Writing between Graphic Spaces and Lived Spaces—Coordinative and Deficit Aspects in the Dysgraphic Child: Praxeological Suggestions

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Abstract: This study is aimed at providing a reflection on the meanings of the child’s body in developmental age in the spaces that coexist in his learning environment, which translate into the ability of the same to coordinate his own motor action in codified spaces, which are spaces vital or the space outlined on the sheet of a notebook. Gross motor and fine coordination form the basis of a long and sophisticated learning process of skills such as writing, an activity that is preparatory for the duration of the entire learning process from a long-life-learning perspective. Writing is primarily a motor action, which is completed and coordinated thanks to the motor prediction of purposeful movements, but also implies the production of associations of graphemes that have a conventionally shared meaning. If these graph-motor skills are not acquired according to the age of development, this could give rise to a possible diagnosis of dysgraphia which results in the obvious difficulties of creating a writing that is legible and harmonious. This disorder could be traced back to the inability to fully and simultaneously dispose of the visual-perceptive, exploratory and spatial coordination faculties both of the whole body and of the individual structures of the eye, hand and upper limb that cooperate the visual-kinetic functions of the graphic act.

Keywords: Coordination, motor planning, dysgraphia, primary school, motor evaluation.

1. Introduction

Writing is a sophisticated psychomotor act, one of the most complex of manual activities, the result of multiple learning and is made up of combinations of skills, which coexist and converge making use, specifically, of a recruitment of both cognitive and graphomotor resources. The act of writing must therefore be understood as a competence that is not limited to a spatial coordination relative to the sheet, but to a spatial-temporal coordination with relative dynamics of attention and memory, presuppositions that allow you to be able to implement a motor program that foresees movements of fine coordination and oculo-manual. Writing requires an act of coding and decoding graphemes, mnemonic functions and related orthographic, graphic and motor skills.

The action of the written gesture should be precise and fluid, which in turn guarantees its reading and understanding.

The process of learning to write is a multi-systemic integration of factors that is placed in a given space, which takes shape thanks to the movement of the hand and the grasping of the pen in order to perform what is called a praxia [1], a planned executive act that allows you to fulfill the main function of communicating, in order to inform, but also to relate to the other, as well as to represent yourself. In the absence of a defect affecting, this important skill, the child, as a rule, learns to write after a path dedicated to this learning that begins in kindergarten and is completed in the first cycle of education, at the end of which he should succeed in writing optimally while maintaining a precise trajectory and orienting the graphic stroke within the page and staff [2, 3]. Learning the ability to
write means being able to synergistically use force mechanisms linked to the hand and upper limb and spatial coordination processes in the horizontal and vertical directions in relation to the space of the sheet.

Writing a text requires the involvement of neural structures and superior skills, linked to the ability to skillfully elaborate a written text, therefore attentional, coordinative and mnemonic skills are preparatory [4]. Graph-motor skills define the school life of a child especially in primary school, and starting from the second year of the first cycle of education, the skills of reading and writing should be fully acquired in various styles such as large and small print, and italics.

The graphic act therefore assumes a fundamental meaning in the developmental life of the child, precisely because in addition to having repercussions on academic achievement, it could compromise the possibility of being able to express oneself, therefore, also having negative effects on his emotional sphere. The reference to the praxeological approach becomes fundamental for a wide-ranging didactic reading that focuses on the various motor combinations compromised by the dysgraphic disorder, soliciting new possible paths to be followed by primary school teachers, as requested by the Italian Ministry of Education in the field of reading-writing learning [5].

2. Dysgraphia

Dysgraphia is a specific learning disorder that is caused by a motor deficit, the etiological reasons of which are to be found in the impairment of the abilities relating to space-time perception.

Article 1 of Italian Law No. 170 of 2010, verbatim quotes For the purposes of this law, dysgraphia means a specific writing disorder that manifests itself in difficulty in the graphic realization [5].

De Ajuriaguerra defined dysgraphia as an impairment of the quality of the graphic line, an aspect that implies the problems related to the manifest executive-motor problems of writing [6].

According to this thought, it should be easy to distinguish a normal calligraphic stroke from a dysgraphic one.

Therefore, the presence of an impairment of a motor nature can be deduced, which exclusively involves the graphism and not the morphosyntactic and orthographic aspects.

The ability to write implies one’s own personal expression, and is different depending on the person, and in this key, when the child is less able to use the communication channel of writing effectively, it could spill over as well as on the subject’s school life, also on his sense of self-efficacy and self-esteem [7].

It can therefore be agreed that dysgraphia should be understood as a disorder deriving from praxis and visuomotor coordination and integration difficulties. The deficit does not concern in isolation a visual or motor disturbance, but the difficulty in transferring visual information to the graphomotor system. [...] The dysgraphic sees what he wants to write, but he doesn't know how to translate what he perceives into motor schemes. Often he cannot even copy a drawing and even more so he cannot copy graphic symbols. There is also a deficit of gaze movements (oculomotion dyspraxia) horizontally and above all vertically [8].

It is not to be excluded and may be frequent for the child, given the difficulty of rereading his paper and therefore of correcting it, the presence of spelling errors. Dysgraphia is attributable to coordination difficulties, which is defined as a dyspraxic-based disorder, while dysorthography is to be considered as a purely semantic index disorder [8].

The difficulty of the primary school child to proceed with the drafting of a written text expresses problems related to the acquisition and control of the visual-motor faculties as well as the praxic-constructive and manual ones [1].

The pathogenesis of graphic skills is to be found in the evaluation of the praxis necessary to carry out the functions of copying, dictation and writing, as well as
other preparatory elements such as the mnemonic recovery of graph-motor patterns. Writing means associating and creating a relationship between the “signifier” and the “signified” by producing the corresponding grapheme. The movement of writing is a motor program with a complex index that results in multiple combined movements of adduction and abduction, flexion and extension, which allow an adequate grip of the writing instrument such as the pen, as well as motor control and muscle contraction and decontraction borne by the upper limb. To better clarify the complexity of multiple movements that follow and coexist in the act of writing, we can speak of kinetic melody [9]. In this vision, the actions of graphemic transduction of phonemes and those of global and fine-motor coordination must be able to operate in a harmonious and organized sense.

3. Perspectives for the Assessment of Dysgraphia

Since dysgraphia is a disorder that is often present in comorbidities, it is a good idea to take into account the absence of physical-intellectual disabilities or language deficits before making any assessments on the matter. Making a diagnosis of dysgraphia in children means being extremely cautious, and discerning the cases in which it is actually necessary to initiate a process of evaluating the graphic act, such as in the case of illegible handwriting, therefore, incomprehensible [10]. The evaluation of dysgraphia must therefore be posed according to a systemic approach and a series of factors must be analyzed from which this type of diagnosis cannot be ignored, therefore it is important to observe: attitudes and postures; any compensatory positions assumed by the head, shoulders and upper limb, the latter often subject to stiffness and contractures, aspects that can prevent translation movements with respect to the sheet; the contact of the wrist and part of the hand on the writing sheet, a fundamental aspect to guarantee the stability and fluidity of the handwriting; the position of the sheet with respect to the trunk, whether vertical or oblique with respect to the gaze of the writer, the grip of the pen (the optimal one is the tripod grip, guaranteed by the stable grip of the thumb, index and middle finger), which, however, allow stability but also wide variations of movement allowing the child to draw and color without difficulty and without moving the wrist [11]. The current standardized procedures most in use in Italy for the assessment of dysgraphia are the “BHK scale, Synthetic scale for the evaluation of writing in developmental age” [12] and the “DGM-P, Test for the evaluation of grapho-motor and postural difficulties of writing” [13]. The BHK scale [12] is specific for the evaluation of the graphic stroke for primary school children, and consists of a copy of a standard test that is the same for all subjects, to be transcribed on a blank A4 sheet. The text is presented in lowercase but must be copied in italics. This scale analyzes 13 parameters regarding the quality of the graphic gesture, and the task is to be performed in 5 min, all timed by the administrator. These parameters are: (1) size of the writing; (2) left margin not aligned; (3) fluctuating trend of the writing line; (4) insufficient space between words; (5) sharp angles or elongated links between letters; (6) broken links between letters: pauses in the trace or absence of links between letters; (7) collision between the letters due to the short distance; (8) irregular size of the letters; (9) inconsistent measurement between letters with and without extension in height; (10) atypical letters; (11) ambiguous forms of letters from a morphological point of view; (12) retouched or traced letters; (13) track unstable [12]. The destabilizing aspect of the white sheet, without pre-structures of coded lines, increases its degree of difficulty, and the child will have to recruit all his coordination skills in the space of the sheet to complete the task, trying to reconcile clarity and correctness of writing. The DGM-P test [13], on the other hand, foresees two types of transcriptions, one for Best Condition, the other in the Fast type condition, both in italics to be
carried out on lined notebook sheets, depending on the grade of the class attended. The parameters examined are: (1) writing speed; (2) learning errors; (3) self-corrections; (4) floating letters; (5) dismetries; (6) confusions between similar letters; (7) ascending/descending traits reduced in dimension; (8) unrecognizable letters; (9) insufficient spaces between letters (collisions); (10) maximum amplitude of the fluctuation of the letters; (11)-(12) maximum variation in the height of the letters (average and ascending/descending) [13]. These parameters allow information to be obtained with respect to: (1) efficiency in learning the movement of writing in italics; (2) speed of execution of the task (evaluated on the basis of the number of letters per minute); (3) the readability of the written text, obtained from the evaluation of the parameters considered. Finally, the DGM-P [13] provides that the operator, in taking stock of the performance, can also observe and consider for each child the possible presence of habits of body posture and grip of the pen that are not very functional for the production of a fluid and well organized graphic act. For this purpose, the test also prepares a special registration form that guides observation through a series of icons that visually represent the different postures that can be assumed by the body districts involved during a writing task [13].

A reeducation path to graphic gesture for dysgraphic subjects or a prevention one (where there are suspicious cases and/or at risk), must include strategies to be implemented not only with respect to graphic skills, but also and above all aim at achieving an adequate manual coordination, and will also have to consider perceptual aspects related to global motor skills, which play so much part in a specific learning disorder such as dysgraphia.

The intention should be aimed at implementing a program consisting of several phases to be integrated: starting from the pursuit of skills inherent in perception, spacetime organization, limb crossing system, rhythm, knowledge, representation of the body scheme and to equilibrium; other programs could then follow, aimed at stimulating laterality, visual-motor coordination and purely manual coordination with targeted exercises of fine coordination of the fingers, up to reaching more specific and complex phases characterized by tactile and visual perceptual stimulation such as the introduction to pictographic and writing techniques, to diversified manual activities such as the manipulation of moldable and manipulable materials, as well as the frequent and repeated structuring of individual graphemes, preferring writing in block letters and cursive, all supported by exercises for the correct grip of the pen and for taking proper postures.

### 4. Praxeology and Motor Evaluation

The scientific recognition of the role played by corporeality in movement in all school segments has prompted a necessary review of curricular activities primarily centered on the body-kinesthetic channel, contributing to the ministerial redefinition of current curricular indications [14]. The current ministerial guidelines of 2012 [14] urge Italian teachers from kindergarten to search for new possible itineraries for planning and scheduling activities related to the various fields of experience. Hence the ministerial invitation to teachers to revisit the possible “paths to follow” starts from kindergarten. The introduction in the school environment of a praxeological approach could offer new teaching suggestions about the choice and integrated use of motor assessment tests capable of identifying and possibly ascertaining the existence of motor difficulties, especially in writing.

The possible reference to the use of diversified forms of motor evaluation in the didactic field, between origin from Parlebas’ reflections [15] on the study and analysis of motor behaviors, open “a window” of reflection on the inclusion of procedures and motor evaluation phases in a diversified way.

If we start from the assumption that movement has a “sense” that is not only attributable to the
physiologically and anatomically observable response, it follows that each action corresponds to a set of criteria that govern the performance of an action itself. The praxeological approach introduced in the international scenario by Parlebas [15] deals with movement starting from the analysis and study of motor behaviors.

The motor conduct is a motor behavior or the sequence of observable manifestations; the motor action actually involves multiple and diversified aspects on the part of the acting subject, and it is possible to go beyond the purely mechanical and biological mobilization of motor behaviors aiming at: a meaningful organization of the actions and reactions of a person who acts, the relevance of whose expression is of a motor nature. A motor behavior can only be observed indirectly: it is manifested by a motor behavior whose observable data are endowed with meaning, and which is lived consciously or unconsciously by the person who acts [15]. From a praxeological point of view, therefore, we no longer want to give importance only to motor action, but we want to “dig” deeper to grasp and understand “the meaning of the motor experience”, highlighting both the objective and observable manifestations of movement (displacements, stops, feints, ...) and the subjective meaning associated with it. It follows that the sense of movement is synonymous with complexity deriving from the integration of anatomical functional aspects with socio-relational ones. Parlebas has no doubts in arguing that movement should be read in a transversal key starting from a real kinesiological grammar that manifests itself through the body and the movement of parts of it.

It becomes essential from the earliest stages of schooling to urge “not a simple automatic repetition of movement”[16] but a personal processing of sensory information. In primary school, in particular the teacher’s attention can only refer to manual eye coordination referable to reading and writing, that are activities that require the execution of increasingly precise and functional movements to carry out a specific action takes shape progressively thanks to synergistic functionality of the visual channel with the movement of the body and its parts.

The integration of the combined movements of the eye with the hand aimed at manipulation would therefore be indicative of a motor action relating to an object that can no longer be considered a simple body movement [17]; in this sense, the development of intellectual processes can be configured as the transformation of processes that were originally directed to external objects in the form of motor actions [17].

The ability to control and harmonize one or more movements both in terms of effectiveness and continuity is in fact linked to a series of factors which are also determined by the specific phase of growth, maturation and development of the different systems that regulate the movement, by the differences, physical and psychological characteristics of the subject and the characteristics of his cognitive system.

In this regard, Meinel clarifies that the prerequisites for coordinated action are reflected in the “functional capacity” (functional maturity) of the movement control bodies [16] to receive, process and transmit information from the environment by developing its functionality in relation to the typology of diversified experiences whose quality depends on the morphological and functional assumptions existing in the organism and its organ systems accompanied by “feedback information” [16].

In this sense, childhood, characterized by specific phases of the processes of functional maturation and psychomotor development, is configured as a period in which only some motor tasks can be carried out, as each motor execution is also linked to the possible ability of motor control. In this perspective, coordination would depend both on the psycho-physical development phase and on the function of the environment in offering the subject executive opportunities and the construction of motor
skills. The motor behaviors are determined by the influence of the five dimensions of the personality (cognitive, socio-relational, biological, expressive and affective) and manifest themselves through:

- the expression of the face
- the look
- personal smell
- gestures and body movements (especially those of the head and hands)
- gait or walking
- postures (standing, sitting, curled up, kneeling, lying down)
- body contacts
- spatial behavior (proximity, orientation, territorial behavior, movement in the environment)
- the use and organization of the space
- the outward appearance (physical dress, other components)
- non-verbal vocalizations (laughing, crying, shivering, whistling, shouting, etc.)
- subliminal perceptions (very small behavioral changes that reveal concern or other unusual feelings), silence or isolation and, finally, the rhythm (respiratory, emotional, motor) [16].

Indeed, the motor behavior is not just a sequence of events, nor a conscience disconnected from reality. It is the opposite: the wholeness of the human being is favored, what turns the person’s actions into something meaningful [15]. The motor behavior concept plays a crucial role in physical education when the external observation point of view (observable behavior) and the internal meaning (personal experience) are combined [18].

According to Lavega [18], the notion of motor behavior can be outlined as it follows: (a) Every motor practice carries an internal logic that express a singular set of motor actions; (b) While taking part in a motor activity, a person is able to get adapted to what the internal logic demands and to the processes that arise as a result of the motor behaviors; (c) The motor behavior does not reflect only the person’s motricity, but also cognitive, affective, emotional and relational components, it comprehends the human being wholeness; (d) A motor practice which is part of the same motor action area activates the same structural tendencies, makes the protagonists face the same problems and/or makes them go through adaptations which share a similar nature, resulting in similar consequences upon their personalities; (e) The motor action are a can be applied in not very organized motor situations, through games and sports.

However, the praxeologic paradigm does not relate only to the development of the motor skills on the game; praxeology tries to find objective characteristics that constitute the functional structure of each motor situation. During entertaining activities and sports, players interact with each other in different ways, in a vast and unique field of motor actions. The natural ocular-manual synchrony is in fact the expression of a constant cognitive and social integration that characterizes the motor system and in particular that part that is expressed in the manipulation [19]; the need arises for the teacher to present operational proposals that respect different stages of development and the different functionality of quality systems connected to movement control. In this sense, childhood, characterized by specific phases of functional maturation and psychomotor development processes, is configured as a period, the achievement of goals and motor skills is strongly correlated with the amount of experiences lived from early childhood. In other words, the influence exerted by experiences would be such as to affect the structuring of coordination skills and especially in hand-eye coordination. According to the Italian ministerial documents for primary school, the teacher’s task is to plan and choose through a plurality of evaluation tools in order to design educational interventions on the ways of being, on the rhythms of development and on the learning styles of each child [20] which are built “through specific formative itineraries” [20] structured on the daily doing and acting of the child.
and the teacher. Particularly important becomes the choice and integrated use of motor assessment tests that are easy to manipulate and use in various situations and in the most different ways [20] to be able to map developments and any difficulties affecting one or more motor functions.

5. Conclusions

A motor evaluation model that can be proposed in the school setting could be the integrated use of motor evaluation tests capable of identifying and possibly ascertaining the existence of motor difficulties and the related triggering causes. The possible integration of diversified forms of motor assessment in teaching opens a window of reflection on the inclusion of procedures and motor assessment phases in the curricular school path by introducing procedures consistent with the school-curricular organization.

Every physical education professor should know, in a scientific manner, by observing and researching, the knowledge that is within the motor behaviors and intervenes in the analyzed context [15, 18]. That is the only way to become a kind of a “reader” of the motor behaviors, uniting the scientific and pedagogical knowledge, rather than being only a guide of the automatization of the identifiable skills of a game. The praxeologic perspective is, therefore, a pedagogical practice that observes, registers and intervenes in the motor situations of students. However, the praxeologic paradigm does not relate only to the development of the motor skills on the game. Praxeology tries to find objective characteristics that constitute the functional structure of each motor situation. During entertaining activities and sports, players interact with each other in different ways, in a vast and unique field of motor actions. We cannot therefore exempt ourselves from speaking of corporeality, since it is the unfolding of all the existing dimensions of an individual, mind-body-soul, and learning cannot take place if one of these three dimensions is not predisposed to coexist with the other two. Furthermore, Corporeality does not only concern the initial time of the child’s first explorations, it concerns the span of his entire life and so too the learning processes are linked to an infinite time, that is to the dimension of long life learning [21].

Having full awareness of one’s body and of the space-time conception means being able to exercise one’s actions also improving cognitive abilities, as well as cognitive learning abilities with respect to primary reading and writing skills, as well as motor learning ones. The primary school child who is consciously trained in the use of his own body in action, is also trained in his corporeality, because knowing his own needs and knowing his potential he is able to use the new resources he has available to be able to learn, and in case of limitations such as specific learning disabilities, he may be able to self-learn, so as to be able to recruit the necessary means to be able to achieve his own personal ormative goals. The body must be seen not as something accessory, but as something central within the learning processes, since a child lives his daily life through the use of the body movement, much more than an adult, at least in his early stages of growth, and must be able to exploit the completeness of his body by consolidating the movement with expressiveness and communication, even of a non-verbal type [22].

Gibson stated that We do not perceive stimuli or images or retinal sensations or even just things; what we perceive are things we can eat, sit on or talk on [23], in the idea that the child’s impaired perceptual capacity can prevent him from acting in his environment in the way he really wants and that best suits his personal needs. According to this approach, favoring the learning of new motor skills through specific praxeological suggestions, allows a dysgraphic child or with other specific learning disorders, to be able to make up for his shortcomings and to acquire new possibilities of action, to be able to master to best his own actions taking place in the world, to select them, and later to discover their
repercussions, to increase and regenerate the process of learning to learn. The relationship between the bodily capacities and the physical properties of the environment in which the child lives his life exists in the interface between his own ego and the world, according to a relationship of reciprocity, of perception-action, since perception must be able to guide action, which is adaptive but gives well-being.

Author Contributions

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