People's Democratic Republic of Algeria
Ministry of Higher Education and Scientific Research
Ziane Achour University of Djelfa
Faculty of natural and Life sciences
Department of Earth and Universe Sciences

Pedagogical handout
Course Handout To obtain:

University habilitation

Title:

CARTOGRAPHIC TECHNIQUES

Intended for first-year undergraduate students majoring in Geography and Regional Planning

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Program

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Stream	:	Geography and land use planning		
Semester	:	Common Core Semester 1		
Teaching unit	:	Core UE		
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Description of the Materials Used:

This course focuses on the visual representation of geographic spatial data, instructing Students on transforming intricate textual and statistical information into clear and precise maps and graphs for the analysis and communication of spatial phenomena. It employs mapping techniques with visual variables and map coding to present data in a scientific and systematic fashion.

This course is suitable for students in geography, land use planning, and spatial analysis.

The primary goals of the course:

- achieve proficiency in the reading and interpretation of both textual and statistical data.
- Transform this data into visual formats (graphs, maps).
- Utilize cartographic and graphic symbolism approaches to graphically express information.
- Select suitable methods to depict spatial phenomena.
- Conveying intricate knowledge efficiently and in a methodical and scientific way.

Skills acquired:

- Data analysis.
- Thematic cartography.
- Informational graphics and visual data display.
- Analyzing and deciphering maps.
- Scientific communication.

General Introduction

For a long time, generations of students, and then practitioners, continued to perceive geography – and, by extension, cartography – as simple descriptive disciplines, limited to the location of places, facts and phenomena. This reductive and largely stereotyped representation is largely explained by the inadequacies of the education system, which has not been able to highlight the operational and strategic dimension of these disciplines.

At the same time, cartographic production, its uses and its media distribution have experienced a remarkable expansion. Mastery of cartographic tools is now a major challenge in all fields related to the knowledge, analysis and management of territories. This considerable growth in mapping is based, on the one hand, on a growing awareness of its role as a decision-making tool, communication, analysis and simulation, and, on the other hand, on the rapid development of computer technologies. These have significantly expanded the scope of mapping and have, in theory, made map design accessible to a much wider audience.

However, a quality map must comply with fundamental requirements of scientific rigor, legibility and aesthetics, in accordance with the basic principles of graphic language. As a true mode of visual communication, cartography cannot be improvised: it is acquired through learning and reveals its full effectiveness only when it allows the reader a quick and clear understanding of spatial information. However, the generalization of computer tools and their apparent ease of use sometimes tend to obscure these essential principles, giving rise to a proliferation of approximate or even erroneous cartographic documents.

Finally, designing or learning to design a map implies keeping in mind an essential characteristic of the cartographic tool: it is based on a visual language whose rules, potentialities and limits are closely linked to the physiological and perceptual capacities of the human eye.

COURSE PART

I. MAPPING

General

The purpose of mapping is the design, preparation and production of maps. Its vocation is the representation of the world in a graphic and geometric form. In this way, it responds to a very old need of humanity, which is to preserve the memory of places and communication routes as well as their useful or hostile characteristics to human activity. Initially a strict description of the known Earth and the maritime or land routes travelled by the military and merchants, cartography has diversified over time. Thanks to its precision and efficiency, it has become, since the seventeenth century, an instrument of knowledge and power in the service of states and a means of predicting and planning man's action on the environment.

An exact science, of mathematical essence, cartography is also an art insofar as it requires the nuance and completion of the objectivity of the Earth's measurements by subjective interpretations. As a science, it is dependent on the progress of knowledge as well as on the progress of the instruments and methods of observation and evaluation of the phenomena which it is intended to represent. Its links are obvious with geography, but also with all the sciences that have to study the distribution of any fact concerning terrestrial space. As an art of expression, it is confronted, upstream, with the techniques of graphic realization and dissemination of thought.

Brief history

Cartography, which certainly preceded writing, began around the sixth and fifth centuries BC. and developed at the same time as geometry and military campaigns. Despite all the shortcomings of ancient cartography, it already contains all the basics of modern cartography: the sphericity of the Earth, projection systems, terrestrial coordinates, the measurement of latitudes and, less precisely, longitudes. Its essential character is that it is an overall cartography, aimed at giving a global image of the world then known or supposed, such as, for example, the figure of the globe of Crates around 150 BC.

In the Middle Ages, it was the Arabs who, as depositories of Ptolemy's ideas, produced great cartographic works. European cartography only experienced a revival from the fourteenth and fifteenth centuries, especially in Italy and Spain. Great navigators such as Christopher Columbus and Amerigo Vespucci greatly expanded geographical knowledge. Nevertheless, cartography is now the prerogative of mathematicians and astronomers.

From the seventeenth century onwards, the administration and military campaigns required increasingly accurate maps. At the instigation of Colbert, a complete cartography of the kingdom was carried out and in 1682 La Hire was able to present a general map of France to Louis XIV. Then, thanks to a new general triangulation, the Cassini established a map of France from 1748 to 1817 that would serve as a model for cartographers around the world for a century and a half.

Modern cartography has benefited above all from the progress of geophysics in the determination of the ellipsoid, but also from the technical improvement of measuring instruments, the systematic use of photography in graphic processing and the development of polychrome printing. From 1930 onwards, the use of aerial photography, then satellite remote sensing in field surveying, and finally the introduction of computer data processing and the automation of graphic operations marked the rise of a new era. The IGN, which replaced the army's geographical service in 1940, published a large number of other maps, maps of the world and maps of French-speaking states, to which it provided considerable technical assistance.

Cartographic knowledge of the world is far from being equally advanced throughout the Earth, at least at medium and large scales. Long based on essentially military or scientific needs, it is insufficient for the economic development of the planet. The hoped-for progress requires international collaboration, remote sensing and automation. This led to a gradual unification of methods and techniques, which gradually erased the originality of national cartographies.

Computer-aided mapping

The introduction of automatic mapping is the most remarkable and far-reaching event that has occurred in the development of mapping in recent decades. The design and production of the maps have been turned upside down. Operational since about 1960, automatic mapping is constantly being perfected with surprising speed, and its use is now common practice.

The purpose of computer graphics is to store information in the form of digitized files in order to be able to process it and automatically produce graphic documents of all kinds. Applied to cartography, computer graphics is computer-aided mapping (CAD). Geographic information systems (GIS) are being created almost everywhere with the aim of collecting, organizing, locating, analyzing and managing an ever-growing and up-to-date batch of mappable data. Computerization therefore affects the entire map production chain, from field surveys or remote sensing to outputs on conversational screens or on black or color printers. Digitization tables, statistical or matrix data processing, computer-controlled electronic plotters allow the rapid and high-quality execution of multiple products: test or control visualizations on screens, changes of scale or projection, the manufacture of printing types and even the creation of figures of a new type such as an morphoses or three-dimensional representations.

At present, the problems encountered by computer-aided cartography have less to do with the technical production of the maps than with the choice and cost of materials and especially with the collection and implementation of the data. The description of the space in digital mode in the databases, the organization and the creation of the cartographic image require the cartographer to be very familiar with the mapped themes. Freed from technical worries by the machine, the cartographer is no longer a simple draughtsman, but an operator capable of mastering the concepts and taxa of the discipline he is responsible for illustrating.

The location of the (x) and (y) figures is relatively easy thanks to automatic plotters; but the qualitative or quantitative data in (z) are far from being known for all points of the plane. The main source of documentation remains the field survey, which is necessarily discontinuous. Remote sensing is comprehensive, but it would only be of full value if, as few countries have done so far, the observations, real or calculated, were related to a grid whose grids were of the same dimensions as those of the elementary image units, or pixels, of satellite documents. Under these conditions, the representation of statistical maps is easier than that of concrete phenomena. Computers automatically plot the isarithm lines, and the task representation of administrative statistics presents little difficulty. But things became more complicated with the introduction of real geographical objects such as landforms, hydrography, buildings, communication routes, etc. However, the IGN has managed to automatically produce the 1:25,000 base map of France from

the 1:30,000 aerial photographs. And we are actively concerned with establishing GISs from various natural, geological, geomorphological, pedological, phytogeographical data, etc.

Yet, as attractive as it is, computer-aided mapping has its limitations. The storage and management of a GIS is often longer and more expensive than a traditional map. Natural phenomena, in particular, which are always complex and generally unique, are hardly repetitive, so that the profitability and advantages of automation are not always assured, even if the legibility and aesthetics of the maps are now affirmed. There is therefore still an honorable place for traditional cartography, particularly in the context of territorially limited works. On the other hand, the call up on a cathode ray screen of documents that can be completed, corrected, modified, extracted and reproduced by the printing press or transmitted by telematic technology offers new perspectives. This opens up a certain path to a certain cartography of research and communication, which, along with the coupling of data banks, remote sensing and computer processing, is perhaps the most original way of cartography in the computer age.

I. DEFINITIONS ET CONCEPTS

1. The map

The map is a tool for communication through images insofar as the designer has been able to take into account the laws of visual perception, the separating power of the eye, color contrasts, and the typographical rules concerning writing.

A very old object, more or less complex, with multiple facets and uses, it is not possible to give a single definition of the map. All the maps have one thing in common, however, that of representing a portion of the Earth's space. Let us remember two definitions of the map:

According to F. Joly, "a map is a geometric, flat, simplified and conventional representation of all or part of the earth's surface, and this in a relationship of suitable similarity that is called a scale".

The map is a reduced, flat drawing of the World or a portion of the World. It can also be a representation on a geographical map background, of any concrete or abstract phenomenon. This representation is made on paper or on another medium such as glass, wood or a computer screen. A map is designed by hand or by a machine. The distances on the map are always in the same ratio as on the ground.

From these definitions emerge five main principles, the practical consequences of which guide or should guide the work of any cartographer, professional or not.

The map is a representation, a drawing: the map is therefore a visual document. This explains why the design and production of a map must respect simple but rigorous rules, derived from the laws of visual perception.

The map is a plane representation: the map materializes the passage from the terrestrial sphere to a plane. This passage is carried out using the projection process. The projection requirement implies that no map is true to the actual shape of the earth's surface. In addition, depending on the projection chosen, the face of the projected territory will be very different. This constraint is only imperative in the context of mapping large areas of land (small-scale work).

The map is a reduced representation: a map is not intended to represent space in real size. On the contrary, the goal is to obtain a manageable document on which the field is represented according to a reduction ratio: the scale.

The map is a simplified representation: reduction imposes a series of graphic operations that are grouped under the generic name of generalization and which aim to choose the objects to be represented and to replace their forms observed in the field with conventional figures.

The map is a conventional representation: the cartographer uses a language, the cartographic language, which has its own grammar. Its knowledge makes it possible to transmit geographical information in the best possible way.

Just as the definition of cartography has given a glimpse of the two main branches of this discipline, the definition of the map differentiates between two main types of maps: on the one hand, basic maps (also called general maps or classic maps) resulting from mathematical cartography and on the other hand, special maps.

2. The elements that make up the map:

Whether it's a base map or a thematic map, it has five essential elements to understand it.

2.1. The Title

a) *Map Title*

Is the main element of a thematic map, it specifies the theme addressed, it insists the observer to read the map in more detail, the title is placed at the top and left of the map. The title is followed by the serial number; This number indicates the cut is part of a larger whole.

The names of the neighboring sheets are specified either in the margins of the cut, or even in the corners, or in the form of a table. You can get an idea of all the cuts at the different scales by consulting the assembly tables.

Also mandatory, the title exposes the content of the card in as few words as possible. The title must be immediately visible: often written in capital letters, you can also play with the weight and size of the letters.

In any case, it must always be brief and not in the form of a sentence with subject, verb and complement. It is unnecessary to include the words' "location" or "map of

because by definition a map locates and the reader is sensible enough to know that he is reading a map.

The choice of a title (often the cartographer's final act) is far from innocent. No software is capable, of course, of naming a card. It is up to the author to give it a neutral and sober turn or, conversely, to express a thought, an opinion.

b) *Documentary sources*

The origin of the document serving as the basis for the map must be cited. This indication is distinct from the title. It is confused with that of the author if the content is original.

When the cartographic background has been purely and simply reproduced, only its origin is indicated. If it has been redesigned, this indication is preceded by the words: " Fond (established by) ... according to ....

c) *Origin of the information presented:*

It is also essential to provide the origin (name of the author, date, etc.) of the information reported on the map when it does not come from the Service.

2.2. The cartographic legend

All graphic variations (symbols, code letters, raster's, line variations, etc.) used on a map must be explained by a legend. A logical order should be adopted for its writing, possibly a table presentation. This legend must be found on each document, even when it is part of a series using the same graphic signs, so that each card can be extracted from its series or file without any problems of comprehension.

2.3. Orientation

The north direction is preferably located towards the top of the map. It may, for ease of layout, not coincide with the vertical axis of the sheet, but it must tend to make a minimum angle with it.

As an exception, the orientation of certain maps, whose north is not directed towards the top of the document, may be respected, if this allows the horizontality of the writings to be preserved.

Note: As much as possible, we should try to give the same orientation to maps of different origin and orientation when they appear in the same document (e.g. end-of-study thesis).

The direction of North is always indicated by an arrow, as simple as possible, preferably placed in the upper half of the sheet.

2.4. The Scale

Each map must bear the indication of its actual scale. This may be different from the original scale of the map used as a cartographic background. The actual scale of the map is indicated graphically, i.e. by a graduated scale bar, with indications of equivalent lengths on the ground. This scale bar makes it possible, despite the enlargements or reductions made during reproductions, to keep an exact indication of the scale ratio.

The scale bar is preferably placed in the lower third of the map.

Note: The scale bar can be used to facilitate photographic reductions or enlargements to a given scale: the photographer is told the length to which it must be reduced after printing to match the desired scale.

2.5. The setting

It served by "wedging" the map, to better balance the overall composition of the document. In particular, it can help a card that is too small to better occupy the available surface area of the media. In principle, the frame is the limit of the representation, and the drawing of the cartographic background must be extended to it, beyond the area of interest. It is therefore preferable to frame tightly on the latter.

The frame must be drawn very simply, with a strong line or a double thin line. Its orthogonality is verified by the diagonals.

II. THE CONSTRUCTION OF CARTOGRAPHIC LANGUAGE

Before embarking on this study, a few general remarks are in order.

For a graphic message to be as effective as possible, it is essential that each phenomenon on the card is easily differentiated by an original symbolism.

If the study of a symbol necessarily involves the application of the rules of graphic language, it must also take into account its relational value with other signs.

The best sign will always be the one that all users interpret in the same way without having to refer to the legend. Consequently, reduce to a minimum the number of conventions prior to reading the map, i.e. the legend.

II.1. Variable Implementation Mode

The geometric descriptors of the objects to which the variables apply are limited to three.

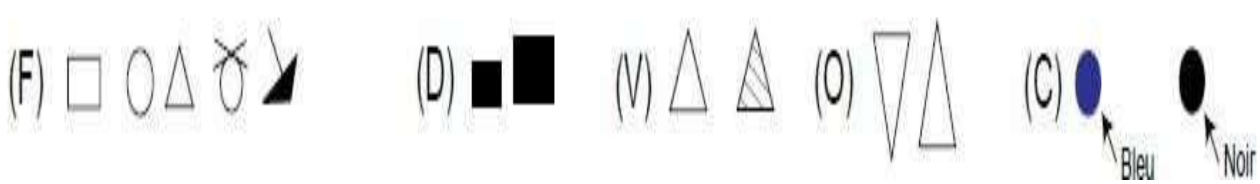
- ***The Update***

It is an abstraction, a place of the plane without surface. To be visible, it will necessarily have a certain purely conventional hold, and only its center will have a positional significance.

This is the element of "fixity" par excellence, but also of isolation. The point remains without a graphic relationship, either with the surface that supports it, or with its congeners. The meaning that will be attributed to it concerns him alone.

These original characteristics allow it to express unambiguously a notion of quantity in a given place by playing on size.

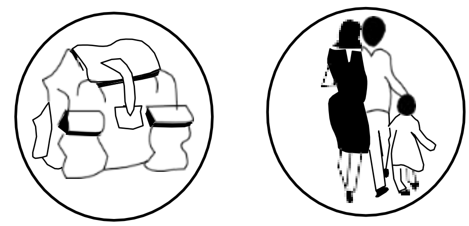
In cartography, any compact, isolated, and small-scale graphic design is considered a one-time design. The visual variables are applied to it:



The one-off symbolism can be **figurative**, **evocative** or purely **conventional**

The figurative symbol

More or less stylized, it will occupy a large enough surface capable of translating enough details to make the subject recognizable (representation of monuments on a medium-scale tourist map for example).

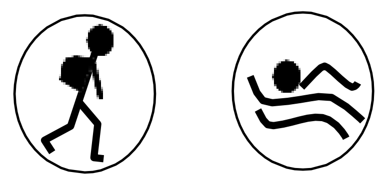


The consequences: easy identification, but a large footprint and an approximate location that will limit its use.

The evocative symbol

This is the ideogram. It has the advantage of simplicity, so it is less cumbersome and highly suggestive. This is the most effective solution because it avoids the reader having to refer to the legend.

However, it should be remembered that any graphic image conveys, for each reader, certain personal connotations that the designer may not have suspected.

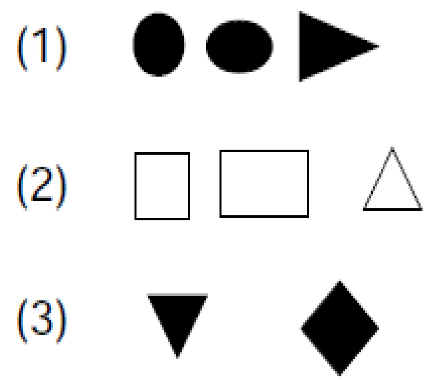


It is therefore necessary to make sure beforehand that the symbol has the same meaning for everyone, and to do this, test it on different readers, taking into account the national cultural context.

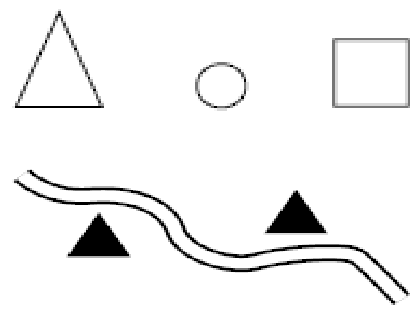
The conventional symbol

It is a figuration of some kind to which an arbitrary meaning is attributed. This type of representation has

The advantage of being able to apply to any concept but always forces you to refer to the legend.

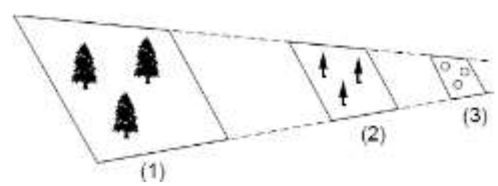


- Play with the simplicity of the forms, preferably geometric, easily memorable and which will not engage the reader in vain semiological speculations.
- Consider the fundamental properties of geometric shapes:
- The movement is translated by the circle or by the oriented asymmetrical triangle (assimilated to the arrow). (1)
- Stability through based, posed shapes (2)
- Instability by acute forms balanced on a point (3). Respect for these properties is not imperative; they are only one criterion of choice among others.



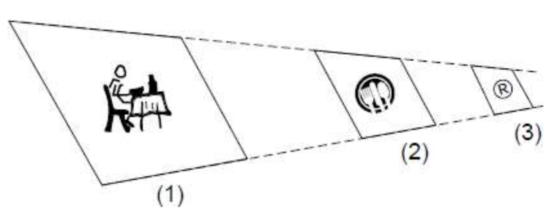
Ensure that the symbol (size and shape) is compatible with all objects that may be juxtaposed (inconsistent alignment of small circles, medium squares and large triangles) or contiguity (placement of triangles on a road network)

Think about the possible disorientation of the symbol during its topographical placement, its meaning should not be altered.



The 3 states of the graphics:

1) *Figurative,*
2) *Evocative*
3) *Conventional*



- ***The line***

A place in the plane that can be the boundary between two surfaces or the trace of a specific element of a network. On the map, the linear elements are many and varied, but regardless of the size of the symbol, only the axis of the visible task has a positional meaning.

- Straight lines are easily assimilated to human creations, while sinuous lines are generally similar to natural phenomena.
- Discontinuous lines may simply signify the temporary interruption of the phenomenon, be more random than its continuous counterpart (irregularly maintained road), or apply to abstract themes (administrative boundaries).

It is essential to always ensure a good differentiation between the families of linear objects, which are often numerous on a map.

- ***The area***

It is a part of the plan that may or may not be limited by a closed line (semiological speaking).

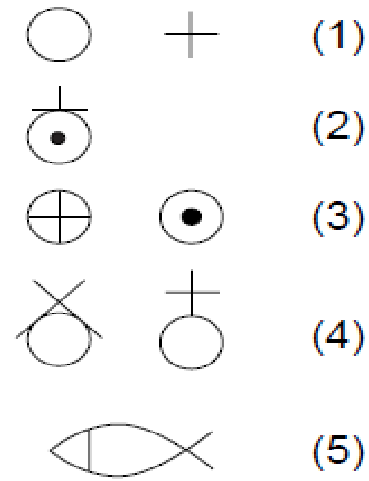
As already mentioned about the form, an area can be "hollow" or full, in the first case the space remains available to introduce the graphic of one's choice, in the other case it is the surface that signifies the area.

The two figures can coexist when the task is also limited by the line. This redundancy has the effect of emphasizing it at the expense of overall readability if the map contains other linear objects, which is often the case. It will therefore be preferable to dispense with the inclusion of zone boundaries if they do not have any particular meaning.

The area will have a given shape, dimension, orientation that characterizes it

The variables will apply to all points on the surface as homogeneous colors (flat tint or or of unitary elements (texture) arranged in different ways (structure).

- ***Graphic texture***



It is the shape of the unitary graphic element whose repetition will cover the area. The constitution of these elements will be:

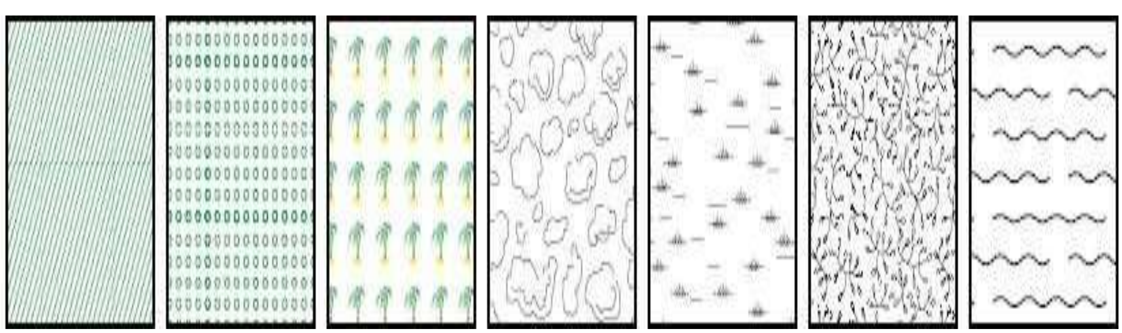
• <u>*Simple Texture:*</u> Elemental Form (1)

• <u>*Complex texture:*</u> resulting from the arrangement of elementary constituents by: Intersection (2), superposition (3), juxtaposition (4) of the creation of a shape original (5).

Depending on whether the dimension of the unitary element is greater or lower than the threshold of perception, a distinction will be made between:

• <u>*Apparent texture:*</u> called "cliché" in cartographic jargon, whose shapes are identifiable (sometimes evocative) and vary infinitely (6). Their singularity allows them to be given a particular meaning (cliché of "small circles" = orchard, "small fish" = fishing area, for example).

(6)

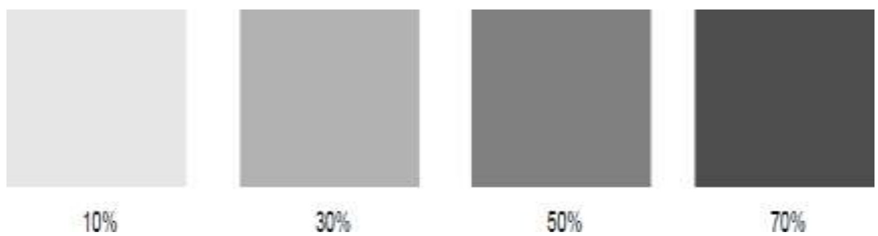


- *A non-visible texture called a "weft"*

The size of the unit element will not be visible or too small for the texture to be meaningful.

Since imperceptible, the shape of a raster texture will generally remain simple, point or line.

Tonal differentiation is achieved by varying the density and/or (slightly) the size of the unitary



element, which will produce a value effect.

- *Graphic structure*

It is the organization of the unitary elements among themselves.

- Random or irregular structure

The layout does not obey any simple geometrical law (7).

- Geometric structure

The elements are organized according to a predictable periodicity characterized by:

- Orientation (8)
- One step: the interval between the center or axis of the elements (9) measured in number of lines per inch (lpi)1 or dots per inch (dpi)2.

- Homogeneous structure (10)

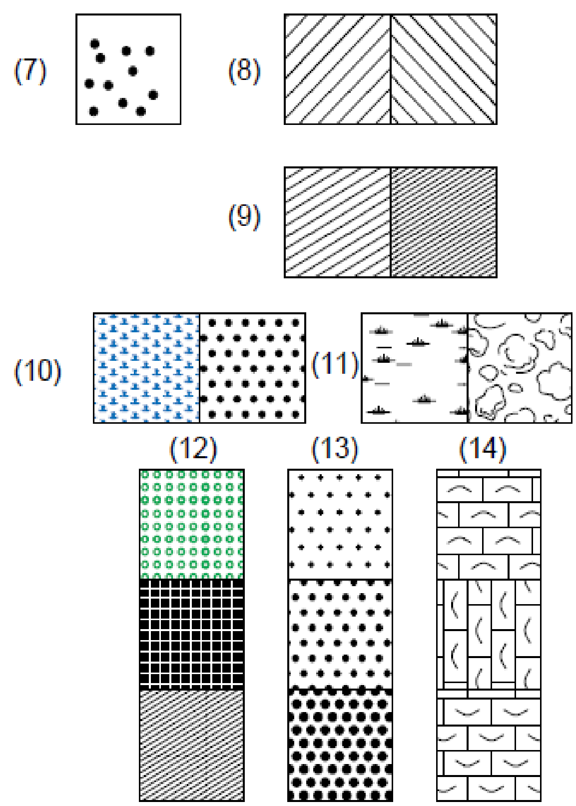
Consisting of graphic elements of identical texture.

- Heterogeneous Structure (11)

Made up of elements of different textures.

Some zonal applications of visual variables:

shape (12), dimension (13), orientation (14).



III. GRAPHIC SEMINIOLOGY

The semiological approach must allow a correct transmission of information and lead to the creation of

a cartographic image that is easily accessible to the reader.

It is based on the rules of construction of symbolism, it is semiology (the study of signs and their meaning), it is also based on a codified use of scriptures and on general aesthetic principles.

III.1. Concepts of graphic language

Before approaching the study of graphic tools, it is necessary to analyze both the approach of the cartographer and the

That of the reader.

a) Symbolism and meaning:

Every practice is meaningful. Each graphic element will always have a meaning, either because you have knowingly made it the medium of your message, or by its mere presence which will force the reader to interpret the sign, even if no particular meaning has been attributed to it by its creator.

So, to prevent the reader from letting his imagination wander at random with uncertain graphic information, remember that **no symbolism is "insignificant",** banish both ambiguous signs as well as irrational filling under the pretext that "it looks pretty in the painting". However, the above caution should not annihilate your creativity.

b) Meaning and Difference:

For there to be a meaning, that is to say matter to be understood, the difference must exist.

The geometric and topological descriptors of objects are based on duality, just as the symbolism attributed to these objects will only have value in duality: Wide or narrow lines, small or large size, dark or light color, warm or cold...

c) Semiology and Levels

In the field of graphic symbolism, the term "level" can be attributed two distinct meanings:

- ***The levels:*** that is to say the successive physically expressed levels that extend between the two extremes of a phenomenon and the graphics that are attached to it. From wide to thin lines or from white to black, there is the graduation of intermediate levels that will translate all the nuances of the difference and modulate its meaning.
- ***The levels:*** characterize, strictly speaking, the relative importance that we want to attribute to the phenomena between them.

d) Meaning and Under standing

Only the user's method of perception will make it possible to enlighten the designer's choices. This approach has a double aspect:

On the one hand, since it is not possible to completely dissociate the content from the form (since the content is expressed through the form and only the latter is immediately perceptible), the user is led to decode the map by applying a recurrent approach that calls on his ability to interpret the proposed symbolism according to his knowledge.

- On the other hand, starting from the spatial context fixed by the symbolism and beyond the initial reading, the reader will then discover the spatial relations, the interactions induced by the juxtaposition of phenomena (content and form combined) and this interpretation in the second degree.

  Example: Why translate the two zones delimiting the noise pollution levels of an airport by two incoherent symbols? The weakest level by a level of gray value and the strongest by superimposing a "grassy" cliché on it? The reader will have some reason to be perplexed about the purpose of this incongruous (unsuitable) plant carpet!

The difficulties between signifier and signified mentioned above, inherent in any form of visual communication, will already be mitigated if the reader enters the graphic space without his knowledge. To achieve this, the cartographer must, throughout the process of developing the product, refer to this principle:

"It is not up to the user to make the effort to understand, it is up to the designer, since he is at the origin of the approach, to make the necessary creative effort in order to convey a clear message rather than a cartographic rebus."

III.2. The constitution of cartographic language

A geographical object is first defined by its position, its location (X, Y) in the plane, proof of its existence, but not of its presence.

Its materiality is only made possible through a graphic design, i.e. a visible "task", whether it's a simple dot or a symbol.

This graphic design has fundamental characteristics that are called "visual variables" (Bertin) and which are 7 in number.

In addition, each visual variable has a "length," which is the number of distinct, non-identical elements that

We can create from this variable and that are recognizable within a complex image.

Visual variables

Some basic rules of graphic representation

1. Implementation* of information

The current supports are two-dimensional (sheet of paper, screen, etc.) On one surface: **3 types of layouts**

1.1. Occasional implementation

1.2. Linear layout

1.3. Implantation zonal

Not to be confused:

- **location** => **graphic notion**
- **location** => **geographical concept**

2. Data: statistical variables

2.1. Qualitative data*

- nominal scales*

- ordinal scales*

2.2. Quantitative data*

- **ratio scale*** (%, ratio)

- **interval scale***, where 3 modes of collection characterize the data:

- **counting** (discrete data, where zero means no values);

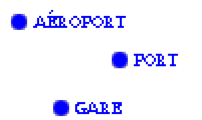
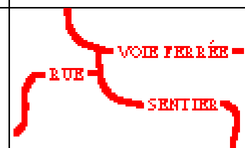
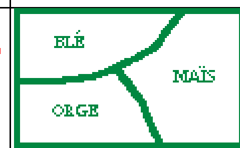
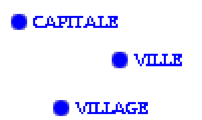
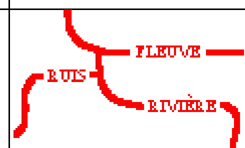
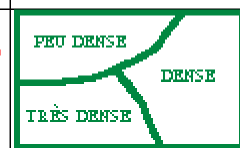
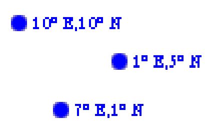
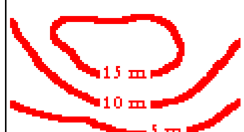
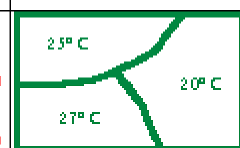
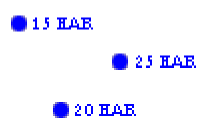
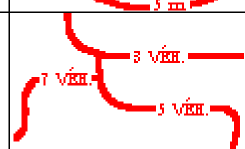
- **measurement** (continuous data, where zero also means no values);

- **Identification** (discrete or continuous data, where zero is a value (temperatures or altitudes for example)

3a. Data: organization and perception

<table>
<tr><td>Nature of the data</td><td colspan="3">------ Qualitative ------</td><td colspan="3">------ Quantitative -----</td></tr>
<tr><td>Scales</td><td colspan="2">nominal</td><td>ordinals</td><td>reports</td><td colspan="2">intervals</td></tr>
<tr><td>Types of data</td><td colspan="2">lists, categories, ...</td><td>chronologies, hierarchies, ...</td><td>Ratios and percentages</td><td>spotted</td><td>counted, measured</td></tr>
<tr><td>Concepts mobilized</td><td colspan="2">Association</td><td colspan="3">Order</td><td>Proportionality</td></tr>
<tr><td>Data Relationships</td><td>This is different</td><td>This is similar</td><td colspan="3">- that, as far as, + that</td><td>x times + or - than</td></tr>
<tr><td>Perceptual attitude</td><td>Differentiation</td><td>Association</td><td colspan="3">Relative Hierarchy</td><td>Absolute Prioritization</td></tr>
<tr><td>Visual variants used as a priority</td><td colspan="2">Color, Orientation, Shape, Grain</td><td colspan="3">Value</td><td>Size</td></tr>
</table>

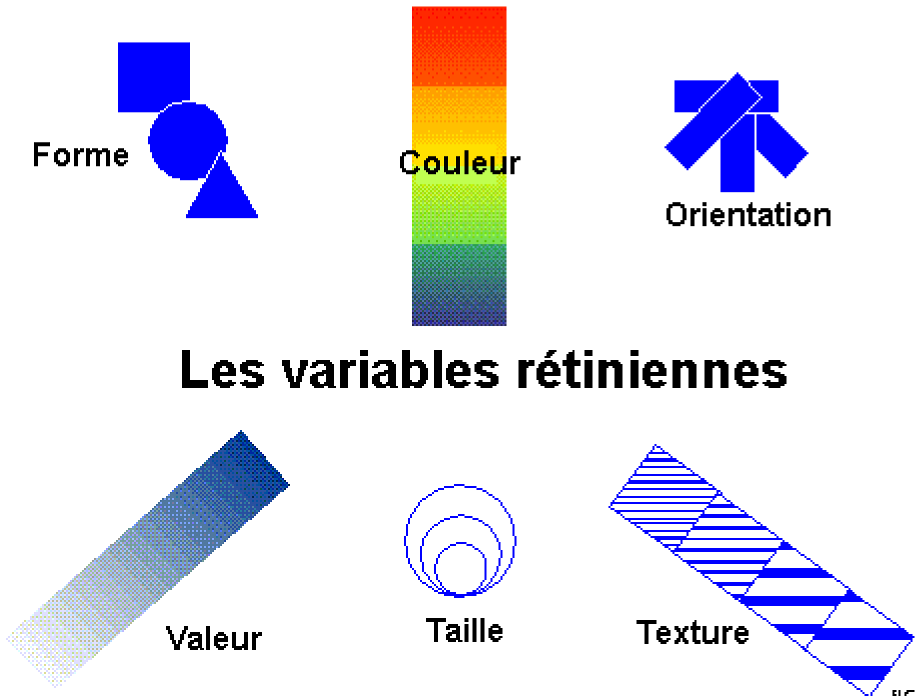
3b. Data: organization and perception (UQAM style)

<table>
<tr><td colspan="2">Statistical characteristics</td><td colspan="3">Geographical location</td></tr>
<tr><td>Nature of the data</td><td>Scales</td><td>Point</td><td>Linear</td><td>Zonal</td></tr>
<tr><td>Qualitative</td><td>Nominal</td><td>
</td><td>
</td><td>
</td></tr>
<tr><td></td><td>Ordinal</td><td>
</td><td>
</td><td>
</td></tr>
<tr><td rowspan="2">Quantitative</td><td>Interval</td><td>
</td><td>
</td><td>
</td></tr>
<tr><td>Report</td><td>
</td><td>
</td><td>
</td></tr>
</table>

4. Visual variables: the semiological code*

There are six visual variables.

fig. 0 - Visual (or retinal) variables

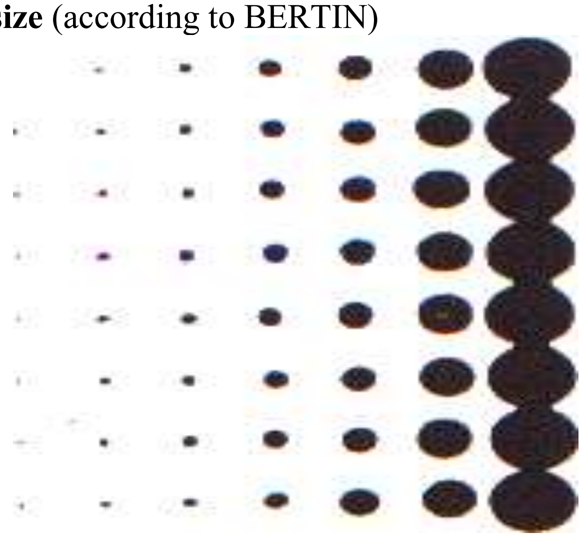


4.1. Size (or variation in height, area, volume, etc., of the figure)

Only for **counted or measured quantitative data**

=> reflects proportionality

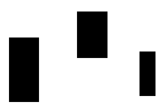
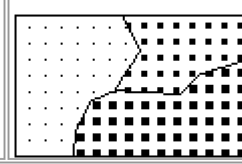
fig. 1a - The visual variable size (according to BERTIN)



The visual variable **size** mobilizes all the concepts, it is:

1. Proportional
2. Ordinate
3. Associative (or selective)

tab. 1 - The visual variable size (according to UQAM)

Point	**Linear**	**Zonal**
		

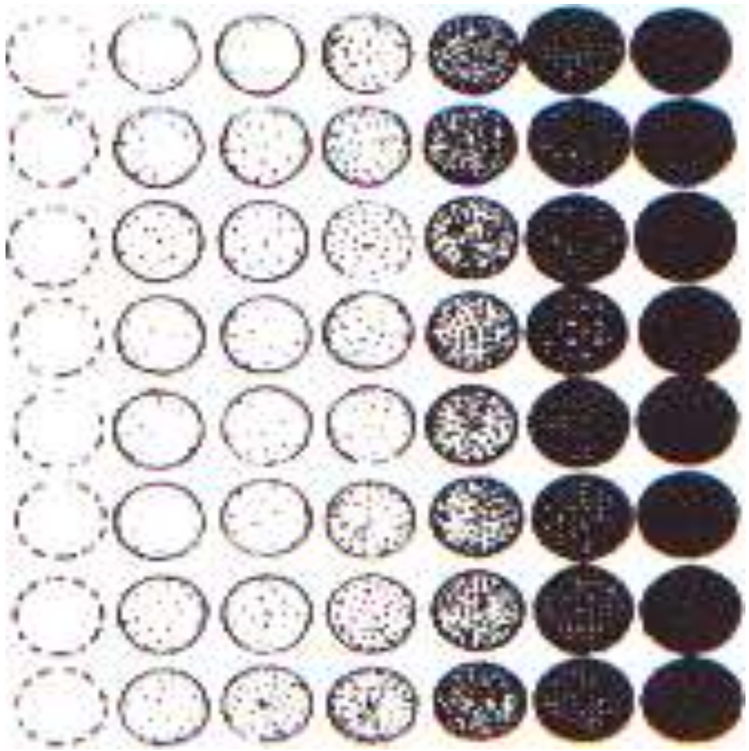
Note: The notion of anamorphisms refers to a modification of geometry. It is not a retinal variable!

4.2. Value (or variation in the ratio of black to white)

For quantitative reported and interval data identified and qualitative ordered data

=> translates the order

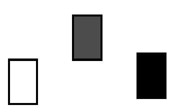
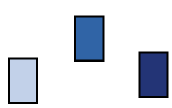
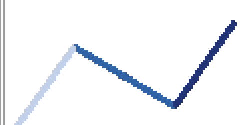
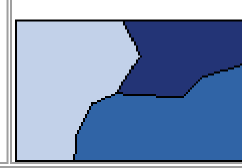
fig. 2 - The visual variable value (according to BERTIN)



The visual variable **value** mobilizes two concepts, it is:

1. Ordinate
2. Associative (or selective)

Table 2 - The visual variable value (according to UQAM)

-	Point	Linear	Zonal
B&W			
Color			

4.3. The grain (variation of the texture in the same ratio from black to white)

Controversial visual variable

- For some authors (BERTIN 1973, BONIN 1983), it is:

Intended for **quantitative data of reports and identified intervals and ordered qualitative data**

=> translates the order

The visual variable **grain** mobilizes two concepts, it is:

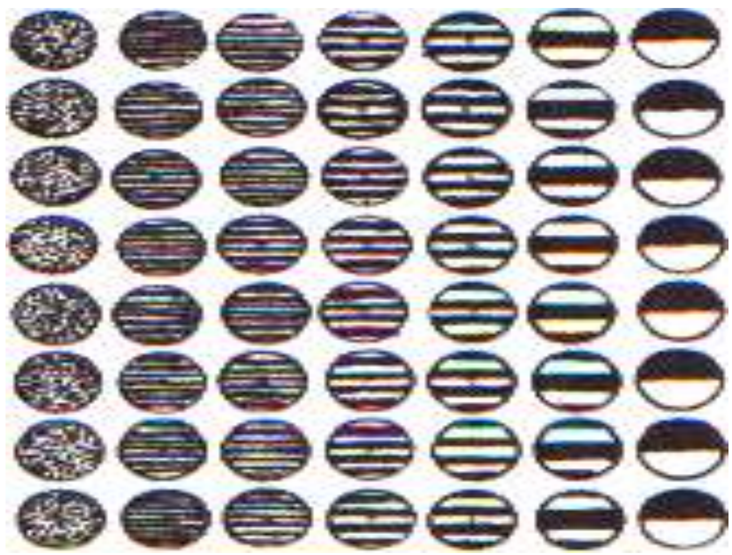
1. Ordinate
2. Associative (or selective)

- For other authors (BEGUIN and PUMAIN 1994), it is:

Intended for **nominal qualitative data**

=> translates the association

fig. 3.1 - The visual variable grain (according to BERTIN)



The visual variable **grain** uses only one concept, it is:

1. Associative (or selective)

tab. 3 - The visual variable grain (according to UQAM)

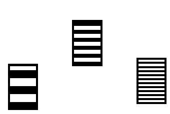
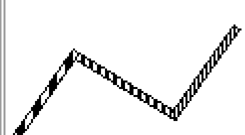
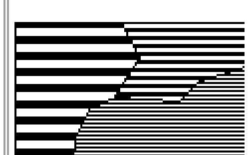
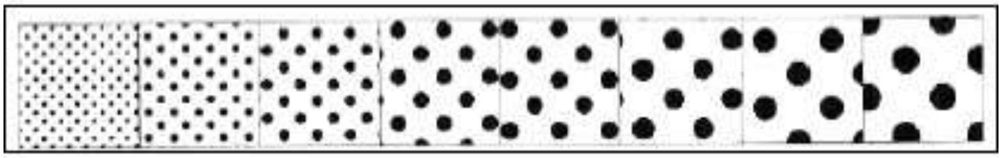
Point	Linear	Zonal
		

fig. 3.1bis - The visual variable grain (according to Lætitia Perrier Truslé & Anne Hecker)

Variation de grain dans une structure trait



Variation de grain dans une structure point

In practice:

- it is little used

The variation in grain is:

○ difficult to achieve:

• Few apps offer it.

○ Difficult to master:

• how the reader perceives it

but it nevertheless possesses

- Strong **selectivity**

=> Contrast a fine-grained screen with a coarse-grained screen

- a transparency effect that makes layering possible

=> through the "blanks" of the top frame

4.4. Color (or variation in hue)

Highly selective visual variable

Intended for **nominal qualitative data**

=> translates the association

The visual variable **color** mobilizes only one concept, it is:

1. Associative (or selective)

- The colors we perceive are a function of light

- If you observe a **blue object** under **orange lighting**

we see him **black** (or we don't see him!)

- Because it has no blue radiation to reflect

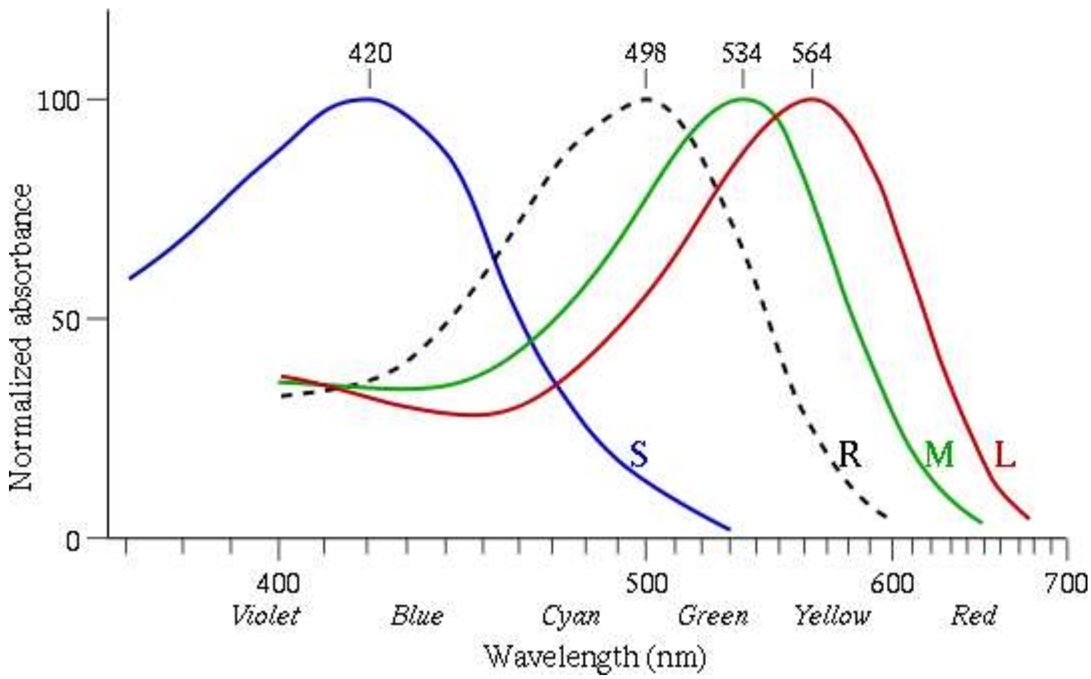
- In general, we talk about colors under a white light

- How do you see colors?

Our retina has 3 types of cones made up of different pigments:

- blue-sensitive S-cones (maximum sensitivity centered at 420 nm);
- green-sensitive M-cones (maximum sensitivity centered at 534 nm);
- red-sensitive L-cones (maximum sensitivity centered at 564 nm).

fig. 3.2 - The response (*absorbance*) of the cones



The rods provide vision in low light.

Like cones, they are **light-sensitive cells** in the retina. Their

role (cones and sticks), to transform:

the **electromagnetic** signal* (light) into a **bioelectrical signal** (nerve impulses)

When we have these 3 types of cones, we are trichromat.

Otherwise, we are: **colorblind!**

Color blindness => have abnormal dichromate or trichromacy

Currently, a lot of work is being done on color perception, such as color blindness. The objective is to produce maps that will be understandable by all.

See among others:

- The color of an object is a function of how it reflects light in the different wavelengths of the visible

How is color constituted?

4.4.1. Electromagnetic spectrum*

fig. 4 - The visible in the electromagnetic spectrum

Decomposition of white light through a prism

=> rainbow

There are two modes of color synthesis:

- **additive synthesis***

- **subtractive synthesis***

4.4.2. Additive synthesis

Radiation summation

=> computer screen, television screen (in the days of cathode ray tubes!)

The principle:

- The **color image on the screen** is obtained by:

- an electron bombardment on a surface of photosensitive particles, the phosphors (equ. of "sub" pixels).

- It results in:

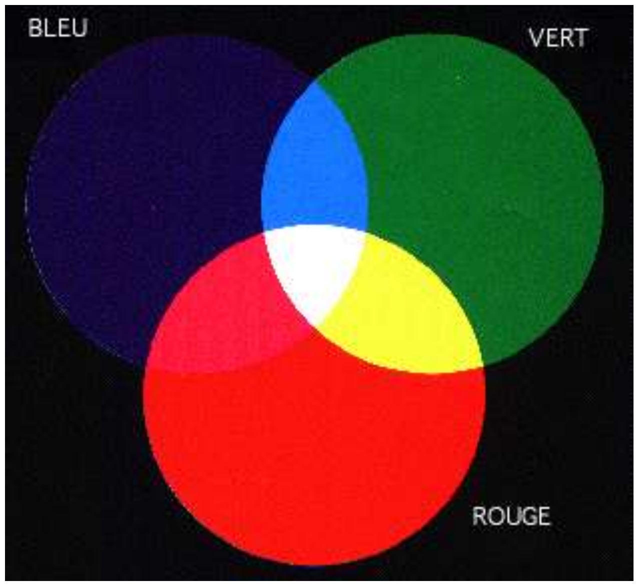
- a selective activation of three phosphors per pixel (one emits a red radiation, the other a green radiation, the third a blue radiation).

- The **resulting color** is an **additive synthesis** of this selective activation.

- The fundamental colors* (R system; V; B) are:

- Red
- Green
- Blue

fig. 5 - Additive synthesis



- Each fundamental color corresponds to a complementary color

Fundamentals	Complementary	Summary
Blue	Yellow	Blue + Yellow = White
Green	Magenta	Vert + Magenta = Blanc
Red	Cyan	Red + Cyan = White

The fundamental + complementary association = white

Because **the complementary is the association of the other two fundamental ones**

- Is it the process of photography or offset printing?

No, color photography is produced by subtracting colors from white light

this is the **subtractive synthesis**

4.4.3. Subtractive synthesis

Filter combination

=> computer printer, painter's palette

The principle:

We start with **white light** (which contains all the colors) and by **suppressing certain wavelengths you get the desired color**

- For **subtractive synthesis**,

The **base colors are pigments** (or dyes) = **the primary colors***

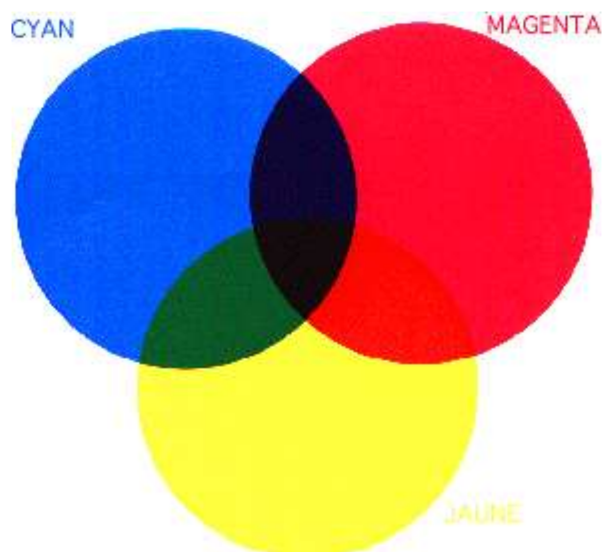
- **Primary colors** (system **C**; **M**; **J**) are:

- Cyan

- Magenta

- Yellow

fig. 6 - Subtractive synthesis



- **These pigments absorb certain wavelengths by subtracting them from white light**

Cyan absorbs red radiation

Magenta absorbs green radiation

Yellow absorbs blue radiation

Note that:

- these 3 dyes are the **complementary** colors of the 3 basic colors of additive synthesis

- when these 3 dyes are present at 100%:

- their mixture gives black;

- All white light is absorbed.

4.4.4. Color Wheel

Example of **subtractive synthesis**

Interest: cartographic printing

- Primary colors cannot be obtained by mixing others

- Secondary colors are obtained by mixing the primary colors equally with each other

Green = Yellow + Cyan

Blue = Cyan + Magenta

Red = Magenta + Yellow

Primary and secondary colors form the basis of bright, or pure, colors

- The **basic color wheel***:

- is a circle divided into 12 equal parts from

- the **3 primary colors** (Cyan, Magenta, Yellow) located at the top of an equilateral triangle inscribed in the circle;

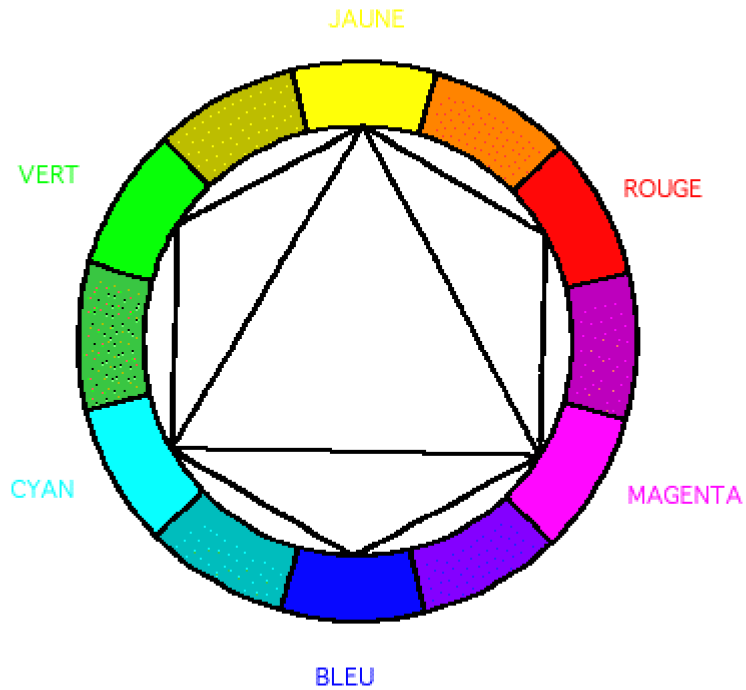
- completed by a hexagon, where, at the remaining vertices are **the secondary colors** (Red, Green, Blue)

- finally, in the remaining six places are the **tertiary colors**

These are achieved by mixing neighboring colors on the color wheel

The basic color wheel is therefore composed of 12 equidistant colors with a specific place

fig. 7 - The basic color wheel



- **Complementary colors are those that are diametrically opposed on the color wheel***
- 2 colors are complementary if their combination gives the **neutral color**
- subtractive synthesis = black >
- additive synthesis = white >

Magenta is complementary to Green

Blue is complementary to Yellow, etc.

- Similarly, each of the 3 primary colors has as a complementary color the mixture of the other two in equal quantities
- **used to determine color chords for mapping**

for **2, 3, 4** or **6** colors

- 2 colors => cold/warm opposition (complementary)

e.g. Green/Red

or Yellow / Blue

- 3 colors => to any vertices of an isosceles triangle

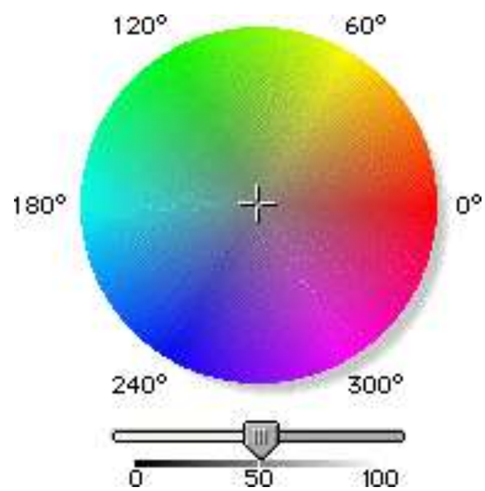
for example, opposition between three primary colors Magenta / Yellow / Cyan

- 4 colors => to any vertices of a square

- etc.

You have to help yourself with the different color wheels of software

fig. 8 - A color wheel in intensity, hue, saturation



In practice, the color:

- is widely used

- its **selectivity** is **high**

=> especially if we oppose:

- warm and cool colors

- fundamental or primary colors and their complements*

- Red and Cyan

- Blue and Yellow

- Green and Magenta

- Possesses a **strong evocative power**

- blue = > water

- green = > vegetation

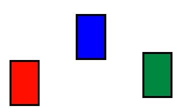
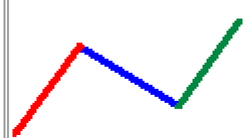
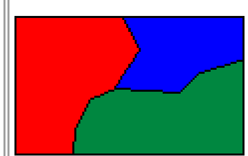
But,

- Do not confuse **tint and color**

=> a shade combines color + value

- The **color is not a variation from light to dark** like the value.

tab. 4 - The visual color variable (according to UQAM)

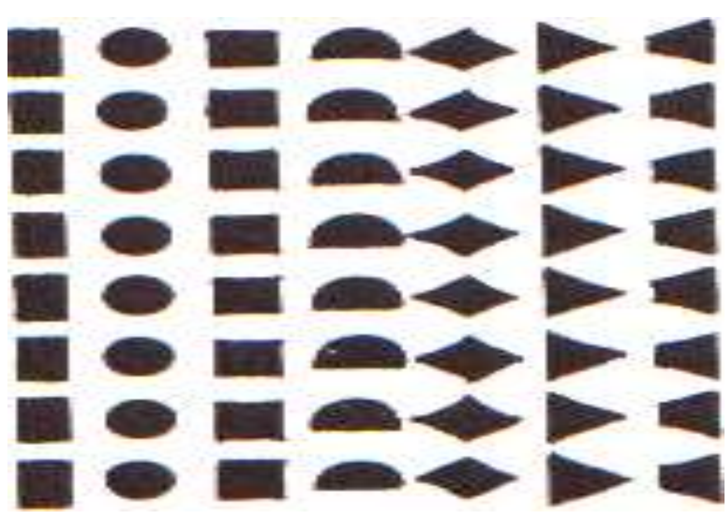
Point	**Linear**	**Zonal**
		

4.5. Form (or variation of the contours of the figure)

Intended for **nominal qualitative data**

=> translates the association

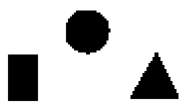
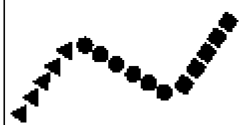
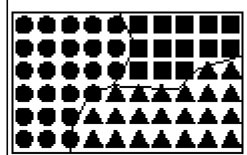
fig. 9 - The visual variable form (according to BERTIN)



The visual variable **form** mobilizes only one concept, it is:

1. Associative (or selective)

tab. 5 - The visual variable form (according to UQAM)

Point	**Linear**	**Zonal**
		

4.6. Orientation (or variation of angle)

Intended for **nominal qualitative data**

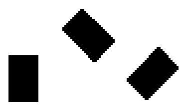
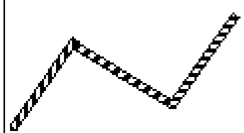
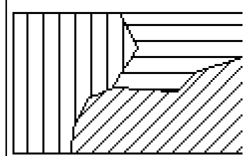
=> translates the association

fig. 10 - The visual variable, orientation (according to BERTIN)

The visual variable **orientation** uses only one concept, it is:

1. Associative (or selective)

Table 6 - The visual variable orientation (according to UQAM)

Point	**Linear**	**Zonal**
		

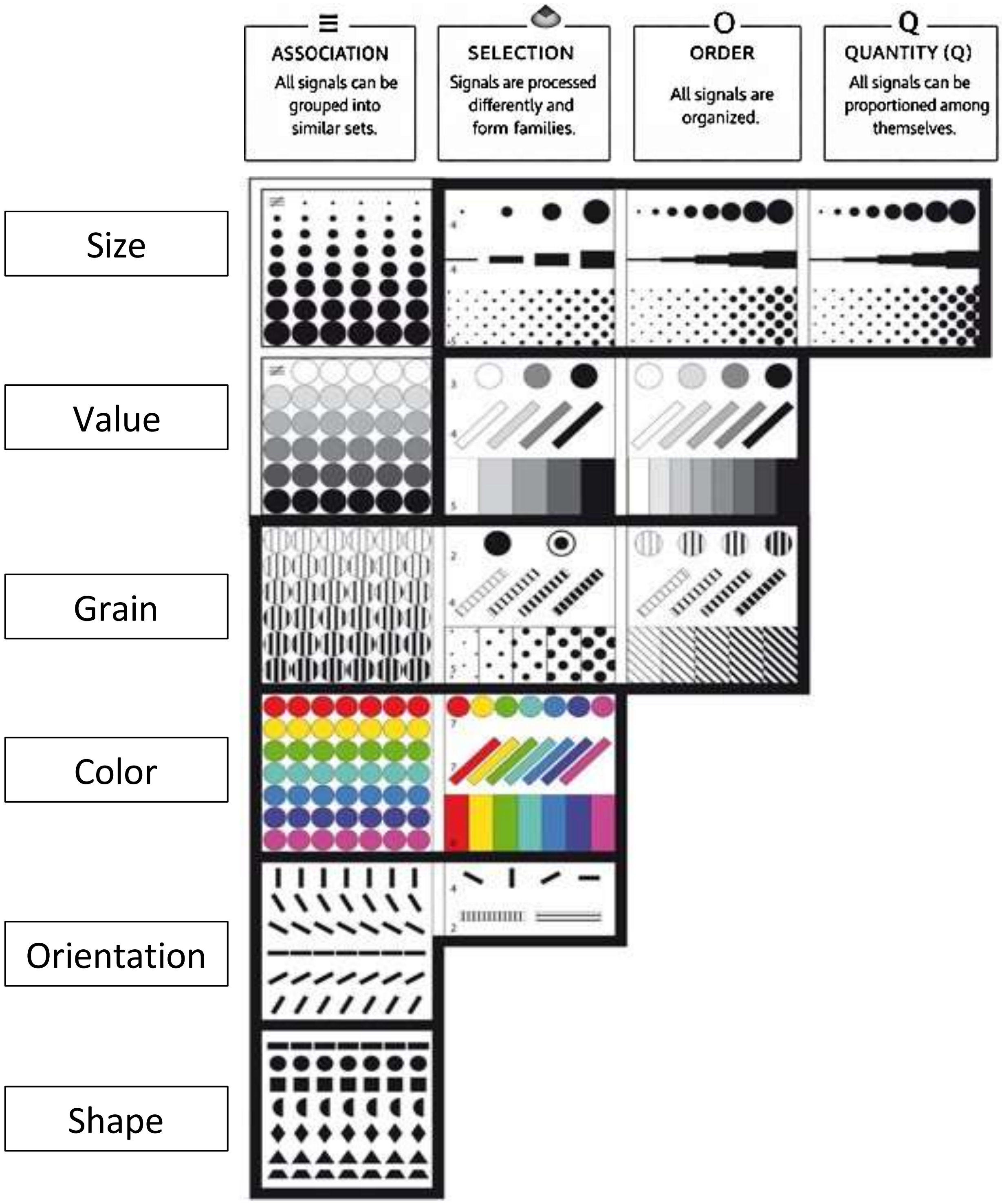
In summary:

	Organization Level		
Visual variables	*Association*	*Order*	*Proportionality*
Size	Has	**O**	**P**
Value	**Has**	**O**	
Grain	**Has**	**O**	
Color	**A**		
Shape	**A**		
Orientation	**A**		

fig. 11 - Summary of retinal variables

s by BERTIN

LEVEL OF RETINAL VARIABLES



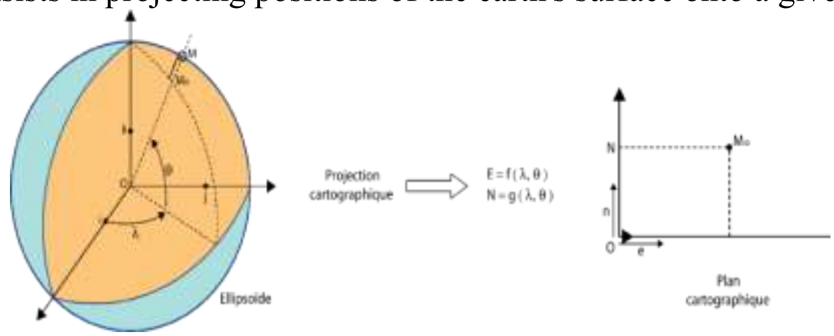
PRACTICAL PART

PRACTICAL WORK N° 01:

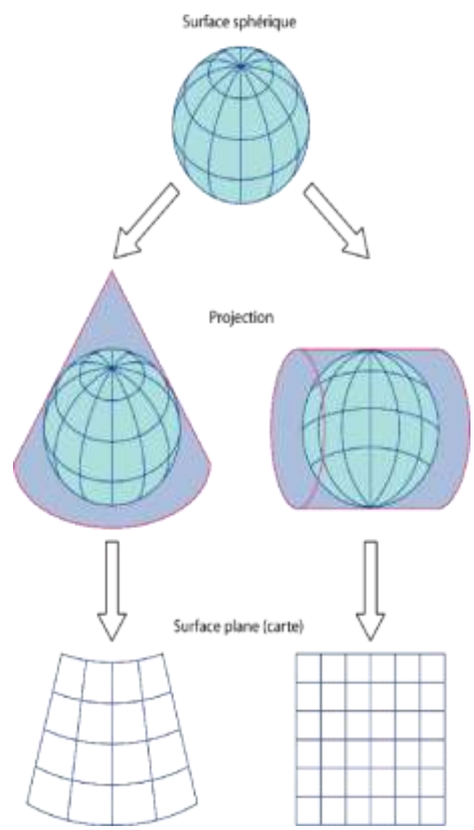
I. MAP PROJECTIONS

The principle of projection consists in projecting positions of the earth's surface onto a given geometric surface:

- A cylinder
- A cone
- Or a flat surface



Then this surface can be cut to take a flat shape (the map)



Types of Projections

1. Geometric figures can be tangent or intersecting to the ellipsoid.

(the average deformation is less for a secant projection as long as the position to be transferred is close to one of the two reference lines)

2. The choice of a projection system will be made in order to minimize alterations.

Adapt the type of projection according to:

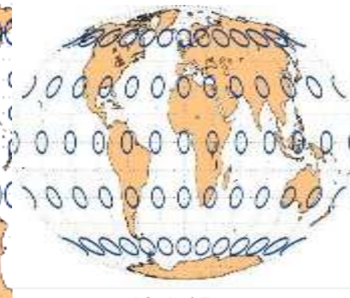
- The situation in the country
- The position on the surface of the globe
  (proximity to a pole, the equator)
- Extent of the country

• (small island or mainland country)

Alterations due to projections

The changes can be to surfaces or corners.

Indicatrices de Tissot
Projection cylindrique conforme de Mercator



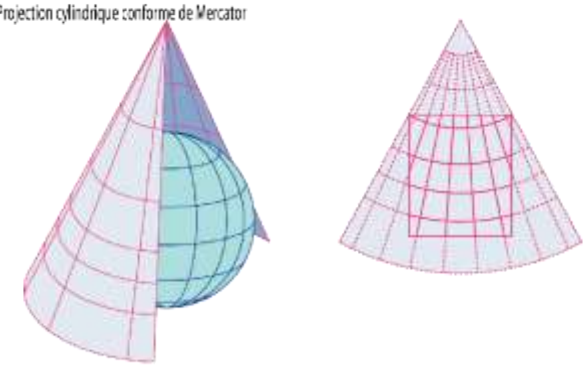
Indicatrices de Tissot
Projection de Mollweide

For UTM (Universal Transverse Mercator) or Lambert Conformal projections, the angles are constant, but the distances (and surfaces) vary = they are called conformal projections

For equivalent projections (e.g. Mollweide projection) the surface ratios are maintained while the angles and distances change.

Examples of projections

Conical Projection

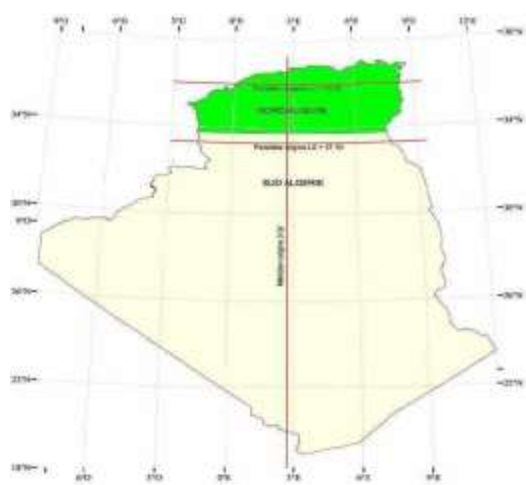


Principe de la projection conique Lambert

- Made from a conical shape
- with cone tangent (or secant) to the ellipsoid

As soon as the projection is applied, the coordinate system changes. A cartographic coordinate system (X, Y) with a given unit of length (m, km, mile or nautical miles) is then used.

La projection Lambert



The reference system used in Algeria is the projection

Which is a Lambert tangent conformal conic projection. In order to minimize deformations (linear alterations), Algeria has been divided into two zones:

- A projection called "Lambert North" which covers the north of Algeria
- A projection called "Lambert South" which covers the south of Algeria.

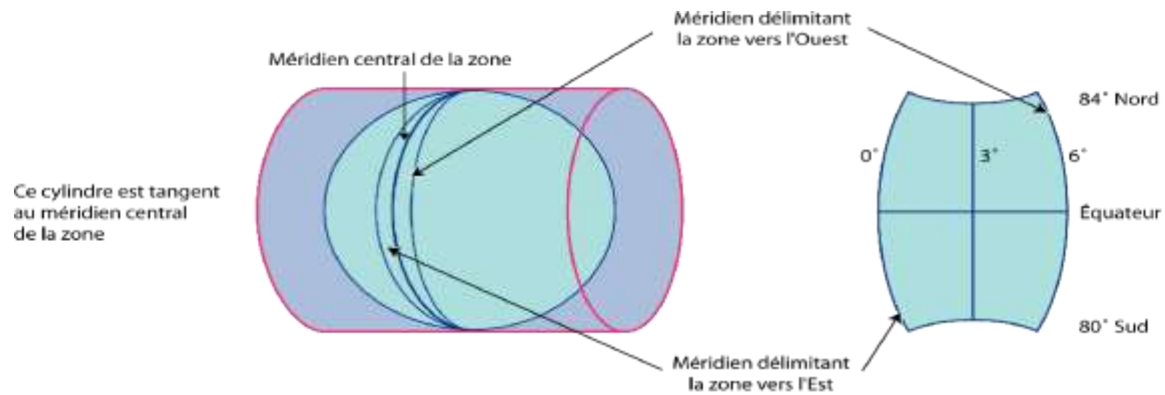
Cylindrical projections

• Made from a cylindrical shape

• tangent to the ellipsoid, a tangency that can be made on the equator or on a meridian.

• The transverse cylindrical projection (UTM projection used for example

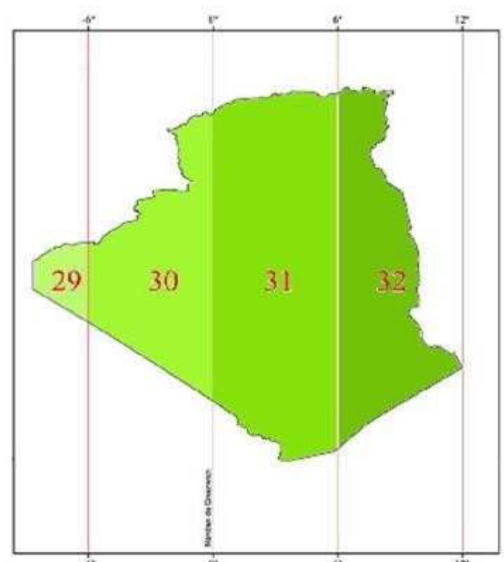
with GPS). Here the central meridian and the equator are transformed into two orthogonal lines, while the other meridians and parallels become curves orthogonal to each other.



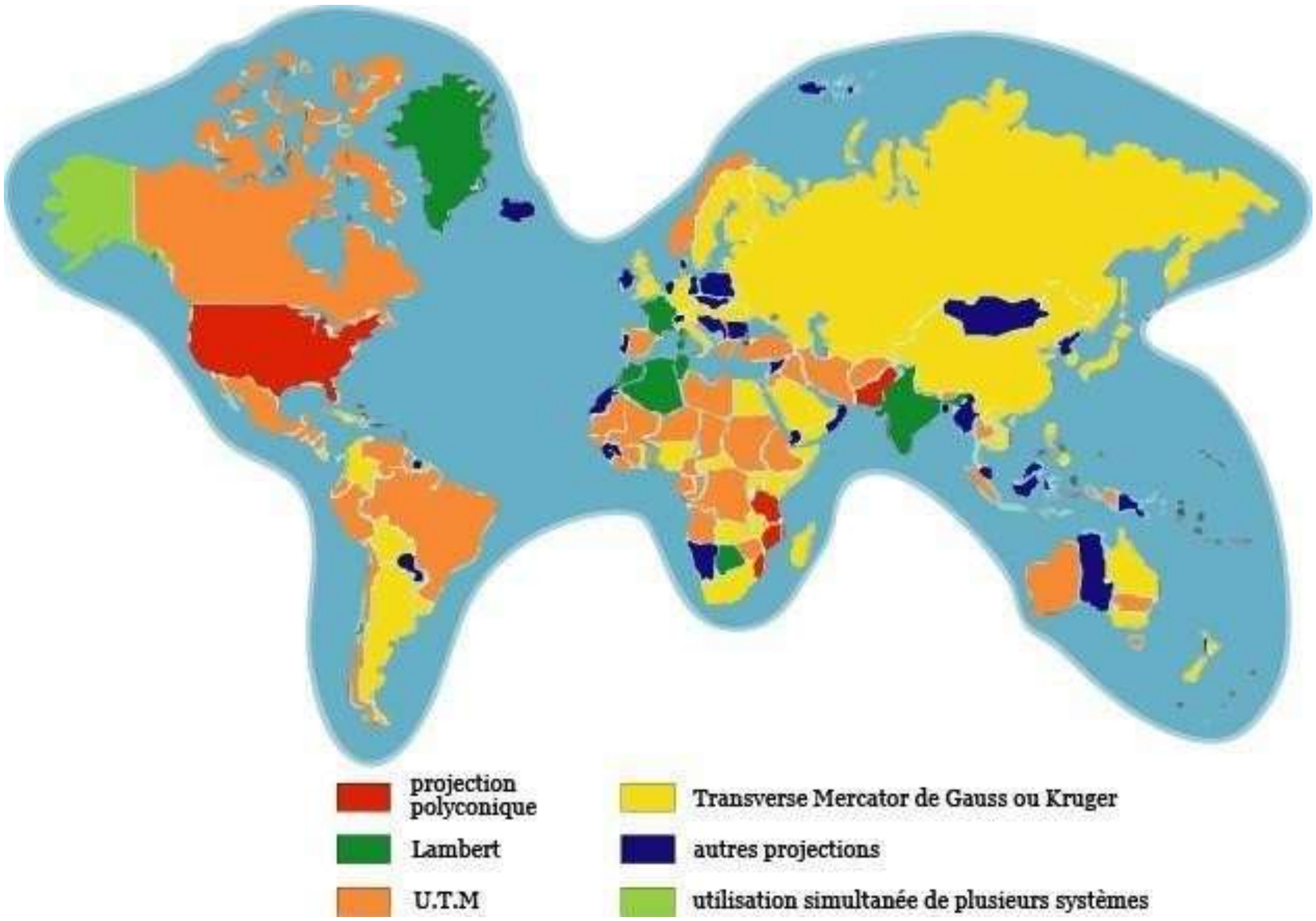
Principe de la projection cylindrique Universal Transverse Mercator (UTM)

La projection U.T.M.

The current flat cartographic representation adopted by Algeria in 2003 is the UTM (Universal Transverse Mercator). Algeria spreads from west to east over four zones: the 29th, 30th, 31st and 32nd, i.e. from 9° west of the prime meridian and 12° east of the prime meridian.



The main projection systems used in the world



II. ANGULAR CONVERSION:

Presentation of sexagesimal degrees

Sexagesimal degrees come in a form of a three-part value.

ddd° mm'

ss,dpi" Example 1:

209° 48' 07.4589"

- The first part ddd is the degree cipher and the value is between 0 and 180.
- The second part mm corresponds to the minutes and the value is between 0 and 59.
- Finally, the third part ss corresponds to the seconds and the value is between 0 and 59. The cipher that follows the decimal point is the expression of the decimals of seconds expressed in submultiples of 10 (tenths, hundredths, thousandths,).

The peculiarity is that the minutes and seconds rotate at 60, i.e. after 59 the upper level (degree or minutes) increments by 1.

Example 2: 183° 59' 45" + 1' = 184° 00' 45"

Transformation of sexagesimal degrees into grades

Transformation of sexagesimal degrees to decimal degrees

The transformation is done starting with seconds, then minutes.

First, we must transform the sexagesimal seconds into part of minutes in the decimal system. To do this, we must divide the seconds by 60 (sixty). Indeed:

60" équivalent à 1'

x" équivalent à y'

So be it

$$y' = \frac{x''.1'}{60''} = \frac{x''}{60}$$

The same procedure must be used to transform the minutes into a part of degrees. Example 3: Let be an angle A

= 125° 36' 18.456" D'où A = 125°36,3076'

$$\frac{36,3076'}{60} = 0,6051267°$$

$$\frac{18,456''}{60} = 0,3076'$$ Soit en degrés décimaux A = 125,6051267°

Transformation of decimal degrees into grades

The ratio is simple; a complete turn is 360 degrees or 400 gon.

D'ou

360°	équivalent à	400 gon
x°	équivalent à	y gon

$$y = \frac{x°}{360} \times 400 = \frac{x°}{\frac{360}{400}} = \frac{x°}{0,9}$$

Soit un coefficient de 0,9.

En poursuivant l'exemple :

$$A = \frac{125,6051267°}{0,9} = 139.5612519 \text{ gon}$$

In a round, there are more grades (400) than degrees (360), so it is normal that the result in rank is greater than the original value in degrees.

PRACTICAL WORK N° 02:

I. ANALYSIS OF GEOGRAPHICAL DATA

Following table showing some socio-demographic indicators of the municipalities of the Wilaya of Djelfa (ONS Algeria)

MUNICIPALITY	NATURE	Class	pop1987	POP1998	Rate_ Increase	Rang Population Estimated
AIN CHOUHADA	COMMUNE	RURAL	6580	8337	2.13	31
AIN EL IBEL	CHIEF TOWN OF DAIRA	RURAL	11225	20436	5.47	8
AIN FEKKA	COMMUNE	RURAL	10248	16842	4.52	11
AIN MAABED	COMMUNE	RURAL	10260	13183	2.25	27
AIN OUESSARA	CHIEF TOWN OF DAIRA	URBAN	46610	82597	5.22	2
AMOURA	COMMUNE	RURAL	3600	5879	4.46	29
BENHAR	COMMUNE	RURAL	10329	10380	0.04	36
BENI YAGOUB	COMMUNE	RURAL	5544	6456	1.36	34
TO ONE	CHIEF TOWN OF DAIRA	RURAL	19438	26617	2.83	12
BOUIRA LAHDAB	COMMUNE	RURAL	5957	8897	3.63	25
CHAREF	CHIEF TOWN OF DAIRA	URBAN	13195	19373	3.47	15
DAR CHIOUKH	CHIEF TOWN OF DAIRA	RURAL	15678	24870	4.19	9
DELDOUL	COMMUNE	RURAL	8472	13171	4.00	19
DJELFA	CHIEF TOWN OF DAIRA	URBAN	90032	164126	5.48	1
DOUIS	COMMUNE	RURAL	3216	10356	10.95	7
EL GUEDDID	COMMUNE	RURAL	10111	11059	0.80	33
THE IDRISSIA	CHIEF TOWN OF	RURAL	12730	21279	4.67	10

	DAIRA					
EL KHEMIS	COMMUNE	RURAL	2354	4769	6.48	26
FEIDH EL BOTMA	CHIEF TOWN OF DAIRA	RURAL	10708	20664	6.02	6
GUERNINI	COMMUNE	RURAL	2172	4038	5.67	30
GUETTARA	COMMUNE	RURAL	7469	11151	3.63	21
HAD SAHARY	CHIEF TOWN OF	RURAL	15436	22277	3.32	13

	DAIRA					
HASSI BAHBAH	CHIEF TOWN OF DAIRA	URBAN	38644	61790	4.26	4
HASSI EL EUCH	COMMUNE	RURAL	6222	10834	5.05	18
HASSI FDOUL	COMMUNE	RURAL	8956	12221	2.80	24
MESSAAD	CHIEF TOWN OF DAIRA	RURAL	50313	77754	3.95	3
MLILIHA	COMMUNE	RURAL	7236	13155	5.46	14
MOUADJEBAR	COMMUNE	RURAL	7175	10365	3.32	23
OUM LAADHAM	COMMUNE	RURAL	8369	13696	4.48	16
THIRST RAHAL	COMMUNE	RURAL	6705	11812	5.16	17
SELMANA	COMMUNE	RURAL	5308	14008	9.01	5
SIDI BAIZID	COMMUNE	RURAL	7710	11360	3.51	22
SIDI LAADJEL	CHIEF TOWN OF DAIRA	RURAL	7667	11776	3.89	20
TADMIT	COMMUNE	RURAL	6576	6172	-0.56	35
ZAAFRANE	COMMUNE	RURAL	10028	12865	2.24	28
ZAKKAR	COMMUNE	RURAL	2221	3142	3.13	32

Why is it geographical?

- What are the spatial units?

Basics of describing geographic data

Vocabulary

Look in the table for the following:

- Statistical unit (individual*);
- Population*;
- Character* (attribute*, variable*);
- Modality*.

▪ What is their function?

The different types of data

There are two families of data:

a) ***Qualitative data***

- Nominal qualitative characteristics*

nominal scales* (alphabetical order)

- n modalities = categories (distinct qualities or states)

Socio-professional categories (employees, managers, etc.) Elements of the plan (motorway, road, path, etc.)

binary scales* (dichotomous*)

- Two modalities (yes or no, man or woman, presence or absence...)

- Ordinal qualitative characters*

scales ordinals*

- 1 rank can be assigned to each observation in the form of:

- *Ranking (1st, 2nd, 3rd, ...)*

- *Order (Large, Medium, Small)*

b) ***Quantitative (cardinal) data****

- Report Scale* (%, ratio)

- Interval scale*

Characterized by 3 collection modes:

count* (= quantitative characteristics counted)

Discrete data, where zero means no values*

*Synonym: quantitative nature of stock**

measurement* (= quantitative characteristics measured)

Continuous data, where zero also means no values*

identification* (= quantitative characteristics identified)

Discrete or continuous data, where zero is a value (e.g. temperatures or altitudes, but also certain rates and percentages)

Be careful with the quantities identified on a scale where only the differences (or differences) make sense.
Is it twice as hot in Laghouat as in Djelfa?

	Temperatures in °C	Temperatures in °F
Djelfa	0	32
Laghouat	10	50
Ghardaia	20	68
Temperature (Laghouat - Djelfa)	10	18
Temperature (Ghardaia - Djelfa)	20	36

[Conversion methods (T to °F = 1.8°C + 32) and (T to °C = 0.5°F - 17.7)]

Only the following deviation is valid for both temperature scales in °C or °F. Temperature (Ghardaia - Djelfa) = 2 * Temperature (Laghouat - Djelfa)
This is linked to the conventional nature of the zero of the scale.

0 does not mean absence of information here

It's the same with rates (cf. BOURSIN 1988 p.8)

CONCLUSION:

- Quantitative data accepts mathematical operators*.
- Qualitative data only accept logical operators* related to order and equivalence

Specify the type of each of the data presented in the geographical information table on the communes of Djelfa.

II. CREATION OF THE STATISTICAL DISTRIBUTION TABLE*

Sorting the variable Increase rate What are the min and max of the distribution?

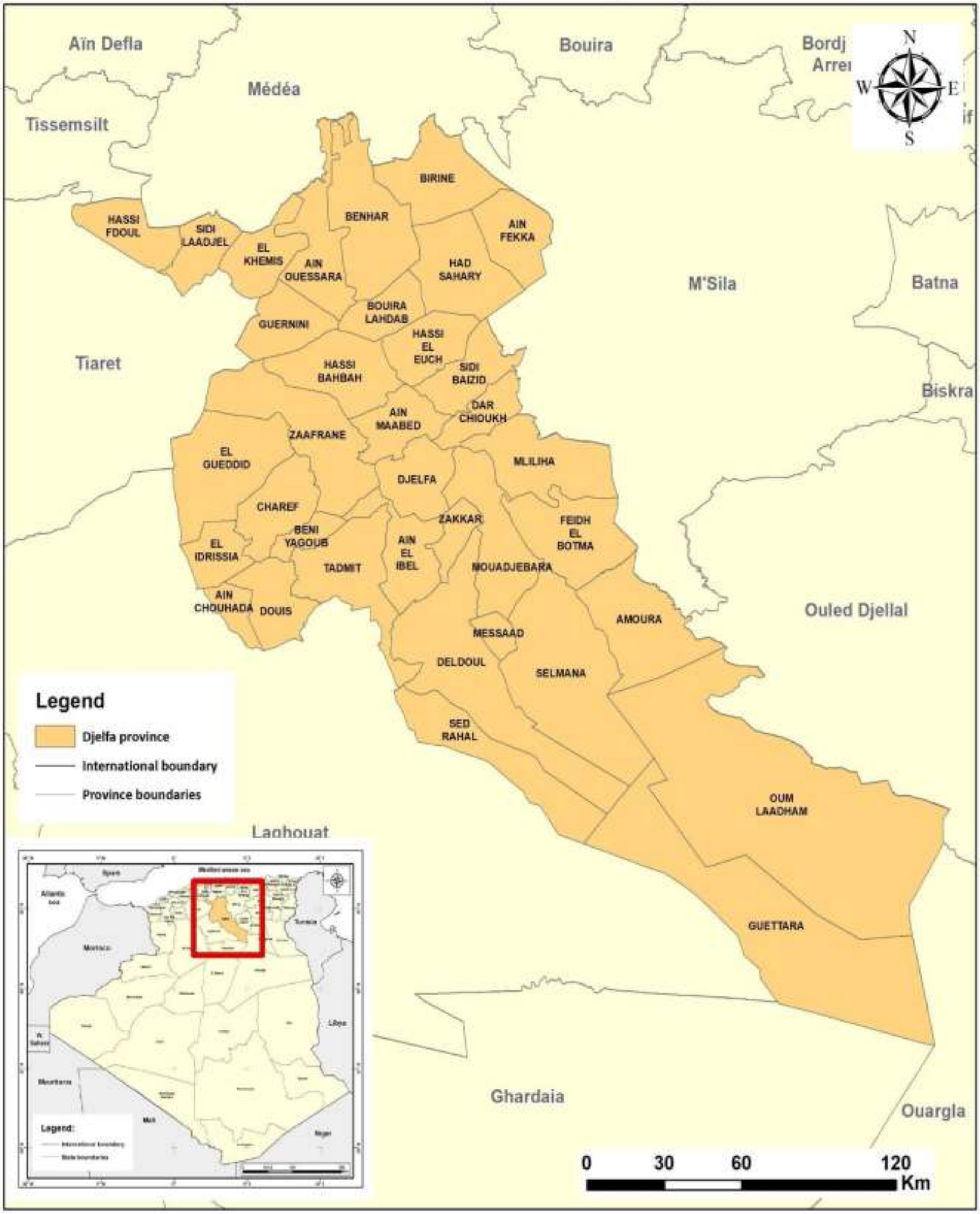
III. CONSTRUCTION OF THE DISTRIBUTION DIAGRAM*

Draw a distribution diagram for the variables (Common, Rate of Increase)

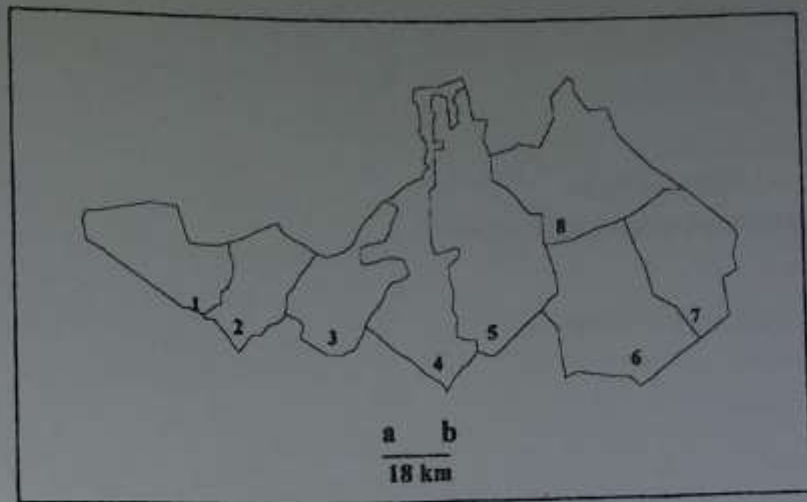
What do we learn about the growth rate of the communes of the Wilaya of Djelfa? How would you map this variable?
Make the map on the next background.

NB: words followed by "" are part of the statistical vocabulary, so their definition must be known. Make yourself a glossary.*

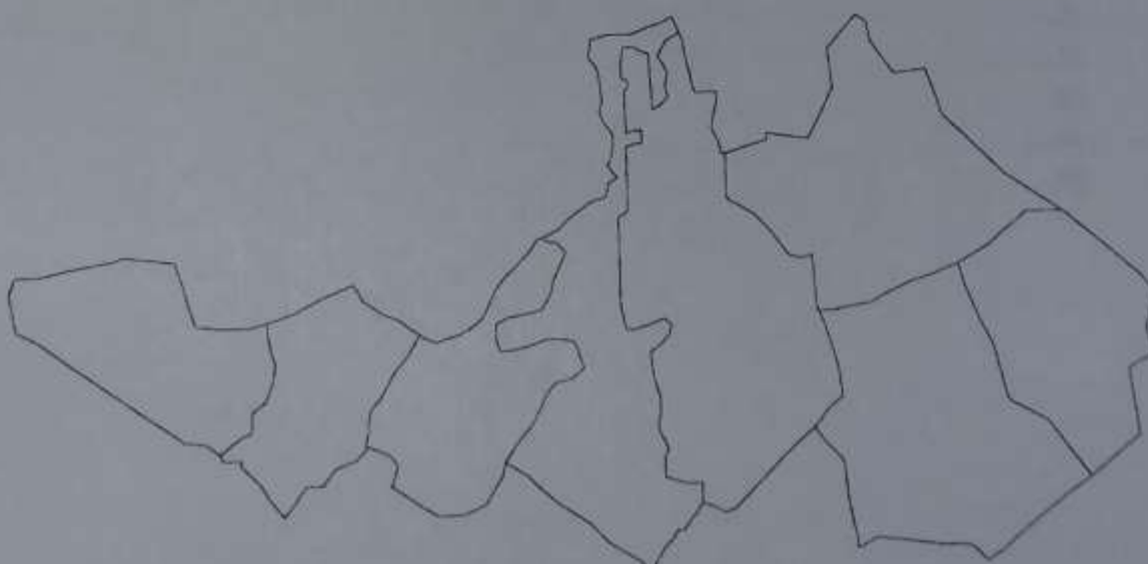
Administrative division of Djelfa province



Commune	*Area (in km²)*	*Population 2022*	*Population by Dispersal*			*Population by Sex*		*Density (Hab/km²)*
			ACL	*AS*	*THEY*	*Male*	*Female*	
Djelfa	542,17	634 043	584 798	23 262	25 982	322 209	311 834	1 169,45
Ain Oussera	809,49	132 677	129 351	/	3 326	68 175	64 502	163,90
Guernini	523,90	5 503	1 242	/	4 261	2 828	2 675	10,50
To someone	800,00	38 120	32 887	1 258	3 976	19 368	18 752	47,65
Benhar	1 070,00	34 920	3 440	9 036	22 444	18 452	16 468	32,63
Sidi Ladjel	373,11	16 817	10 087	/	6 730	8 701	8 116	45,07
El Khemis	500,24	6 440	1 271	/	5 169	3 373	3 067	12,87
H/ Fedoul	491,51	14 626	3 305	/	11 321	7 761	6 865	29,75
Had Sahary	854,09	47 168	34 449	/	12 719	24 533	22 635	55,22
Bouirat L.	378,40	14 782	7 202	/	7 580	8 012	6 770	39,06
Ain F'Ka	464,24	37 094	23 886	/	13 208	19 193	17 901	79,90
H/ Bahbah	773,74	138 233	123 164	/	15 069	71 006	67 227	178,65
Zaafrane	1 197,80	13 123	5 263	/	7 860	6 865	6 258	10,95
H/El you	509,14	13 009	7 717	/	5 292	6 749	6 260	25,55
Ain Maabed	328,02	35 834	26 591	/	9 243	18 088	17 746	109,24
Dar Chioukh	338,70	40 178	35 195	2 495	2 488	20 360	19 818	118,62
M'Liliha	908,07	15 914	4 192	3 295	8 427	8 248	7 666	17,52
Sidi Baizid	523,90	9 119	2 292	1 543	5 284	4 789	4 330	17,40
Charef	590,55	32 486	20 958	1 794	9 734	16 540	15 946	55,00
The Guedid	1 152,16	15 805	8 238	1 218	6 349	8 177	7 628	13 ,71
Benyagoub	*194,17*	18 188	8 571	/	9 617	8 970	9 218	93,67
The Idrissia	375,09	60 553	54 950	/	5 603	31 200	29 353	161,43
Douis	502,76	10 742	7 752	/	2 990	5 534	5 208	21,36
A/ Chouhada	211,25	5 229	3 482	1 098	649	2 791	2 438	24,75
Ain El Bell	562,37	45 043	26 559	9 792	8 693	23 076	21 967	80,09
Moudjebara	737,70	21 517	10 884	/	10 633	11 002	10 515	29,16
Tadmit	788,58	21 388	3 524	7 637	10 226	11 116	10 272	27,12
Zaccar	225,02	2 079	1 594	/	485	1 084	995	9,23
Messaad	147,76	150 750	142 859	1 293	6 598	77 660	73 090	1020,23
Deldoul	1 865,00	12 909	3 045	3 397	6 467	6 894	6 015	6,92
Selmana	1 894,00	30 875	2 490	9 254	19 131	16 206	14 669	16,30
Thirst Rahal	950,00	16 840	7 702	/	9 138	9 004	7 836	17,72
Guettara	4 864,30	11 410	4 357	2 975	4 078	6 163	5 247	2,34
Feidh Botma	868,00	61 271	50 631	/	10 640	31 042	30 229	70,58
Lovea	1 052,40	11 389	5 711	3 187	2 491	5 827	5 562	10,82
O/ Ladham	3 888,72	47 778	8 894	/	38 884	26 504	21 274	12,28
TOTAL	**32 256,35**	**1 823 852**	**1 408 531**	**82 534**	**332 786**	**937 500**	**886 352**	**57**



Carte 01



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Carte 02

PRACTICAL WORK N° 03:

I. PROPORTIONALITY

To represent quantitative data counted or measured

Visual variable used: **Size**

Objective: to vary the size of a figure in proportion to a quantity

- Occasional installation

  variation of the area of 1 symbol

- Linear layout

  Variation in line width

- In surface implantation, there are several solutions None is optimal

Return to 1 point location, with choice of 1 reference point Deformation of the zones according to the amount affected (anamorphisms) Use of 1 sowing of value points

Method: there are 2 methods of determination

- By calculation
- By abacus

Calculation of proportional figures implanted in a punctual location The principle

In point or zonal implementation, the most used sign is the circle

- If the area of the circle is proportional to the quantity to be represented, then:

Formula n°1

$S = P * R^2 = Q$

Since 2 quantities are proportional, then their surfaces are also proportional The proportionality rule eliminates the PI

Formul

a n°2

$$S1 \quad P \quad * \quad \mathscr{R}^2 \quad Q1$$

$$\mathscr{R}$$

2

= 1 = 1 = — —

2 2

$S2$ P ∗ R$\mathscr{R}^2$ 2 $Q2$

In practice, the quantities are known but not the rays.

Methods

Determine the reference circle, namely: look for the largest quantity (which becomes Qref) Note: if you are in a zonal location

Look for the lowest layout area for the highest quantity (refer to the basemap and Data)

- Determine the bearable radius (without masking the neighbors)
- Then, transform the equation as follows:

Formula n°3

$\mathscr{R}$ 2 $Qref$

r

e ——

Formulas°

4

$\mathscr{R}$

f

= $Q1$

——

2

1 $\mathscr{R}2$

$\mathscr{R}2 = Q *$ ref

1 1 Qref

Then, calculate any radius Ri as follows:

Formula n°5

𝒭2

𝒭i

* ref

− √Qref

=

√Q

1

Finally, draw the circles on the map.

When to do proportional circle classes?

- Logically, when the data is grouped

take the center of each classroom

Calculate the radius

Draw a single circle for all individuals in the class

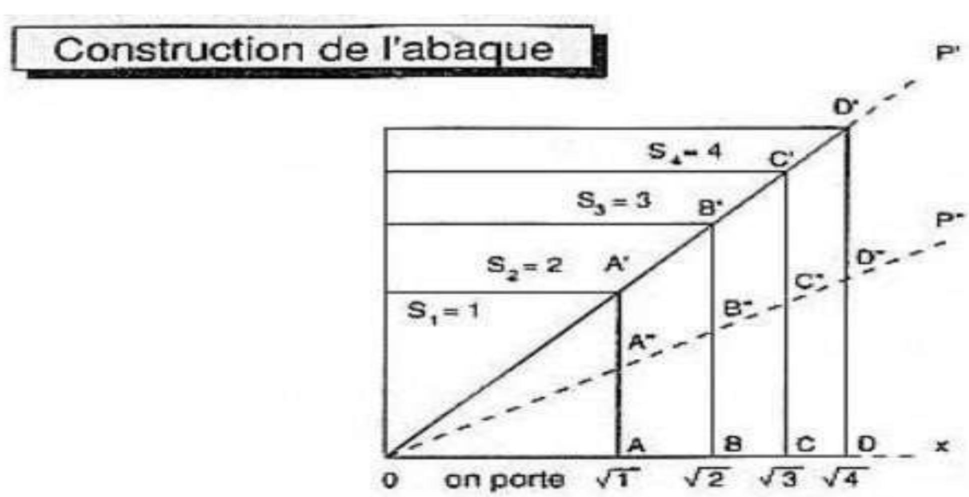
Otherwise, loss of information when the data is continuous

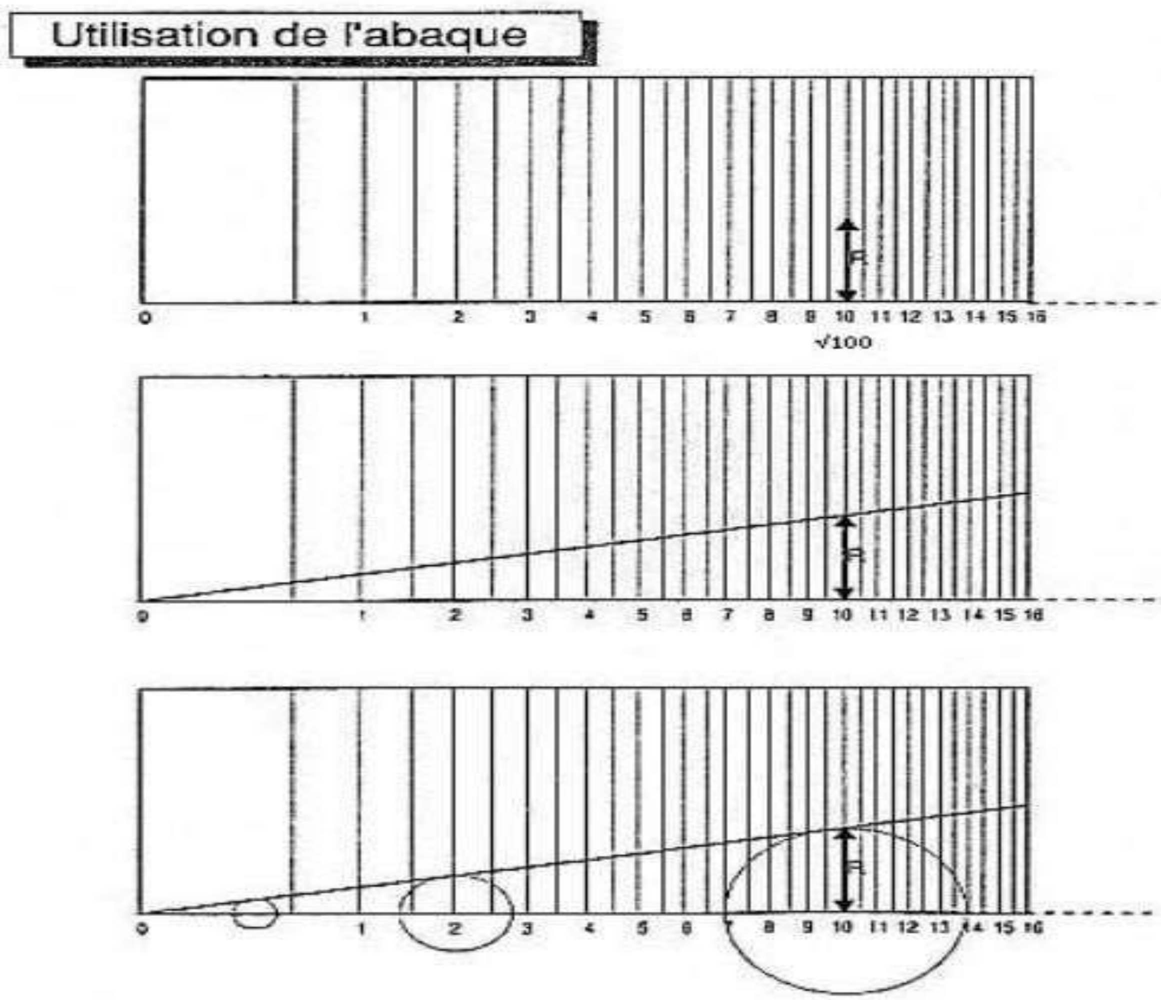
By an abacus

Graphic method that is based on the design and/or use of 1 abacus. Several types of charts

- H. Lenz-César, J. Bertin, A. Robinson...
- H. Lenz-César (available in the article downloadable here or there in the Cahiers de geography du Québec) Same principle of construction as by the calculation except that it is already plotted from a few reference values.

Abbot of Lenz-Caesar





- Find the square root of a few quantities
    - Maximum quantity

Position them on 1 axis graduated from 0 to square root of Qmax The progression here is geometric (function of the square root)

Example:

If Qref = 100 then the square root of 100 = 10 We set the curve of the abacus to this value

If it's too long (doesn't fit in the editing format!), divide by 10 or 100, etc.

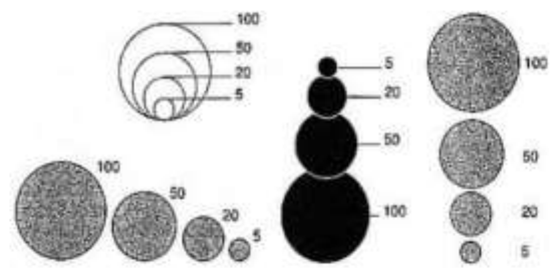
Construction of the legend

Linear abacus

- Draw 1 axis and carry the following quantities on it:
    - "Round" quantities
    - Maximum distribution

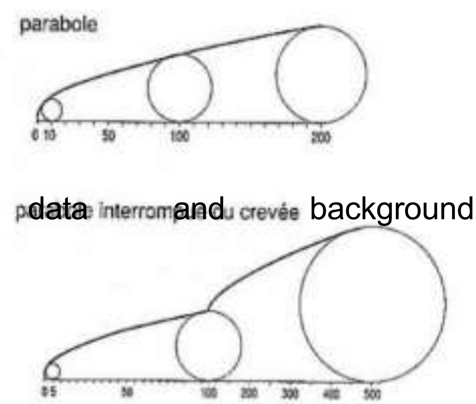
This time, the distance is no longer proportional to the square roots but to the values

It is no longer the radius that is drawn but the diameter because the reader measures the diameter on the map



- Draw only one circle, that of Qmax
- Finally, if the distribution is very long

Make one abacus per slice (logarithmic progression)



Exercise:

To present the 1998 population of the municipalities of the Wilaya of Djelfa using geographical

of card.

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