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*\*The reference pages relating to the text are in brackets*

# 1. Chunk and chunking

There is a way to get around and overcome the problem posed by the limits that the brain shows in the acquisition and memorization of new information (Miller  $7 \pm 2$ ): grouping the single information (chunk) into superordinate units of knowledge capable of aggregating them in an organic way (chunking), so as to expand the total number of elements acquired and remembered, without exceeding the limit of  $7 \pm 2$ . It is a method that allows you to

- considerably increase the amount of knowledge learned
- bring together masses of scattered details in organic configurations as a whole
- carry out the bi-directional management of knowledge (from particular to general and vice versa)
- facilitate the reticular representation of knowledge

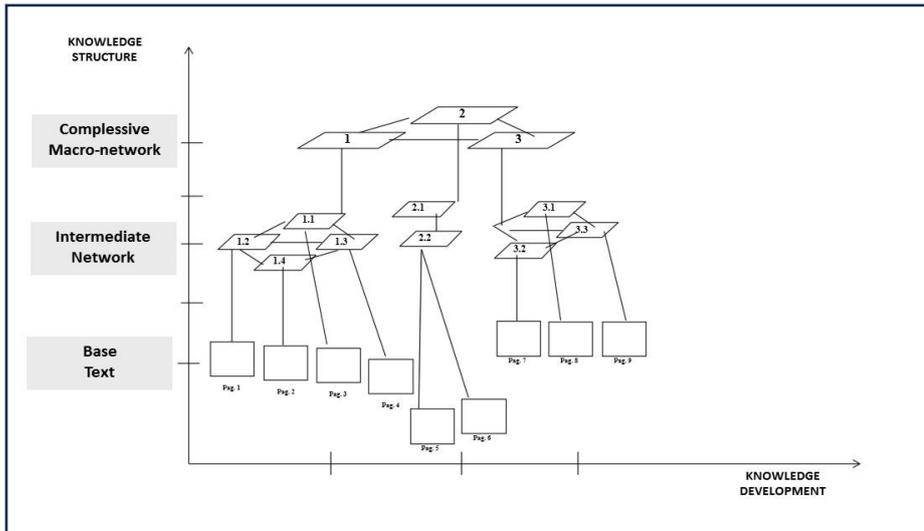
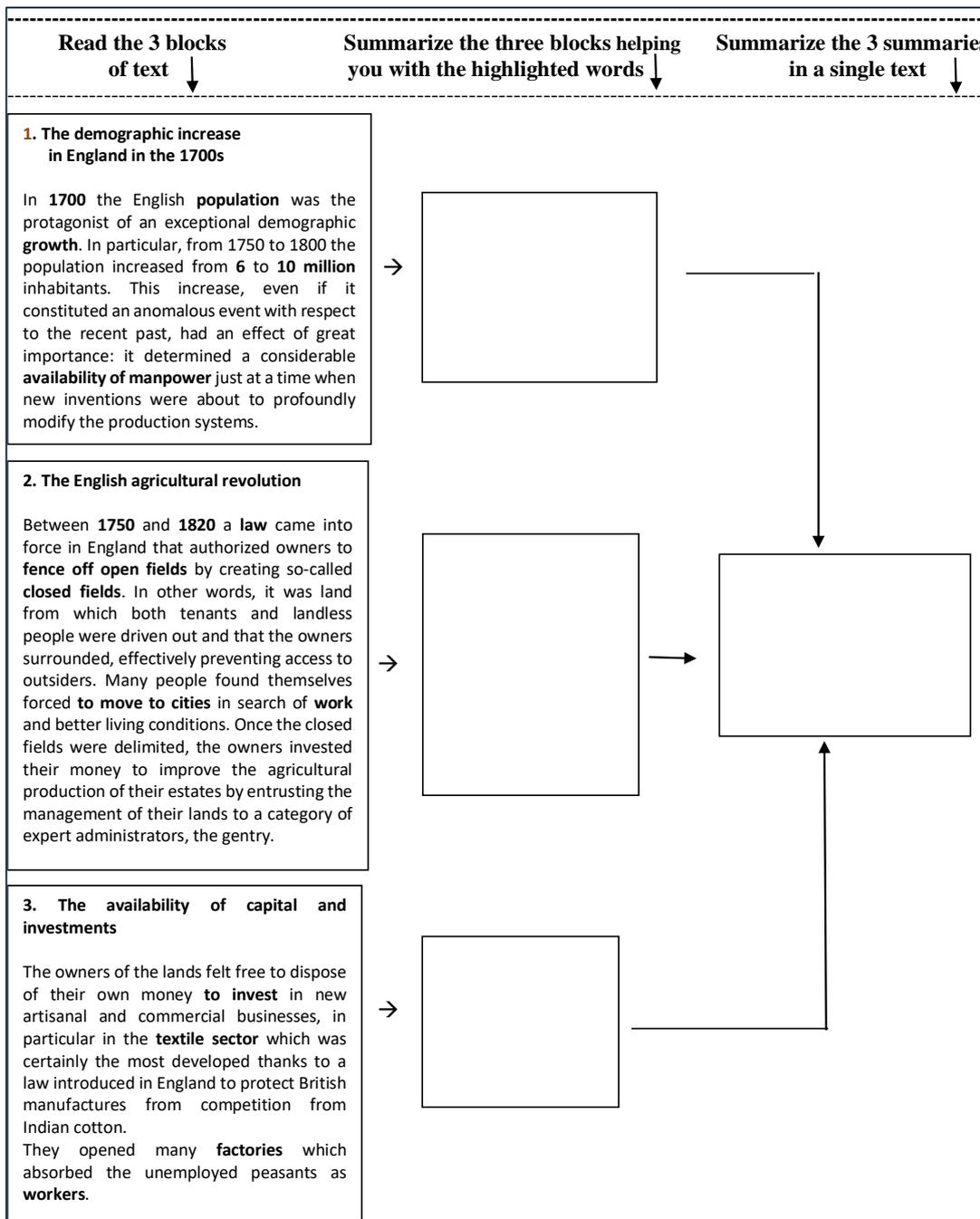


Fig. 2 (pp.11)

Example of the use of chunking in relation to a History text



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## 2. Understanding and integration of knowledge

When we talk about the process of understanding in the didactic-training field, two diametrically opposed attitudes emerge among the operators in the sector: there are those who limit themselves to observing and evaluating the results, leaving the student to do it alone or there are those who want intervene directly in the process by proposing strategies and indications that can optimize the results.

It was precisely following this intention that our design imagination was focused, giving life to intervention methods such as Structuring Dialogue (pp. 18-22).

*Example of Structuring Dialogue taken from a course for aspiring babysitters.*

|                           |   |   |
|---------------------------|---|---|
| Problem situation         | ➔ | Give an antibiotic syrup and after about 10 minutes you notice breathing difficulties and short jerky movements, even if not convulsive, in the sleeping child. |
| Inquiry question          | ➔ | What are you doing?   |
| Previous Knowledge Level  | ➔ | <b>A.</b> I call the emergency room because I know that anaphylactic drug shock can occur from a few seconds to half an hour after taking it.                   |
| Uncertain Knowledge Level | ➔ | <b>B.</b> I wait half an hour before calling the emergency room because I want to understand if the symptoms become more serious.                               |
| Missing Knowledge Level   | ➔ | <b>C.</b> Nothing: I just check the situation: maybe he's just dreaming.  |

### 3. From skills to competences

Competence is often understood as the use of previously learned skills in unexpected contexts. Referring to this concept often used in school and academic contexts, it is possible to imagine a series of particular didactic activities that favor the emergence of competences from the skills already present in memory, subtracting them from chance and returning them as an expected result at the end of a training course organized.

If we ask a skilled performer to tackle a new or unexpected task, we are actually asking him to demonstrate what level of mastery he has achieved. The behavior is always the same, but the context of its application changes:

- a familiar situation but much more complex and articulated ("... you are good at solving problems of plane geometry, now let's try the solid one ...")
- a totally new but not particularly anxious situation ("... you have learned how to use the cash register; now, knowing that we are in rush hour, let's do a test with two customers who have their carts full of shopping and are in a hurry ... ")
- an unexpected and intense emotional situation ("... you have shown that you have learned the landing maneuver on the simulator very well; today we propose you to apply them in stressful or failure situations ...")

*But it is precisely the logical space that separates the concepts of skill and competence that offers us the possibility of using some particularly interesting "hidden evidence". These are three processes studied for years in the laboratory which, re-proposed in the didactic-training field, allow certain competences to emerge from skills already acquired and, possibly, certified through level tests:*

- *cognitive transfer, that is, the phenomenon by which something previously learned can be extended to a subsequent learning activity;*
- *transcoding, that is the ability to spontaneously restructure a certain knowledge in different ways, as an adaptive response to situational changes;*
- *the assignment of new contexts of meaning to the contents learned: the same configuration acquires different identities depending on the contexts in which it appears. There are reciprocal links between context and meaning and they give life to the so-called cognitive cycle, that is, the context manages to give meaning to a stimulus, but this meaning serves as a verification of our expectations and prepares others.*

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#### 4. Management of emotional influences

The regulation of one's emotional state is in general one of the most difficult tasks for a human being to carry out and also the teaching process is always strongly influenced by what students and teachers feel on an emotional level. Awareness of these influences can determine the choice and use of targeted strategies that can stimulate or contain, depending on the case, the effects of the emotional states in action.

Acting in this direction, we think that two basic considerations need to be taken into account:

- it is experimentally established that too much anxiety inhibits cognitive processes and little anxiety does not activate them sufficiently
- we cannot separate the affective aspects from the cognitive ones because in the psychic reality emotion and thought are not separate

Therefore, it is necessary to combine an emotional culture with an intellectual culture, so that the student perceives the emotional resonances contained in the cultural object he is examining and participates in an emotional experience that involves and enriches him.

Therefore, the primary objective of a teacher is not so much to provide an increasing amount of information as to encourage the willingness to learn, that is, to create a mental space available to receive new data and new experiences. In this sense, the usable micro-strategies are infinite and essentially depend on the teacher's didactic imagination but one of them seems particularly effective to us: more precisely, we are talking about a lesson explained using simulative mental contexts.

The extract below proposes a sort of dialogue between a group of medieval peasants and an avatar (a hypothetical knight who wants to free them) with which the student is induced to identify so as to involve him personally also on an emotional level.



Fig. 9 (pag. 31)

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## 5. Recursive reading: "I read what I see" ... "I see what I read"

Recursive is defined as the type of reading that occurs in the presence of a page consisting of two or more components (linear text + image, linear text + concept map, linear text + image / sound + concept map ...) that are isomorphic, that is a page in which the concepts contained in the text are exactly and exhaustively represented in an image (with or without sounds) or in a reticular structure and vice versa.

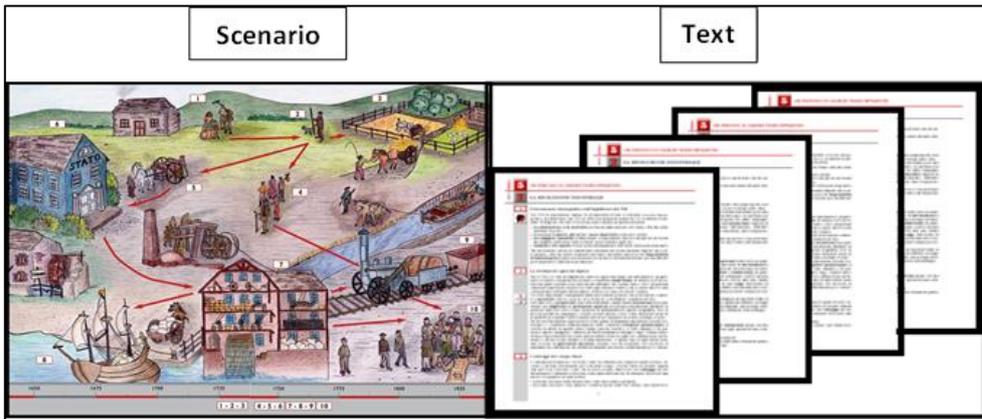


Fig. 11 (pag. 33)

Planning pages in which the images visually show what is explained in words next to them generates a recursive type of reading: what I see in the image provides an overview that prepares you to read the text and what I read in the text explains with the words the details of the image itself. This type of reading can make it possible to have an enhanced understanding of a content because it integrates the two languages (possibly also the sound one) in a single communicational syntax that creates an overall harmonious configuration that brings together details and overall views in a single format.

The idea of proposing such a scenario derives directly from the results of a study a few years ago: the Brandsford and Johnson experiment (1972). The results of this experimental experience show that a relevant figure shown before a text that talks about its contents ...

- ... has the ability to aggregate the parts of the text presented later into a meaningful unit,
- ... acts as an interpretative key to the material proposed through verbal language,
- ... provides a knowledge structure useful for remembering.

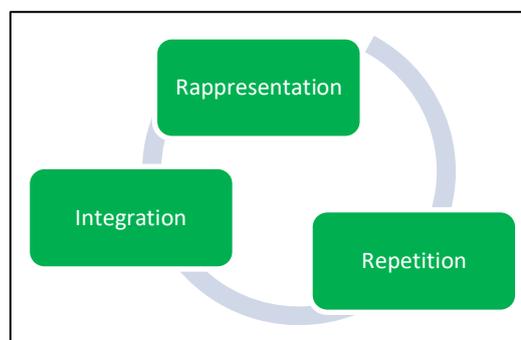


Fig. 12 (pag. 35)

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## 6. Figure-background organization

The conscious management of the principle of figure-background organization, both on a perceptual and cognitive level, can allow the preparation of didactic materials that favor the rapid identification of the relevant concepts in a written text and facilitate their consequent acquisition, eliminating the most possible ambiguities and indeterminacies due to flat and monotonous layouts or, on the contrary, too rich in confusing stimuli.



We normally perceive shapes that have a certain shape on backgrounds that are relatively uniform, even if the patterns of stimuli contain unknown objects. In particular, the figure has a defined extension, while the background extends indefinitely. The figure is closer, in apparent relief against the background which is perceived as further away.

But also the reader of a text needs to distinguish what is most important from what is less or not at all. That is, he needs to perceive something that is in the foreground because it is more important and that it stands out well from what is in the background because it is less important.

Hence the importance of careful use of bold, white spaces, highlights, typographical characters, etc. to guide the reader's perception towards the crucial points of the content you want to convey. Observe the difference in performance between a layout without planning and another that takes into account the principle of figure-ground organization.

There are various explanatory models proposed by science. The main ones are four. The nomological-deductive model (Hempel-Oppenheim, 1948): the set of knowledge necessary for the explanation of a phenomenon is called explanans. It includes one or more hedging laws and initial conditions. The natural phenomenon for which an explanation must be given is called explanandum. The fundamental characteristics of the model are the following: a. it is a model, although not the only one, of a law of coverage: this means that the explanans must contain a law of nature; b. it is a deductive model, that is, the explanandum must be obtained through a deductively valid argument from the explanans. The general conditions necessary for the application of the model are: the explanation must be a valid deductive argument; the explanans must contain at least one general law; the explanans must have empirical content; the statements that make up the explanans must be true.

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The **key features** of the model are as follows:

- it is a model, although not the only one, with a law of coverage: this means that the *explanans* must contain a **law of nature**
- it is a **deductive** model, that is the *explanandum* must be obtained through a deductively valid argument from the *explanans*

The **general conditions** necessary for the application of the model are:

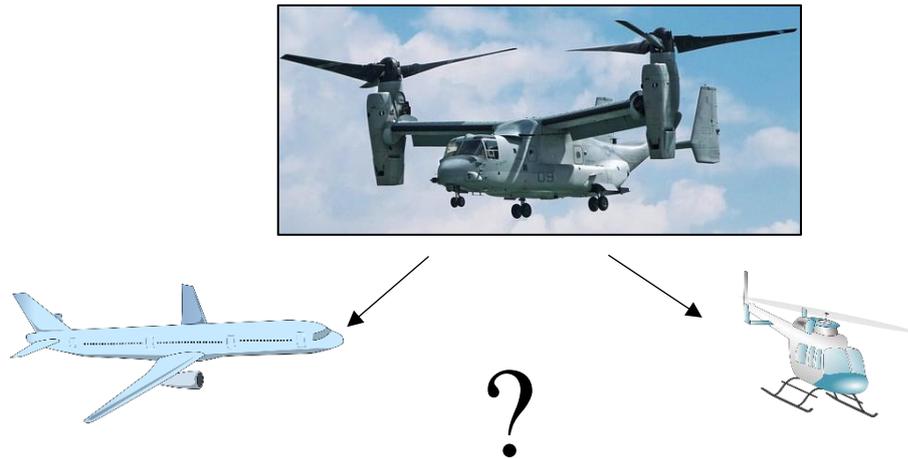
- the explanation must be a valid deductive argument
- the *explanans* must contain at least one general law
- the *explanans* must have empirical content
- the statements that make up the *explanans* must be true

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## 7. Plasticity of the schemes

Mental schemes are essentially malleable: a scheme detects its own adequacy or not with respect to the data to be processed and, if it does not detect it, it is able to reconfigure itself in an adaptive function, giving life to new schemes (starting from itself or from others). On the didactic-training level, this plasticity has great charm because it allows us to prefigure the genesis of new cognitive structures, the emancipation from ignorance, the development of the person himself under the intellectual profile.

*Let's do a little experiment: What is this aircraft? Let's take a good look at it before answering ...*



*... Is it a plane or a helicopter?*

Let's see ...

- airplane diagram → elongated cockpit, landing gear, front cockpit, wings, propellers... Propellers? Yes, but not upwards ... therefore, this aircraft is not a real airplane! It has a feature that does not fall into the canonical categories

- helicopter scheme → upward propellers, landing gear, long cockpit (some may remember the shape of the gigantic American military transport helicopter called Chinook), ... but it has wings like an airplane! And, then, it's not a real helicopter!



At this point, the two diagrams we had in memory are inadequate to explain the reality that we are facing: this aircraft is a third thing compared to an airplane or a helicopter and probably also has a name that distinguishes it from both of them.

The two schemes in memory, if they want to be adequate to the sensitive data and to account for this aircraft, must transform and give rise to a scheme that incorporates the aforementioned characteristics of the other two and that has its own name specific. In fact, whoever invented it called it a "convertiplane".

From now on, when we see a plane with the propellers upward like a helicopter, we will evoke the scheme of the convertiplane → Here is an example of schema malleability.

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## 8. Potential and limits of overlearning

The so-called overlearning is the continuous repetition of a certain material that is extended beyond the point of acquisition. It represents a phase of the study process that involves students who want to refine their preparation to the maximum. Using various methods, it is possible to obtain maximal or sub-maximal levels of performance, without exceeding those limits that make the efforts made counterproductive.

According to various authors, its advantages are countless:

- increase in the discrimination of new meanings learned and their retention
- increased responsiveness of the student to subsequent presentations of the same material
- reduction of the risk of further forgetfulness
- raising awareness of learning new tasks related to the previous one
- familiarity with the objects of study which in turn determines a reduction in the cognitive load

Below is a short example taken from a course for elementary school teachers dating back to 1990 in which methodological indications are given. In particular, in that context, it was suggested to choose from the activities indicated in the diagram below to prepare a sort of overlearning session to refine the students' oral exposure skills.

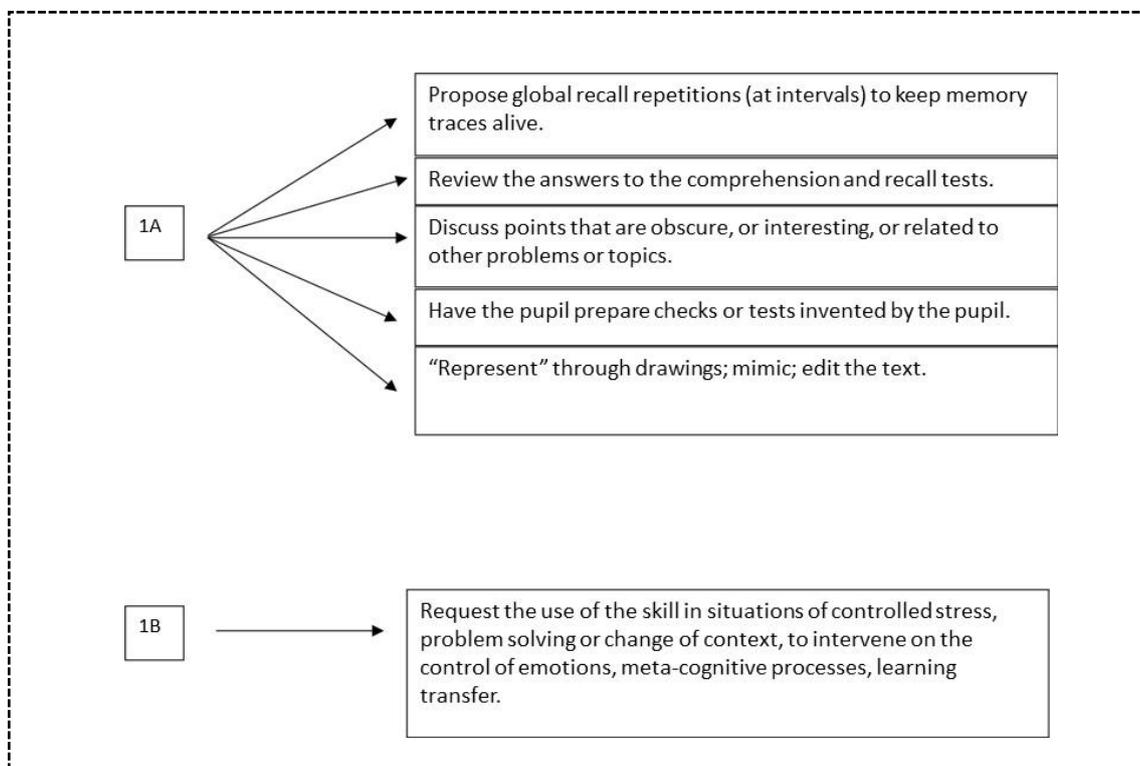


Fig. 16 (pag. 51)

## 9. Depth of analysis

Providing useful tools to be able to disassemble and reassemble a text puts the student in a position to carry out a profound re-coding of its content, that is, to master its underlying logical structure and remember it for a long time. Of course, the richness of this coding also depends on the ways in which he uses these tools, that is, on the intensity and level of concentration with which he engages in the coding work itself.

While recognizing the value of simple "labelling" of the text (underlining, highlighting, recall symbols, lateral notes, ...) and, above all, of the "summary" (however less effective in communicating synthetic overall views that show the contemporaneity of the relationships between concepts), the most suitable analysis tool seems to be the "map".

The classic Conceptual Map is that model of representation of knowledge that makes objective the simultaneity of connections within a network of concepts and does so by displaying nodes that correspond to concepts and lines (arrows, if they show explicit causal links) which instead represent the relationships existing between these concepts.

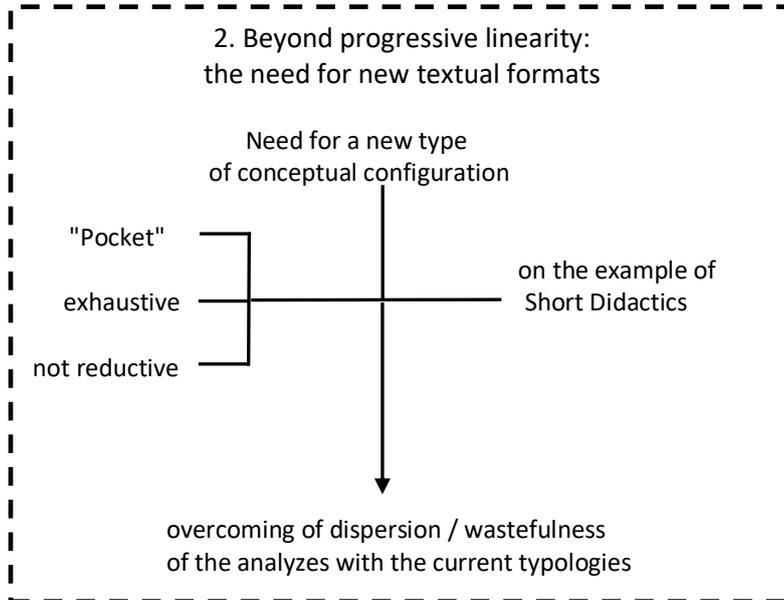
But there are other types of maps that can be used as tools for reconstructing a text; one of them is the Text Map, a graphic-conceptual configuration that represents the flow of contents of a linear text in a sequential way through grids.

Below, we show an example of how a text can be represented schematically in the two types of maps mentioned above... two different ways of achieving deep analysis.

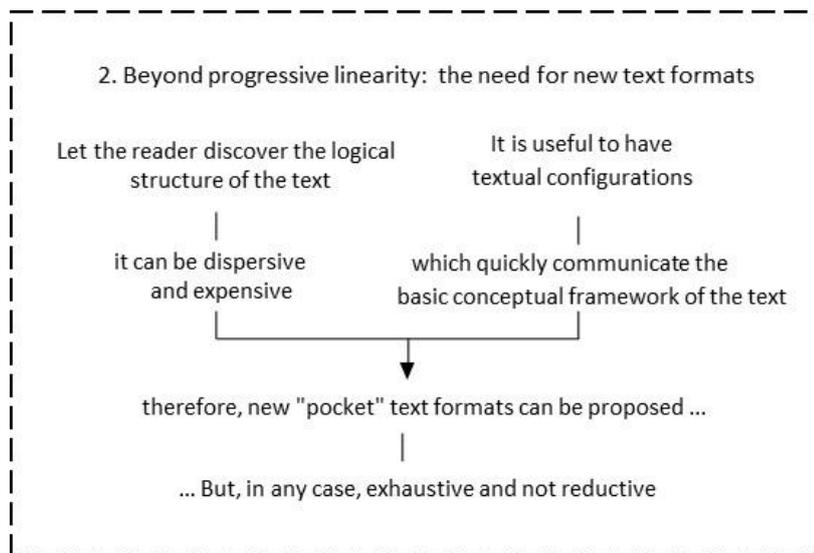
### *2. Beyond progressive linearity: the need for new text formats*

*Writing many pages of linear text and letting the reader discover the underlying logical structure of the speech can be dispersive and wasteful: he can waste a lot of time before fully succeeding or he can do it incompletely, giving space for inappropriate interpretations. To avoid such drawbacks, perhaps it would be better to have new textual configurations capable of quickly communicating the basic conceptual framework of the text, that is, its most intimate logical structure. Perhaps we should have new textual formats, so to speak, of a pocket-sized type but in any case exhaustive and capable of communicating the essential without becoming reductive (otherwise we run the risk of caring for the sick with a treatment worse than the disease: "before I said too many things and little was understood, now I say too little and understand even less"). It is true, however, that some experiences carried out in the educational field, such as those proposed by Short Didactics and its distillation procedures, even with all the limitations of the case, indicate that an effort in this sense is possible and desirable.*

## Conceptual Map



## Text Map



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## 10. Activation propagation

The process of propagation of the activation of conceptual nodes that occurs within a semantic network.

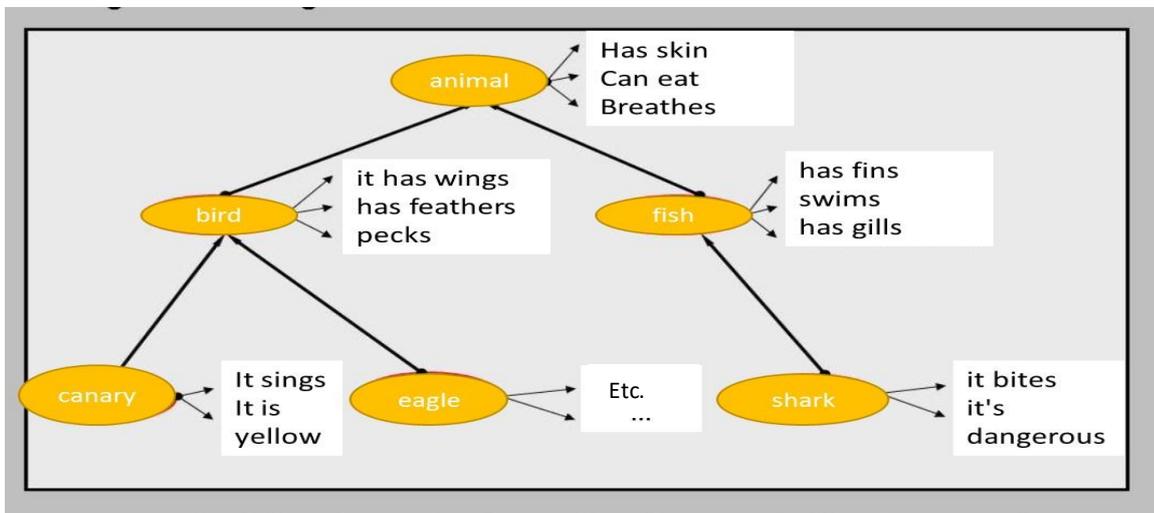


Fig. 17 (pag.56)

- Within this network, once a node has been activated (which corresponds to a concept), the nodes that are closest to it in a logical sense are also activated instantly. Activation fades as you move away from the node that was first triggered.
- The (logical) distance between the associative nodes varies according to the ease with which the activation of a node activates a neighboring one.
- When a subject is involved in an information retrieval effort, identifies a concept or meaning and activates a particular network node; the result is the recovery of the information associated with that node.
- Activation, however, does not only affect the node involved, but also involves a consequent propagation of the activation in the surrounding areas.
- A fundamental factor is the strength with which the memory traces have been fixed: the stronger the bonds that initially connected the nodes, the higher the possibility of accessing the associated information



If valid strategies are used to fix and memorize a well-structured conceptual network, an energetic activation of the nodes of which the network is made up will produce a propagation capable of quickly recovering even the adjacent nodes and the information associated with them.

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## 11. Repetition and memorization

Repeating is one of the engines of learning and is the simplest recipe to remember. Repetition in its apparent banality and fatigue is a constructive process that shapes, roots, embodies knowledge. Of course, repetition does not in itself imply an automatic transfer of information and only an significative rehearsal improves the memory.

|

"Repeat" is a control mechanism that requires a rather active participation on the part of the individual.

|

The content being stored must be, so to speak, appropriately "refreshed" through repetitions, otherwise it is lost due to the arrival of new information that takes its place in the restricted "space" of working memory.

|

The retention of information in memory can take place in two ways:

- thanks to an emotional driving force that does not require particular repetitions (when an event or a thought is associated with emotions and sensations that are important to us, we do not find it hard to remember)
- thanks to a cognitive driving force that requires various repetitions (when we have to repeat a long and elaborate text, we are forced to review it several times to remember it well)

|

The higher the number of times you travel that road, the clearer the way for a later recovery. But every time you do it ... it's like a rediscovery: new meanings emerge, unexpected conceptual configurations are created, systematizations of consolidated networks take place.

|

Any memorization strategy can be valid; the important thing is that it is set according to logic  
"Do not study by heart, but use your memory to study!"

## 12. Scripts

A “script” is a basic cognitive structure that orients behaviors in similar contexts and that is expressed in a sequence of actions carried out more or less in the same way in situations that are similar to each other.

|  |   |  |
|--|---|--|
| <p>Classic example of Schank and Abelson: the restaurant script (1975)</p> <p><i>Scene 1:</i></p> <ul style="list-style-type: none"> <li>- Entrance into the restaurant</li> <li>- eyes at the tables</li> <li>- place to sit</li> <li>- at the table</li> <li>- sitting position</li> </ul> <p><i>Scene 2:</i></p> <ul style="list-style-type: none"> <li>- ask for the menu</li> <li>- read the menu</li> <li>- decide what to order</li> <li>- order the waiter</li> </ul> <p><i>Scene 3:</i></p> <ul style="list-style-type: none"> <li>- get food</li> <li>- eat food</li> </ul> <p><i>Scene 4:</i></p> <ul style="list-style-type: none"> <li>- ask for the bill</li> <li>- get the bill</li> <li>- go to the cashier</li> <li>- to pay</li> <li>- leave the restaurant</li> </ul> |  | <p>The main function of the script is to favor the mental representation of human actions, that is, the understanding of experiences to guide behavior.</p> <p>In this perspective, the development of scripts for the representation of events constitutes a fundamental mental tool not only for the knowledge of daily life, but also for the structuring of the semantic system and of the conceptual categories of an individual's thought.</p> <p>In fact, by breaking down the temporal and causal sequence of a script, one becomes able to "abstract" properties, characteristics and functions of the objects and specific actions of a specific episode or event as well as to grasp the temporal and causal links.</p> |
|--|---|--|

Here is a practical example of how to use a script on a didactic level to teach a historical concept.

*Instructions: read the scheme on the left which broadly proposes a Script of the historical phenomenon we call "Popular Insurrection" and the one on the right which recalls five crucial moments of the French Revolution. Then write a short text explaining the facts (diagram on the right) using the script (diagram on the left).*

|   |   |
|---|---|
| <p><b>Initial situation:</b> Excessive power of the leader or ruling class; abuses, bullying, lack of freedom (Discomfort of the people).</p> <p style="text-align: center;">↓</p> <p><b>Intermediate situation:</b> Exasperation of the people, stiffening of the ruling class, police interventions to stifle disagreements (Escalation).</p> <p style="text-align: center;">↓</p> <p><b>Final situation:</b> Revolt of the people, Repression military, political upheavals (Tragic events with uncertain outcomes).</p> | <p>Absolutism</p> <p>↓</p> <p>Third Estate Claims</p> <p>↓</p> <p>Storming of the Bastille</p> <p>↓</p> <p>Robespierre</p> <p>↓</p> <p>Power to the Directory</p> |
| <p>Summary of the facts: .....</p>  |   |

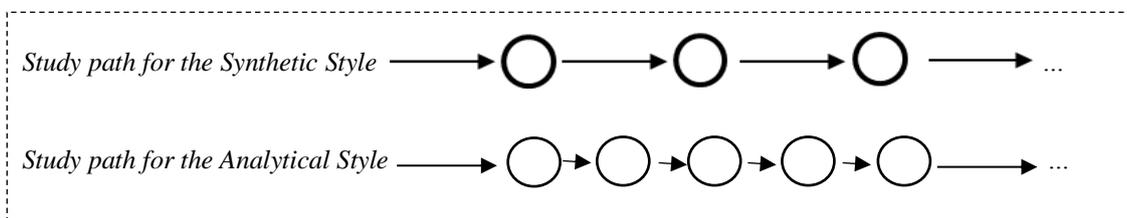
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### 13. Cognitive styles and parallel paths

On a theoretical level it is possible to conceive the possibility of setting up personalized study paths that allow everyone to learn according to their cognitive style. Numerous experiments have highlighted the existence of particular typical perceptual behaviors that differentiate individuals from each other, especially in the contexts of study and training. On a practical level, however, there are some design problems that make problematic the actual implementation of programs that make use of the innumerable knowledge we have on cognitive styles.

In theory, each student could use learning material structured according to his cognitive style, to have a so-called “gentle” impact with what he has to learn. Ignoring this evidence could represent a source of obstacles and problems for those whose cognitive structure proves less flexible and adaptable. Thus, a control implemented on the cognitive style could imply positive developments for those who have rigidity and closure in dealing with learning tasks.

However, it is realistic to think of isolating the most versatile polarizations on an operational level, such as the one called "analytical style - synthetic style", and to create parallel study paths that communicate the same contents using transmission methods aimed at analysis or synthesis.



In the case of the analytic-synthetic polarization it would be conceivable to create a path full of details and possible redundancies and another one that shows the same contents at a higher level of synthesis, perhaps in the form of conceptual maps. It is also possible to imagine paths that include transitions between the two levels, taking into account that most people have learning styles that are located between the two ends.

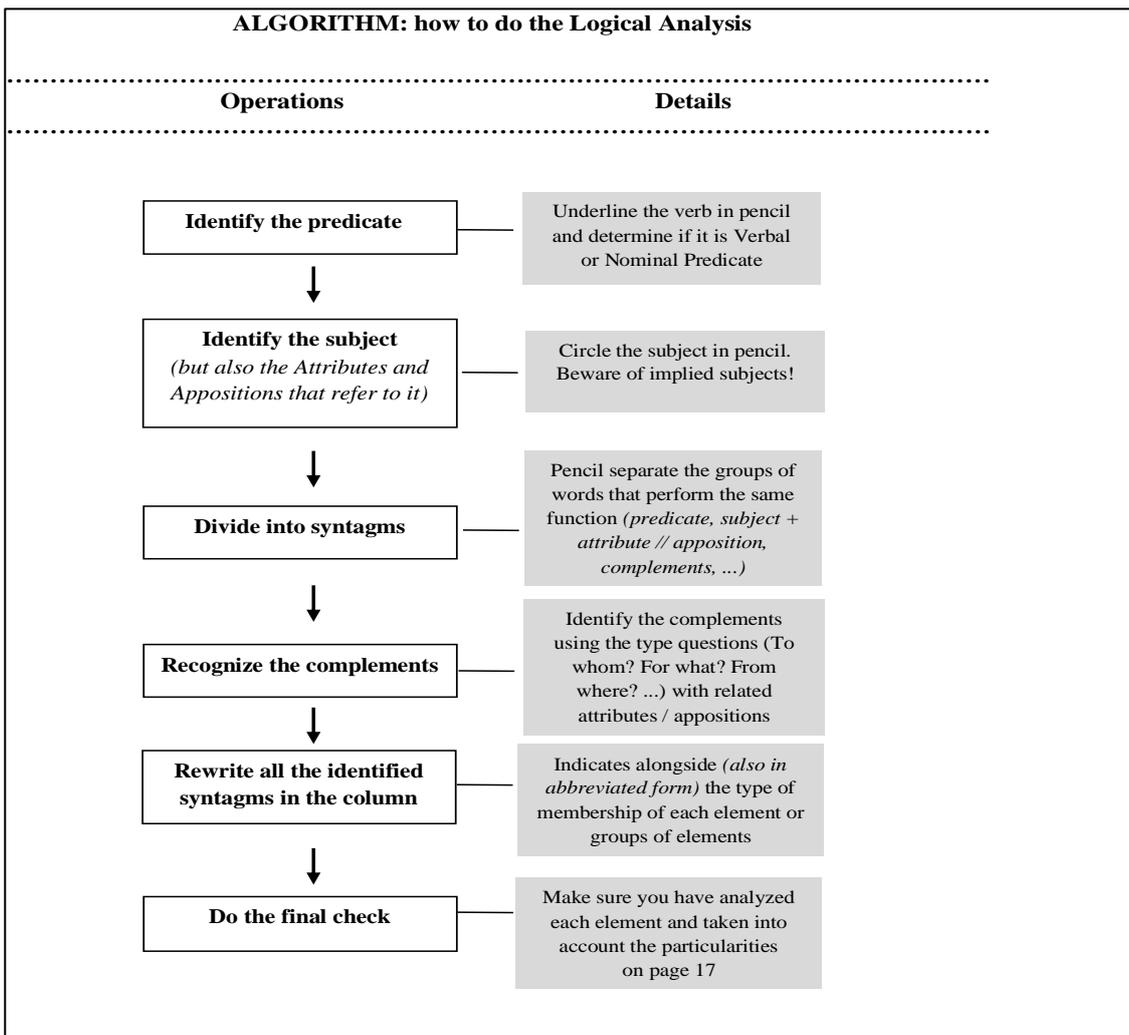
## 14. Use algorithms

This is a classic example of "hidden evidence", that is, a full-bodied and articulated set of little known or forgotten scientific findings, but easy to consult (books, sites, ...). Indeed, there are some methodological approaches, such as Landa's Algo-heuristic theory, which argue that many learning problems arise trivially from not knowing the right procedure to solve a problem or to perform a task.

Precisely for this reason the development of adequate algorithms and their teaching can constitute an important step towards emancipation from ignorance by those who, unfortunately, have not had the opportunity to know "how to do" a certain thing.

In very general terms, it can be said that an algorithm is an unambiguous prescription that provides instructions relating to relatively elementary operations to be used for solving problems or performing tasks.

Algorithms can be classified according to their characteristics or their functions. There are deterministic ones (those that provide 100% the expected results) and probabilistic ones (those that guarantee it only in percentage). For example, the former include algorithms that have to do with the operation of automatic devices, while the latter include many instructional algorithms that are based on a knowledge of the functioning of the human mind which, for obvious reasons, is incomplete and constantly evolving (*see the example on Logical Analysis below*).



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