The Scientific Statement of Clinical Posturology

Pierre-Marie Gagey

Any presentation of new knowledge must be based on a general representation of the scientific knowledge, to be understandable by those we want initiate.

In the absence of a consensus on an epistemology theory, that has become, I will begin to solicit your acquiescence, at least temporarily, in the theory of scientific knowledge of Karl Popper [1] that I will adopt as a reference for this presentation. According to Popper, a scientific statement of a knowledge must adopt a deductive process: Because I know this and that, I deduce from it, by a rational reasoning, an object, universal and falsifiable, that is to say verifiable by anyone. Such a presentation thus focuses on the logic of new knowledge by deliberately leaving aside the historical, and therefore psychological, aspects of the discovery of this knowledge [2].

What we believe we know

The formula: « What we believe we know » fits logically into Popper's thinking: since every scientific statement is falsifiable, we admit that we are not definitively sure of knowing. Scientific certainty is hanging. The evidence, even shared in what we are accustomed to naming a proof, is not a criterion of truth, it is still lacking its becoming through the others; become who remains hanging, in the course of history.

The inverted pendulum

We « know » that the human body is unstable by construction since its center of mass is located above its fulcrum on the ground.

The « Animal Machine »

The stability, in fact, of the body of the man thus raises a question. But We « know » that « the body of man is a machine » [3]. This stability, in fact, of the body of man is therefore part of rational mechanisms to discover.

The postural tone

We « know » that, in order to fight against the gravity that tends to make it fall, the body generates muscular contractions which are not accompanied by movements but fix, in time and in space, the position of the parts of the body . What is called postural tone [4].

Vigilance

We « know » that this tone collapses during sleep [5]. Which means the intervention of the brain in the tonic phenomena. Tone, like all other muscular activities, is controlled by the central nervous system [4].

The regulation of postural tonic activity

We « know » that the state of the tonus at the instant "t" depends on its state at the instant "t-1", modified by the integration of all sensory information of variation of position of the body in the space between these two instants [6, 7, 8, 9, 10, 11, 12, 13, 14]. The logic of this sequence is not designated.

The time series of chained events

We « know » that the power of predicting the evolution of this type of chained time series is limited in time; a minor modification of the initial conditions is likely to result in non-proportional consequences to this modification [15, 16, 17, 18]. The regulation of postural tonic activity is therefore represented by a time series of chained events that take place in the body and in particular in the central nervous system.

The dynamics of sensory integration

We « know » that, within the neuron, the summation, positive or negative, weighted or not, of the presynaptic events « supposes the astonishing temporal and spatial coincidence of a huge quantity of nerve impulses which converge at the same time on the same neuron, therefore, their perfect synchronization »[19].

Therefore

A minimal change in the timing of central nervous system events related to regulation of postural tonic activity may result in tonic consequences not proportional to this change.

This logical deduction of all that we « know » constitutes the scientific statement of clinical posturology.

Like every scientific statement, it abstracts from all the other properties, individual or otherwise, of that thing which is the body of man, to reduce it to an object of postural knowledge. But this reduction is the indispensable condition for the universal dimension of the statement : it is « possible » for every individual.

Verification of this statement

By plantar orthoses

The area of the plantar sole located above the small elevation of the sole at the level of the orthosis, perceives contact with the ground earlier. The presence of an orthosis introduces a modification of the timing of all postural plantar information. The importance of this change in timing depends on the thickness of the orthosis.

Experiments show that it is not only possible to modify the regulation of postural tonic activity by fitting orthoses, but also that the importance of these modifications is inversely proportional to the thickness of the orthosis.

By optical prisms

A prism deflects the light beam. The wearing of an optical prism deviates the visual space of the individual. It introduces a spatial disparity between the visual and proprioceptive postural information. I perceive at the same time visual and proprioceptive information that no longer corresponds to the same place, so there is a change in the timing of this postural information.

Experiments show that it is possible to modify the regulation of the postural tonic activity by the port of optical prisms and that these modifications follow a topological logic : according to the position of the

base of the prism one does not obtain the same modifications of the regulation of postural tonic activity [20]

Critique of the statement

This statement has an universal dimension, but it designates not a fact, but a simple possibility, which gives it a certain ambiguity. The statement justifies the exploration of this rational possibility, but it also covers possible, for instance financial, exploitations of this simple possibility, without it being possible to set the limit between these two uses. The practice of posturology by various specialties and the fundamental works will lift — and have already begun to partially lift — this fundamental ambiguity [21].

References

1. Popper Karl R. Logic der Forschung, Julius Spinger, Vienne, 1934
2. Gagey PM (2016) Critique de la Posturologie: Une psychologie de la découverte. Kindle, Amazon
3. Descartes R. (1664) Traité de l'homme. Jacques LE GRAS, au Palais, à l'entrée de la Galerie des Prisonniers.
4. Galien (195) Peri neuron anatomes, Opera Omnia, Tome IV, ch. 7
5. Aristote Les Parties des Animaux. Trad. Pierre Louis. G. Budé, Paris, 1956
6. Sherrington, C. S. 1898) Decerebrate rigidity and reflex coordination of movements J. Physiology, 22, 327.
7. Magnus R. (1924) Körperstellung. Springer (Berlin).
8. Thomas A., de Ajuriaguerra J. (1948) L'axe corporel. Musculature et innervation. Masson (Paris), 538 pages: 37-38.
9. Fukuda T. (1981) Statokinetic Reflexes in Equilibrium and movement. University of Tokyo Press, Tokyo.
10. Flourens Pierre Jean Marie .(1830) Expériences sur les canaux semi-circulaires de l'oreille dans les mammifères. Mémoire lu le 13 octobre 1828. Mémoires Acad. Sci. (Paris) IX (2e s.) 467-477.
11. Romberg M.H. (1840) Lehrbuch der Nervenkrankheiten des Menschen. Berlin, Duncker
12. Longet F.A. (1845) Sur les troubles qui surviennent dans l'équilibration, la station et la locomotion des animaux après la section des parties molles de la nuque. Gazette Médicale de Paris, 13: 565-567.
13. Heyd W.H.S.C. Der tastsinn des fusssohle als aequilbrirungsmittel des körpers bein Stehen. Thèse de médecine Tübingen 1862
14. Cyon E. de (1911) L'oreille organe d'orientation dans le temps et dans l'espace. Alcan (Paris),.
15. Poincaré H. (1908) Science et méthode. Flammarion, Paris
16. Baron JB, (1955) Muscles moteurs oculaires, attitude et comportement locomoteur des vertébrés. Thèse de Sciences, Paris, 158 pages.
17. Lorenz EN, (1972) Does the Flap of a Butterfly's Wings in Brazil set off a Tornado in Texas? Meeting of the American Association for the Advancement of Science, Washington, D.C December 1972.
18. Gagey P.M. Martinerie J., Pezard L., Benaim Ch. (1998) L'équilibre statique est contrôlé par un système dynamique non-linéaire. Ann. Oto-Laryngol., 115: 161-168.
19. Agid Y, Magistretti P. (2018) L' Homme glial: Une révolution dans les sciences du cerveau. Odile Jacob, Paris,
20. Gagey PM (2016) The law of the canals and postural clinic, MTP&RehabJournal, 14:324-330 http://dx.doi.org/10.17784/mtprehabjournal.2016.14.324
21. Scheibel A, Zamfirescu F, Gagey PM, Villeneuve Ph. (2017) Pratiques en Posturologie. Hommage à Bernard Weber. Elsevier Masson, Paris.