

STILI COGNITIVI DEGLI STUDENTI E CONDOTTE MOTORIE: RILEVAZIONE E ANALISI DEL SEGNO GRAFICO ATTRAVERSO L'IMPIEGO DI MASQUERADE

COGNITIVE STYLES OF STUDENTS AND MOTOR BEHAVIOUR: DETECTION AND ANALYSIS OF THE GRAPHIC SIGN THROUGH THE USE OF MASQUERADE

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Abstract

Graphomotricity is a function inherent in the human being, which «allows to trace a message of any kind in a determined space thanks to the combined movements of the arm and the hand in close connection with the whole body, first place of expression of emotional life, cognitive and relationship» (Boscaini, 2008).

The way in which the person distributes the writing on the sheet can be considered the expression of the way in which it moves in the environment (Moretti, 2006, Torbidoni & Zanin 2013, Conficoni, 2018) and the way to trace the graphic strokes and to arrange the words on the sheet, can be indicative of the subjective orientations (cognitive, volitional and affective) towards the world.

The aim of this research is to verify the correlation between certain features of the handwriting and the configuration of fundamental cognitive styles (executive, judicial and creative), as they were identified by J. R. Sternberg.

It is also possible to assume that there is a transfer from the space lived with the body, to the space of the sheet, through a process activated by bodily and emotional experience.

The detection of cognitive styles is conducted on about 300 subjects aged between 13 and 19 years, through the administration of the test developed by J.R. Sternberg. The detection of the graphic features will take place through the software Masquerade, developed by the Company Spin Off Nite (Natural Intelligent technologies) of the University of Salerno and will be focused on the graphic signs explorable through the use of this tool.

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La grafomotricità è una funzione insita nell'essere umano, che «permette di tracciare un messaggio di qualsiasi tipo in uno spazio determinato grazie ai movimenti combinati del braccio e della mano in stretta connessione con la globalità del corpo, primo luogo di espressione della vita emotiva, cognitiva e di relazione» (Boscaini, 2008).

Il modo nel quale la persona distribuisce la scrittura sul foglio, può essere considerata l'espressione del modo con cui essa si muove nell'ambiente e il modo di tracciare i tratti grafici e di disporre le parole sul foglio, possono essere indicative degli orientamenti soggettivi (cognitivi, volitivi e affettivi) verso il mondo.

Lo scopo di questa ricerca è quello di verificare la correlazione tra alcuni tratti della grafia e la configurazione degli stili cognitivi fondamentali (esecutivo, giudiziario e creativo), così come sono stati identificati da J. R. Sternberg.

È possibile ipotizzare, inoltre, che esista un transfer dallo spazio vissuto con il corpo, allo spazio del foglio, attraverso un processo attivato dall'esperienza corporea ed emotiva.

La rilevazione degli stili cognitivi è condotta su circa 300 soggetti di età compresa tra i 13 e i 19 anni, attraverso la somministrazione del test elaborato da J.R. Sternberg. La rilevazione dei tratti grafici avverrà attraverso il software Masquerade, messo a punto dalla Società Spin Off NiTe (Natural Intelligent technologies) dell'Università di Salerno e sarà focalizzata sui segni grafici esplorabili attraverso l'impiego di tale strumento.

Keywords

Cognitive styles; body; Graphomotricity

Stile Cognitivo; Corpo; Grafomotricità

Introduction

The World Health Organization (ICF, WHO, 2001) has published a conceptual system and a reference framework model, which stresses the need to assess something more than the simple physical and bodily functions of the individual, on a scale of health and illness/abilities and disability, paying attention to the various aspects of human activity and participation in society in the different domains of life.

Graphic production is a fundamental learning goal and is a complex and accurate motor activity (Bravar et al., 2014) that requires simultaneously: regulation of muscle tone, definition of Euclidean space (at least the perceptions of: above-below; left-right), combination and dissociation of motor acts in succession and/or simultaneously. It also provides for other executive functions such as visual-perceptual abilities, memory, attention, and the ability to sequence a series of fine movements.

All this implies the activity of neural networks, not only cognitive, but also motor and also depends on the ability of spelling coding and memory of letters and syllables, as well as coordination of movements. We can say that «writing is a combination of oculus-manual coordination, movement and language that translates into graphic signs with meaning and is a motor act that requires skill, speed, fluidity and precision in the production of the written sign» (Olivaux, 2014).

When the writing learning process achieves a balance between space, shape, and movement (of the hand), the child enters the first phase more mature and manages to write in a straight line oriented on the pages and measuring the right strength to be imprinted to draw the lines harmonious and fluid (Manetti, 2018; Pratelli, 2019).

Therefore, a correct development of the ability to write, being founded on memory, reflexes and motor activity, is essential to obtain a higher school performance and as a sign of maturity of development. These more instrumental aspects, linked to the ability to skillfully elaborate a written text, are fundamental because they play a preparatory role compared to the ability to laboriously produce a written text (Longcamp et al., 2011; Wamain et al., 2012; Gainotti, 2014; Sim et al., 2014; Sabatini, 2016).

1. The dynamic of the graphic gesture

The graphic gesture is therefore a means of personality formation and allows the learner to acquire the prerequisites of writing and also the most important cognitive and instrumental potential: harmonious motility, fine motility, eye-to-hand coordination, observation and concentration.

Involving both a psychic and motor-postural condition, the dynamic of the graphic gesture has a fundamental role in the psychomotor development of the child, which can and must be evaluated in its complexity. Each movement possesses a fluidity that binds to the muscle tone, a dissociative property that allows to mobilize only those bodily districts deputized to the intentional activity, a possibility to oppose to the force of gravity and a regularity in the unit of time.

The function that allows the accomplishment of coordinated and effective gestures is called praxia and is the one that determines each graphic trait. The latter adjusts according to the intensity of the nervous impulse, receptive mode, reactive-motor, and all psychophysiological aspects of an individual, including experiences and knowledge, but “innate is never supplanted” (Moretti, 1980). In other words, graphism, while transforming itself into the evolution of the individual, never loses the characteristics that make up the individuality itself because it originates in its innate nature and therefore constitutes for man a possibility of language.

Since the individuality of man resides in the human brain, any spontaneous expression deriving from the brain, such as graphic motility, acquires its own individuality from certain peculiar signs. Since there are no two equal individuals, there are no two equal scriptures: everyone has his own graphic movement, he has his own graphic language (Zucchi, 2000).

«The graphic gesture is the personalized modality of the execution, correlated to the individual psychomotricity and belongs, like the graphic act (alphabet, culture), to the structural level of the graphic sign (understood in general sense), while the graphic sign as a single datum and the graphological sign as a symbolic-conceptual elaboration of the datum belong to the symbolic level» (Zucchi, 1990, p. 150).

As Zucchi observes, the order to write is imparted by the will of the subject and this determines a wider activity, which involves the pyramidal system for the drive and the extrapyramidal system to regulate the intensity and succession of movements required. The intervention of the cerebellum, which regulates the posture, the direction of the graphic movement and the coordination of movements, must also be ascribed to this activity. Finally, the graphical process involves the spinal cord, the brain stem, the midbrain, the diencephalus, the cerebral hemispheres, the motor and sensitive cortex, the circuits of memory, learning, the areas and centers of emotion, the centers of language.

But the process is so extensive that it is understood that even the ways of tactile and proprioceptive sensitivity are involved, providing the cerebral cortex with information regarding the written translation of verbal symbols, that are precisely elaborated by the associative and mnemonic systems of the cortex itself. For writing it is necessary, in fact, the temporal (acoustic), post-central (kinesthetic), occipito-parietal (optical-spatial) and premotor (dynamic) sectors and there is a circular exchange of information thanks to the combined sense-motor action of: the periphery with muscle effectors (skeletal or voluntary muscles) and sensory receptors (muscle-tendon and cutaneous); the centres of the sensory-motor and cerebellar cortex; the interchange between the nerve centres themselves, that is, between the sensitive and motor areas and between these areas, the subcortical centres and the cerebellum.

This system of interactions allows the regulation of the intensity and frequency of the nerve impulses and the spatio-temporal succession, coordinated of the automatic and semi-automatic movements automatic, modulating the fineness of movement of the muscular segments that are found from the humerus to the fingers of the hand. The basic movements of the graphic gesture are bending, with extension and abduction antagonist, with adduction antagonist.

These movements give the vertical dimension (graphic height), the horizontal dimension (track height) and the depth, or rather the pressure, (better to call it engraving force) with which it is intended «the tracing force of graphism and with this also the depth of the groove that the tip of the pen digs into the paper and the thickness of the individual strokes» (Palafferri, 1986, p. 32).

Just the graphic pressure is at the base of the personality, «being relative to the ‘ability to produce and consume energy dynamically, the intensity and variety of which originate directly from the individual’s vital sphere, the degree of strength and depth of instincts, tendencies, will, creative impulse and, in general, also of the same feeling» (Palafferri, 1986, p. 32) and therefore

it is the first element that is analyzed.

The subject dynamically and automatically synthesizes all of himself in graphomotory expression and organizes his idea, the words he thinks and what he wants to communicate. The individualization of writing comes progressively from the process of automatization which, as the relationship between body, body pattern and sense of self develops, progresses, and generates a gradual acceleration of movements, created by the nervous mechanisms that determine the execution of writing.

That the graphic trace is an expression of the psychomotricity of the child can also be deduced from the observation of the way of scribbling, which he has in the phase even before learning. In fact, scribbling first, drawing, and writing then, must be considered real languages that in their spontaneous form manifest the characteristics of the temperament of the young individual and his maturation through the evolution of the graphic language itself. The evolutionary path includes the stages and progress of self-consciousness and body experimentation, as well as the relationship between the organizational movement of writing and education received from the environment. The automatization of the writing happens, therefore, in the within of fundamental functions which the function of active adaptation (motricity), the lateralization, the oculo-manual coordination, the knowledge and the perception of the own body, the spatial and temporal perception, the psycho-sensory organization.

There are specific techniques to analyze the graphological sign. They must be synthesized from the psychological point of view in an always dynamic sense, that is, by observing the movement in relation to the graphomotor context, keeping therefore in mind that graphomotricity is a real expressive language and that languages must be listened to and understood through a psychomotor and symbolic understanding, which allows you to enter into communication and establish a valid dialogue.

Graphomotricity is a function inherent in the human being, which «allows to trace a message of any kind, in a given space, thanks to the combined movements of the arm and hand, in close connection with the whole body, the first place of expression of emotional life, cognitive and relationship» (Boscaini, 2008). This function represents for the individual the possibility of experiencing and communicating his own interiority through the signs that he traces on any type of surface suitable to imprint it. The recorded trace is proof of the physical, cognitive existence of the person and of his way of being.

The study of graphomotricity allows you to navigate within a complicated phenomenon, that of specific learning disorders (DSA). This chronic disorder begins to manifest itself in the period of the primary and secondary school of first degree and later acquires different characteristics during the evolutionary age and the successive phases of learning (Consensus Conference, 2010).

This category includes misfortune, dyscalculia, dystography, dyslexia (Hammill, 1990) and, as more recently emerged, dyspraxia. But the most disappointing fact is that in all these cases only rarely a correct diagnosis is reached (Van Hartingsveldt et al, 2011) precisely because there is a lack of in-depth studies on graphomotricity.

In fact, deepening the study of DSA has come to the awareness that these originate from neurobiological dysfunctions, connected with the writing process (graphomotricity), calculation and reading and depart from the automation and serialization systems that the central nervous system realizes to improve the impulses it receives and must transfer to the periphery of the body (Brown & Minns, 1999).

The difficulty of writing by hand is often due to an increased level of neuromotor noise, which entails, as compensation, a greater phasic rigidity of the limb system (Smits-Engelsman et al., 2001). The authors also explain that “handwriting requiring a high level of coordination and high precision force regulation is reasonably influenced by the lack of coordination of the general motor-control system”.

In the younger ones, among whom digital writing is more widespread, this evidence-competence is lost: in fact, the progress of typing is a repetitive and mechanical movement in which

there is no motor-fine coordination and there is a mere visuo-searchspace that involves a pressing on the keys sometimes excessive and however poorly controlled. “To confirm this, studies in the literature have shown that, excluding the semantic component, the disgraced subject has no difficulty in producing the motor gesture and that a proprioceptive training improves the motor control and therefore the graphic trait as obtained indirectly in subjects with coordination disorder (Developmental Coordination Disorder) to follow-up of a motor improvement program aimed at general dynamic coordination” (Lovecchio et al., 2018).

Italian studies have proposed protocols that are based on the correlation between learning disorders and praxis-motor difficulties that have been contrasted through “gym” experiences, obtaining significant improvements in bed-writing (Lodi et al., 2014).

This approach demonstrates a return of the Montessorian and Steinerian didactics, based on learning that derive from bodily experience and that consider central the primitive concepts of *formamentis*: space, time and logic (Pea, 2007), defined as “not derived” because they cannot be explained through other previous concepts and are such that only real experience allows for their understanding, is the case of “time”, whose understanding is subordinated to the movement of man, which since Aristotle, was taken as a means of making an image of it and explaining its passage.

The graphic trait, therefore, must be studied according to the dynamics of space/time that takes place in a defined geometric space that is the sheet, arriving at hypothesizing that one can reach the existence of a transfer between the space lived by the body, to the circumscribed space of the sheet. The experimental approach, in practice, was therefore based on an original analogy between physical activity and writing.

2. Dysgraphia

Writing, more specifically, calligraphy, is a personal and subjective expression of an identity, therefore, different depending on the individual. It is during the adolescence period that this process seems to assume a defined profile, in particular in this time the boys customize their calligraphic style.

Therefore, in the face of personalization with respect to writing, it is necessary to distinguish a calligraphy in the norm from a disgrace, which as a peculiar characteristic is not understandable nor readable, which does not “respect” those which are the agreed rules of the language to which they belong.

While disortography is a disorder linked to semantic attribution and the consequent ability also of written comprehension and linguistic expression, «the disgraced sees what he wants to write, but he does not know how to translate into motor schemes what he perceives. He often can't even copy a drawing and can't even copy graphic symbols. In addition, there is a deficit in the movements of the eye (dystonia of the oculomotion) horizontally and especially vertically» (Sabbadini, 2005).

The dysgraphia is therefore a disorder that implies a motor impairment, in the programming and execution of a voluntary act, a practice such as the act of writing (Sabbadini G., et al., 1995).

The Russian neuropsychologist Lurija in his studies (1984) speaks of kinetic melody, that is the set of those neural structures that contribute to the fine and controlled execution of sophisticated actions such as the ability of writing. According to Lurija, the process of graph-motor activity is very complex and refers to psychological prerequisites that allow you to recognize phonemes and reproduce them in graphic form.

There are two main functions to consider in the graph-motor process:

- translation of phonemes into visual diagrams: translating phonemes into corresponding graphemes presupposes the ability to recognize them first and then transcribe them (phoneme/grapheme transcoding);
- visuo-kinesthetic translation: this is the executive phase of the process in which it is possible to recognize an unfortunate profile, in which the oculus-motor movement is necessary.

The written production of the single letter, therefore, also the discrimination between one symbol and another, which in the evolutionary phase is presented as a conscious process that refers to an important attentive control, process that should be automatic, Therefore, that provides an acquired ability in adolescence.

The brain mechanisms that according to Lurija come into play in the domain of writing are many, which do not refer to a specific neural area, but which includes an interdependence of structures belonging to various brain areas, such as the temporal cortex, parietal, occipital and prefrontal. In case of lesions to one of these cortical zones, the extraordinary ability to *vicariance*, guarantees in any case the carrying to the term an action like the graphic and writing act from the remaining and concurrent areas in the process, an act that needs to be reiterated turns out to be hypercomplex that could in its subsequent analysis of the writing detect the compromise that is upstream.

If we consider the concept of written “expression” and reflect carefully, we could say that writing makes use of a high communicative ability and that in addition to symbolic and linguistic attribution, must be converted into graphemic production, that for a subject that has abnormalities or slight impairments in neural structures in charge, specifically in the motor field (Tressoldi, Sartori, 1995).

In particular, there are components necessary to reach an effective executive act of writing: *allographic recovery*: the faculty that allows you to select mnemonically the grapheme to be reproduced among the many known graphemes of your linguistic code; *retrieval of graphomotor patterns*: the ability to use adequately and simultaneously the body movements and the fine coordinating action leading to the execution and completion of the task, task that should already be previously and mentally structured, and if otherwise this does not happen in time and according to a proper compatibility of attribution of meaning to the movement itself, what is obtained is a disgraceful calligraphy; *neuromotor efficiency*: is nothing other than the actual and collateral activation of the occipital and prefrontal structures involved that give rise to the oculomotor act; *the organisation of the page and letters*: the spatial orientation, the conventionally recognised form of graphemes and the alignment of the text are essential for comprehensible and functional written production for those who will read the content; *forms and proportions*: in a disgraceful stroke can be easily identified a calligraphic disorganization with regard to proportions, very often the calligraphy is either extremely small or extremely large.

Ajuriaguerra has identified several unfortunate profiles in the course of investigations conducted on children, taking into account both the graphic trace and the graphic motility as analyzed aspects of morphological but also kinesthetic type:

- *“rigid” style*: this style is framed in a gait to the right and with letters that exceed the width of the line allowed. In fact, the letters are particularly narrow and pointed and angular in shape;
- *“abstinent” style*: the child who has this style does not at all respect the proportions, in fact, the writing continues throughout its stroke in an irregular manner and does not reflect a consistent horizontal gait throughout the text produced, It turns out to be very small with prevalence of roundish shapes;
- *“impulsive” style*, which includes rather hasty and dynamic children in movement. They have, in fact, a poorly controlled, imprecise and very “pulled” track;
- *“clumsy” style*, in which messy pages are highlighted, little organized in terms of homogeneity between spaces and lines, letters deleted several times or retouched and difficulty in tying them: children, in fact, prefer the printed one;
- *style characterized by extreme slowness and accuracy*: it shows an apparently perfect calligraphy that however hides the long execution times;
- *“scribe cramp” style*: this style is the most problematic style as different movements involving different body districts are evident; from head to neck and there is an extreme contraction of the entire upper limb that involves painful states that force the child to increase the speed of writing because he finds it difficult to write in those conditions, and very often for these reasons he refuses to continue.

These profiles can be identified individually or even overlapped in the same individual. It is necessary that the evaluation of the disgraceful subject points to investigate the executive part of the gesture, in particular the morphological aspect and that it keeps in mind in order to obtain an effective evaluation of all those aspects previously encountered, aspects such as motor development and motor coordination, sensory-motor aspect, visual-spatial aspects, visual-oculo-motor aspect, visual-constructive aspect and design on copy and on request, praxis-constructive aspect; sequencing and gestural.

Motor planning is at the basis of the act of writing, which provides an adequate manual skill acquired over time, but implies a fundamental prerequisite that is the ability to fine coordination, ability to follow a rhythm in case of dictations or in the intention to take notes, in the eye-eye-manual visual control and in the *hand-finger-wrist* and *forearm scheme*.

It is important, therefore, to evaluate the overall coordination, through the analysis of movements of temporal space coordination, of the correct gait, of the system of crossing of the limbs, of which the whole soma in space is at the base - running, jumping, marching, walking, etc. - which require the acquisition of cross-limb motor diagrams, which presupposes an adequate and simultaneous use of the two hemispheres, and only a conciliation between the two brain parts can allow an optimum acquisition of reading and writing activities, fundamental to the learning process, both cognitive and motor.

To be able to distinguish a simple difficulty in the act of writing from that of a real disorder of the unfortunate type, is of fundamental importance in the evaluation of the misfortune. A difficulty in performing legible calligraphy is sometimes not entirely attributable to a real disorder, the characteristic of a calligraphy maybe not very readable can be due to temporary factors and probably also associated with emotional or psychological difficulties, usually transient.

For this reason and at the moment in which there is a simple problem of an emotional and situational type in writing, it will be possible to understand that it is a condition that is completely untouchable. When instead we are faced with a real disorder such as the misfortune, you will notice that the subject may have some slow and partial improvements but would not succeed, in the absence of a targeted intervention, to get a normal handwriting profile.

The first parameter to be analyzed with respect to a suspect disgraceful profile, is to make sure that the written product is readable, and that the calligraphy is beautiful, and tidy does not mean that it is readable, therefore accessible to the reader, with a clear communicative impact.

The second parameter, the subject to be evaluated should be able to write following the rhythm of who "said".

3. Theoretical assumptions

The theoretical assumption from which this investigation starts is that the writing expresses the orientations of the subject towards the world (Moretti, 2006, Torbidoni & Zanin 2013, Boscaini, 2008). The way of tracing the letters and the way in which the person arranges the writing on the sheet are considered the expression of the cognitive, affective, and volitional attitudes that he activates to respond to the solicitations coming from the context.

The expressive potential of handwriting makes it possible to recognize in it a "device" capable of highlighting the traits that mark the personality of the writer.

The reference framework that supports the interpretation of the graphic line can be found, in this regard, in the system that oversees the interpretation of the child's drawing or the family's drawing.

The meaning that the spatial variables assume in this context can in fact also be extended to writing, so that it becomes a "sign" suitable for revealing dimensions such as the perception of oneself, the way of relating to others, the dynamism that crosses the cognitive, strong-willed, and affective, dimensions.

The references between writing and personality make it possible to recognize in the handwriting the expressive elements of the mental orientations through which the subject faces the emergencies coming from the context.

In this sense, the graphic stroke can be considered as a manifestation of cognitive styles, that is, of those particular subjective dispositions which, according to R. Sternberg (2006), represent the interface between intelligence and personality.

According to the author's definition, these mental resources do not express intelligence, but the preferential ways of engaging it in learning tasks. They highlight the connections between the cognitive dimension and the constitutive traits of personal identity and precisely for these reasons they can "leave a trace of themselves" in the peculiarities of the graphic stroke.

The profile of cognitive styles adopted in this survey is that developed by the MIT group of the University of Padua (Cornoldi & De Beni, 2015). This choice finds its justification in the fact that this model represents a validated declination of the relative constructs in the didactic field.

The graphic signs analyzed by the research work, on the other hand, are those that can be detected through standardized and scientifically validated tools. More precisely, in this survey, have been selected the traits that can be measured through the "Masquerade" software, a tool developed by the Company *Spin_off N.I.Te* (Natural Intelloigence Technologies srl) of the University of Salerno.

Cognitive styles

The cognitive styles identified by the *MIT* group of the University of Padua are defined through pairs of "opposite and complementary" traits.

They are understood by the model as sets composed of two dimensions which, although alternative to each other, are organized in such a way that the increase of one corresponds to a similar decrease of the other.

1. *Systematic-intuitive style*: «the systematic style is characterized by the procedure in small steps and the consideration of all the variables involved, while the intuitive style works preferably on hypotheses that it seeks to confirm or refute» (Cornoldi et al, 20015, p. 42; tda).
2. *Global-analytical style*: the global style is that of people who prefer to first analyze the object as a whole and then identify the individual parts; the analytic style, on the other hand, is specific to the person who prefers to focus on the details first and only later to bring them together in an overall structure.
3. *Impulsive-reflexive style*: the impulsive style is typical of those who, when faced with a problem, immediately seek the solution without the mediation of reasoning; the reflexive style, on the other hand, is specific to those who arrive at the solution only for subsequent steps, based on the anticipated representation of the sequences of action, on self-regulation, on the preventive verification of the consequences.
4. *Verbal-visual style*: the verbal style is specific to those who prefer systems of representation of knowledge based on the linguistic-verbal code; the visual style, on the other hand, is specific to those who prefer forms of representation of knowledge anchored to codes of an iconic and visual-spatial nature.
5. *Very Autonomous-Little Autonomous style*. It is the style that indicates the subject's ability to personally manage the processes of self-regulation of learning and finalization of the action.

The distinction between the polarities that define the styles is represented by the Average.

In any case, as you progress from the lowest scores to the highest scores, the intensity of the trait relating to the first polarity decreases and the intensity of the trait associated with the second polarity increases in a complementary way. In this sense, the lower scores on the test represent a prevalence of the first trait, while the higher scores express a prevalence of the second trait.

Graphic strokes

The graphic strokes considered in this survey are the following:

1. The *Amplitude of the angle between two strokes*: indicates the way to draw the connection between two graphic strokes that have opposite directions (for example, the way to draw the transition between a descending and an ascending stroke, or vice versa). It can be considered a projection of the basic mood, that is, the underlying emotional tone of the person, independent of the circumstances and emergencies of the context. In this sense, the higher intensities of the sign indicate a calm and relaxed basic mood, while the lower scores express an agitated tone, oriented in a reactive and impulsive sense. Furthermore, the reduced amplitude of this angularity is considered an index of mental rigidity and poor helpfulness towards others and the context. On the contrary, the wide angularity indicates open-mindedness, thoughtfulness, and willingness to accept the solicitations coming from the context.
2. *The Caliber*: from a graphometric point of view, it represents the size of the handwriting, considered starting from the average height of the letters that are placed in the central body of the handwriting. Its intensity is considered as the projection of the value that the subject recognizes to his own ego, so that the intensity of this experience is directly proportional to the intensity of the sign.
3. The *Distance between words* detects the average extension of the spaces that separate the final letter of a word and the initial letter of the next word. It indicates the extension of the *breadth of views*, but it is also considered a signal of weighting and reflectivity. Also in this case, the intensity of these strokes is considered directly proportional to the intensity of the graphic sign.
4. The *Interletter*: is the sign that detects the average distance between the letters that make up the same word. It is considered a projection of the “space” that the subject is willing to grant to others. In the higher values, it indicates helpfulness towards others and the tendency to reflexively accept the solicitations that come from significant relationships. In the lower intensities it indicates instead an attitude of closure towards others and the tendency to overestimate one’s own needs and own points of view with respect to those of others.
5. The *Tied sign*: it is the sign that detects insofar as the letters that make up the same word are connected to each other by connections or are drawn in a “detached” way from each other. The sign is considered to express the tendency to establish emotional ties and to identify logical relationships between concepts, knowledge, objects of the world.

4. Results of the survey

The data analysis focused on the detection of the Regression index of the graphic signs on the styles and the percentage of variance explained by each of them (index R^2 .) In this sense, regressions that find values of $p \leq .05$ were considered as significant.

a) Systematic-Intuitive style

The signs that show a significant direct regression on this style are the *Distance between words*, ($p.09$; $R^2 = .20$) and the amplitude of the *Angle between two strokes* ($p .00$; $R^2 = .94$).

The regression of the *Distance between words* can be interpreted as a function of the harmony between the meaning of the sign and the characteristics of the styles, keeping in mind that the increase in style values indicates the transition from the Intuitive to the Systematic side. In this sense, the higher scores of the sign can be interpreted as a signal of its interaction with the Systematic side and therefore of the tendency to weighting and to the orderly and sequential execution of the action. The correspondence between the two variables also indicates the tendency towards an anticipated representation of the action, the consequent anticipated evaluation of the cause-effect links and the preventive planning of action. On the contrary, the reduced distance

between words is found in correspondence with the lower values of the style, therefore in correspondence with the Intuitive side. It indicates the tendency to unplanned and impulsive initiation of the action, and the absence of preventive focus on the variables of the problem (Fig.1).

Distance between words

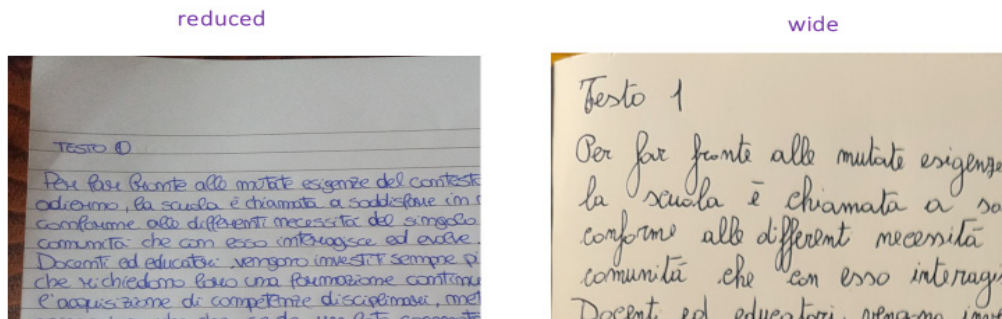


Figure 1: Examples of graphics with small and large distance between words

The wide *Angle between two strokes* is found in correspondence with the highest values of the style, therefore in correspondence with the Systematic side. It can be interpreted as a manifestation of the ability to “keep under control” sudden changes in the way of solving problems (“frantic” search for solutions), especially when the solution adopted don’t achieve the expected results; It also expresses the inclination to move from one solution to another, not immediately, but in a methodical and reasoned way. On the contrary, a reduced *Angle between two strokes* is found in correspondence with the lower values of the style, therefore in correspondence with the Intuitive side (Fig.2).

Angle between two strokes

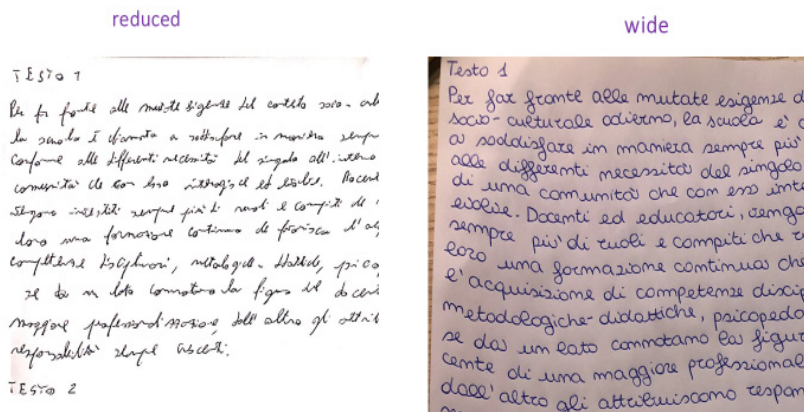


Figure 2: Examples of graphics with reduced and wide Angle between two stroke

It can be interpreted as a manifestation of the tendency to move from one solution to another in an immediate way, often devoid of weighting and not focused on finding the reasons for the change (way of proceeding by trial and error).

b) *Analytic-Global style.*

The signs that present a significant direct regression on this style are the *Distance between words* ($p. = .00$; $R2 = .81$), the *Angle between two strokes* ($p. = .00$; $R2 = .92$) and the *Caliber of the writing* ($p. = .03$; $R2 = .18$).

The wide *Distance between words* is found in correspondence with the highest values of the style, therefore in correspondence with the Global side. The point of intersection between the latter and the graphic sign can be identified in the fact that both represent the manifestation of the ability to look at the situation with an overall view, capable of grasping all the elements of the situation in the right relationships and in the right perspective. The reduced distance between words, on the other hand, is found in correspondence with the lower values of the style, therefore in correspondence with the Analytical side. Also, in this case the sense of the regression can be identified in the overlapping area between the meaning of the two variables. This intersection can be considered a manifestation of the tendency to consider the situation in reference to single and partial elements. The interaction between this sign and the Global style also denotes the difficulty in perceiving the connection between the same elements and the connections between the parts and the whole.

The wide *Angle between two strokes* is found, however, in correspondence with the highest values of the style, therefore in correspondence with the Global side. The “harmony” between style and sign can be recognized in the fact that they are both a manifestation of the tendency to look at environmental variables in their entirety, with a serene, relaxed attitude and tendentially inclined to grant trust. Furthermore, both variables are indicative of an helpful and collaborative attitude, focused not so much on the meanings relating to the individual elements, but on the elements of “trust” suggested by the whole. In the higher scores, this harmony can be expressive of the tendency to satisfy the environmental demands “a priori” (trust “regardless”), without making the appropriate evaluations and weightings on them. On the contrary, the reduced angle between two strokes reveals a regression on the lower values of the style, therefore in correspondence with the analytical side. The correlation between the reduced angularity and the style in question may indicate a sign of “resistance and opposition”, a projection of the tendency to relate to the situation with the attitude of “vigilance”. In the higher scores of the sign, (which are also the lower ones of the style) this association can indicate a marked tendency to environmental hypercontrol, and also the consequent attitude of “distrust” towards others and towards the demands of the context. The regression of the angularity of the handwriting on the Analytical style can, therefore, be indicative of a resistant and oppositional relationship towards the environment, the signal, in short, of a “distrust regardless”.

Finally, the sense of the regression of the *Caliber* on the Analytical-Global style can be understood by referring to the constructs of Self-esteem and Self-efficacy (Bandura, 2000). These constructs can, in fact, explain the intersection between the meanings of the sign and the meanings of the style. In very general terms, self-esteem indicates the value that the subject assigns to the representation of his own ego. In this sense, it can be considered expressive of the ability to look at oneself in a Global way. Self-efficacy, on the other hand, indicates insofar as the subject feels capable of successfully carrying out a certain task. It arises from the ability to look at oneself in an analytical way, that is, to perceive one’s own resources and potential in a sufficiently clear way. Self-esteem and self-efficacy therefore represent two different ways of looking at oneself and, on the other hand, the way in which the subject looks at himself is projected into the Caliber of writing. On the basis of these premises, it is possible to affirm that a large Caliber indicates a way of looking at oneself at the same time Global and positive; on the contrary, a reduced Caliber indicates a way of looking at oneself at the same time Analytical and negative (Fig.3).

Caliber

reduced

Wide

TESTO 1

Dei fini fronte alle molte esigenze del contesto socio-culturale lo studio è chiamato a ristrutturarsi in maniera sempre conforme alle differenti necessità del singolo all'interno comunità che con loro interagisce ed evolve. Poiché vengono insistenti sempre più le nozioni e compiti di lavoro una formazione continua di formazione d'aggiornamento, psicologica, metodologica, didattica, pratica, etica, in grado di formare la figura del docente maggiore professionalizzazione dell'altro gli attribuisce responsabilità sempre crescenti.

TESTO 2

TESTO 1

Dei fini fronte alle molte esigenze del contesto socio-culturale lo studio è chiamato a ristrutturarsi in maniera sempre conforme alle differenti necessità del singolo all'interno comunità che con loro interagisce ed evolve. Poiché vengono insistenti sempre più le nozioni e compiti di lavoro una formazione continua di formazione d'aggiornamento, psicologica, metodologica, didattica, didattica, pratica, etica, in grado di formare la figura del docente maggiore professionalizzazione dell'altro gli attribuisce responsabilità sempre crescenti.

TESTO 2

Abbiamo aumentato la...

Figure 3: Examples of graphics with reduced and wide Caliber

The regression data indicate that the Wide Caliber is found in correspondence with the highest values of the style, therefore in correspondence with the Global side. Based on what was previously stated, it can be considered an expression of the tendency to consider oneself more for the feelings of self-esteem (which arise from a global representation of the Self) rather than for those of self-efficacy (which instead arise from the judgment on the individual skills and individual abilities to perform specific tasks). The reduced Caliber, on the other hand, is found in correspondence with the lower values of the style, therefore in correspondence with the Analytical side. It can be considered an index of the tendency to evaluate oneself more for the experiences of self-efficacy (judgment on individual skills and on the individual abilities to carry out specific tasks) rather than on those of self-esteem (which arise from a global representation of Self). Precisely for these reasons, in the smaller values of the sign, the regression of the Caliber on the Analytical Style can be an index of criticality, because it can represent the epiphenomenon of the difficulty in integrating the evaluation, even positive, of its resources into a global and valued representation of own Self, which even if they are witnessed by adequate levels of self-efficacy, do not translate into the positive representation of self, typical of the experiences of self-esteem. Precisely for these reasons, in the smaller values of the sign, the regression of the Caliber on the Analytical Style can be an index of criticality, because it can represent the epiphenomenon of the difficulty in integrating into a global and valued representation of the Self, the evaluation, even positive, of its resources.

c) Impulsive-Reflexive Style.

The signs that reveal a significant regression on the style are the *Interletter* ($p = 0.09$; $R^2 = .20$); the *Angle between two strokes* ($p = 0.00$; $R^2 = .93$); the *Tied sign* ($p = 0.03$; $R^2 = .20$). The *wide interletter* is found in correspondence with the highest values of the style, therefore in correspondence with the Reflective side. The areas of intersection of the variables can be recognized in the fact that both argue in favor of a subjective orientation marked by the willingness to accept the solicitations that come from significant relationships. The reduced inter-letter is found, on the contrary, in correspondence with the lower values of the style, therefore in corre-

spondence with the Impulsive side. In it we can recognize a signal of reduced helpful towards others and the tendency to reject the solicitations coming reactively and impulsively from relational contexts, including affective ones.

The Reflexive side of the Style also finds a positive regression on its values of the *Angle between two broad traits*. This datum can be interpreted as a signal of behavioral continuity, that is the specific ability, which it found in both variable, to remain in the task for the time necessary for its performance.

The intersection between style and sign also denotes significant attitudes to self-monitoring and to the connection between means-ends and action-result. On the other hand, diametrically opposite provisions are found in the case of the reduced angle between two, which highlights significant regressions on the lower values of the style, therefore in correspondence with the Impulsive side. The meaning of this convergence can be interpreted as the projection of a tendency to impulsive and sudden changes in mood and behavior, and also of an inclination to resentment, to “angularity”, to reactive and oppositional rejection of environmental request.

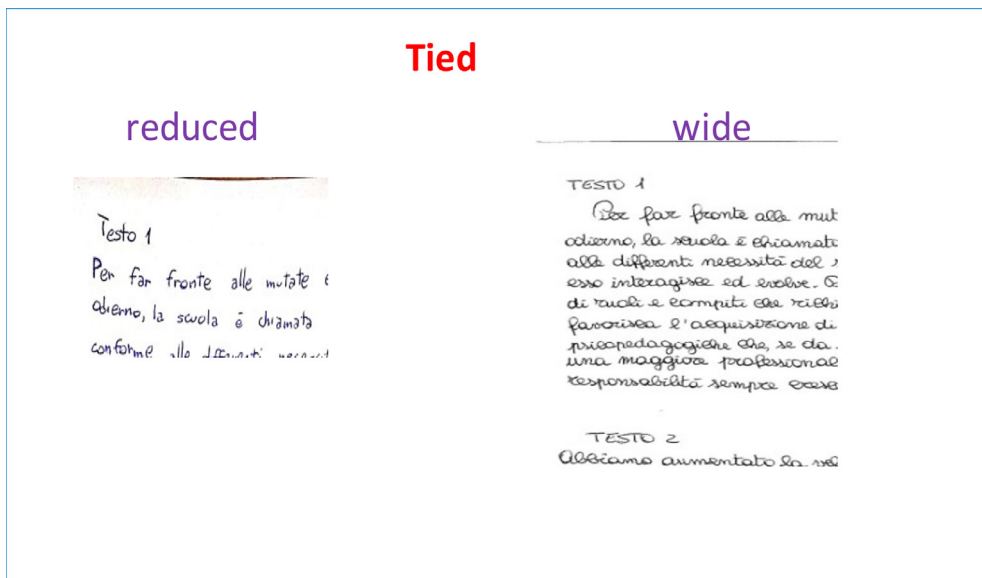


Figure 4: Examples of graphics with reduced and wide Tied

The intensity of the wide Tied Sign is found in correspondence with the highest values of the style, therefore on the side of Reflective behavior. It can be interpreted as a specific manifestation of style, with whose meaning it has a marked correspondence. Both variables, in fact, indicate the tendency to establish logical and consequential connections between concepts, and positive relationships with the presence of the environment. The reduced Tied sign is found, on the other hand, in correspondence with the lower values of the style, therefore in correspondence with the Impulsive side. The convergence between style and sign can be recognized in the fact that both express the tendency to establish improvised and simply juxtaposed connections between concepts. They also denote the consequent difficulty in establishing logical connections and emotional ties with the presences that move in the context (Fig.4).

d) Verbale-Visual Style

The signs that detect a significant regression on the style are the distance between words (p. 0.08; $R^2 = .78$ and the angle between two strokes (p. 0.00; $R^2 = .78$).

The high amplitude of both signs is found in correspondence with the highest values of the style, therefore in correspondence with the Visual side. The areas of intersection of the Style

with the two variables can be considered as a confirmation of the substantial convergence of the provisions associated with the respective configurations. The intrinsic dynamism of this harmony is recognizable in the preference for coding systems of an iconic-synchronic nature, and in the consequent attitudes:

1. to intend reality through overall visions;
2. to focus on the complexity of the elements that characterize tasks and contexts;
3. to place the situational variables in the right relationships and in the right perspective.

The tendency to consider objects in order to the configurations of the whole, in the most extreme cases, can however testify to a certain difficulty in identifying the peculiarities of the contexts and tasks with which the subject is called to confront.

The reduced signs *Angle between two strokes* and *Distance between words* are found, instead, in correspondence with the lower values of the style, therefore in correspondence with the Visual side. Also in this case, the sense of the regression can be found in the overlapping areas between the features of the style and the peculiarities of the two graphic signs. It can be interpreted as an index of the preference for coding systems of knowledge of a diachronic-linguistic nature, focused on the precise consideration of the elements in their singularity, and less oriented to organize (at least in the starting phases of the learning tasks) the cognitive paths based on overall visions.

e) More Autonomous-Less Autonomous style,

The Style detects a statistically significant regression with the sign “Angle between two strokes” (p. 0.00; R2 = .90). The high amplitude of this sign is highlighted in correspondence with the highest scores of the style, therefore on the Most- Autonomous side. The meaning of this evidence is also identified in this case in the convergence between the meaning of the sign and the meaning of the style. The Most-autonomous side, as well as the wide angle between two words, are, in fact, indicative of the ability to plan, self-regulate and finalize behaviors. At the same time, they also testify to the tendency to implement the preventive evaluation of the action and its consequences. Elements common to the two variables are also identified in the aptitude to suspend the immediate response to a current stimulus, to make it functional to the achievement of a future goal, more significant for the person and/or for the task he is carrying out. On the contrary, the Less-autonomous style, as well as the lower scores of the graphic sign in question, are indicative of an episodic and fragmentary behavior, even if not necessarily reactive (reactivity is present only in the higher intensities of lack of autonomy). Furthermore, both variables highlight the difficulty of developing action plans, a certain tendency to improvisation, a marked focus on the present, as well as poor coordination and difficulty to project elaboration of temporal plans.

Conclusions

The results produced by the empirical investigation allow us to confirm the initial hypothesis of the existence of a possible projection of subjective dimensions in the handwriting. This statement, however, needs to be clarified, as it is necessary to identify the cases and signs in which this association is most relevant, in order to distinguish them from cases that do not detect this relevance. In general terms, it is possible to state that the interaction between styles and handwriting is detected with a certain consistency for all the graphic signs described in the previous pages. Of these, it should be noted that the graphic trait that presents a significant regression on all cognitive styles is the *Angle between two strokes*. In particular, the reduced angularity is expressive of the left side of the styles (the one that, in their definition is reported as first), while the more intense angularity correlates with the right side of the same (the one that in the definition of the style is reported as second). Furthermore, all the signs that show significant regressions refer to traits located in the central body of the handwriting. In this sense,

a first conclusion allowed by the survey is that *only for these signs* it is possible to confirm an association with the features. However, this conclusion is not possible for signs that extend *above or below the central body of the handwriting*. With respect to these variables, the research has highlighted two critical elements. In some cases, the lack of interaction between signs and styles is due to the absence of statistical indices that indicate the significance of this association. This is, for example, the case of the *ascending line* (a line that, as it proceeds to the right, tends to move towards the top of the sheet) and of the *descending line* (a line that, as it proceeds to the right, tends to move towards the bottom of the sheet). The values of this sign, although detected by the survey, in no case show significant regressions on the styles. The other critical element concerns, however, the measurements relating to the upper and lower extensions of handwriting (graphic signs that extend into the upper or lower area with respect to the central body of the handwriting). These traits have significant interactions with the styles, however their graphological meaning does not appear syntonic with the traits that specify their characteristics.

In any case, the particular configuration of the signs that have significant statistical indices allows us to affirm that they can represent a valid support for the activity of the teacher. Their detection does not require a specific measurement, because they can be evaluated by simple observation of the handwriting. For these reasons, they can represent for the teacher a tool that allows to obtain “directly in the field” useful elements for the knowledge of the students and to organize learning paths more syntonic with the peculiarities of each one.

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