?

**H:** Não, faz. Depende do tempo, do servião, porque ocupa muito tempo, dá muito trabalho também. E, as vezes a gente tá meio, sem muito servião e a gente pega e faz. Senão, vende aqui pra alguns vizinhos que faz né. Aí eles vendem, eles vêm pega, eles dão depois sete ou oito garrafão de vinho pro próprio consumo, então eu pego o vinho já pronto.

**A:** Ah tá. Ah, se vocês tiverem em casa eu gostaria de experimentar.

**H:** Justo agora eu não tenho, desse aí eu não tenho.

**A:** Então são só duas ruas de uva de vinho.

**H:** Só.

**A:** E a uva é menorzinha, ela é mais. . .

**H:** É.

**A:** E o sabor dela é mais azedo?

**H:** Azeda.

**A:** Azeda. Não é boa pra comer?

**H:** Não não. Vixe, se você chupar aquela uva ela dá uma dor de cabeça na gente.

**A:** Nossa.

**H:** Ela é muito forte.

**A:** Por que que tem esses pregos aí pra. . . pra segurar as caixas?

**H:** Porque. . . são de segunda mão que a gente fala, de segunda mão. Então é, as vezes você pega um e tá despregado, essas coisas, aí você traz prego e martelo junto pra, pra re-pregar.

**A:** E um caixote dá cinco quilos?

**H:** É.

**A:** E realmente pra medir o peso do caixote é mais assim, é na prática?

**H:** Na prática. Não tem como fica pesando. Por exemplo, você vai trazer. . . (not understandable; ca. 00:35:17)

**A:** Aí como é que faz, a pessoa que vai colhendo, vai, vai deixando assim enfileirado? Aí outra pessoa passa pra recolher os caixotes? Nossa essa terra tá muito mais molhada do que a de lá.

**H:** É, essa aqui é a idade.

**A:** Por que que tem tanta diferença?

**H:** Depende do tipo de solo. Tem solo que seca mais rápido, tem outros que não seca tão rápido. Depende do tipo da terra, da. . .

**A:** Mas tem também, o papel que seja mais inclinado, também influencia?

**H:** Também, isso influencia. Pode influenciar.

**A:** E pra uva mesmo, pra crescer, pra brotar, faz diferença ou não?

**H:** Hum... não, geralmente não.

**A:** Bom dia

**E:** Bom dia, tudo bem?

**A:** Tudo. O senhor tá bem também?

**E:** Bem.

**H:** Olha só, deixaram cacho pra três. Por exemplo, aqui é a diferença do que a gente tava fazendo de encaixar, aqui você já colhe direto do pé e na caixa, né.

**A:** Hum.

**H:** Pega menos na uva, é uma coisa melhor, né.

**A:** Vocês fazem sempre duas camadas, né.

**H:** Esse é, duas camadas.

**E:** Aonde que tem?

**H:** Ali atrás. Será que não vai dar quatrocentas aqui?

**E:** Ah ele não saiu e tá guardando agora. Sei lá quanto que deu.

**H:** É, mas a turma já pegou tudo.

**A:** O ideal é tentar não tocar muito a uva.

**H:** A uva, é. Menos você pega nela, melhor é.

**A:** Aqui o seu irmão já leva direto esse carrinho pra...

**H:** Ah, mas cada um colhe de um jeito.

**A:** Eu vi que tinha gente que deixava os caixotes enfileirados. Quantas pessoas são em total, oito?

**E:** Seis é, aqui colhendo tem seis.

**A:** Seis? Bom dia!

**Meeira:** E aí, vai colher?

**A:** Ah, eu vou tentar. (laughings)

**Meeira:** É mais fácil do que embalar.

**A:** É?

**Meeira:** É.

**H:** Essas uvas que deixam aqui pra três, pra mim é tentação. Até parece mais docinha ainda.

**A:** Cipó mesmo assim cresce. Tem que ficar tirando o tempo inteiro.

**H:** É, isso que eu falei. Quando vai saindo tem que cortar, né. Ó, eu vou arranjar uma tesoura (not understandable; ca. 00:41:51). Quer um café?

**A:** Aqui também é pra descer depois.

**H:** Ah é. Ah isso aqui vai pra tudo quanto é canto. Isso aqui tá ficando velho mas vai pra tudo quanto é lado.

**A:** Ah já sai daqui do, do terreno.

**H:** Café?

**A:** Espera um pouquinho.

**H:** Pra lá era dos meus parentes, né. Agora pra lá é de um rico. E o cara tinha um gado, uns bezerros, mas não eram cem cabeças deles. de boizinho, de tamanho pequeno.

**A:** Hum hum.

**H:** Quando chegamos aqui no sábado de manha pra trabalhar. Os boi tava tudo no meio. . .

**A:** Nossa!

**H:** Tinha comido tudo. Eles comeram tudo, sabe! Aquilo nossa, meu deus! Aí chamamos o dono dos boi. Ó daquele jeito é. . . calculamos mais ou menos o prejuízo e ele teve que pagar. Aqui assim tava, nossa. . .

**A:** (interrupts) Mas será que o cara tinha seguro, porque aí. . .

**H:** Não. . .

**A:** O que que tem aí, essas aqui?

**H:** O que?

**A:** Tem um monte de planta aí.

**H:** Isso aí é abóbora.

**A:** É no chão. Abóbora?

**H:** É, abóbora.

**A:** Isso é pra alimentar o solo ou faz aí?

**H:** Não não, isso aqui a gente planta pra comer mesmo, pra gente ter as abóbora pra. . .

**A:** Mas aí mistura o gosto? Fica com gosto de uva ou não?

**H:** Não, não. Não tem nada a ver, ó lá. Aqui embaixo tem uma, olha.

**A:** Ah, essa é aboóbrinha verde.

**H:** É, é abobrinha comum que a gente compra. A gente planta uns pés assim no meio pra gente ter pra comer, né. E aí aproveita o adubo pra. . .

**A:** (interrupts) Mas isso é pra vocês. Olha a flor aqui

**H:** É, aí aproveita o adubo da uva, né. e tem sempre humidade, então. Tem mais por exemplo aqui, nessa ponta.

**A:** A tesoura pra colher, tem que ser uma tesoura especial?

**H:** É

**A:** E ela é especial pra colher, não pode ser outra?

**H:** É, ela é própria pra colher. Tem as de poda, né, que são diferente. Depois eu mostro lá em casa as de poda.

**A:** Hum hum. Aí tem que tirar bem, pra não aparecer galho, né?

**H:** É.

**A & Meeiro:** Bom dia.

**A:** Coloco mais um ou não?

**H:** Não, esse eu coloco no fundo só pra afirmar os outros em cima. Olha Andrea. Já arrancou essa rua inteira aí? Quem tá com rua inteira aí?

**17-12-07**

**Interview number 3**

**A: Andrea**

**H: Hedinho**

**H:** É, em oitenta e sete, era uma quarta-feira à tarde, a gente tava trabalhando na uva tudo desbrotando, fazendo aquele servião que nem hoje que a gente tava fazendo só que a árvore tava mais grandona.

**A:** Em Outubro?

**H:** No mês de Outubro. E o céu tava assim, que nem hoje, limpo o dia inteiro, o tempo bom e tal. Quando foi à tarde, formou assim umas nuvens desse lado de cá ó, que no fundo você via que era tempestade que ia vir, dava pra perceber.

**A:** Hum hum.

**H:** E quando foi umas oito e meia da noite começou a chover. Das oito e meia até nove e dez, choveu puro granizo.

**A:** Nossa.

**H:** Perdemos tudo, tudo tudo tudo tudo e não sobrou... só sobrou aqui o tronco da uva. Porque esses galhos perdeu, rasgou é... como é que eu vou dizer pra você... arrancou, cortou, arrancou fora. A chuva veio com vento ainda também, vou aproveitar de pegar essas caixas. É... veio com vento forte, sabe?! Nossa mas aquilo destruiu tudo.

**A:** Aí tem que esperar um ano inteiro até crescer de novo?

**H:** Isso, a uva demora dois anos pra ela se recuperar de uma chuva dessas.

**A:** Nossa!

**H:** Aí a gente ficou, nem sabia nem o que fazer pra ela, sabe?

**A:** Hum hum.

**H:** Largamos ela lá, ela brotou. Aí a gente tinha umas famílias que trabalhavam pra nós naquele tempo, foram tudo embora. Nossa, quem vive da fazenda. Eles eram meeiros não eram empregados, eram meeiros.

**A:** Meeiro é o que?

**H:** Meeiro é assim, por exemplo, eu dou essas duas quadras de uva pra um casal, trocar e cuidar, né?! Forneão adubo, inseticida (not understandable; ca. 00:02:00). Mas então o negócio hoje em dia não tem mais muito. Na região nossa, já até acabou. . .

**A:** Hum hum.

**H:** Aí eu sei que até a EPTV de Campinas veio filmar. . . pra cima, é, ali onde (not understandable; ca. 00:02:38)

**A:** Ali pra três?

**H:** É, naquela cerca ali. Aqui em cima tinha milho plantado.

**A:** Hum hum.

**H:** Destruiu tudo o milho.

**A:** Também.

**H:** Tava pequenininho assim, sumiu! Aí. . . eles fizeram essa cerca agora, porque quando era dos meus primos ainda, nunca teve cerca!

**A:** Hum.

**H:** Né?

**A:** É, é da família, né?

**H:** É da família, você nunca. . . aí eles venderam e nós fomos obrigados a fazer. Ainda mais depois que eles trouxeram aquelas vacas. Aí tinha uma valeta ali, uma vala que era pra escorrer água, sabe?! Juntava, tipo uma curva de nível. E, ali no canto ali, depois eu mostro, tinha uns pés de conca<sup>20</sup>, laranja essas coisas. Não sei se você conhece o que um mata-burro?

**A:** Não, mata-burro eu não conheço.

**H:** Não conhece? O mata-burro substitui uma porteira. Por exemplo, se eu tenho aqui, é. . . gado solto qualquer coisa, eu não quero fazer. . . aqui é uma estrada, e eu não quero pôr uma porteira no meio aqui, que vai me atrapalhar; eu faço um mata-burro. O que que é um mata-burro? O mata-burro é feito um buraco no chão quadrado, né, vamos dizer de dois por dois, que nem você faria uma porteira. Faz fundo assim, e aí por cima você coloca mourão, ou viga ou caibro, né, ou vigote de madeira quadrada, uma do lado da outra sempre deixando um espaço entre uma e outra. Aí por exemplo, a largura que for o caibro, você deixa

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<sup>20</sup>one variety of apple

o vão e faz assim.

**A:** Hum hum.

**H:** O gado ou o cavalo, por exemplo, não vai passar por cima, ele tem medo. E se ele passar, ele enfia a perna ali, quebra, é por isso que chama mata-burro.

**A:** Ah tá!

**H:** E aqui tinha muito disso antigamente.

**A:** E isso pra segurar, pra não pra não entrar nada.

**H:** Aí em vez de você pôr porteira, você faz um mata-burro. Tinha muito disso antigamente. Hoje quase nem se vê mais isso.

**A:** Porteira é o que?

**H:** Porteira é um portão grande. É uma porteira de madeira. Aí, nessa vala, então daí nesse buraco de mata-burro encheu de pedra que a enchurrada levou. Sem brincadeira, ali ficou pedra durante 1 semana dentro daquele buraco.

**A:** Nossa.

**H:** Cheio de pedra ali. Vou lá pegar mais caixas... foi triste demais... Aí naquele tempo a gente não tinha seguro, não tinha nada. Aí literalmente nós perdemos tudo. Ficamos, vamos dizer, quase 2 anos sem ganhar dinheiro, sem nada. Aí foi complicado, foi uma época muito difícil pra gente se recuperar daquilo.

**A:** Vocês fazem curva de nível aqui?

**H:** Hã?

**A:** Curva de nível?

**H:** Faz, tem que fazer.

**A:** O que que é uma curva de nível?

**H:** Curva de nível você faz pra evitar a erosão no solo, esboroamento<sup>21</sup> essas coisas. Por exemplo, aqui não precisa no caso aqui porque é bem plano, mas em terreno que tem declive, aí você faz ela... é uma valeta, né, faz ela funda de um lado e do outro fica assim, pra água não, não...

**A:** Como é que é?

**H:** Por exemplo...

**A:** Aqui não tem.

**H:** Aqui não precisa porque o terreno é plano. Num terreno que tem declive, aí ele é feito pra água da chuva essas coisas não abrir valeta, não abrir vala, essas coisas.

**A:** Hum hum.

**H:** Então você faz aquela curva de nível. Por exemplo, o terreno é assim.

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<sup>21</sup>crumble, fall apart

**A:** Hum hum.

**H:** Eu sempre faço a curva em nível assim, ó, que nem se fosse uma bacia.

**A:** Ah, então em vez da rua ser reta, ela é mais arredondada.

**H:** É, a curva de nível é pra proteger. Vai sempre entre cem metros uma da outra, duzentos metros uma da outra. . .

**A:** (interrupts) Mas o mourão fica assim, mais assim encurvad. . .

**H:** (interrupts) A curva de nível não, isso é só pra proteger o solo, pra evitar a erosão. Não é, é só pra n. . .

**A:** (interrupts) Fica um buraco aqui ou?

**H:** É, é uma valeta que vai servir de um tipo de um esgoto, pra água de chuva.

**A:** Ó, essa aqui não dá pra tirar.

**H:** Ah, deixa aí. Se for tirar ele, vai espatifar tudo. . .

**A:** Eu acho.

**H:** Olha aqui o que eu vou fazer na carreta. Eu vou colocando embaixo as que tão cheias.

**A:** Tem um cacho pequeno aqui.

**H:** Não deveríamos deixar isso pra três, né?

**A:** Hum.

**H:** Aqui tudo era terra, né, produzida, terra igual à essa. . . estragou assim e nunca mais aproveitou pra mais nada, só pra isso aí.

**A:** Ah, a grama estraga?

**H:** Não porque você vê, cavoucou a terra, modificou o relevo dela.

**A:** Ah tá.

**H:** Topografia tudo, nunca mais deu num lugar desses. . . Faz tempo que a gente tem planta que é importada, vem dos Estados Unidos.

**A:** Nossa.

**H:** Tem uma aqui, aqui em cima tem mais dois.

**A:** (interrupts) Os dois são iguais ou?

**H:** Dois campos, três campos na verdade mas é tudo uma uva só.

**END**

**17-12-07/GRAV3**

**A: Andrea**

**H: Hedinho**

**A:** Essas aqui são de noventa então por linha?

**H:** É, de noventa, noventa e dois. . .

**A:** Mas a separação das ruas é a mesma?  
**H:** É a mesma, é, a medida...  
**A:** Quanto que era, um metro e setenta?  
**H:** É, um e setenta por oitenta.  
**A:** E oitenta de cada... entre cada planta.  
**H:** Isso.  
**A:** E aqui não tá pronto ainda?  
**H:** Ah aqui nós vai começar a colher amanhã.  
**A:** Ah então tá quase pronto. Peguei aqui um cachinho.  
**H:** Nos vamos tá aqui amanhã. Ó o tamanho.  
**A:** Aqui não deu.  
**H:** É. Aí tem uma falha de pé é, geralmente é por causa da falha de um cerco.  
**A:** Tem quanto tempo que vocês plantam aqui nesse sítio?  
**H:** Essa uva aqui tem quatro anos, a mais velha. É quatro anos que a gente tem...  
**A:** Que começaram a arrendar também o sítio?  
**H:** É, isso.  
**A:** Então ainda não replantaram.  
**H:** Não, não. Isso ainda não.  
**A:** E ele tinha alguma coisa aqui no sítio ou?  
**H:** Não, não tinha nada.  
**A:** Quantas quadras tem?  
**H:** São três, quatro na verdade. Essa aqui, uma ali, outra ali e outra lá em cima.  
**A:** Quantas linhas tem?  
**H:** Ah, aí agora você me apertou Andrea, viu. Eu não sei... certo quantas linhas tem.  
**A:** Mas dá pra fazer uma estimativa. Quanto que tem de comprimento a quadra?  
**H:** Aqui tem noventa, aqui por exemplo já tem rua com cem, tem rua mais curta, depende o quadro da terra, né.  
**A:** E a largura?  
**H:** É a mesma, aí isso não muda...  
**A:** (interrupts) Aí tem quanto...  
**H:** (interrupts, continues) A rua e a linha e a distancia entre pé é sempre a mesma. Não pode ser mudado.  
**A:** Ah, então é realmente quadrada a, o, a área?  
**H:** É, depende muito. Ó um pé de uva branco, ó.

**A:** Ah é.

**H:** Olha, inteira branca.

**A:** Inteira branca. Quando vem fazer a colheita aqui, para a colheita lá e vem todo mundo pra cá?

**H:** Vem pra cá, é.

**A:** E aqui vão começando, vão começar a tirar os cachos pequenos e depois os grandes?

**H:** Aqui vamos ver se a gente leva já tudo, né, tirando os pequenos e separando. . .

**A:** (interrupts) Colocando em caixa separada.

**H:** (continues). . . na hora de colher a gente faz em caixa separada.

**A:** Hum hum.

**H:** Aqui tem mais. . .

**A:** Uma, duas.

**H:** Três.

**A:** Aquela ali.

**H:** Essa fileira aqui é só as três porque ela divide aqui, né. Essa aqui é plantada em um ano, dali pra cima depois desses mourãozinho verde redondo é outro, foi plantado no ano seguinte.

**A:** É, mas quase não tem separação de rua, né.

**H:** Não, até como se fosse plantado num ano, né. Depois a gente continua no outro ano a plantar uva pra cá, né.

**A:** Hum hum.

**H:** Tem olha, essa uvas também, bem comprida, tá vendo, né. É diferente no caso da. . .

**A:** Realmente as outras são mais curtas, lá.

**H:** Aqui a gente foi obrigado a fazer isso por causa do próprio dono do sítio. Então ele queria que fizesse muito assim. . . então a gente aí é, fica meio de mão atada, né.

**A:** Hum.

**H:** Tem quer fazer mais ou menos como a pessoa quer, sei lá. . .

**A:** É porque ele é o dono.

**H:** É. Aqui falta um pouco mais pra madurar. Isso aqui até o fim de semana fica bom.

**A:** Quanto você acha que vai render aqui?

**H:** Ah, eu espero a gente tirar aqui uva de cinco a seis mil caixas, dessas caixas.

**A:** Hum hum.

**H:** Vamos ver se a gente consegue, né. Isso aqui é... (not understandable; ca. 00:05:55)

**A:** É mas ali o gado fica só desse lado aí.

**H:** É, o gado é só desse lado aí.

**A:** E esse é de outra, é do dono?

**H:** É lá do, do Eduardo lá, da comunidade.

**A:** Ah tá. A uva de lá do sítio tava mais gostosa.

**H:** Mais doce, né? Eu também acho, viu. E isso aqui é por causa da terra.

**A:** Da terra.

**H:** Que essa terra aqui, ela é uma terra um pouco mais, vamos dizer, entre aspas mais fraca.

**A:** A cor é diferente.

**H:** Porque é, por ser meio arenosa e tudo isso ela já não é uma terra ali de plantar, né.

**A:** Tem alguém chegando. Tem coisa que eu acho que durante todo o processo assim de, de plantar, podar tudo, não tem explicação, né?

**H:** É, tem algumas coisas...

**A:** (interrupts) Como essa coisa assim quer ver, uma muda dá e a outra não dá, a que tá do lado.

**H:** Ah é, exatamente.

**A:** Que faz no mesmo dia e... mesmo no periodo da manhã e...

**H:** Por exemplo aqui, o seu Mark(? , dono da casa) ele é um homem que gosta muito de árvore. Ele tinha uma árvore no meio da uva ali, ele não deixou a gente tirar.

**A:** Hum hum.

**H:** Quando a gente plantou aqui, ela era pequenininha. E aí ele não deixou e agora olha o tamanho que tá essa árvore. Isso pra nós na verdade prejudica, por causa dos passarinhos.

**A:** É.

**H:** Passarinho estraga muito.

**A:** E faz sombra demais, né?

**H:** A sombra também. A uva, não da uva, né. Olha aqui, pode ver... Isso aqui é pouco o que vai dar pra aproveitar.

**A:** Nossa.

**H:** Só que ele não entende isso, sabe Andrea, não adianta querer explicar isso aí. Ele tem uma ideia fixa, né, na cabeça.

**A:** Isso que ele até vem do país, né, que trouxe bastante vinho podia. . .

**H:** (interrupts) Olha aqui ó, um cacho interessante, ó.

**A:** Ah é.

**H:** É metade branco, metade. . . né.

**A:** Como é que eu faço pra. . . (not understandable; ca. 00:09:23). É.

**H:** Saiu?

**A:** Saiu, mas sai escura. Fazer outra, mas faz sombra como o pé. Péraí. Agora eu acho que vai, agora saiu. Nossa aqui tá muito bicado de passarinho. Nossa.

**H:** Se colher logo ainda aproveita. Só que aí tem que pegar o cacho na mão, limpar ele.

**A:** Isso aqui dá muito mais trabalho, né, pra tentar aproveitar.

**H:** Pra aproveitar que nem esses. . .

**A:** (interrupts) Tem que ficar cortando.

**H:** Tem que passar a ponta da tesoura tudo aqui.

**A:** É.

**H:** Porque o outro lado tá bom, ó.

**A:** É. Quanto que custa mais ou menos arrendar um sítio?

**H:** Olha, varia muito. Cultura que você vai plantar no sítio né, o tipo de cultura. Prazo pra arrendamento. . .

**A:** (interrupts) Aí eles cobram de acordo com o que for plantar?

**H:** Por exemplo, uva é dez por cento do valor bruto que você tem. Se eu colher dez, cem caixas, dez são do, vai pro proprietário. Nossa, essa uva aqui não tem nada pra comer.

**A:** Ah, então ele, não é um valor fixo mensal. Depende da, depende do ano, depende da safra, depende da. . .

**H:** (interrupts) Não, é, depende. Por exemplo, o outro sítio que a gente arrenda onde planta milho, aquele é por mês. É um sítio de vinte alqueire e lá a gente paga mil e quinhentos reais por mês de arrendamento. O contrato pra três anos.

**A:** Hum hum.

**H:** Aonde a gente planta milho ali em cima, do lado daquela obra ali, ali nós arrendamos também por três anos por doze por cento da , por safra, pro proprietário, né.

**A:** Hum hum.

**H:** É assim, depende às vezes de vários proprietários, que quer de um jeito, quer de outro. Mas eu no caso, eu prefiro que nem lá no outro sítio que a gente planta milho, que você paga um xis por mês, né e, tudo o que você produzir é seu deu

tanto, não tem que ficar prestando conta, nem nada, né.

**A:** Mas o problema é que por exemplo assim, é, durante o inverno que não dá nada. Aí não paga nada ou tem que pagar?

**H:** É, aí não paga nada. Não, paga do mesmo jeito. Você paga por mês, é que nem se fosse o aluguel de uma casa. É mesma coisa.

**A:** Mas aí paga quanto, porque não tem um por cento...

**H:** Não, não. Que nem lá que eu to falando, é mil e quinhentos por mês o ano todo.

**A:** Ah tá.

**H:** Produza ou não produza, você arrenda o sítio e, você cuida como seu.

**A:** Hum hum. Mas aqui por exemplo? Em Julho quando não tem safra?

**H:** Não, aí não paga nada, só paga quando dá, tem a safra.

**A:** Ah tá.

**H:** Só quando tem safra.

**A:** E o senhor acha que mesmo assim fica mais em conta pagar um preão fixo todos os meses do que...?

**H:** Aqui nesse caso aqui, aqui por exemplo é melhor por safra porque, é só uva que eu tenho aqui. Agora que nem, aquele outro sítio lá, lá eu já planto batata, lá a gente planta milho, lá eu posso plantar feijão, então é melhor por mês, né que...

**A:** Hum hum.

**H:** A porcentagem por exemplo de uma lavoura de batata é alta pra caramba, então em vez de dez por cento no montão em geral ela é muito alta no valor.

**A:** Hum hum.

**H:** Por exemplo, que nem esse francês, ele manter esses sítios, essa casa aqui eu acho que na França ele não teria condição de ter isso.

**A:** Nunca.

**H:** Né. Mesmo ele sendo um homem muito bem de gosto, de vida, ele não teria como, por isso que ele é, ele gosta muito. E ele é assim, tipo... ah, “esse fim de semana eu não vou aí pro sítio”, ah tá, “eu tô indo pra, pra Paris. Segunda eu tô de volta, terça eu tô de volta”. Aí ele vai pra lá, passa o final de semana na casa dele, volta... é assim. Ele tinha os pais até pouco tempo, os pais faleceram...

**A:** Moravam na França?

**H:** Moravam na França, faleceram à pouco tempo.

**A:** E ele veio sozinho, ou veio com mulher e com a, com...?

**H:** Ele é divorciado, ele é sozinho.

**A:** Então a filha não mora aqui?

**H:** A filha não mora aqui, ela mora em São Paulo, mas não mora com ele. Ela morou muito tempo e estudou nos Estados Unidos.

**A:** É.

**H:** Mas é...

**17-12-07**

**Interview at the cemetery**

**A:** Andrea

**H:** Hedinho

**H:** Pra você ver como é que o tamanho do negócio.

**A:** Essa é a trava?

**H:** É a trava!

**A:** Tá escrito em alemão.

**H:** É tudo em alemão.

**A:** Steffen. Eles também moraram aqui?

**H:** Isso, também eram daqui. Olhando assim a grosso modo, o que você me diz de contraste, o que você vê de contraste?

**A:** Aqui entre as duas?

**H:** Sim.

**A:** É, aqui quase não tem lápida, né.

**H:** Que aqui enterrava os alemão, e os brasileiros é ali.

**A:** É mesmo?

**H:** Exatamente. Ou os chamados católicos. Pra eles, né, católico também não tinha vez.

**A:** Olha.

**H:** Então é uma coisa assim meio, né... e aqui também tem muito escravo enterrado, escravo que veio...

**A:** (interrupts) Mas, mas eles não conseguiram, tipo em Friburgo assim, as pessoas que começaram a comprar sítio não... não tinham mão de obra escrava, os alemães?

**H:** Não, não, não. Eles não...

**A:** (interrupts) Porque eles já estavam abolidos, né.

**H:** Não, é, já estavam abolidos.

**A:** Nossa, realmente, hein?

**H:** A única coisa que a gente sofre muito aqui é depredação por parte dos povo que vem pra roubar as coisas, entendeu. É, roubam muito.

**A:** Ah, falaram pra mim.

**H:** Né. Sabe por exemplo, olha essa plaquinha. Em memoria à pessoa mais idosa sepultada nesse cemitério, José Mina. Nasceu na África, no ano de mil setecentos e noventa e seis e foi trazido como escravo para o Brasil e faleceu em sete do sete de mil novecentos e dezesseis com a idade de cento e vinte anos.

**A:** Nada menos, hein. Cento e vinte anos!

**H:** Cento e vinte anos. Olha aqui, esses aqui são os túmulos dos fundadores dessa cidade. Tem até cachorro morando aqui dentro. Esse aqui são os túmulo do. . .

**A:** (interrupts) Ah, do Kräenbrühl.

**H:** Do Nikolaus Kräenbrühl. Do Nikolaus e da esposa dele.

**A:** Eles tão numerados também, né?!

**H:** Esse aqui é de pé. Luisa, Luisa, Friderica.

**A:** Friderica. Já. . . já é abasileirado o nome.

**H:** Só o Luisa. . .

**A:** Não, nasceu em. . . mil oitocentos e trinta e oito.

**H:** Esse aqui também era fundador da cidade, Serrati(Seranth, Feranth?). A placa dele ó, sumiu as letras né, com muita chuva tudo. . . vai sumindo.

**A:** Nossa.

**H:** Então você vê ó, eles quebram os muros, né. Aqui ó,

**A:** Margarethe e Maria Úrsula Kräenbrühl.

**H:** Ah, você que ler em alemão, ó, é. . . fala né, *hier*, como é que é?

**A:** *ruht*.

**H:** *Ruht in Gott Margarethe und Úrsula Kräenbrühl*.

**A & H:** *Geboren Ytem*.

**H:** Suíça, nascida na Suíça.

**A:** Vinte e oito de Dezembro de mil oitocentos e quarenta em Barnaduz.

**H:** É. E esse. . .

**A & H:** Graubünden.

**H:** *Ge*. . . como é que fala?

**A:** *Gestorben*, morto.

**H:** *Gestorben* em abril de mil novecentos e quinze. Então você vê ó, é uma contradição. Por exemplo, esses túmulo são de marmore, né. Lógico que tá deteriorado pelo tempo, por causa da idade, mas ó o contraste com o outro lado. . .

**A:** Realmente.

**H:** Aqui são, esses túmulos são mais dos fundadores da sociedade. Tem outros ali também... olha o que aconteceu; há um tempo atrás teve uma invasão assim... e roubaram muita coisa, Andrea.

**A:** Nossa senhora! Que judiação!

**H:** Olha, pra que que vai fazer isso, me explica? Pra que?

**A:** Não tem sentido.

**H:** Né, pra que que vai fazer um negócio desses? Destruíram muito, né.

**A:** É uma judiação.

**H:** Do que eu sei assim, arrancaram muitas placas disso aqui e jogaram esparramados por aí. A nossa sorte é que aquele senhor Walter Krähenbrühl, ele foi zelador do cemitério por uns dez anos.

**A:** Hum hum.

**H:** Então ele fez uma planta do cemitério com cada túmulo, cada nome, tudo. Aí a gente conseguiu localizar de novo e conseguiu botar as plaquinhas...

**A:** Nossa senhora!

**H:** Ó, aqui ó. É uma filha daquela minha tataravó lá que eu mostrei da ponta. É uma filha dela. Emma Magdalena Armbrust.

**A:** Que ela nasceu aqui, né?!

**H:** É, nasceu aqui...

**A:** Em setenta e sete.

**H:** É, nasceu em setenta e sete e morreu em noventa e quatro. Dá o que? Dezoito anos... dezoito. Dezoito, dezessete anos.

**A:** É, oitenta e sete... noventa e sete... dezessete.

**H:** E isso aqui...

**A:** (interrupts) E ela morreu de peste?

**H:** Não. É, você consegue ler o que tá escrito aqui ou não?

**A:** É, nos te amamos muito, é... aqui fala, a sua morte não sei o que que fez e ainda não conseguimos é, entender que, que você se foi tão rápido, né.

**H:** Pois é. Isso aqui eu descobri na verdade há uns dez anos, menos de dez anos atrás.

**A:** Hum hum.

**H:** A história dessa moça. A minha tataravó daquela das fotos, ela foi um dia pra Monte Mor porque queria deixar (not understandable; ca. 00:07:06). E deixou os filhos aqui, lá onde a gente mora, cuidando da casa papapa e ela levou os filhos mais pequenos no colo, ficou essa filha, as outras filhas maiores, o filho

mais velho que é o meu bisavô, que tá enterrado ali e depois a gente vai ver, e ficaram. Quando a minha tataravó chegou lá em Monte Mor que ela foi visitar os parentes, o meu bisavô chegou atrás dela de à cavalo, porque ela tinha falecido. E porque? Aí foi-se, foi-se aí depois descobriram que ela estava grávida de um colono, no caso, que não era alemão e isso nesse ano aqui, e daí imagina o que seria uma moça grávida. . .

**A:** (interrupts) Dezesete anos e solteira.

**H:** Solteira e grávida. Ela pra não envergonhar a família naquela época, se suicidou. E você acredita que meu avô contou essa história aqui depois de eu insistir muito com ele. Porque eu descobri o túmulo dela aqui, andando por aqui, olhando. . . pa bati o olho, eu falei nossa quem que é essa daí?

**A:** Nunca ouviu falar, né?

**H:** É, quem que é. Cheguei no meu avô, ele fugiu que nem o diabo foge da cruz, da conversa. Pra você ver, não tinha nada, ó a idade, o meu avô não era nem nascido nessa. . . meu avô nasceu em mil novecentos e nove. Ele não era nem nascido nessa época. Aí eu falei, aí tem coisa, aí eu fui com a minha vó, mãe da minha mãe que vinha a ser sobrinha dela também no caso, que ela é irmã daquela que eu contei que tinha epilepsia que né?

**A:** Hum hum. Que também morreu jovem.

**H:** É. Que era filha também daquela mulher da foto. Aí minha vó contou, ela falou foi isso, isso, isso e isso. Aí eu fui por cima do meu avô, eu falei *vadder*, porque a gente fala *vadder* em alemão pro avô e vó que é no dialecto *plattdeutsch*, lá.

**A:** Hum hum.

**H:** E eu falei “*vadder*, porque o *vadder* não contou isso pra gente?”. O que que tem isso? Não, isso é uma vergonha que nós escondemos que isso foi combinado na família que a gente nunca contaria isso pra ninguém.

**A:** Não podia falar disso.

**H:** Não podia. A gente era proibido, ele falou “eu aprendi que eu era proibido falar, e eu nunca falei”. Aí ele contou melhor, detalhou a história, que daí não tinha nada a ver vô, são mais de cem anos. . .

**A:** É, é.

**H:** Mas, pra época então talvez é, nunca ninguém traduziu isso aqui pra mim. Agora você dizendo isso, né, por isso que elas falam, porque não entenderam a morte dela, porque que. . . Ela poderia ter feito outra coisa.

**A:** Hum.

**H:** Sei lá, abortar, não sei. Achado um marido pra casar às pressas, também não sei o que ela poderia ter feito.

**A:** É, se ela tivesse contado pros pais provavelmente teriam achado um marido, né.

**H:** Então pra cá, praquela minha tataravó da foto foi um choque muito grande. Minha vó conta que ela nunca esqueceu mesmo já idosa que ela faleceu com setenta e . . . cinco anos de idade, pra época era idosa. É, ela nunca esqueceu dessa filha. Nunca, nunca, nunca.

**A:** Só que ela nunca falou dela.

**H:** Também nunca contava a história né, do que foi. . .

**A:** É.

**H:** Aqui tem alguns túmulos que são do começo. Esse túmulo aqui por exemplo é o primeiro.

**A:** Mil oitocentos e oitenta e seis.

**H:** É a primeira pessoa que foi sepultada no cemitério.

**A:** Acho que essa aqui aparece na . . . no livro da . . .

**H:** É, Maria. . .

**A:** Elisabeth.

**H:** Goldmann.

**A:** Mil oitocentos e oitenta e quatro.

**H:** Essa é a primeira, a primeira sepultura. A número um. Aqui tá o meu. . . aqui tá o meu tataravô que foi buscar a bandeira lá e morreu de febre amarela, da peste. É esse aqui. E era o primeiro esposo daquela da foto lá, que a gente viu.

**A:** Ah, então os números estão relacionados a quem morreu, em ordem de. . .

**H:** É, por morte.

**A:** Por morte.

**H:** Ele morreu em mil oitocentos e noventa e dois, dois anos antes dela.

**A:** É ele nasceu na Alemanha, né?

**H:** Sim, ele nasceu na Alemanha.

**A:** Trinta e três ou cinquenta e três?

**H:** É, cinquenta e três.

**A:** É, morreu jovem também. Quarenta e poucos anos.

**H:** E aqui, dá pra você ver o que. . .

**A:** (interrupts) Não, trinta e nove.

**H:** (continues) dá pra traduzir essa placa, Andrea?

**A:** É também, é cedo demais né. É demasiado cedo que você deixou... ah, que você deixou aqueles que hoje estão chorando ao lado do seu caixão. Que choram por ti, né.

**H:** Isso, hum hum. É, ele morreu bem novo.

**A:** Morreu jovem.

**H:** Também tem umas coisas ali que são... olha, a outra judiação que fizeram aqui. Olha, tudo quebrado, e não tem muito o que ser feito.

**A:** Uma judiação, realmente.

**H:** A plaquinha com os nomes, roubam tudo. Sabe, é uma... dá desgosto na gente.

**A:** Quem que é aqui?

**H:** Hã? Quem é?

**A:** É.

**H:** É o sobrenome é, Frederico Quitzau e agora o nome dela eu não me lembro.

**A:** Ah, esses aqui são parentes do Zé Augusto?

**H:** Isso, são bisavôs do Zé Augusto.

**A:** Hum hum.

**H:** É, bisavôs do Zé Augusto. Aqui ó, esse túmulos também são de fundadores... são os meu tataravôs também. É, Ana Ströh e... também são tataravôs por parte da minha avó do lado do pai. Aqui ó...

**A:** É os dali também são Ströh, né?

**H:** Aqui ó, olha a data de falecimento. Esse aqui nasceu em mil novecentos. O nome tá meio apagado...

**A:** Luis...

**H:** (interrupts) Não, é Luis.

**A:** Grog? Georgius?

**H:** É, Ströh.

**A:** Ströh.

**H:** Morreu...

**A:** Mil novecentos e dezessete.

**H:** É, dezessete de Dezembro de mil novecentos e dezessete. Ó, tá fazendo aniversário hoje, de morte. Hoje é dia dezessete.

**A:** Ah é.

**H:** Aqui ó. É a mesma coisa, também é Ströh. August, August Ströh morreu...

**A:** Em mil oitocentos e noventa e seis.

**H:** Nasceu né.

**A & H:** Dez de Dezembro de mil novecentos e dezessete.

**H:** É, agora aqui. Albert Ströh, né.

**A:** Mil novecentos e dois. . .

**A & H:** Dezessete de Dezembro de mil novecentos e dezessete.

**H:** Três irmãos. Morreram tudo de febre amarela.

**A:** Nossa.

**H:** E aí, contava a minha avó, né que os pais tão aqui, os três filhos tão aqui e os pais aqui. O meu tataravô morreu. . .

**A:** (interrupts) Eles morreram antes.

**H:** É, eles morreram bem antes. Ele morreu em mil novecentos e vinte e oito, por exemplo. Ó. Ela morreu dois anos depois, dezesseis de Dezembro do dezenove.

**A & H:** De mil novecentos e dezenove.

**H:** Ela morreu na época, eles falaram que ela morreu de tristeza pelos filhos, ou seja, depressão. Ela morreu de depressão pela perda dos filhos.

**A:** Ah tá.

**H:** Que ela não aguentou e dois anos depois ela morreu.

**A:** Nossa, mas perder os três filhos de uma vez também. . .

**H:** Dois no mesmo dia, né. Um poucos. . . uma semana antes, depois dois já no mesmo dia é. . .

**A:** Muita dor.

**H:** Muita dor. É realmente, e ela não suportou. E essa capela ali ó. . .

**A:** (interrupts) Dizem que uma coisa que o ser humano não consegue superar nunca é a perda de um filho.

**H:** É, diz que existe nome pra tudo. Se você perde o pai você fica?

**A:** Órfão.

**H:** Órfão. Se a mulher perde o marido ela fica viúva.

**A:** Viúva.

**H:** E o marido, se perder ela fica viúvo. E quem perde filho? Não tem.

**A:** É verdade.

**H:** Né, é uma coisa que que. . . Essa capela que tá caída, esse é relaxo meu, isso aqui é relaxo meu.

**A:** (laughings) Hedinho!

**H:** Por exemplo eu mostro as coisas boas e as ruim também. Isso aqui é relaxo meu. Por que? Quem que tá sepultada aqui é aquela minha tataravó da foto. Ela tá sepultada aqui. E isso aqui caiu no começo do ano, agora desse ano isso aqui caiu, a capela.

**A:** Hum hum.

**H:** E eu preciso arrumar um pedreiro, que venha aqui. Eu quero desmanchar tudo, fazer uma, uma sepultura por exemplo como aquela ali, ó. Simples assim, aproveitar a plaquinha, a cruz e não modificar muita coisa e fazer.

**A:** É, tentar reutilizar os tijolos pra ficar da mesma época.

**H:** Os tijolos que dá pra fazer. Primeiro, eu não tenho tempo e não sei fazer servião de pedreiro, não tenho tempo, não sei. Mas, segundo e o maior problema: todo pedreiro que eu consigo, quando eu falo que é pra fazer um túmulo no cemitério... fala

**A:** Foge.

**H:** Foge e não quer saber. Ainda mais se é aqui, ficar sozinho aqui dentro, não vem. É, superstição.

**A:** É.

**H:** Coisa boba que pra mim não tem nada a ver. Ali ó, do lado daqui desses túmulos ali, desses túmulos de azulejo branco, aquele sete meia, sete meia cinco, meia seis não sei.

**A:** É.

**H:** Ali é um irmão meu, que nasceu... minha mãe, é, ela teve complicação no parto, né, e a criança parou de mexer naquela época e ela ficou uns três dias com a criança morta na barriga, sem saber. Faz pouco né, quarenta anos... ele teria quarenta e dois anos hoje.

**A:** Era mais novo?

**H:** Mais velho.

**A:** Era mais velho?

**H:** Era o entre eu e o Carlos, lá. Entre eu e aquele mais gordo, aquele irmão meu mais gordo.

**A:** Esse Carlos é igual ao seu pai.

**H:** É. E a minha mãe perdeu ele quando nasceu, e era menino também.

**A:** Nossa. E tiveram que fazer...

**H:** (interrupts) Ó lá o sobrenome da Angela, não do...

**A:** Ah do ex-presidente.

**H:** Do ex-presidente, perdão, Augusto Schröder. É pai, esse Augusto Schröder é pai da minha tia que tá sepultada ali em cima. Ah, esse Jacinto Thameros é, esse é o homem que veio pra cá e descobriu essas terras no caso. Ele também que, arrastou o povo pra cá na verdade. Esse homem na verdade ele foi um bravador(?), sabe porque? Porque ele deixou a família, a esposa, lá na fazenda

Sete Quedas, saiu com uma mochila nas costas, no livro lá dos Krähenbrühl fala dele.

**A:** Eu vou ler depois.

**H:** Fala dele. Ele saiu com uma mochila nas costas e “eu vou procurar terra porque nos não podemos mais viver escravos desses fazendeiros”, e ele saiu e veio parar aqui. Saiu assim, de facão na mão e uma mochila nas costas.

**A:** Nossa senhora.

**H:** Demorou um mês pra ele ir e voltar, aí quando ele voltou ele trouxe todas as... olha por exemplo esses aqui já são famílias que não tem mais nenhum relato... Jürgen Federic Perca(?). São famílias que talvez só veio essa pessoa, e ninguém sabe, não tem relato desses familiares, dessas pessoas.

**A:** É, realmente.

**H:** Aqui também é um tio meu que tá sepultado aqui.

**A:** Tem bastante, eu to vendo que tem bastante...

**H:** Parente?

**A:** Não, é... corpo que tá cremado, que tão as cinzas dentro.

**H:** Não, é, geralmente ou a família não tinha condições de fazer tudo. Então por isso que...

**A:** Ah, cremavam?

**H:** Não, só enterravam só e ficava assim mesmo.

**A:** Não, mas tá escrito na placa que são a... que as cinzas que tão repousando aí.

**H:** Ah tá, bom. Aí já é, eu já não sei.

**A:** E na Alemanha é muito comum é... os corpos, cremarem os corpos.

**H:** Ah tá. Esse aqui são meus bisavôs, os pais do meu avô.

**A & H:** Maria Armbrust e Reinaldo Armbrust.

**A:** Aí já tá escrito em português.

**H:** (interrupts) E ele, ele é irmão daquela que se suicidou.

**A:** Hum hum. Mil novecentos e quarenta e sete.

**H:** Aí tinha, né...

**A:** (interrupts) Nessa data eles já não podia escrever em alemão.

**H:** Exatamente. Foi na época...

**A:** (interrupts) Por isso que eles mudaram para português.

**H:** O engraçado deles dois, Andrea, é que eles nasceram no mesmo ano e morreram no mesmo ano. Em mil oitocentos e setenta e novo e faleceram em mil novecentos e quarenta e sete. Mesmo, mesma data de... mesmo ano de nascimento.

**A:** É doze de Julho, vinte e três de Dezembro.

**H:** É.

**A:** Também dizem também, tem casal assim é, é, casal já bem idosos que se morre um deles o outro não aguenta e...

**H:** Ah, eu tenho experiência, a minha avó foi assim. O meu avô faleceu, era dez meses depois e faleceu também. Não tinha nada! Absolutamente nada. Eu até falei mesmo, agora vai da pra vó recuperar da... que ela sofreu muito com a doença do meu avô...

**A:** Hum hum. Ou puxa pra cima ou cai.

**H:** É.

**A:** A minha avó por exemplo, ela já foi ao contrario. Depois que o meu avô morreu ela conseguiu... ganhou vida (laughings).

**H:** A minha vó não, a minha vó deprimiu. Aqui são as sepulturas ali deles lá do seu Gumercindo que era o dono do sítio ali, que é o pai do Eduardo, aqui também são parentes deles. Mas roubam tudo, quebram tudo, é...

**A:** Judiação, né. Pena que deve... isso é que deve vim la do bairro Vida Nova, né?

**H:** É, o Vida Nova tá ali, ó lá. Aqui tá o meu avô e a minha avó sepultados.

**A:** Alfredo e Noemia.

**H:** Ela morreu agora em dois mil e sete. Ela que foi criada pela, minha tataravó.

**A:** E o, o seu avô foi o que começou lá a, a plantar uva. Foi ele que começou a trabalhar o sítio...

**H:** (interrupts) É, mas não. O meu avô que começou a plantar uva não é esse.

**A:** Ah não?

**H:** Não, é o que... ele tá sepultado em Indaiatuba. Meu avô não queria ser sepultado aqui, até quando ele faleceu, nós perguntamos pra minha avó e aí, como é que nos vamos fazer, vai no Friburgo não vai. Aí ela falou não, é pra fazer a vontade dele, e é o que nós fizemos.

**A:** Por que que ele não queria vim aqui?

**H:** Não sei. Simplesmente ele não queria... sabe o que ele falava? É coisa meio de doido né, mas ele dizia que aqui a turma fazia muita macumba e quebrava muito as cosias, então ele não queria ninguém quebrando...

**A:** Ah, que pena.

**H:** Né, e ele não quis ser sepultado aqui e não foi...

**A:** (interrupts) Esse seu avô aqui é o sobrinho daquela, da moça de dezessete anos. Esses aqui?

**H:** É, não. Ela a avó é sobrinha. A avó é sobrinha o meu avô não. O meu avô já

é outra família. Essa aqui foi a última pessoa que foi sepultada aqui, ano passado em maio. Nasceu em mil oitocentos e noventa e nove. Que é a sogra da Wilma lá de casa, ela era empregada doméstica aqui do, do João com o Eduardo. Uma mulher de cor, é mãe do empregado. . .

**A:** (interrupts) Ah ela não tem já descendência alemã?

**H:** Não, mas isso aqui daí já foi modificado. . .

**A:** (interrupts) Aqui já misturou.

**H:** Sim

**A:** Antigamente era alemão daqui desse lado e brasileiro do outro.

**H:** É vamos dizer que até naquela caseira ali assim mais ou menos você só vai achar alemão. Daqui pra cá já, de uns trinta anos pra cá a coisa modificou. E ela, uma senhora de corpo forte, trabalhadeira com setenta e poucos anos, você olhava ela e . . . pode durar cem anos. Ela teve um enfarto dentro do hospital na mão do médico e o médico não conseguiu salvar.

**A:** Nossa senhora!

**H:** Deu pra matar mesmo, sabe assim quando dá assim de uma vez só pra acabar com tudo. Dentro do pronto socorro do hospital, ela foi por causa de uma tosse que ela estava gripada, a filha pegou e levou ela no médico, levou ela no pronto socorro. Na verdade ela chegou enfartando, e o médico não deu tempo de absolutamente nada, né. Apagou, desligou, tirou da tomada. Ninguém dizia que ela morreria assim. Isso aqui também tem um negócio engraçado, esses dois aqui que tão sepultados não tem os nomes nada aqui, mas a gente sabe. São dois de cor também, e esses dois foram criados por casais alemão.

**A:** Hum hum.

**H:** Né, esse aqui era o, como é que fala pra eles. Eu sei que o nome dele era Joaquim, mas ele tinha um apelido, agora eu não lembro. E aqui era o Ernesto. Esse Ernesto era um pretinho de cor, bem de cor que ele foi achado nas ruas em Campinas por um casal de desses Steffen que tem sepultado aí.

**A:** Hum hum.

**H:** Não me lembro agora direito quem, aí eles criaram ele como filho, dentro de casa. Pegaram ele na rua, foram fazer compras em Campinas e viram esse moleque andando pela rua e perguntaram de quem que é, á esse aí não tem família, esse tá perdido. Aí a, no caso, a mulher foi lá pegou, trouxe ele, sabe assim criancinha pequenininha. Criou, deram escola pra ele, deram estudo, deram tudo. Falava alemão que, fu, e era preto igual a um caboclo. O certo é que foi engraçado no dia do velório dele, ele foi velado no cemitério da saudade lá em Campinas. Só

tinha alemão no velório, né. Aquela alemãoada e o povo mais curioso pegava e iam olha o defunto, chegava no defunto preto! Dizia então, mas como isso? O alemão velando preto? Né, então foi isso...

**A:** Foi adotado na verdade.

**H:** Foi adotado e foi criado como um filho mesmo, sem preconceito... Aqui é a parte do Marcos, por exemplo esse pedaço aqui...

**A:** Hum hum. Hey!

**H:** Guilhermina e Alfredo. Guilhermina é filha daquela Augusto Schröder ali embaixo, ela é filha dele. Ela morreu em dois mil e quatro. Eles que eram donos daquele sítio que eu mostrei lá dos meus primos que foi vendido...

**A:** Ah, o que foi vendido?

**H:** É. Meu tio já morreu à mais tempo, em oitenta e três, ela morreu agora em dois mil e quatro.

**A:** Dois mil e quatro.

**H:** E ela faleceu no mesmo dia que...

**A:** (interrupts) No mesmo ano que sua avó.

**H:** E no mesmo dia que ele faleceu.

**A:** Verdade, exatamente no mesmo dia.

**H:** Vai vendo, você sabe quantas... esse meu avô, esse meu tio ele era compadre daquele meu avô ali embaixo. Eles eram muito amigos, os dois chamavam Alfredo. E eles pescavam muito juntos, caçar juntos, essas coisas aí. E meu avô falou pra ele "hey Alfredo, se você morrer primeiro, você depois vem buscar eu, hein? Que eu não vou ficar aqui sem você". E o meu tio pegou "é mas"... , falou pro meu avô, daí o meu avô tinha apelido de Alfredão "é Alfredão, mas se você morrer primeiro depois você venha buscar eu". E ficaram com isso. Tio Alfredo morreu em vinte e quatro de Setembro de oitenta e três. Meu avô morreu primeiro de Outubro de oitenta e três...

**A:** Nossa!

**H:** Uma semana depois.

**A:** Exatamente uma semana, né?

**H:** Exatamente. E eu vou falar uma coisa pra você, o meu avo não tinha nada!

**A:** Não tinha nenhum problema...

**H:** De repente, capotou também. Com setenta e três anos.

**A:** Nossa senhora!

**H:** Então como é que a gente fala, tem coisa que fica assim né. Crê não crê, acredita ou não acredita e... Tá abrindo a chave aqui, estava com problema,

tentaram estourar isso daí. Essa aqui é a capelinha daqui do cemitério.

**A:** É pelo que eu vi assim a maioria das pessoas morreram assim, mais assim rapidamente, né.

**H:** É.

**A:** Sem ter tanto sofrimento. Isso aqui é a capela.

**H:** Essa aqui é a capelinha. Geralmente, às vezes, quando tem algum velório se faz aqui, né, o culto do dia de finados também é aqui. E esse aqui é, esse aqui é pra preservar. Esse aqui é o bangüé que a turma tinha, pra carregar o corpo pra Campinas, carregava o ataúde nesse aqui, é o mesmo bangüé da época. Ó que madeira que coisa aí! Quanto caixão que carregou naquele tempo.

**A:** Agora eles já não usam ele?

**H:** Não, isso já reformou. Fica guardado. Então é, foi puxado energia elétrica aqui, foi posto água que aqui não tinha água, né. Foi construído isso aqui que não existia. Mas o povo rouba tudo. Tá com o seu boné aí o deixou lá dentro?

**A:** Tá aqui.

**H:** O povo destrói tudo. Ó lá, roubaram tudo os fios que é iluminado, né. Ali por exemplo, era quartinho de ferramenta, guardava as ferramenta. Mas já não tem como, sabe, manter nada. Eles roubam tudo.

**A:** Judiação.

**H:** Em oitenta e seis caiu aqui... então sobrou...

**A:** (interrupts) Que vinha pra Viracopos?

**H:** Tinha levantado vôo.

**A:** De Viracopos?

**H:** De Viracopos pra Buenos Aires.

**A:** E não saiu daqui.

**H:** Ele levantou vôo e caiu. Não se sabe até hoje porque e, aquilo na época, nossa, só como um trágico como um acidente de avião hoje, do mesmo jeito. Os corpos...

**A:** (interrupts) Caiu ali?

**H:** Caiu aqui ó, vamos ver que dá pra gente ver. Tá vendo aquele resto de casa ali ó? que é só uma parede de pé ali. Aqui ó, tá vendo ali?

**A:** Ah tô, tô.

**H:** Então, aqui do lado, entre meio essa parede dessa casa e aquela lá...

**A:** Aquela outra casa?

**H:** Aquela linha de mato ali, aqui do outro lado aí, o avião deu de bico daqui e enterrou no chão. Se você for cavoucar lá, você acha até hoje pedaços de avião.

**A:** Nossa senhora!

**H:** Então morreu todo mundo! E aí deu né, nos jornais da época. Pessoal de Friburgo tem muito guardado. E daí então, depois que acabou tudo operação de rescaldo, aquelas coisas, aí sobrou perna de um braço de outro, mão de um pé de outro, pedaço de corpo de um e pedaço de corpo do outro que nunca se conseguiu naquele tempo saber quem era, né.

**A:** Hum.

**H:** Aí então foram colocados tudo dentro de uma urna só, e foram sepultados aqui. Na verdade um cemitério como esse é um patrimônio...

**A:** (interrupts) É um patrimônio histórico, isso aqui deveria ter, ser mantido muito melhor. A prefeitura de Campinas também deveria dar...

**H:** (interrupts) Mas não, não se interessa. Nos já procuramos, a gente não consegue cuidar mais disso exatamente por causa disso. Você não, o pessoal só rouba não... não tem como você, né. Então é complicado e aí, a prefeitura não se interessa por isso, nem um pouco. Essa aqui é a parte onde eram sepultados as crianças, as crianças.