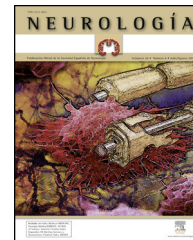




# NEUROLOGÍA

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## REVIEW ARTICLE

### Balzac and human gait analysis<sup>☆</sup>

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#### Abstract

**Introduction:** People have been interested in movement analysis in general, and gait analysis in particular, since ancient times. Aristotle, Hippocrates, Galen, Leonardo da Vinci and Honoré de Balzac all used observation to analyse the gait of human beings. The purpose of this study is to compare Honoré de Balzac's writings with a scientific analysis of human gait.

**Sources:** Honoré de Balzac's *Theory of walking* and other works by that author referring to gait.

**Development:** Honoré de Balzac had an interest in gait analysis, as demonstrated by his descriptions of characters which often include references to their way of walking. He also wrote a treatise entitled *Theory of walking (Théorie de la marche)* in which he employed his keen observation skills to define gait using a literary style. He stated that the walking process is divided into phases and listed the factors that influence gait, such as personality, mood, height, weight, profession and social class, and also provided a description of the correct way of walking.

**Conclusions:** Balzac considered gait analysis to be very important and this is reflected in both his character descriptions and *Theory of walking*, his analytical observation of gait. In our own technology-dominated times, this serves as a reminder of the importance of observation.

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**PALABRAS CLAVE**

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Observación

**Balzac y el análisis de la marcha humana****Resumen**

**Introducción:** Desde tiempos remotos, el hombre se ha interesado por el análisis del movimiento y especialmente por el estudio de la marcha. Aristóteles, Hipócrates, Galeno, Leonardo Da Vinci u Honoré de Balzac analizaron, mediante la observación, la forma de andar del ser humano. El objetivo de este trabajo es mostrar la relación de Honoré de Balzac con el análisis científico de la marcha humana.

**Fuentes:** *Teoría del andar* de Honoré de Balzac y otras obras de este autor que hacen referencia al modo de andar.

**Desarrollo:** Honoré de Balzac se sintió atraído por el análisis de la marcha, aspecto que se demuestra en las descripciones de sus personajes que incluyen, con frecuencia, referencias a la forma de caminar. Además, escribió un tratado sobre la marcha titulado *Teoría del andar*, en el que con un estilo literario y con gran capacidad de observación definió la marcha, mencionó que se divide en fases, indicó cuáles son los factores que la modifican como la personalidad, el estado de ánimo, la estatura, el peso, la profesión o la clase social, y describió cuál es la forma correcta de andar.

**Conclusiones:** Balzac considera muy importante el análisis de la marcha y esto se manifiesta tanto en sus descripciones de personajes como en su *Teoría del andar*, en la que realiza una observación analítica de la manera de caminar. En una época dominada por la tecnología como la nuestra nos recuerda la importancia de la observación.

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**Introduction**

Bipedal gait is a typical form of locomotion in humans, and one of the distinguishing features of our species. Numerous neurological disorders, including hemiplegia or hemiparesis, cerebral palsy, Parkinson's disease, and multiple sclerosis, give rise to alterations in gait. Alterations, which include impaired balance or coordination, changes in muscle tone, and paralysis, are common reasons for consultation. Gait analysis may be either instrumental or observation-based and complemented by the Tinetti Assessment Tool, Get-up-and-go test, etc.<sup>1-3</sup> At present, movement analysis laboratories are equipped with sophisticated instruments and systems, including dynamometric platforms, instrumented insoles, infrared cameras, and electromyography and posturography techniques, all of which measure gait parameters. In this technologically advanced setting, it may come as a surprise that there could be a link between gait analysis and Balzac (Fig. 1), a French novelist active in the first half of the 19th century. And yet, several published medical articles have already mentioned Balzac's fascination with the study of human gait.<sup>4-10</sup> Balzac felt it was important to describe the walk of the characters in his novels, and he also wrote a treatise on gait titled *Theory of Walking*<sup>11</sup> in which he employed a literary style, his usual dose of sarcasm, and in many cases, a measure of social criticism. This erudite personal style, however, does not detract from the fact that Balzac's pronouncements on gait were quite accurate.

The purpose of this study is to highlight Honoré de Balzac's interest in human gait, which can be observed in the descriptions of many of his characters as well as in his *Theory of Walking*.



Figure 1 Honoré de Balzac

**Gait in Balzac's character descriptions**

Balzac's novels contain detailed descriptions of their characters, and the author often made ironic mention of their ways of walking.

In *The Vicar of Tours*, to name an example, he offers a sarcastic description of the walk of an old maid: "...her movements were not equally distributed over her whole person, as they are in other women, producing those graceful undulations which are so attractive. She moved, so to speak, in a single block, seeming to advance at each step like the statue of the Commendatore".<sup>12</sup> This description invokes physical factors, such as stature or rigidity in movement,

as well as social factors such as single status; according to Balzac, this lends a wooden quality to a person's movements.

Another novel that might be analysed is *The Duchesse de Langeais*, in which Balzac draws parallels between one's personality and one's way of walking and moving: "There was something of the despot about him, and an indescribable suggestion of the security of strength in his gait, bearing, and slightest movements".<sup>13</sup> Balzac linked movement not only to personality, but to his characters' social class and occupation. *The Unknown Masterpiece* provides an example: "From the quaint costume of this newcomer, his collar of magnificent lace, and a certain serene gravity in his bearing, the first arrival thought that this personage must be either a patron or a friend of the court painter".<sup>14</sup>

In *Eugenie Grandet*, Balzac describes Monsieur Grandet as a man whose self-confidence was manifest in his manner, address, and walk. In many such descriptions, as well as in his *Theory of Walking*, Balzac states that an individual's personality can be revealed by his gait. "Attitude, manners, bearing, everything about him, in short, testified to that belief in himself which the habit of succeeding in all enterprises never fails to give to a man".<sup>15</sup>

Other books, including *La Grande Breteche*, *The Atheist's Mass*, *The Physiology of Marriage*, and *A Daughter of Eve*, also feature character descriptions that mention gait.

In a series of articles titled *La cuestión palpitante*, Galician author Emilia Pardo Bazán stated that "what remains graven on the mind, after reading Balzac, is not the theme of the novel, or even its dramatic conclusion. It is the author's tremendous gift for describing the figure, the walk, the voice, and manner of a character so that we can see and recall him as well as the living persons we know".<sup>16</sup> With this pronouncement, she emphasised the importance which this French author lent to his character descriptions and to gait as one of a person's fundamental features. It is significant that a reader would mention having a clearer memory of the author's descriptive passages than of the plot, and more so when she specifically cites descriptions of gait. This indicates that Balzac's works do indeed contain many descriptions of walking.

## Theory of Walking

*Theory of Walking*, by Honoré de Balzac, is probably the first treatise written on gait. In fact, its opening lines express the author's surprise that something as important as gait – a man's way of walking – had not been examined by previous studies. Volumes had been written about dancing and mimicry and biomechanics, and there had been a few references to walking patterns in literary works and medical references, but Balzac felt that no one had studied this important topic as thoroughly as it deserved. He listed a few authors who had mentioned gait, such as Virgil, who wrote, "by her step, the goddess is revealed"; or Demosthenes, who reprimanded Nicobulus for walking like a devil. In fact, references to walking patterns and abnormalities were already to be found in the Edwin Smith papyrus (written some 4000 years ago). Similarly, Aristotle, Hippocrates, Galen, Leonardo da Vinci, Galileo, Newton, and Borelli (Fig. 2) all showed a keen interest in

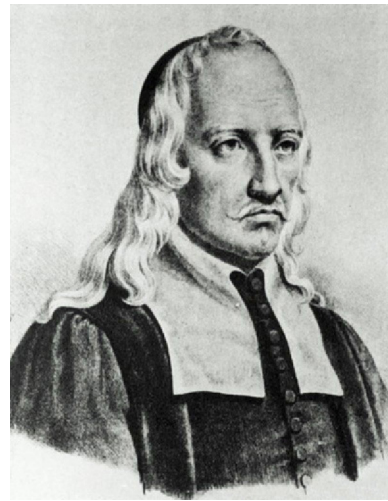


Figure 2 Giovanni Alfonso Borelli

movement analysis and normal and pathological gait.<sup>11,17–19</sup> While Balzac mentioned Borelli's biomechanical studies summarised in his masterpiece *De motu animalium*, he still found these contributions to be insufficient. Balzac could not understand why such a key feature would have been addressed so superficially, with only fleeting mentions by scientists, researchers, scholars, and philosophers. He therefore decided to conduct his own studies of gait, proclaiming, "so it seems this science is mine!" Balzac was conscious of having found a precious patch of unexplored terrain, and he threw himself wholeheartedly into describing this new field that so intrigued him.<sup>11</sup>

In addition to including gait as a feature of his character descriptions, Honoré de Balzac decided to write an essay on gait analysis, *Theory of Walking*. Here, he defines the concept of gait and the factors affecting it, and then explains the procedure he followed to carry out the analysis. After having observed numerous people walking down a Parisian boulevard, the author proposed a series of postulates as the framework for explaining human gait from a scientific, scholarly, and even sarcastic point of view (Table 1).<sup>11</sup>

*Theory of Walking*, *Treatise on Modern Stimulants*, and *Treatise of Fashionable Life* (with its sections on dress and on gastronomy) have been published in Spanish as a collection titled *Dime cómo andas, te drogas, vistes y comes... y te diré quién eres*. These essays were intended to make up a larger volume titled *The Pathology of Social Life*, but Balzac never finished that project. However, he did publish several of these texts in magazines between 1830 and 1833. These essays testify to his keen observations and detailed descriptions of traits including way of walking; the consumption of stimulants such as liquor, tobacco, or coffee; and ways of dressing and eating. Balzac was a masterful reporter of his times. *Theory of Walking* was first published in *l'Europe Littéraire* in the August-September issue of 1833.<sup>11</sup>

## Concept of gait

Balzac defines gait as "the physiognomy of the body".<sup>11</sup> This expressive concept of gait indicates that a person's way of

**Table 1** Balzac's aphorisms from his *Theory of Walking*<sup>11</sup>

Aphorism	Description
Aphorism 1	Gait is the physiognomy of the body.
Aphorism 2	Gaze, voice, respiration, and walk are identical reflections of one's thoughts. Since a man cannot control all of these different and simultaneous signs at once, seek out the one telling the truth, and it will reveal his full self.
Aphorism 3	Rest is the silence of the body.
Aphorism 4	Slow movement is essentially majestic.
Aphorism 5	All brusque movements betray a vice or poor manners.
Aphorism 6	Grace requires rounded shapes.
Aphorism 7	Every part of the body participates in movement without any part being predominant.
Aphorism 8	Human locomotion is made up of very distinct stages, and when these become muddled, the mechanics appear stiff.
Aphorism 9	When walking, a woman may flaunt it all while revealing absolutely nothing.
Aphorism 10	Some movements of a skirt are worthy of a Monthyon Prize.
Aphorism 11	When the body is in motion, the face should remain immobile.
Aphorism 12	All unwarranted movement is extremely wasteful.

walking has much to reveal about that person's character. Later definitions are more descriptive and biomechanical and gloss over any psychological, anthropological, or social features. In contrast, these traits play key roles in Balzac's theoretical framework. These new definitions inform us that walking is a form of human locomotion in which an individual takes one step after another, or a series of alternating bipedal and unipedal stances.<sup>20–22</sup>

Rather than simply defining the concept of gait, Balzac describes the proper way of walking: "... a man must stand straight but not stiffly and drive his two legs forward along a single line without listing noticeably to the right or the left. He must let his full body participate imperceptibly in his overall motion, introduce a measure of sway that with its regular rocking motion eliminates the secret cares of life, tilt the head, and never hold his arms when standing still as he does while walking". Likewise, the author states that "human locomotion can be broken down into stages".<sup>11</sup> Since this initial description was published, every author to analyse and describe gait has broken it down into phases.

### Gait analysis

Since ancient times, mankind has expressed an interest in analysing movement, especially gait. We find works by Aristotle, Hippocrates, Galen, Leonardo da Vinci, and Borelli, all

of whom had only their powers of observation to aid them in describing human or animal movement.<sup>2,17</sup> In *Theory of Walking*, Balzac does mention Borelli and others who had studied movement in the past. However, he was adamant that no one before his time had taken the trouble to complete a serious and scientific study of walking, an action that is at once so frequent and so important to human life. "Nobody—not one physiologist or doctor lacking patients, not one idle scholar or raving lunatic or statistician tired of counting grains of wheat—not a single person has ever tried to apply the laws of movement to the human body".<sup>11</sup>

Balzac praises use of one's powers of observation, expressing that an observer is a man of genius and that all great inventions are the result of analytical observation. According to this author, great observers include Gall, Lavater, Mesmer, Cuvier, and Newton. Balzac adds that these scholars "proceed from the effect to the cause, whereas other people cannot see either one". He himself used analytical observation as the method for studying gait. From a seat on Boulevard de Gand in Paris, he was able to contemplate passers-by, not merely to observe, but also to define, describe, analyse, and draw conclusions. By following this method, he aimed to determine the laws that regulate gait and describe anomalies in walking. His interest was also drawn to the factors able to modulate gait including racial, cultural, social, and climatic differences, in addition to more mechanical factors such as footwear, weight, height, or effects of various diseases. He emphasised that many people wished they could dissimulate their intentions with their step, as well as with their expression, eyes, and voice. With these statements, Balzac shows that body language, mimicry, and gait can be feigned or modified to resemble something else. Actors are able to portray different characters, spies may hide their identities, and courtesans, social climbers, and the *nouveaux riches* may hide their true natures. The author adds that those who understand his postulates on gait will be the ones able to change it to suit their purposes, by conveying good humour, refined manners, empathy, and noble bearing, rather than vulgarity, stupidity, or condescension.<sup>11</sup>

Balzac describes a few of the physiological observations that he had completed before writing his *Theory of Walking*, and which sparked his interest in the study of movement in general and of walking in particular. Balzac first witnessed a man lose his balance and put out his hands in an attempt to stop his fall as he lost his centre of gravity. On another occasion, he filled his sister's sewing basket with coins and saw that she was unable to lift it on the first try; believing it would be lighter, she had not made much effort. Balzac then removed the coins discreetly, and the next time his sister went to lift her basket, using all her strength because she thought it would be heavy, she nearly tossed it over her head. These events raised the questions about movement that would eventually lead Balzac to write his study of gait.<sup>11</sup>

Balzac's study was based on critical observation; he did not use any analytical tools or measurements. The novelist followed his own procedures for assessing movement and movement disorders. His monograph was first published in 1833, whereas the first instrumental studies of gait would not be published until 1836, the year in which the Weber brothers completed the first mechanical analysis and measurements of human locomotion. In this book, later



translated as *Mechanics of the Human Walking Apparatus*, they describe the phases of the gait cycle, movements of the centre of gravity, and alterations in gait. While the measurements they took were very simple, they are considered an important contribution.<sup>2,11,17,18</sup>

Balzac stated that the process of viewing, analysing, generalising, and classifying would deliver the 'code of walking', with its postulates that would provide lazier scholars with an understanding of the secrets of gait (Table 1).<sup>11</sup>

### Factors that modulate gait

Balzac asked himself which factors might change gait, whether humans in ancient times walked well, if any population could be said to walk better than the others, and if sunlight or climate could affect walking.<sup>11</sup> Other authors, in subsequent studies of gait, also described factors affecting the way people walk. Some of these descriptions bear a strong resemblance to Balzac's own.<sup>6,7,23</sup> Throughout his treatise, Balzac lists many factors affecting gait, including height and weight, type of work, social class, and a variety of psychological factors.

### Weight

Balzac mentions the effect that body type, whether overweight or underweight, has on a person's walk. His pronouncements on obesity were as follows: "While it is true that dignity, in the sense of majesty, requires a certain fullness of flesh, it is nonetheless impossible to claim this to be true of a man walking, since his belly throws the rest of his body off balance. Walking ability disappears with obesity. An obese man finds himself forced to surrender to the ungainly movements imposed on him by his rotund belly. . . Obediently following his belly, this poor rich man looked twisted. He pushed his limbs forward painfully, one after another, with a dragging, sickly movement like a dying man resisting to the end, even as he is pushed to the brink of the grave".<sup>11</sup> With a liberal dose of irony, Balzac describes gait being altered in the overweight population, and this claim was later corroborated by other authors who have analysed gait and described that in obesity and pregnancy, forward displacement of the individual's centre of gravity causes lumbar hyperlordosis. In many cases, excess weight in these patients causes them to strike the ground with the entire sole of the foot instead of with the heel, avoid lateral displacements, and limit horizontal hip rotation. Likewise, excess weight can promote the development of deformities in the lower limbs that may alter the normal walking pattern.<sup>5,7,8,23</sup>

In his description of emaciation, Balzac writes, "Along came a diplomat built like a skeleton, slumping along in a single piece like a marionette whose strings are slack. He seemed as tight as a mummy in its bandages". Thin people walk slowly, dragging their feet in an attempt to save energy, and calculating a minimal amount of effort.<sup>2,7,8,11,23</sup>

### Dress

Balzac linked dress to the way of walking, especially when he mentions use of corsets by women: "A beautiful woman,

distrustful of the end of the busk of her corset, or irritated for whatever reason, had transformed herself into Venus Callipyge and strode along like a guinea fowl with her neck outstretched, pulling in her front, and arching that part of her opposite to the busk".<sup>11</sup> Here, Balzac shows how a garment was able to alter the posture of a walking woman, thereby changing her gait pattern. Even if the corsets described by Balzac have fallen into disuse, clothing may still affect walking to a greater or lesser extent. For example, we find very narrow skirts that oblige women to take small steps, and even heavy coats that can make the wearer walk somewhat bent. Even more studies have examined changes in gait owing to footwear, for example, high-heeled shoes or very heavy shoes such as army boots.<sup>2,7,8</sup>

### Personality

In both his character descriptions and in *Theory of Walking*, Balzac refers to an individual's personality and how it may be reflected by his walk. A person's gait pattern and speed and the way he holds his head or moves his upper limbs can shed light on whether he is aloof, timid, or self-confident. Slow, measured steps and a relaxed posture may indicate serenity, laziness, apathy, or disinterest; short bursts of hasty and unsure steps point to a nervous, restless, and irritable personality. In turn, the self-assured person's head is held high, and he or she displays an energetic, firm, and decisive step.<sup>24</sup>

### Height

*Theory of Walking* lists stature as another factor affecting gait: "... a tall young lady with her feet close together and mouth pressed tightly shut, completely rigid and slightly bent, walked forward with little jolts, like poorly-made clockwork; her springs seemed to be rusted and her joints frozen".<sup>11</sup> In effect, certain gait parameters may be altered by height, or more specifically, by the length of the lower limbs that determine stride length or gait cycle length.<sup>7</sup>

### Professions

On several occasions, Balzac mentions that men who walk quickly have an occupation and are in a hurry to complete their tasks or to reach their workplace on time. Noblemen, in contrast, walk slowly and unhurriedly; no one is waiting for them, since they are gentlemen of leisure.

"Men who are condemned to repeat the same movements in their daily work all demonstrate, in their step, a marked source of locomotion, whether in the shoulders, thorax, or hips". With this sentence, he shows how work affects posture and movement through the position adopted while working, or the repetitive motions required in the workplace.<sup>9</sup> Balzac also highlights 2 cases in which profession affects gait, namely sailors and soldiers. In the first case, the men spend long periods of time on an unstable surface and have to make a series of adjustments. Soldiers, in turn, have to march in a specific way, following a specific cadence, and this gait pattern will invariably affect their normal gait pattern.

Returning to sailors, Balzac provides the following detailed description: "Sailors remain with legs apart, and always ready to bend or contract. Obligated to sway about on the deck with the swell of the waves, they are rendered incapable of walking straight on dry land. With all this sidestepping, they would do well to become diplomats". Balzac concludes this section with a critical touch of irony.<sup>11</sup> Lelièvre also described the walk of sailors and fishermen, indicating that, as a result of the movement of their ships, these men separate their feet to create a wider base of support and better balance on an unstable surface. In addition, the knees and hips remain flexed. When on dry land, their walk displays considerable lateral movement. This description resembles Balzac's; both authors emphasise separating the feet as a way of widening the base of support and improving balance. Likewise, they mention that these features are also seen on land, since these professionals have difficulty walking in a straight line and they display lateral movements.<sup>23</sup>

According to Balzac, soldiers have an unmistakable way of walking. "Almost all of them remain motionless above the kidneys, like a bust on a pedestal, while their legs beat away below the abdomen as if controlled by a sergeant entrusted with keeping the lower limbs in perfect order. The upper body seems not to have the faintest idea of the movement occurring below. . . The soldier is continually obliged to bear the total sum of his strength in his chest, which he always thrusts out as he stands straight".<sup>11</sup> Soldiers are trained to walk in a certain way, with an upright bearing and a specific cadence and speed; this training will eventually be noticeable in their normal walking pattern.<sup>7</sup>

He also expressed that judges "obliged to spend their lives in the seat of justice, are easily recognisable by their restrained air and a slight movement of the shoulders", and invited the reader to observe the results of spending long hours seated for professional reasons. His examples included doormen, sacristans, tailors, office workers, and drivers whose knees remain flexed for hours; this may limit the extension required for walking, and thus exert a definite effect on their movements.<sup>7,8,11</sup> Workers who remain on their feet throughout their daily activities, such as wait staff and shop assistants, may also present alterations in movement, posture, or gait. Indeed, maintaining the same posture during long periods of time, engaging in repetitive movements, and using specific instruments or tools at work or when participating in sports are all factors that can affect an individual's movements and gait.<sup>7,8</sup>

### Social class

As mentioned in the section on professions, 'high-born' persons walk more slowly because they have no reason to hurry and live lives of leisure. This provides an example of how social class and lack of an occupation may influence walking speed.<sup>11</sup>

The writer G.K. Chesterton touches on this subject in *The Queer Feet*: when the thief wished to pass himself off as a gentleman, he walked slowly and cultivated a disinterested air. When imitating a waiter, however, his walk was different, hurried and darting, almost on his toes. By adopting these attitudes while walking and moving, the gentlemen

present mistook him for a waiter, and waiters were convinced that he was a gentleman. Father Brown, who had overheard these variations in the same man's footsteps, was able to identify the thief.<sup>25</sup>

### Additional factors

Balzac also listed other potential factors including climate and race. While he mentioned disordered gait caused by diseases that were probably neurological in origin, he did not describe those diseases.<sup>11</sup>

### Conclusions

Honoré de Balzac was a pioneer in the field of gait analysis, both for his frequent literary descriptions of people's ways of walking and for having written what was very probably the first treatise to offer a specific and in-depth study of gait: *Theory of Walking*.

This book presents his critical observations of different gaits, provides a definition of gait, and describes a concept of proper gait. Balzac also stated that gait was divided into different phases and he listed the factors affecting it. While the entire essay is embellished with the author's personal style, sarcasm, and critical tone, it does contain many accurate statements about walking, and these make Balzac's writings a necessary reference for anyone with an interest in human gait analysis. Furthermore, in these technology-dominated times, they make us recall the importance of observation.

### Conflicts of interest

The authors have no conflicts of interest to declare.

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