

Gravity in psychomotor skills

From sensorimotor to affectivity

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Abstract

Gravity is an essential component of human life on Earth. Current neuroscience teaches us that even fetuses are gradually subjected to it. Developmental neurophysiology links a poorly coordinated or uncoordinated vestibular system to other sensory modalities. Pathology, such as autism spectrum disorders, can manifest as motor, cognitive, emotional, affective, and social impairments, thus confirming Winnicott's work. This data shows that adapting to gravity is a true organizer—in Spitz's sense—of child development and should encourage psychomotor therapists to better consider the phenomenon of "gravity anxiety."

Gravity, affective and sensori-motor development, psychomotricity, autism spectrum disorder.

Introduction

Two young fish are swimming in the ocean. An old fish passes by and says to them, "Mmm... Today, the water is cold."

Then he leaves.

The two young people look at each other, astonished. One says to the other: "Water? What is water?" (Volpones, 2023) [1]

Gravity is an essential component of our environment; it is the structuring element of our orientation and our existence on Earth. We adults, like the two young fish with the water, generally pay no attention to gravity, which is nevertheless an inevitable and omnipresent physical phenomenon in time and space. Gravity is the force¹ which exerts an attraction on us towards the center of our planet. It has shaped the evolution of all living species. This leads Adamopoulos et al. (2021) [2] to state that: "Gravity does not only distort spacetime² It also distorts the biological continuum. It is only when we perceive its effects (when we fall, when an object slips from our grasp, or when we carry something heavy) that we become—perhaps—aware of it. Gravity, etymologically "weight" (gravitas, in Latin), can hurt us. Falling, for example. But

1. A. Einstein (1915) showed us that gravity is not a force but a deformation of spacetime. For our purposes here, let's pretend otherwise.

2 What Einstein showed us (1915).

Getting up, jumping, straightening up, raising our arms, picking things up, bending over, lying down and feeling our supports are the daily lot of earthlings.

Gravity is the force that informs us about certain spatial data, such as up and down (Ahrend-Löns, 2024) [3]. We need spatial orientation and the support of the planet Earth (and, more prosaically, the ground). We are oriented along an up/down axis. When standing, we continuously oscillate—thanks to our flexor and extensor muscles, those known as "anti-gravity" muscles—to maintain our body as close as possible to absolute verticality. Some of our sensory modalities are essential for this, but also for perceiving the spatial relationships between external objects and for correctly identifying

our body's position.

While Isaac Newton (1687) [4] and Albert Einstein (1915) [5] fundamentally theorized the laws of gravity in astrophysics, this principle seems to be completely ignored in psychomotor development. Yet, adapting to gravity is a fundamental and foundational sensorimotor skill for human beings, even from the womb. Many other skills depend on this relative adaptation, such as balance and certain sensorimotor coordinations, but also emotional regulation, memory, body schema (Pireyre, 2021) [6], cognition, and attentional and language abilities...

In this article, we will explore the anatomy and physiology of the vestibular system and its links to proprioception and vision. We will see, in passing, that the body schema cannot exist without this threefold coordination. We will study the sensorimotor aspects developed by Bullinger. We will examine the progressive acquisition in utero and after birth of the "mastery" of gravity. We will make connections with Winnicott's fundamental and pioneering contribution regarding the fear of collapse. We will put forward theoretical and clinical propositions concerning autism spectrum disorders and, finally, discuss the contributions of psychomotor therapy.

The neuroscience of gravity

The vestibular part of the inner ear houses the utricle and saccule, phylogenetically ancient sensory organs, and the more recent semicircular canals, which are responsible for balance and postural reflexes. These are graviceptors. The utricle and saccule play a static role in maintaining balance and posture at rest. The semicircular canals have a dynamic role, contributing to the body's balance during movement.

Whether static or dynamic, the vestibular system constantly provides the brain with a model of gravity based on head position. It thus underpins posture, movement coordination, and gaze stabilization (Tele-Hari et al., 2021) [7]. In doing so, it also enables the coordination of eye and head movements. The resulting visuospatial abilities allow for the adoption of an allocentric perspective. This ability, in turn, facilitates the decoding of others' emotions and empathy.

Vestibular stimuli are conducted by the eighth cranial nerve, the vestibulocochlear nerve. In the inner ear, vestibular and auditory information are combined. They then separate in the brainstem. There, some vestibular fibers reach the vestibular nuclei, while the rest travel to the flocculonodular lobe of the cerebellum, also called the archicerebellum. The vestibular nuclei in the brainstem are important for the development of motor reflexes that control eye movements and posture. The vestibulo-ocular reflex, in particular, ensures that eye movements are coordinated with head movements. It plays a role when we turn our head while maintaining visual fixation on an object. The vestibulo-spinal reflex maintains posture during changes in head position. It is therefore involved in the necessary tonic adjustments.

Pathways from the cerebellum extend to the brainstem and, again, to the spinal cord. At these levels, no coordination has yet occurred with other sensory pathways. This integration takes place higher up, at the levels of the thalamus and cortex (Delle Monache et al., 2021) [8].

is carried out and, more specifically, in the parieto-insulo-vestibular cortex. This is a vast set of cortical territories which link not only vestibular, tactile, proprioceptive and visual information but also affective and mnemonic information (Nikolaeva et al., 2021) [9].

Sensorimotor coordination

Proprioception, like vision, is therefore very strongly linked to the vestibular system. Thalamic neurons respond to both vestibular and proprioceptive inputs from the neck, upper limbs, and trunk. As for the lower limbs, equipped with proprioceptors in the soles of the feet and lower legs, they constitute the base of support (Ahrend-Löns, 2024) [3]. The internal model of gravity is crucial for limb localization and thus involves proprioceptors (Gallagher et al., 2021) [10].

The brain constantly calculates and corrects head positions in real time and—based on these positions—gaze and body orientation to, among other things, maintain our balance. It does this through the coordination of the vestibular, proprioceptive, and visual systems. This triple coordination takes place in specific areas of the parietal cortex. The vestibular system is a prerequisite for proper triple coordination: "signals from the otoliths are sufficient to affect the visuo-proprioceptive transformation" (Gallagher, 2021 [10] and Tele-Hari et al., (2021) [7]). The vestibular system is the primary basis of our triple coordination. Moreover, again according to Gallagher (2021) [10], a vestibular alteration can impair triple coordination. This alteration can occur during the sensorimotor development period, early in life, but possibly even during the uterine period. However, the consequences, possibly multifactorial, of such an alteration can be immense. Tele-Hari et al. (2021) [7] list them exhaustively: sensory dysfunctions, pathological multisensory integration, psychomotor developmental delay, cerebral palsy, intellectual disability, autism spectrum disorders.³ADHD, language development disorders, learning disabilities and dyslexia.

This list is revealing because these consequences are not fully understood by current psychomotor theory. The aim of this article is therefore to suggest that the correct management of gravity plays a crucial role in our perceptions and behavior.

I proposed (Pireyre, 2021) [6], based on international literature, the following definition of body schema: "The body schema is a non-subjective physiological function. It is a sensorimotor, three-dimensional, unconscious, automatic and constantly readjusted representation of the global and/or segmental position of the body and its movements. This representation involves different sensory systems, their coordination and their integration (proprioception, vision, balance). Proprioception is, in adults, the main reference."

Gravity management is therefore fundamental, among other things, to the establishment and integrity of the body schema.

The fetus and the baby are subject, in their own way, to gravity. Let's see what

this means. At the very beginning of life

We will now focus on the development of sensorimotor regulation of gravity. Adaptation to gravity is only possible through the establishment of sensorimotor coordination. Brain development is a process that begins in early gestation. The maturation of graviceptors is completed in the later stages of pregnancy, so we will begin with the fetus.

The vestibular system is the first sensory system to develop in the embryo.³ We will study later and more precisely what the situation is for this population.

The vestibular organs (utricle-sacculle and semicircular canals) begin to develop as early as the 15th week of pregnancy (Provasi et al., 2021) [11] and are functional around the 20th-22nd week, but are not truly active until the 32nd week. By birth, they are almost fully developed. The vestibular efferents, which allow the control and modulation of vestibular muscles and organs in response to vestibular stimulation, develop from the earliest fetal stages (Prégaldien et al., 2024) [12]. After birth, the higher pathways, those projecting to the thalamus, cerebellum, and various cortical areas, must be established. This establishment also involves the coordination of the vestibular pathways with those of other relevant sensory systems.⁴ This means that, in utero and from the third trimester onward, the fetus possesses a system capable, albeit limited, of processing gravity information. Does it need this system? This is where the "astronaut baby" hypothesis, once championed by neuroscience, comes in. This hypothesis relates to the question of the "level of gravity" present in the uterus. We will see that the question of amniotic fluid is also crucial.

The idea that the fetus floats in total weightlessness—that is, that it doesn't feel its own weight—cannot be valid throughout the nine months of pregnancy. Yet, this was the hypothesis of the "astronaut baby." It is only when space becomes limited, towards the end of pregnancy, that the fetus is exposed to a certain amount of gravity. This is referred to as "microgravity." In practical terms, until the 26th week, the fetus only "weighs" 5% of its mass. That is to say, if it weighs 800 grams, it only "feels" 5% of that weight.⁵To give another perspective, there is enough space so that contact between the uterine wall and the baby's back is not constant. After the 26th week, the baby's perceived mass decreases to 60-80%. Thus, if the baby weighs 1,000 grams, it only feels about 600 to 800 grams. Gravity then begins to become "perceptible" (Stanojevic et al., 2022) [13]. During the last weeks of pregnancy, the fetus lives in a very confined spatial environment. Its movements become less frequent, and the amount of amniotic fluid decreases. Gravity increases. After delivery, it increases even further relative to its level in the uterus. In other words, the difference between inside and outside has diminished. This means that, throughout the nine months of pregnancy, gravitational pressure slowly increases until, at the end, we can no longer speak of microgravity (and therefore of an "astronaut baby"). This slow evolution has the great advantage of gradually accustoming the baby to Earth's gravity (Meigal et al., 2022) [14].

The amount of amniotic fluid is also an important factor. It remains relatively viscous from the beginning of pregnancy until the end, and its density changes very little.⁶It is the density of the baby's body that will vary (Wilkinson et al., 2023) [15]. This is what we call "buoyancy." That is to say, at equal densities—baby's body and amniotic fluid—as is the case in early pregnancy, the fetus literally floats. It is then "insulated from gravitational accelerations." Then, when the density of its body increases and becomes greater than that of the amniotic fluid, the fetus loses much of its buoyancy.⁷It therefore becomes denser than the surrounding liquid, which exposes it to the irruption of gravitational stimuli.

In summary, we can say that gravity is conventionally 1G on Earth.⁸Before the 26th week of pregnancy, the fetus's mass is 0.05g. It then gradually increases to 0.6 to 0.8g. Birth exposes the baby to a further increase of 0.2g.⁹Which is no small thing. Especially since arrival in the air exposes the baby to the loss of uterine containment, a sharp drop in ambient temperature, the onset of spontaneous movement that seems chaotic and unpredictable, and the irruption of new sensory stimulations. Dos Santos Riesco et al. (1996) [17] then speak of *birth shock*. These are primarily modifications.

4 Urbancic et al. (2023) [] tell us that this maturation will not end until adolescence. 5 It is until this period that we can speak of the astronaut baby.

6. The density of amniotic fluid changes primarily due to the occurrence of fetal secretions. These are caused by the baby's excretions as well as exchanges at the skin level (Wilkinson et al., 2023) [15]. 7. The question of how the fetus experiences the buoyant force remains open...

8 It is 0.5G on the moon.

9. It increases by 0.4G for a premature baby. Therefore, they do not benefit from gradual exposure to Earth's gravity and often lack the muscle tone and motor skills of a full-term newborn. The gravitational shock is thus greater for them than for a full-term newborn.

transient changes in tone and tendon reflexes that last, most of the time, 24 hours. As the pregnancy progresses, it becomes less and less easy for the fetus to move due to increased gravity, decreased amniotic fluid, and loss of buoyancy (Stanojevic et al., 2024) [17].

Exposure to gravity increases progressively in utero. Movements gradually become limited. In the air, for the full-term newborn, immaturity makes the "shock of birth" significant. The immaturity of the sensory systems and their coordination necessary to overcome gravity thus makes the first bodily sensations in the air extremely intense. Mastering gravity is impossible. We will see later the links between the vestibular system and emotions, and particularly the potential, whether organizing or overwhelming, of anxiety.

Bullinger and the sensorimotor

According to the Swiss psychologist and disciple of Piaget, after birth, the development of coordination allows for the acquisition of absolute verticality. This coordination is organized around the body's points of contact with the ground or supporting surface. For Bullinger (2004) [18], when the vestibular, proprioceptive, and tactile systems are coordinated, the baby's spontaneous movements decrease. Then, thanks to improved postural organization, "oriented" movements emerge, which in turn allow for better auditory and visual localization of stimuli. In the case of a vestibular disorder, the vestibulo-ocular reflex is disrupted. In the case of a proprioceptive disorder, postural instability may occur.

The same will be true if the triple coordination (vestibular-tactile-proprioceptive) is impaired. But in this case, the postural instability will be "massive": postural stabilization is impossible, and the bodily adjustments that usually allow orientation in the environment (using the visual and auditory systems) are impossible. The child then "slips off our lap, and the movements of the head, torso, and body segments, as well as the contortions of the body, are continuous."

Physical containment is essential to help such a baby. It must be carried "in a small, tight bundle."¹⁰ against the adult's chest, with all four limbs together, head supported with neck flexion, and both breaths synchronized. In this way, the child can begin to calm down. In the case of typical development, the sensorimotor mastery of gravity will allow for the development of absolute verticality, "straightening up, sitting, then standing, and finally walking." Gravity is then "instrumented," meaning that the baby masters this component of their development on a sensorimotor level. In 2011, Bullinger introduced the concept of the space of gravity.

Assaïante (2015) [19] confirms Bullinger's theory by considering that the development of the body schema is linked to the establishment of good postural control. "Posture first ensures a balance function during the initiation and execution of an action. Furthermore, posture serves as a frame of reference for effectively organizing movement." Action and movement are intimately linked to the body schema, itself the result of coordination between the vestibular, visual, and proprioceptive systems. Good postural development signals a good start to adaptation to gravity. The same is true for the establishment of vestibulo-visuo-proprioceptive coordination (in the case of the body schema) and vestibulo-tactile-proprioceptive coordination (in the case of gravity control). We will return later to the priority of the vestibular system's development in sensory development compared to the other systems. Because this prior experience will be crucial to understanding certain impaired behaviors of children with autism spectrum disorders.

From Bullinger's sensorimotor theory, we can retain the fact that a good understanding of gravity by the baby is necessary for the development of good postural control and an adequate grasp of verticality. From this positive development stems typical psychomotor and relational development.

¹⁰ But not blocked.

"If the instrumental elaboration of gravity is atypical, 'sensations of endless falling are described. This is probably one of the sources of the primitive anxieties manifested by the young child' (Bullinger, 2015) [20]. Let us see how psychoanalysis, through Winnicott, has studied in its own way the relationship between the baby and gravity, as well as possible pathological occurrences. Winnicott's hypotheses can be found in his article entitled: 'The Fear of Collapse.'"

Winnicott and the "fear of collapse"

The aim of this paragraph is to draw a parallel between the sensorimotor management of

gravity—as discussed above—and the fear of collapse proposed by Winnicott (1974) [21]. The latter could be the psychological counterpart to the sensorimotor aspect described by neuroscience. Indeed, when the English psychoanalyst speaks of the phenomenon of collapse, he describes it as a feeling of "not ceasing to fall." In psychomotor therapy, this can be compared to the bodily sensations verbalized by some patients during relaxation. Their impressions of being heavy or light, whether or not induced by the therapist, actually conceal experiences of relaxation or tension. A "heavy" part of the body is a relaxed part. A "light" part is a tense part. These sensations—in the case of relaxation—can even lead to the evocation of a possible sensation of "sinking"—of "falling"—into the ground. And even below ground level when the relaxation session takes place upstairs. This is exactly what Lewis Carroll [22] describes when he has Alice fall down the rabbit hole at length. In the case of a feeling of lightness, patients tend to speak of a sensation of "taking off." The sensation of falling due to a lack of muscle tone or relaxation relates quite well to a certain form of management—transient during relaxation—of gravity. While the sensation of "taking off" gives an impression of mastery or liberation from gravity, being heavy means being subject to it. Being light gives the illusion of liberation.

We will therefore posit that Winnicott's fear of collapse corresponds to a sometimes pathological management of seriousness. We will see later that children with autism spectrum disorder (ASD) are in this situation.

For a newborn, axial hypotonia can create a feeling of heaviness, a sensation of sinking into the mattress. This is all the more pronounced because life in the air is subject to gravity, unlike the early stages of uterine life.

What does Winnicott say? What he calls "collapsing" could be a universal phenomenon, perhaps so distressing that he prefers the term "primal agony" to "anxiety" ("anxiety would not be a strong enough word here"). The clinical subtlety of this psychoanalyst is considerable when he explains that this agony, expressed in one way or another by the patient, relates to an anticipation—the fear of falling endlessly—but has, in fact, been felt earlier in the person's life ("it is possible that this collapse has already occurred and took place shortly after the beginning of the individual's life"; "I maintain that the clinical fear of collapse is the fear of a collapse that has already been experienced"). The question that then arises is: "Why does the patient continue to be tormented by this, which belongs to the past?"

Because when this phenomenon occurred, the psyche was not mature enough to retain this feeling except in the form of sensorimotor and emotional traces. No memory, no possible inscription in language ("the ego is too immature"). Another question posed by Winnicott, but to which he does not provide a clear answer: why does the feeling of collapse shown by the patient on the couch appear "in reaction to the analyst's failings and errors?"

Psychomotor therapy offers a partial answer when it considers the concept of separation. Patients with autism spectrum disorder (ASD) most often break down during moments of separation that are more or less "masked" or implicit. For example, a child might simply collapse to the ground.

at the end of the session, but also at the beginning when the patient has to leave their parent in the waiting room. More surprisingly, the separation can be materialized by a relative and brief spatial distancing of the psychomotor therapist from their patient or even by a moment of distraction (a "psychological distancing") on the part of the professional.

The analyst's "failures and errors" could then represent for the analysand a feeling of "collapsing"

separation. If the analyst is wrong, then they demonstrate their fallibility, which consequently makes the patient feel the self/other difference against which they "need" to defend themselves. This kind of confrontation with difference is "collapsing."

Winnicott then proposes an equivalence between the fear of collapse and a "specific fear of death." Again, the reference to early traces in the patient's life clearly reflects this fear of death. Indeed, the death expressed here does not correspond to the usual definition of this stage of life. It refers more to a feeling of annihilation, without the sense of finality.

Winnicott also introduces the concept of emptiness as "frightening." So frightening, in fact, that the patient may create a "controlled emptiness by not eating or not learning." We will return later to the clinical implications of this observation by the English psychoanalyst. Finally, the period of life affected by the first feeling of collapse is possibly "situated shortly after the beginning of the individual's life," Winnicott tells us. I have hypothesized (Pireyre, 2024) [23] that the deep root of anxiety or the feeling of collapse is to be found at the moment of birth. This fundamental stage of human life represents the first separation, the one that intensely confronts the newborn with gravity, the one that is the prototype of all subsequent separations. Which "only" repeat this first time. These recurring separations could therefore refer back to the first separation, that of birth. That of the shock of "birth," or rather that of the gravitational shock and possibly gravitational anxiety. We would then be in an infinite repetition of this first experience of gravity. This endless repetition of the gravitational shock of birth is very well demonstrated by patients with autism spectrum disorders.

Autism spectrum disorders

The literature detailing vestibular neurodevelopmental disorders—and their developmental, relational, and cognitive consequences—in individuals with ASD is extensive. Authors do not simply list these disorders; they often also link them to specific neurodevelopmental characteristics. Here are a few examples:

Van Hecke et al. (2019) [24] point to "poor" postural performance in 80% of people with ASD and even describe it as "very early identifiable clinical abnormalities." When the vestibular system is impaired, "drawing, writing, and reading are compromised skills."

Three types of cerebellar abnormalities are observed in ASD:

- the vestibulocerebellar Purkinje cells are smaller than classically— this characteristic hinders the inhibitory role of the cerebellum
- Furthermore, the basal ganglia are structurally and functionally different.

Riquelme et al. (2016) [25] note that the sensorimotor coordination necessary for gestures and manual dexterity is impaired. "The development of gross and fine motor skills is delayed." Postures are "dysfunctional," muscle strength is lower than in neurotypical individuals, gait is sometimes stiffer, movements may be slowed, and deficits in movement planning and execution are observed. While tactile hypersensitivity is common, hyposensitivity characterizes proprioceptive functioning, particularly in the upper limb.

Tavares Dos Santos et al. (2023) [26] note that hand strength is lower than in neurotypical individuals, as is the strength of the leg extensors on the thigh. This leads these authors to conclude that "ASD has a negative impact on muscle strength."

Hariri et al. (2022) [27] state that motor deficits are found in 24% to 79% of individuals with ASD. There is a wide range of prevalence. ASD thus predisposes individuals to motor disorders, poor postural control, and some degree of hypotonia. Furthermore, anxiety is common. The basal ganglia are known to be dysfunctional.

Ghafar et al. (2023) [28] suggest that postural stability is impaired, particularly with regard to maintaining an upright position. In this situation, individuals sway more than the control group. However, this ability to maintain a stable vertical position is "fundamental for typical motor development," and "impaired postural control limits the development of other motor skills." Structural and functional abnormalities of the cerebellum and basal ganglia are noted. The cerebello-thalamo-hypothalamic connections, including the brainstem, are affected.

Oster and Zhou (2022) [29] suggest that individuals with ASD have delicate balance and motor control. To such an extent that balance testing can be closely linked to the diagnosis of ASD. Furthermore, the following signs are observable in ASD: "motor delay—particularly in walking—frequent stumbling or falling, poor coordination, and clumsiness." Consequently, and very early in development, the child may develop a tendency to be "fearful and insecure, leading to social isolation." The neural networks connecting the brainstem and cerebellum are altered.

Santa Helena et al. (2025) [30] noted marked postural instability, an atypical gait, impaired coordination development, ocular dysfunction, and balance problems. Visuospatial, memory, spatial, attentional, and executive function difficulties were observed. Morphological and functional differences are present at the level of cerebello-cortical connections.

Li et al. (2021) [31] demonstrate a delay in postural development and suggest that "it takes a long time for significant improvements to occur, but without ever reaching a typical adult level." In individuals with ASD, the center of gravity is mobile. However, its stability is necessary for "optimal" postural control and for a low risk of falls. For these authors, impaired postural control is a "marker of developmental disorders."

Mansour et al. (2021) [32] confirm that postural instability, gait abnormalities, and gaze disturbances are crucial signs of ASD. Regarding gaze, observers noted irregularities in horizontal eye movements as well as vestibulo-ocular reflex disturbances. They suggest that early interventions focusing on eye contact—but also on gestures and vocalizations—allow for better social interactions.

Abnormalities of the brainstem and cerebellum are noted.

Molloy et al. (2003) [33] observed a greater swing in ASD and linked it to a deficit in the integration of visual, vestibular, tactile and proprioceptive information.

It is important to note that the "gravity difficulties" observed in individuals with ASD are not entirely linked to vestibular system abnormalities. Even though the vestibular system is primarily involved, as it is the first sensory system to mature during development and therefore represents a significant role in this process.

The foundation for the development of future coordination skills. Most authors, in fact, cite poor sensorimotor coordination. This is particularly true of triple coordination (vestibular, visual, and proprioceptive) – the body schema – but also quadruple coordination (vestibular, tactile, proprioceptive, and visual). The postural, motor, and praxic abnormalities observed in ASD, according to these authors, result from sensorimotor coordination disorders and lead to difficulties in many other areas, such as cognition, social interaction, academic achievement, and emotional regulation (with potentially severe anxiety).

The sensorimotor management of gravity is therefore a central phenomenon in child development – from the uterine period onwards – and in the functioning of individuals with ASD. A sensorimotor disorder with such repercussions on numerous psychomotor, relational, and emotional functions consequently falls squarely within the scope of intervention by psychomotor therapists.

In psychomotor therapy

Each psychomotor therapist conducts a psychomotor assessment during the initial meetings with the patient. A personalized support program—a treatment plan—is then developed in collaboration with the referring physician. This support may focus on psychomotor or even sensorimotor functions. In this section, drawing on my training and experience, I will explain that the therapeutic approach in psychomotor therapy can also address the presence of anxiety secondary to the sensorimotor difficulties experienced by patients with autism spectrum disorder (ASD). This aligns with the recommendations of the French National Authority for Health (HAS).¹¹ Because this requires professionals to adopt a "positive approach" in:

=> Language attitudes:

- "Use empathetic listening and paraphrasing; verbalize what the person is feeling"— Use a means of communication that is appropriate for the individual.
- Use positive vocabulary, avoid negation
- Adopt a firmer tone but without raising your voice
- Reassure, calm down.
- « Etc. »

=> And in the postures:

- "Being willing to let the person express themselves"
- Make yourself available
- Demonstrate to the person that you are listening to them through your verbal and non-verbal communication— Offer help, don't do it for them.
- To get down to the person's level
- Change the way you approach the person
- Avoid showing anger
- Maintain a completely calm attitude.
- « Etc. »

These guidelines are precise enough to fit within the framework of a psychomotor therapy approach centered on bodily and psychological sensations—which include "gravitational anxieties"—and imprecise enough to leave open the possibility of approaching the patient using other methods. Indeed, in matters of ASD, no one holds the sole "truth," and no one is

¹¹ Website of the High Authority for Health consulted on August 5, 2025.
capable of effectively helping all patients.

I have made (Pireyre, 2024) [23] therapeutic proposals for the treatment of gravitational anxieties that Winnicott called "fear of collapse." And which May-Benson et al. (2020 [34] also identify well: "gravitational insecurity is characterized by intense anxiety about certain categories of movements such as those that require leaving contact of the feet with the ground or occurring on unstable

surfaces and changes in head position [...] It may involve lying on the floor, leaning on a support, doing "somersaults," walking on certain objects, going up and/or down stairs or a chair, jumping, falling or doing sports."

The physical capacity¹² and psychic¹³ This is necessary and aligns well with the HAS (French National Authority for Health) recommendations. When properly implemented, it fosters the patient's trust in their therapist and allows the therapist to focus their intervention on the contact of the patient's feet and back with the floor. The strength of the hands, highlighted as deficient by some of our authors, should also be encouraged. All of this is achieved through respectful suggestions for physical exercises, a positive, caring, and open attitude, and nuanced and precise verbalization using simple but not patronizing vocabulary.

The vestibular system and the sensorimotor coordination that develops after and from it are now recognized by neuroscience as crucial for many developmental milestones, as we have seen. Deroualle and Lopez (2014) [35] propose another "contribution": Body awareness, as well as self-awareness and awareness of others (and therefore empathy), are partly based on vestibular sensory foundations, as is the self-other distinction. These hypotheses are supported by Urbancic et al. (2024) [36]: deficits in sensorimotor coordination based on the vestibular system can extend to "body perception" at various levels, such as "visuospatial body perception," "body possession," and even the impression of being "placed in another person's body." These surprising "feelings" can be observed in individuals with ASD. Here again, a caring and respectful psychomotor therapy approach is necessary. This is especially true since it is virtually impossible for such a patient to verbalize these kinds of feelings, and for laypeople to imagine that such feelings could exist.

Psychomotor therapy for individuals with ASD must therefore be individualized and adopt several approaches, most often successive: sensory, sensorimotor, "affective" (in the sense of a genuinely calming approach to the different forms of anxiety), behavioral, social, and emotional. Psychomotor therapy is particularly well-suited to such approaches.

Conclusion

"Gravity shapes our perceptions and behavior" (Gallagher, 2021) [10].

For a baby, adjusting to gravity involves complex mechanisms involving various sensory systems and their coordination. Neuroscience tells us that the vestibular system is the linchpin of this learning. This is both because it is structurally—but not functionally—mature first, in utero, and because gravity is a universal phenomenon in space and time. This may explain it. Individuals with autism spectrum disorder (ASD), due to atypical neurodevelopment, have difficulties with this universal constant. This leads to difficulties of all kinds—cognitive, emotional, and affective—as well as disorders identified so far by certain psychodynamic theories.

As a hypothesis, we could also consider that other populations besides those with ASD might have issues with severity.

We previously discussed Winnicott's ideas concerning psychic defenses against

12 Physical containment involves allowing the patient to feel their boundaries and their bodily envelope. 13

Psychological containment involves listening to the patient with empathy.

The collapse. Disorganization around food or learning is possible. Consequently, certain eating disorders such as anorexia or bulimia would be involved. The search for lightness that denies gravity, or the search for heaviness that submits to it, could be at play. Similarly, certain intellectual disabilities, but also certain intellectual high potentials, could mask difficulties, more or less pathological, in managing gravity.¹⁴.

Some elderly people, with or without dementia, could also be affected, as their relationship to falls, and therefore to gravity, tends to become more significant with age. A differential diagnosis would need to be established between post-fall syndrome and an underlying, long-standing, and

structurally ingrained "gravity anxiety." Here, the concept of separation could be a crucial indicator, as, as mentioned, gravity anxiety is strongly linked to this type of feeling.

Finally, we should emphasize here Winnicott's extreme lucidity and clinical competence, who, more than 50 years before the majority of the articles cited in the bibliography here, identified, partially¹⁵ But fundamentally, there is the existence of a fear of collapse. Psychomotor therapy would gain much by confronting psychoanalytic theories, among others, with the considerable emergence of neuroscience. Psychoanalysis offers fundamental theoretical knowledge that it would be a shame to ignore. After all, all patients need—among other things—to be listened to.

It is proposed here to call this anxiety of collapse described by Winnicott "gravitational anxiety." The expression "gravitational anxiety," in fact, does not simply refer to the sensorimotor aspect. It also contains a psychic component.

Let us conclude, with humor and "gravity" at the same time, with the primary concept of this article, universal gravitation, whose anagram found by Klein and Perry-Salkow (2011) [37] is as follows: "vital law reigning over life."

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14 Not eating, but also eating and learning, or not learning, would each be two facets of the same phenomenon. As is often the case in the realm of the psyche.

15 Partially: because he did not consider the bodily aspects.

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