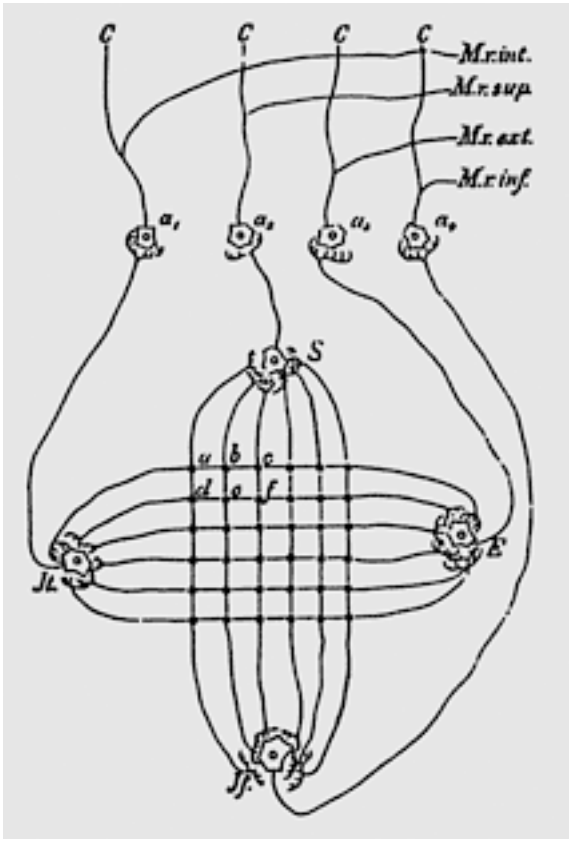
Beyond the Temples of Science

Bohemian Neuroscience in *Fin-de-siècle* Berlin

Sven Dierig and Dennis Meyhoff Brink

"All great discoveries are made outside the temples of science." Carl Ludwig Schleich 1922



An early representation of a neural network. It depicts only neurons; glial cells are ignored. From Exner 1894, p. 39.

In the late 1840s, the pathologist Rudolf Virchow recognized that most of the cells in the brain could be categorized into two distinct groups: nerve cells, and a far more numerous group of cells that surround the nerve cells and fill the spaces between them. Virchow called this second category of brain cells the neuroglia (literally 'nerve glue'). Half a century later, Heinrich W. G. von Waldeyer, a professor of anatomy, published a programmatic synopsis concluding that nerve cells do not constitute a continuous network: instead, the nervous system is composed of discrete individual nerve cells separated from each other by narrow gaps. To mark the difference to the conception of nerve cells associated with Virchow, Waldeyer called these anatomically autonomous units of the nervous system "neurons" (Waldeyer 1891, pp. 1-64).

In 1894 the physiologist Sigmund Exner declared, that any mental state was the result of an antagonism of exciting and inhibiting forces in the network of "neurons" described by Waldeyer. Based on this perspective, everything else in the brain was relegated to the role of functionally passive material filling in the meshes of the neural network. Exner hardly commented on the tissue of the neuroglia, and when he did, he described it as a "supporting

substance" (Exner 1894, p. 7). To Wilhelm Wundt, the best known psycho-physiologist at that time, it was simply "glue-giving material" (Wundt 1893, vol. 1, p. 40).

By 1900 neuroscientists had established the image of a neural-network brain, whereas their knowledge about glial cells was still at the level of 'nerve glue.' Neurons, as dictated by an authoritative manual from the turn of the century, were "the only representatives of the nervous functions." They were the "main factors of mental and nervous activity in general" (Kölliker 1896, p. 808).

However, one person vehemently opposed the accepted scientific opinion about the passivity of neuroglia: the artistically inclined doctor and poet Carl Ludwig Schleich. He declared the neuroglia to be the central switching apparatus in the brain and asserted that an "active function" and consequently "psychological importance" was to be ascribed to the neuroglia (Schleich 1897, pp. 71-112). At that time, the brain research establishment considered such a thesis absurd. Schleich himself was viewed as someone whose own brain must be "turning into glue" (Schleich 1922, p. 139). Both he and his glia theory were ignored by his scientific contemporaries, making the Berlin doctor an "alien of his age" (Jung 1940, p. 4).

The Psychology of the Decadent Individual

Schleich's brain theory was formed outside the world of scientific laboratories, in a milieu of eccentric bohemians who created their own laboratory and forum for discussion in the wine cellars and salons of *fin-die-siècle* Berlin. Here, the Polish poet, writer, and piano player Stanislaw Przybyszewski, played a crucial role, both as a thinker and as a piano player.

Przybyszewski, who was one of Waldeyer's students, made his literary debut in 1892 with *Zur Psychologie des Individuums* (The Psychology of the Individual). Taking the psycho-physiological (self-)analysis of exceedingly sensitive and creative individuals as a point of departure, Przybyszewski's essay presented a programmatic demand to replace naturalism, the predominant conception of art in German-speaking countries at that time. Art should not depict the social struggle of life, Przybyszewski argued, but should become a modern study of the soul.

Like Nietzsche, Przybyszewski felt he was living in an age of "herd instincts." He was disgusted by a society in which everything extending "beyond the level of the traditional, usual, and everyday had to be opposed as detrimental and dangerous to the public." In the everyday reality of modern mass society, there was no room for the "individual of today" and slender hope for the "assertion of excessive aptitudes." Therefore an individual who "lacks general consent for his thoughts and actions," will, Przybyszewski declared, become ill due to an "inhibited will." Faced with "inhibited outflow" and "unused nerves," he will be damned to lead the life of the "individuum decadent" (All citations Przybyszewski 1892, p. 101-105).

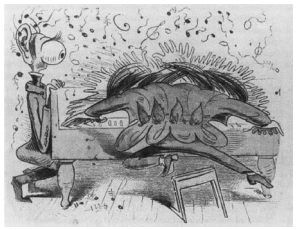
According to Przybyszewski, one effect of excess in the brain caused by inhibition is a "pathologically increased sensitivity." An oversensitive brain, Przybyszewski explains, "perceives differently from all other, it feels where other humans perceive nothing, and because the brains of his fellow humans are incapable of reasoning where this individual experiences the most violent vibration, it is simply lonely and forsaken" (All citations Przybyszewski 1892, p. 101-105).

Edward Munch's "psychic naturalism," illustrated by his painting Jealousy from 1896. In the foreground is Przybyszewski; in the background, Munch himself fighting for a woman's heart.

On the other hand, the extraordinary intense way of perceiving is also the creative potential of the decadent individual. If a person is equipped with a hypersensitive brain due to stifling social arrangements, this creates the nervous-physiological prerequisites for him or her to deviate from the masses *in the arts as well*, and thus to transcend the aesthetic of naturalism. In Przybyszewski's view, a new art, "so infinitely different from a bleak naturalism with its wretched, spiritless *coins de nature*," could be produced only by a decadent individual such as Edvard Munch, whom Przybyszewski knew from Berlin avant-garde circles (Przybyszewski 1892, p. 120).

Brain Experiments on the Steinway

The members of the Berlin avant-garde, who met regularly in Schleich's private salon, not only appreciated Przybyszewski's writings but also valued his abilities as a piano player. Recollections of encounters with Przybyszewski acknowledged his "passionate and deeply moving and wistful" way of playing and speak of him as the "incarnation of music" (see Matuszek 1996, p. 103-106). Przybyszewski himself describes his performances and their nearly hypnotic effect on his audience in his *Erinnerungen an Berlin* (Memories of Berlin): *"And all of this [was] played by a person who fell into a kind of eerie trance while playing and infected the others with it! Had I been a virtuoso, I would certainly have dazzled them with my technique and they would have been unable to pay attention to anything else, but thus during the performance of someone 'inspired,' an amateur lost in ardent rapture, only the 'spirit' of the music had any effect"* (Przybyszewski 1985 [1926-30], p. 166).



'The Virtuoso – finale furioso' by the German painter and cartoonist Wilhelm Busch. In the 1860s Busch caricatured the contemporary enthusiasm for solo pianists in the Munich satirical magazine 'Fliegende Blätter'. From Busch 1959, vol. 1, pp. 286-291.

Such romantic notions may also be recognized as a highly plausible plan of experimentation. In this perspective, Przybyszewski undertook practiced experimental psychology by means of the piano. Rather than testing hypotheses about the sensation of hearing with laboratory methods, Przybyszewski intended to investigate the *Psychology of the Individual* experimentally through a suggestive piano performance. With the aid of Chopin, as Przybyszewski declares in *Memories of Berlin*, tones sank into the unconscious while he played, loosened the constraint on the specific sense energies, and opened up new conduction pathways, along which waves of excitation enabled the stored creative potential energy to flow freely. Thus, Schleich's musical salon became Przybyszewski's experimental laboratory, and Schleich's Steinway his laboratory instrument.

Neuroglia as a Piano Damper

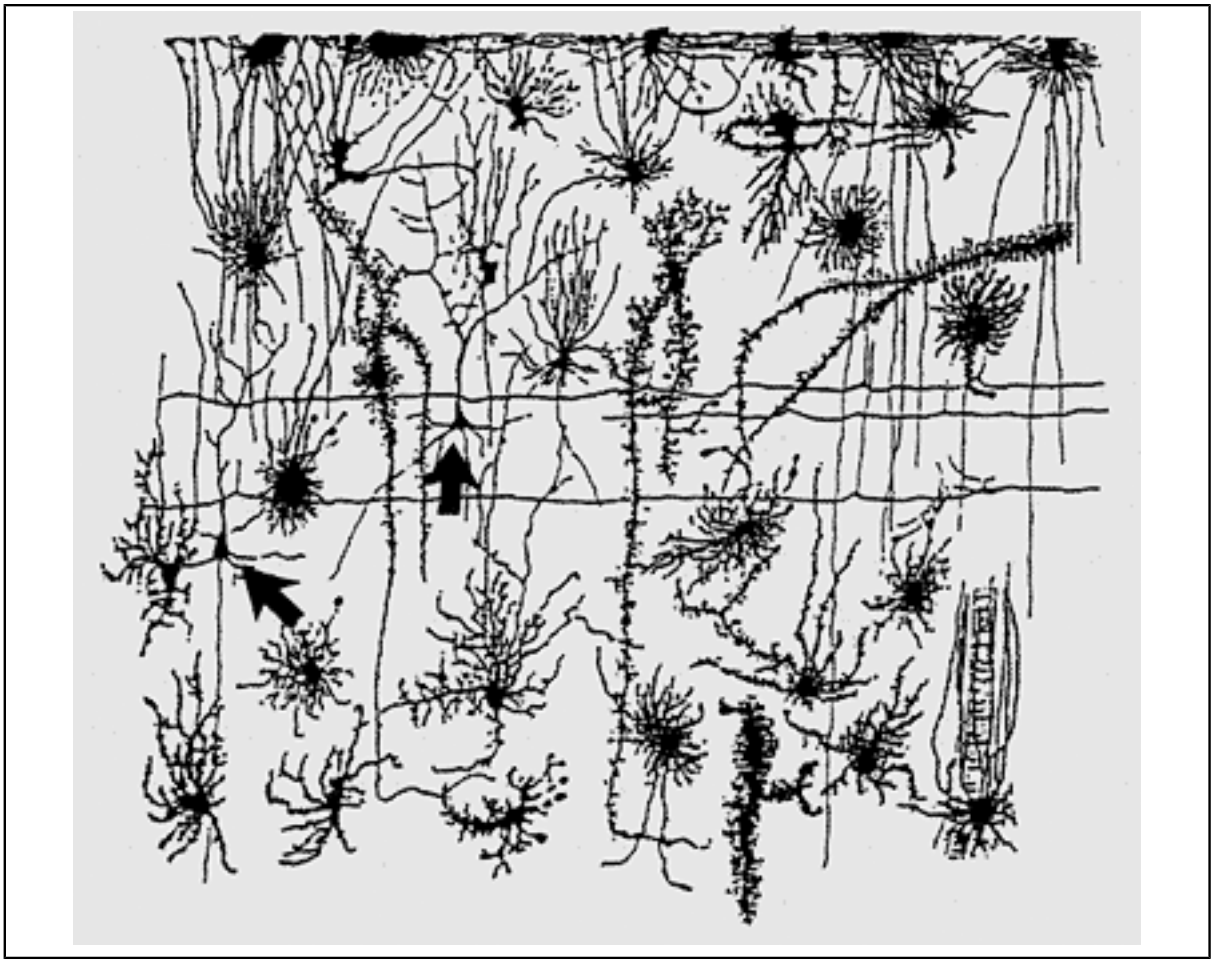
Schleich claims in his memoirs, that his original theory of the brain came to him suddenly on one of those evenings "around the year 1890" when the "ingenious pianist" Przybyszewski was caressing the keys of his very own Steinway (Schleich 1922, p. 167). In the flash of a second the new theory about the cellular-physiological bases of psychic phenomena crystallized in Schleich's brain. He depicted the decisive moment of creative brain discharge as follows:
Suddenly I jumped up. Stanislaus! I shouted. My dear friend! The neuroglia is a damper pedal! An electric sordine, an apparatus for switching registers, an inhibition regulator! Eureka! Heavens! And a zillion F sharp Majors! Brother, say it again. He has gone crazy. But it is a revelation! (Schleich 1922, p. 167)

Schleich regarded his own brain as the site for Przybyszewski's successful piano experiment: here, the "synthetic blending of two methods of association, the scientific method, which adds one subject to the next, and the modern method, which associates matters according to their emotional values," had yielded fruit, while Przybyszewski was "playing Chopin so thrillingly." As Schleich points out, "subjectively unconscious intuition coupled with the clear perception of the naturalist had produced new truths whereby science and art became intermingled" (Schleich 1922, p. 140).

Thus, Schleich's musical salon was transformed into an experimental laboratory where the theory of the autonomy of the neuron and the theory of inhibition and excitation in the brain were combined in the formula of the "electric sordine." In the system of nerve strings, the neuroglia functioned as piano dampers which, if removed from the nerve strings, allow the strings to oscillate and conduct excitation; or, if lowered to the strings, dampen their oscillation so that excitation is inhibited.

The Brain's Switching Apparatus

In contrast to the flowery style of his memoirs, Schleich expressed his idea about the function of neuroglia in the prosaic terms of contemporary neuroscience in his Schmerzlose Operationen (Painless Operations, 1897). The neuroglia, Schleich argues, is the inhibiting substrate, the modulator of inhibition in the brain. The terminal branches of the neurons merely approach each other, "and in between them lies precisely the isolating substance of the neuroglia." Inserted between the neurons (and their appendices), the neuroglia supplied a switching mechanism which organized and regulated the ebb and flow of nervous excitations. Consequently, the glial cell was an "actively functioning substance" just like the neuron, a cellular element which plays an active role in psychic events (All citations Schleich 1897, pp. 86-87).



A more realistic view of the cells in the brain. Neurons (marked with an arrow) and glial cells are stained by a silver impregnation method. From Retzius 1890-1914, vol. 6, plate ix.

Instead of the action and non-action in the same system assumed by contemporaneous psychology and physiology, Schleich claimed that inhibition and excitation are linked to different anatomical substrates: neuronal excitation is modulated by glial inhibition. As Schleich points out, contemporary physiology, psychology and psychiatry "everywhere work with a thoroughly unreal, purely fantastic inhibition mechanism … However, it contradicts every analogy from the science of electricity that one and the same element, like the nerve cell, spontaneously executes now inhibition functions now actions" (Schleich 1897, pp. 83-84).

God and the devil

Schleich shared the fate of his artist friends. Just as Munch's paintings, Schleich's notion of a glia-neuron brain was either ridiculed or ignored. To the leading brain researchers Schleich's idea was not worth a footnote. The only place where his brain theory ever attracted attention was in the inner circle of the Berlin avant-garde. It seems to have been August Strindberg, who took the model of a glia-neuron brain seriously. Schleich recalled that:
Everything I could contribute to mechanics in the field of biology for my part, such as e.g. the presumption of an active inhibition apparatus in the brain, interested him most keenly. All of physics and chemistry in general, he asserted, could be traced back to power and inhibition, which sustained the workings of the entire universe. Then he remarked with inimitable, triumphing joy, 'You have finally caught hold of him: God and the Devil!' (Schleich 1917, p. 7)

It would take nearly a hundred years before 'common' brain researchers would catch up with Schleich's knowledge about neuroglia. Only in the last decades of the twentieth century did knowledge on neuroglia accumulate rapidly, and an extraordinary body of evidence has now been assembled by investigators from all fields of neuroscience supporting a key role for the glia in brain physiology.

Bibliography

Busch, Wilhelm. 1959. Sämtliche Werke. Edited by Rolf Hochhuth. Gütersloh: Bertelsmann

Exner, Sigmund. 1894. Entwurf zu einer physiologischen Erklärung der psychischen Erscheinungen. Leipzig/Vienna: Deuticke

Jung, Carl Gustav. 1940. Foreword in Carl Ludwig Schleich. Die Wunder der Seele. 9th ed. Berlin: Springer

Kölliker, Albert von. 1896. Handbuch der Gewebelehre des Menschen. Leipzig: Engelmann

Matuszek, Gabriela. 1996. "Der geniale Pole?" – Stanislaw Przybyszewski in Deutschland, 1892-1992. Paderborn: Igel

Przybyszewski, Stanislav. 1892. Zur Psychologie des Individuums. Berlin: Fontane

Przybyszewski, Stanislav. 1985 [1926-30]. Ferne komm ich her... Erinnerungen an Berlin und Krakau. Leipzig/Weimer: Kiepenheuer

Retzius, Gustav. 1890-1914. Biologische Untersuchungen. 6 vols. Stockholm: Samson and Wallin

Schleich, Carl Ludwig. 1897. Schmerzlose Operationen: Oertliche Betäubung mit indifferenten Flüssigkeiten. Psychophysik des natürlichen und künstlichen Schlafes. 2nd ed. Berlin: Springer

Schleich, Carl Ludwig. 1917. Erinnerungen an Strindberg nebst Nachrufen für Ehrich und von Bergmann. Leipzig/Munich: Müller

Schleich, Carl Ludwig. 1922. Besonnte Vergangenheit: Lebenserinnerungen 1859-1919. Berlin: Springer

Waldeyer, Heinrich Wilhelm Gottfried von. 1891. Über einige neuere Forschungen im Gebiete der Anatomie des Centralnervensystems. Deutsche Medizinische Wochenschrift 44: 1-64

Wundt, Wilhelm. 1893. Grundzüge der physiologischen Psychologie. 2 vols. 4th ed. Leipzig: Engelmann