

The Boundaries of Science / Pseudoscience

by Ute Frietsch

The term "pseudoscience" is used to imply that a person or group who is using the term "science" to describe their activities, thereby laying claim to the associated societal status, is not entitled to do so. The prefix "pseudo-" is derived from the Greek word ψεύδειν, meaning "to cheat, lie or deceive". Thus, the accusation of pseudoscience suggests the fraudulent appropriation of the status of science. The term primarily implies a value judgement. It is viewed as being of little descriptive or analytical value in present-day discussions of the theory of science. While attempts to establish a normative definition of the concept seem doomed to failure, an investigation of historical usage of the term is interesting from a conceptual historical perspective. A description of the varying theoretical concepts and empirical usages of the term pseudoscience over longer time periods as well as in intercultural and transnational comparisons of scientific systems also describes ex negativo the historical and cultural development of concepts of scientific validity.

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Introduction: Central Questions of a History of Knowledge

In spite of the controversial nature of the term, which is apt to attract attention, the term "pseudoscience" hardly features in present-day scientific discourse. The study of science (→ Media Link #ab)¹ as part of the humanities, social sciences and cultural sciences is currently centred around questions which run counter to a normative definition of the criteria of pseudoscientificity. The history of science, which is primarily understood as the historiography of the natural sciences, is increasingly being supplemented by a history of knowledge. The latter concept also incorporates the history of the relationship between the natural sciences and the humanities, as well as the history of the humanities, social sciences and cultural sciences, non-academic forms of knowledge, and implicit knowledge which is applied in practices (→ Media Link #ac).

▲ 1

This expanded concept of knowledge also brings with it a differentiation of the opposing field of concepts. The terms used need not necessarily be negatively connoted. The historians of science Robert N. Proctor (b. 1954) (→ Media Link #ad) and Londa Schiebinger (b. 1952) (→ Media Link #ae) launched the neologism "agnotology" in an attempt to encourage the systematic investigation of forms of "non-knowledge".² The philosopher Martin Mulsow (b. 1959) (→ Media Link #af), on the other hand, concentrated in his "other history of ideas" on precarious knowledge and thus on the losses which can occur when knowledge passes into history.³

▲ 2

Similar questions have been posed previously. In the 1960s, the French philosopher Michel Foucault (1926–1984) (→ Media Link #ag) attempted to differentiate between types of scientific validity by relating the topos of "counter-culture" (in contrast to "subculture" and "dominant culture"), which was prominent at that time, to the disciplines of ethnology, psychoanalysis and linguistics, describing these disciplines as *contre-sciences*.⁴ Foucault investigated the "human sciences" – a term he used to refer to psychology, sociology, cultural history, the history of ideas and the history of science⁵ – and rejected descriptions of these as "pseudoscientific chimeras"⁶ or "fake sciences"⁷, though he himself fundamentally called into question their scientific validity. In Foucault's view, the main aspect militating against these disciplines being accepted as science is the fact that they have adopted concepts and methods from the disciplines of biology and economics, and from the philologies, instead of developing their own instruments.⁸ Foucault expressed his criticism in order to develop the profile of his own scientific concepts. In particular, he contrasted the history of ideas with his own concepts of "archaeology" and discourse analysis.⁹

▲ 3

However, due to the hegemonic position enjoyed by the historiography of the natural sciences, theorists of science in the 20th century were quick to use the description "pseudoscience". The concept of pseudoscience was usually defined with reference to the falsification principle of the Austrian philosopher and theorist of science Karl Popper (1902–1994) (→ Media Link #ah). According to Popper, the pseudosciences have no interest in improving the veracity of their theses and topics by means of falsification (disproof) or correction. Instead, the statements of these disciplines are of a kind which precludes empirical verification or refutation. Popper, who engaged with this topic for the first time in 1919, viewed Sigmund Freud's (1856–1939) (→ Media Link #ai) psychoanalysis, the individual psychology of the Austrian physician and psychotherapist Alfred Adler (1870–1937) (→ Media Link #aj) and the Marxism of the disciples of Karl Marx (1818–1883) (→ Media Link #ak) as examples of non-falsifiable pseudosciences.¹⁰

▲ 4

The term "pseudoscience" fits well in the linguistic analytical discussions which occurred in the early-20th century. The central concern of these – for example of the Vienna Circle, an informal group of philosophers and theorists of science – was to expose traditional philosophical questions – such as reflections on "being" in the philosophy of Martin Heidegger (1889–1976) (→ Media Link #al) – as pseudo-problems, and as metaphysical questions which are fundamentally to be avoided in the sciences.¹¹ By defining non-falsifiable approaches as pseudoscientific, Popper implied that psychoanalysis, individual psychology and Marxism deviated from an established fundamental norm for scientific validity while presenting themselves –fraudulently, as it were – as being scientific. Reflecting retrospectively in an autobiographical work, Popper explained the supposed necessity of rejecting and denouncing these types of theories in this way with reference to the historical context of his work: for example, the collapse of the Austro-Hungarian Empire and the emerging revolutionary movements after the First World War.¹²

▲ 5

However, on the whole, debates on the theory of science did not succeed in establishing criteria for determining pseudoscientificity that were sufficiently precise while also being generally applicable. The British philosopher of science Philip Kitcher (b. 1947) (→ Media Link #am) argues that the application of Popper's falsification criterion to the natural sciences also raises problems. In the natural sciences, theories often employ a bundle of hypotheses, and determining the status of these as auxiliary or central hypotheses is not always straightforward, according to Kitcher. Furthermore, Kitcher claims, it is not helpful immediately to tarnish a hypothesis which is still new with the accusation of pseudoscience, thereby excluding it from consideration.¹³ The German historian of science Michael Hagner (b. 1960) (→ Media Link #an) views pseudoscience as a classificatory rather than an analytical concept. The variability of scientific norms and values, he argues, make it impossible to identify and distinguish between scientific and pseudoscientific theories and methods in a generally applicable manner. Most recently, an attempt was made to differentiate between the two concepts in the late 1980s during the discussion about creationism and the theory of evolution. In 2002, the term "pseudoscience" was finally removed from the system of science classification of the respected history of science journal *ISIS*.¹⁴ In its entry on "Pseudo-science and quackery", *The Oxford Companion to the History of Modern Science* of 2003 also points out that the term cannot be viewed as a descriptive, timeless or objective category due to its pejorative character and the limited validity of its historical usage to date.¹⁵

▲ 6

A History of the Relationship between the Sciences

There has been a general consensus that attempts to differentiate between science and pseudoscience are (or have been) a typical concern of modernity or a typical modernist project.¹⁶ However, this view is based on the assumption that science equates to the modern natural sciences, as well as on very sparse historical sources. In the coming years, the digitization of modern and pre-modern sources will make it possible to ascertain in a more systematic way the point in time when the adjective "pseudo" began to be used in relation to groups of scientists and to science. Related descriptions, such as heretical, dogmatic, anti-scientific, unscientific, non-scientific, esoteric,¹⁷ fantastical etc., must be taken into account to the extent that they helped to define the concept of pseudoscience more clearly in the historical context. The various antonyms used, such as "real science", "mainstream science", "successful science", "orthodox science" and "official science", also tell us more about what the intention behind the use of the term "pseudoscience" was in the various historical and cultural contexts.

▲ 7

Different terms dominate in the various fields of science. To write a history of the scientific problematization of theology, the term "heresy" would be most useful; in jurisprudence (→ Media Link #ao) the term *Querulanz* ("quarrelsomeness") was central;¹⁸ in medicine the concept of "charlatany" was central; and in the natural sciences, the focus was on "pseudoscience". However, there was a degree of overlap and displacement between these terms. For a history of the relationship between the sciences, these descriptions – though often counterintuitive – are particularly informative. A selection of historical examples are presented below. These demonstrate that the meanings of the description "pseudoscience" became more specific in the context of international dialogue between scientists, and that the spectrum of meaning varied significantly depending on the scientific discipline which was dominant at the time.

▲ 8

Pseudo-Scientia: The 16th to the 18th Centuries

In Christian Europe, theology was considered the highest of the sciences until the 18th century. The university sciences, which were based on the scholastic model of the refinement of concepts, each developed their own criteria regarding the prerequisites that theories must meet in order to be scientifically acceptable. In addition to rules regarding logic and theological theorems, codes of behaviour were also developed, such as the *elenchus*: a fully-fledged method of questioning which served to protect orthodox doctrine and as a scientifically legitimate means of silencing one's theological opponent. In theological debate, it was considered duty of a priest until the 18th century to deal with an opponent's argument word for word – initially in private communication and, if this did not have the desired effect, in published refutations – to completely prove the opponent's error (*pseudos* in Greek).¹⁹

▲ 9

The prefix "pseudo-" entered common usage among critics of the Catholic church in the 13th and 14th centuries. The reference to "false prophets" (*pseudoprophetae*) in the New Testament served as a precedent for the denunciation of opponents as "pseudo".²⁰ The biblical statement had apocalyptic connotations and established a connection between "pseudo" and the work of the devil. In the 16th and 17th centuries, there was increasing debate about the theological correctness of natural philosophical statements, which was now also conducted among natural philosophers. Natural philosophical statements which impinged on theological topics were debated particularly intensively. The description "pseudo", which entered natural philosophical debates during this process, implied both the accusation of heresy – a deliberate deviation from theological doctrine – and the accusation of charlatany, which emphasised the economic aspects of the supposedly fraudulent behaviour. The accusations of heresy, charlatany and "pseudo" had in common that they could be applied to scientific theories and practices, and they were used to vilify and criminalize one's opponent.²¹

▲ 10

In the orthodox and the occult natural philosophy of the 16th and 17th centuries, "pseudo" was used in various combinations. The supporters and opponents of the Swiss physician and alchemist Paracelsus (1493–1541) (→ Media Link #ap) labelled each other pseudo-Christians, pseudo-prophets, pseudo-philosophers, pseudo-chemists, pseudo-chemists and pseudo-astronomers. The London theosophist and physician Robert Fludd (1574–1637) (→ Media Link #aq) reflected critically on this hereticizing (and predominantly personalized) use of the word, which effectively equated "magic" with "pseudo". In his work *Summum bonum* published in 1629, he attempted to differentiate between the parts of magic which he identified as *scientia* and *sapientia vera* – and thus theologically unproblematic – and those which he viewed as *pseudosophia* and *cacosophia*.²²

▲ 11

In 1645, the French priest Pierre Le Cazre (1589–1664) (→ Media Link #ar), who was at that time rector of the Jesuit college in Dijon, took up the accusation of "pseudo". In his polemical work *Physica demonstratio*, which was 44 pages in length and included drawings, he depicted Galileo's laws of gravitation as pseudoscience.²³ Le Cazre was prompted to publish this work, which carried the accusation of "*pseudo-scientia*" in its title, by the publication of the treatise *De Motu Impresso* by the mathematician, physicist and priest Pierre Gassendi (1592–1655) (→ Media Link #as). In this work, Gassendi suggested that the laws of gravitation which Galileo Galilei (1564–1642) (→ Media Link #at) had proposed corresponded (→ Media Link #au) with the worldview of Nicolaus Copernicus (1473–1543) (→ Media Link #av).²⁴ Publication had been preceded by private correspondence, which had failed to lead to agreement.²⁵ Le Cazre's accusation of "pseudo-scientia" was prompted by Galileo's claim that with his mechanics and his laws of gravitation he had developed "due *nuove scienze*"²⁶. By branding them "pseudo", Le Cazre was trying to expose Galileo's "new" knowledge as fraudulent arrogance. This "new" science, he argued, must be rejected as *pseudo-scientia* and replaced with the "true" science.²⁷ Le Cazre tried to discredit the already deceased Galileo using the latter's own scientific weapons. He accused him of having an incorrect definition of movement, deficient principles, paralogisms, insufficient evidence, faulty reasoning, and inadequate experiments.²⁸ Gassendi then defended Galileo against Le Cazre in three letters published in 1646 under the title *De proportione, qua gravia decidentia accelerantur*.²⁹ He explained Galileo's statements regarding continuous acceleration in free fall, though he became entangled in contradictions when he responded ironically to Le Cazre's suggestions regarding more suitable experiments.³⁰ The accusation of "pseudo-scientia" was cited by Gassendi but not defined more concretely.³¹ The debate continued until around 1648, due not least to the French theologian, philosopher and natural philosopher Marin Mersenne (1588–1648) (→ Media Link #aw), who in his copious correspondence with scholars in France, Italy and the Netherlands elicited the positions of both the supporters and opponents of Galileo.³² Due to the prevailing climate, the supporters of Galileo remained cautious. It was obvious that the natural philosopher of the Jesuit order was intent on having the laws of gravitation (as he had previously the theory of heliocentrism) declared heretical because they contradicted Aristotle (384–322 BC) (→ Media Link #ax) and the Bible. In stating their positions, all parties tried to prove their assertions mathematically or with reference to experiments. While certain controversies were fruitless and the freedom to philosophize was restricted, the debate about Galileo's "pseudo-scientia" can nonetheless be described as an epistemological discussion about the prerequisites of a *vera scientia* (true science).³³

▲ 12

In view of the circle of people involved, it seems likely that the term "pseudo" had been taken from the controversy about Paracelsus's chemical philosophy and inserted in the debate about Galileo's laws of gravitation. The two natural philosophical disputes had in common that the claim to novelty – which in the theological context was viewed as presumptuous – was in itself sufficient to attract the attention of opponents. There was also an overlap of participants between the two discussions. Gassendi had defended Mersenne in 1630 in publication directed against the Paracelsus supporter Fludd;³⁴ both of them had condemned Fludd as a practitioner of magic. In the context of the same debate, Fludd described Mersenne as a "roaring, bragging, and fresh-water Pseudophilosopher".³⁵ As an acquaintance of Mersenne, Le Cazre may have taken the combative term "pseudo" from his criticism of alchemy and magic, related it to discussions about the scientific validity of the new physics, and in so doing intensified the accusation of "pseudo-sophia" to an accusation of "pseudo-scientia".³⁶

▲ 13

In view of the transnational scope and importance which these debates developed, it is not surprising that the terminology involved remained in common usage into the 18th century. For example, the Zedler encyclopaedia published in 1739-1741 lists the terms "Pseudochymici"³⁷ for a fraudulent alchemist, "Pseudo-Mathematici"³⁸ for a fortune teller, "Stemgucker" (stargazer) and "Traumdeuter" (dream interpreter) and several other terms, some of which can be traced back to the discussions referred to above.³⁹ This vocabulary was also employed in the controversy over the Enlightenment in Prussia from the 1780s, in which the discussion was about a true and a false Enlightenment. Critics who felt that the French model of Enlightenment would be going too far in Prussia, described their opponents as "Pseudoaufklärer"⁴⁰ (pseudo-Enlightenment thinkers) or bemoaned the demise of faith being brought about by the "Pseudoreformation":⁴¹ "Der Kampf der Aufklärung gegen den Aberglauben im Namen der Vernunft begann im Namen der (wahren) Wissenschaft und des (wahren) Glaubens, und zwar unter der Voraussetzung der Übereinstimmung beider", Werner Schneiders wrote.⁴² However, during the course of the 18th century, the alliance between modern science and the Christian religion became increasingly fragile. From the perspective of one side, science was tending towards a form of atheism; from the perspective of the other, religion tended towards superstition. In this way, both religion and science came to be suspected of being based on erroneous beliefs.⁴³

▲ 14

New Pseudoscience: The 19th Century

In the 19th century, the combative term "pseudo" developed in a new direction. It gradually lost its theological connotations.⁴⁴ While previously natural philosophical statements which impinged on theological topics had been suspected of being "pseudo", now statements and practices which were based on theology and which made reference to aspects of the natural sciences (which were emerging as the new dominant sciences) were labelled with this term.

▲ 15

A philosophy of science emerged in which it was possible to discuss the theoretical and methodological prerequisites of science. A clear distinction between science and the arts was established, and the institutional structures of universities reflected the emergence of the new disciplines.⁴⁵ As the modern concept of science developed, the distinction was also drawn between the science of one's own period and the lack of scientific rigour in earlier periods. Pre-modern sciences were now viewed as being "pseudo" per se. The assumption also emerged that in the pre-modern era no attempt was made to define scientific rigour.

▲ 16

Thus, in the second edition of his *Physiologie* published in 1825, the French physician and anatomist François Magendie (1783–1855) (→ Media Link #ay) described phrenology (→ Media Link #az) as a "pseudo-science".⁴⁶ In contrast to the first edition of 1816, the second edition included a foreword discussing the theory and history of science: "Les sciences naturelles ont eu, comme l'histoire, leurs temps fabuleux. L'astronomie a commencé par l'astrologie; la chimie n'était naguère que l'alchimie ...".⁴⁷ Thanks to Galileo, the scholars of the 17th century had learned that one should not imagine (*imaginer*) or believe (*croire*) in order to learn about nature, instead one must observe it.⁴⁸ In his note on memory, Magendie wrote:

▲ 17

La Phrénologie, que je nommerais volontiers une *pseudo-science*, comme était naguère l'astrologie ou la nécromancie, a tenté de localiser les diverses sortes de mémoires; mais ces tentatives, louables en elles-mêmes, ne soutiennent pas encore l'examen.⁴⁹

In subsequent editions, the foreword and notes were expanded further. In the third edition (1833), alchemy is identified as a pseudo-science of the past. Craniology – Franz Joseph Gall's (1758–1828) (→ Media Link #b0) theory of the analysis of character traits based on skull shape (→ Media Link #b1) – was identified as a pseudoscience of the present (→ Media Link #b2).⁵⁰

The translated and edited version of Magendie's work (*Physiology*) published by John Revere (1787–1847) (→ Media Link #b3) in 1844, which was intended as a textbook for medical students, retained these descriptions, which in this way became commonly held views in the English-speaking world too. Thus, American medical students were also introduced to phrenology and craniology as "*pseudo-science of the present day*".⁵¹

In his descriptions, Magendie gives no indication whether the former "pseudosciences" were already recognized and described as such in their own period. However, he clearly assumes that there was consensus among his contemporaries about the distinction between historical forms of science and pseudoscience. This supposedly reliable historical verdict served to support the perhaps contentious evaluation and condemnation of contemporary forms of knowledge. This included the evaluation of phrenology and craniology as pseudosciences, which Magendie based on the argument that the proponents of these disciplines repeatedly relied on belief instead of making observations. In a note in the 1833 edition, he concedes that this belief contributes to the *amusement*, while the truth leads to *ennui* (boredom) for those who believe in miracles.⁵²

In his discussions, Magendie juxtaposed belief (*imaginer, croire*) and natural philosophical observation (*observer*). Popular belief gives rise to pseudoscientific phenomena; the observation process of the *sciences naturelles*, on the other hand, is the basis of scientific rigour. A statement of this kind would have been problematic in a period in which pre-Enlightenment theology was the dominant science. Consequently, this attitude would have stood little chance of being recognized as scientific in Christian Europe before the 18th century.

Further instances of the emergence of more concrete definitions of "pseudoscience" followed. In 1844, *The Northern Journal of Medicine*, a medical journal in Scotland, published under the title *Last of Gross Popular Delusions: Quackery in Diseases* an anonymous review of a number of works which dealt with the homeopathy (→ Media Link #b4) of the German physician Samuel Hahnemann (1755–1843) (→ Media Link #b5) in a controversial way.⁵³ The author, who rejected Hahnemann's homeopathy, used terms such as "pseudo-inductions",⁵⁴ "pseudo-observation"⁵⁵ and "pseudo-science"⁵⁶ to distinguish between "quackery" and "regular medicine"⁵⁷. "Gross popular delusions", he implied, belonged in the past. But Hahnemann's homeopathy was an example of how a "popular delusion" and "quackery" can continue to exist in the present. Interestingly, the reviewer accused the opposing side of using the term "pseudo-science". He states that supposed innovators in the sciences – such as Hahnemann and his disciples – reject earlier scientific achievements as "pseudo-science", while real innovators in the field of medicine – such as Georg Ernst Stahl (ca. 1659–1734) (→ Media Link #b6), Friedrich Hoffmann (1660–1742) (→ Media Link #b7), Herman Boerhaave (1668–1738) (→ Media Link #b8) and William Cullen (1710–1790) (→ Media Link #b9) – are always conscious of the fact that they are merely adding new knowledge to that which has already been achieved in Hippocratic medicine.⁵⁸ But whether the review used the term "pseudo-science" in the affirmative or the negative, it demonstrates that the debate about the prerequisites of scientific rigour – just like the debates about Galileo and Le Cezre before it – was conducted on the transnational level and that the respective combative terms were used liberally by all parties. The anonymous reviewer also took the opportunity to differentiate between the scientific traditions of Great Britain and "German mysticism".⁵⁹

The British biologist Thomas Henry Huxley (1825–1895) (→ Media Link #ba), who defended Charles Darwin's (1809–1882) (→ Media Link #bb) theory of evolution, also helped to establish "pseudoscience" as a slogan. In his essays on the philosophy of science entitled *Scientific and Pseudo-Scientific Realism* and *Science and Pseudo-Science*, which were published in 1887, he listed various examples of pseudoscience.⁶⁰ These included an understanding of natural laws as physical and independent entities, as propounded in the tradition of scholastic realism by representatives of the church but also by "devotees of the occult sciences of our day" in defending practices such as séances.⁶¹ He also

listed other examples of "nonsensical" conceptual realism and terminological mistakes which feature in the work of those who only imitate a natural sciences approach.⁶² With wit, sarcasm and the unshakeable confidence of the modern natural scientist, Huxley confronted all those religious and secular office holders who comment on natural scientific topics without having received the appropriate training.⁶³

▲23

The source texts discussed here only represent a first random sample, which suggest an epistemological arc of development. It will only be possible to describe the exact epistemological development of the terms "pseudo" and "pseudoscience" from the 17th to the late-19th centuries after a more comprehensive range of source material has been evaluated.⁶⁴

▲24

Pseudoscience and National Socialism

In the 20th century, the discussion about the differentiation between science and pseudoscience became a nightmare for many theorists of science.⁶⁵ One reason for this was the failure of attempts to define demarcation criteria on the theoretical level. The difficulty in defining the term pseudoscience with reference to the theory of science was accompanied by the problem of empirical application.

▲25

The term is too polemical to provide clarity in the context of an epistemological discussion – for example, regarding the threshold of scientific validity⁶⁶. Until the late 19th century, it was primarily used in a polemical fashion, while in the 20th century systematic attempts were made to define it with reference to the theory of science. However, in the context of the battles between political systems in the 20th century the label "pseudoscience" continued to be used in a very variable manner to discredit opponents without adhering to the formalities of scientific theory in the process. As a result, even opinions which in historical retrospect appear scientifically superior became labelled as pseudoscience.⁶⁷

▲26

The "emptiness" of the term pseudoscience as it has been used in the modern era is exemplified by its usage in Germany after 1945. The term became popular after the Second World War because it offered a way of differentiating oneself from the scientific system of the Third Reich.⁶⁸ The desire for such a differentiation was ethically understandable. However, it had the effect of obscuring continuities – not just intellectual continuities, but also those which were material or practical in nature. For example, the fact that data had been collected during the Third Reich which continued to be used for scientific purposes after the end of the National Socialist system could not be analysed due to the clear distancing which the term implied. The accusation of pseudoscience was to this extent too simplistic and promoted the illusory concept of a "pure" science not influenced by external interests.⁶⁹

▲27

Pseudoscience as an Argument in the "Science Wars"

In the context of attempts to establish a general differentiation between scientific validity and pseudoscience, in the 20th and 21st centuries the scientific validity of the humanities and social sciences themselves came under scrutiny – that is, precisely those disciplines which were striving for a differentiation between science and pseudoscience.⁷⁰

▲28

The American physicist Alan Sokal (b. 1955) (→ Media Link #bc), who in the 1990s succeeded in his "experiment" of having a nonsensical text in which he parodied social sciences statements about the natural sciences published in the journal *Social Text*,⁷¹ initially used such terms as "nonsense", "charlatany" and "imposture" to denigrate the

approaches of science studies, of deconstructivism, social constructivism and feminism (→ Media Link #bd).⁷² In 2005, he expanded his vocabulary to include the term "pseudoscience".⁷³ He began investigating the logical and sociological commonalities between the "cultural studies of science"⁷⁴ and pseudosciences,⁷⁵ during which he focused again on "postmodern relativism", which he claimed undermined the universality of natural scientific statements. He views the theory of the incommensurability of paradigms as formulated by the American physicist and philosopher of science Thomas S. Kuhn (1922–1996) (→ Media Link #be) as an example of this relativism. He satirized the practical implications of this theory as follows:

▲ 29

After all, doing real science is difficult. Why bother investing the time to seriously learn physics, biology or statistics if it's all, in the end, just a matter of opinion anyway? One paradigm against another, your paradigm against mine.⁷⁶

Not without justification, the term "science wars" has been used to describe the polemical debate about how the natural sciences should be appropriately analysed in terms of the history and sociology of science.⁷⁷ As the description "war" illustrates, some of the argumentation is primarily strategic, tactical, rhetorical, manipulative or political in nature, while also being conspicuously lacking in coherence as regards the theory and history of science. Sokal's reference to Kuhn would, for example, be insufficient if his intention had been to fairly represent his theory. The reference merely describes the potentially unwelcome implications ("your paradigm against mine") which in his view can result from Kuhn's theory ("One paradigm against another"). According to Sokal's view, historical relativism leads to (inter-) subjective relativism, which in turn leads to the by-now topos of "postmodern arbitrariness".

▲ 30

Sokal views (pseudoscientific) theories such as "intelligent design" and creationism as typical contemporary postmodern phenomena,⁷⁸ a view which he clearly feels justifies his polemical and distorted representations of postmodern theories. However, this type of polemic does not meet basic scientific standards, such as coherence and a fair representation of what other people have said. Sokal responds to such objections impugning his competence in the humanities by commenting on the scientific rigour of the humanities:

▲ 31

I stress that my use of the term "science" is not limited to the *natural* sciences, but includes investigations aimed at acquiring accurate knowledge of factual matters relating to *any* aspect of the world by using rational empirical methods analogous to those employed in the natural sciences. Thus, "science" (as I use the term) is routinely practiced not only by physicists, chemists and biologists, but also by historians, detectives, plumbers and indeed all human beings in (some aspects of) our daily lives.⁷⁹

Apart from other problematic implications, the crux of this polemical comparison lies in the fact that detectives and plumbers – in contrast to historians – do not work scientifically, though they may make use of scientific knowledge in their work. Sokal thus adopts a science theoretical position which states that "science" and "pseudoscience" exist in a relationship of qualitative continuity to one another. According to this position, there is a graduated and also qualitative difference between pseudoscience and science.⁸⁰

▲ 32

Conclusion: The Assessability of Scientific Practices

In view of its semantic connotations, the term "pseudoscience" is at best appropriate for use when one is denouncing a fraudulent practice. In the case of phenomena such as "intelligent design", creationism and UFO research, this kind of denunciation may be appropriate and effective. However, the term "pseudoscience" is of no assistance in identifying

more precisely the objectionable aspects. The term thus tends to be used to discredit entire understandings of science – an approach that is intrinsically counter-productive and unsuitable.

▲ 33

Internal and inter-disciplinary measures used to establish a method or to develop the profile of a discipline differ fundamentally from defining the boundary between science and non-science.⁸¹ In fact, it is the responsibility of the scientific disciplines themselves to integrate theories, methods and practices which are relevant to their areas if they deem them to be suitable, or to exclude them if they deem them to be unsuitable. A preliminary decision regarding their scientific validity based on a theory of science thus seems superfluous, particularly as it can lead in the event of disagreement between disciplines regarding priorities to unnecessary conflicts and to people overstepping their competencies.

▲ 34

If the goal is the analysis of scientific practices rather than the denunciation of fraudulent (that is, ostensibly scientific) phenomena, there are many other more useful terms. These include, for example, the categories of "thought style" and "thought collective" coined by the Polish cognition theorist Ludwik Fleck (1896–1961) (→ Media Link #bf), which enable us to critically evaluate the inclusion and exclusion processes of sciences.⁸² To counteract the emergence of grey areas, ongoing discussion and processes of self-reflection regarding the parameters of science are necessary.⁸³ Discussions about plagiarism and the purchase of academic titles in particular demonstrate that it is necessary to develop a more precise terminology for describing and analysing deficiencies in the scientific process. When referring to such specific practices, the categories of good scientific practice and of lapses in scientific practice are more useful than vague discussions about pseudoscience.⁸⁴

▲ 35

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Appendix

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Notes

- ¹ *Translator's note:* The word "Wissenschaftlichkeit" is translated differently in different parts of the text, using "scientific validity", "scientific rigour" and "scientificity" at different points depending on the context. "Pseudowissenschaftlichkeit", on the other hand, is uniformly translated as "pseudoscientificity". "Theory of science" and "philosophy of science" are used rather than "scientific theory" and "scientific philosophy" because the latter can mean a theory or a philosophy which is considered to meet scientific standards, rather than a theory or a philosophy of science. In the case of the humanities, the term "wissenschaftlich" is usually rendered not as "scientific", but as "academic" or "meeting academic standards". In the English-speaking world, historians, literary scholars etc. tend not to describe their work as "scientific", instead talking about it being "academic" or "meeting academic standards" (as opposed to being popular). This presents a difficulty in this article, which explores the boundary between the natural sciences and the other disciplines and draws comparisons and parallels. In this instance, the term "scientific" is used to refer to the humanities and social sciences too. For a brief overview of the use of the term "science" in English, beginning in the 16th century, see Harkness, The Jewel House, 2007, pp. xv–xviii.
- ² Proctor, Agnotology 2008.
- ³ Mulsow, Prekäres Wissen 2012.

4. ^ Foucault, Die Ordnung 1995, pp. 447–462. In 1979, Nowotny and Rose discussed – without reference to Foucault – "counter-movements in the sciences", by which they meant science-critical movements within and outside of the sciences, cf. Nowotny, Science 1979, pp. 1–26.
5. ^ Cf. Foucault, Die Ordnung 1995, p. 425.
6. ^ Ibid., p. 437.
7. ^ Ibid., p. 439.
8. ^ Cf. Frietsch, Die Ordnung der Dinge 2008.
9. ^ Cf. Foucault, Archäologie 1995, pp. 193–200.
10. ^ Cf. Popper, Conjectures 1963, pp. 33–39. However, Popper was of the view that they could be improved in terms of their scientific status; thus he described them as "pre-scientific", cf. *ibid.* pp. 37–39; pp. 49–50.
11. ^ For example, cf. Carnap, Scheinprobleme 2004; Popper, Conjectures 1963, pp. 39–41.
12. ^ Cf. Popper, Ausgangspunkte 2012, pp. 38–48. Similarly, he explained the impetus behind his efforts to identify in intellectual history the "enemies" of an open society (for him, these were – due to the totalitarian tendencies in their writing – in particular Plato [427–347 BC], Georg Wilhelm Friedrich Hegel [1770–1831] and Karl Marx [1818–1883]) retrospectively as arising out of Adolf Hitler's (1889–1945) invasion of Austria, cf. *idem*, Vorwort 1992, p. IX. In this way, Popper made the ethical and political implications of his theory explicit.
13. ^ Cf. Kitcher, Darwins Herausforderer 2008, pp. 419–421. These arguments were already voiced by the Hungarian mathematician, physicist and theorist of science Imre Lakatos, who replaced Popper's falsification criterion with a description of the effectiveness of research programmes, with which he sought to rectify the deficiencies in Popper's theory and Thomas Kuhn's theory. According to this description, experiments and falsifications are neither always decisive for the effectiveness of research programmes nor will their replacement occur in a sudden change of paradigms, cf. Lakatos, Science 1978.
14. ^ Cf. Hagner, Bye-bye Science 2008, pp. 26–31.
15. ^ Cooter, Art. "Pseudo-Science" 2003; cf. Hagner, Bye-bye Science 2008, pp. 26f. However, the philosopher Sven Ove Hansson and others are working on another definition, for example, cf. Hansson, Defining Pseudoscience 1996.
16. ^ Cf. McKnight, Preface 1992, p. vii; Hagner, Bye-bye Science 2008. To date, there has been no historical description of the development of the different theoretical concepts or of the empirical usages of the term pseudoscience. An overview work of this kind could determine more exactly how concepts of scientific validity are connected historically, as well as intra and inter-culturally. Methodologically, it is important that concepts of "pseudoscience" are only analysed with regard to those historical instances in which this specific term (the prefix "pseudo" with regard to "scientia" and with regard to specific groups of people or professions, as well as corresponding translations) was used. Cf. Rupnow, Einleitung 2008, p. 11. This collection of articles is an important compendium on the use of the term "pseudoscience" in the 19th and 20th centuries, though it focuses more on the supposed phenomenon than on actual usage of the term.
17. ^ In present-day usage, the term "esoteric" generally has multiple meanings. The term is sometimes used synonymously with "hermetic" or "occult"; for example cf. Neugebauer-Wölk, Die Geheimnisse 1997; it is also occasionally used in the sense of "elite" scientific insider knowledge; cf. Nowotny, Science 1979, p. 17.
18. ^ On research into the history of Querulanz, cf. Gaderer, Querulanz 2012.
19. ^ Martin Gierl has researched in detail this "elenchus" procedure for the protection of the pure doctrine in 17th century theological debate; cf. Gierl, Pietismus 1997, particularly pp. 60–92, pp. 114–124.
20. ^ Cf. Matthew 24:11; Acts 16:13; 19:20; 20:10 and *passim*.
21. ^ For detailed citation references, cf. Frietsch, Häresie 2008. Here and in the discussion that follows, I base my understanding of the usage of the terms "pseudo" and "pseudo-scientia" from the 13th to the 18th century on passages from this already published article. Also, cf. Frietsch, Häresie und Wissenschaft 2013.
22. ^ Cf. Frizius, Summum bonum 1629, p. 4.
23. ^ Cazraeus, Physica demonstratio 1645. The expression "pseudo-scientia" is used in the title as well as on p. 6 and p. 43.
24. ^ Gassendi, De Motu 1642.
25. ^ For a more comprehensive discussion of the conflict between Gassendi and Le Cazre, cf. Palmerino, Two Jesuit Responses 2003.
26. ^ Cf. Galileo, Discorsi 1638 (author's emphasis).
27. ^ Cazraeus, Physica demonstratio 1645, pp. 5f.: "... novam illam evanescere scientiam ... ut reiectâ Galilaei pseudo-scientiâ, veram nos ac certam in eius locum substituamus ...".

28. ^ Ibid., pp. 5–8.
29. ^ Gassendi, *De Proportione* 1646.
30. ^ Cf. Palmerino, *Two Jesuit Responses* 2003, pp. 204–218. Palmerino depicts the affair as a "comedy of errors", *ibid.*, p. 208.
31. ^ Cf. Gassendi, *De Proportione* 1646, p. ãii verso and p. 8 of the first and p. 137 of the second letter.
32. ^ Mersenne, *Correspondance* 1932–1988, vol. 1–17.
33. ^ It will only become clear how comprehensively the combative term "pseudo-scientia" was defined in this dispute when all of the relevant sources have been evaluated. The debate was primarily conducted through correspondence, some of which was private, some of which has not been published up to the present, and some of which has disappeared. However, the following source texts are central: Cazraeus, *Physica demonstratio* 1645; Gassendi, *De Proportione* 1646. See also the following research literature: Galluzzi, *Gassendi and l'Affaire Galilée* 2001; Palmerino, *Two Jesuit Responses* 2003. Galluzzi and Palmerino do not focus specifically on the use of the term "pseudo-scientia" by Le Cazre and Gassendi.
34. ^ Cf. Gassendi, *Theologie Epistolica Exercitatio* 1630.
35. ^ Cf. Huffman, *Robert Fludd* 1988, p. 67.
36. ^ The epistemological discussion about true and false science was driven forward in the 17th century by Fludd and Mersenne, who each developed their own terminology in this regard.
37. ^ Zedler, *Art. "Pseudochymici"* 1961, vol. 29, column 1083 [online page 555]; *ibid.*, *Art. "Ciniflones"* 1961, vol. 6, column 71 [online page 51].
38. ^ *Ibid.*, *Art. "Mathematicus (Pseudo-)"* 1961, vol. 19, columns 2052–2053 [online pages 1074f.].
39. ^ *Ibid.*, *Art. "Ciniflones"* 1961, vol. 6, column 71 [online page 51]; vol. 29, columns 1082–1086 [online pages 554–556]. Gierl gives a citation reference for 1707 for the term "Pseudorthodoxie", cf. Gierl, *Pietismus* 1997, p. 409.
40. ^ Werner Schneiders quotes the term "Pseudoaufklärer" from a 1789 source, cf. Schneiders, *Die wahre Aufklärung* 1974, p. 133.
41. ^ For example, in the *Allgemeine deutsche Bibliothek*, the most important review journal of the German Enlightenment, in 1793 an *Apologie aus katholischen Grundsätzen* was quoted as describing the Enlightenment as a "Pseudoreformation". In this way, the reviewed Catholic publication sought to defend the *Religionsedikt* under Friedrich Wilhelm II of Prussia (1744–1797), cf. [Anonymous], *Schriften* 1793, vol. 114, 1, p. 223.
42. ^ Schneiders, *Art. "Aberglaube"* 1995, p. 25 "The struggle of the Enlightenment against superstition in the name of reason was begun in the name of (true) science and the (true) faith, and under the assumption that these corresponded with one another." transl. by N. Williams.
43. ^ *Ibid.*, p. 26.
44. ^ Indeed, the connection between heresy and "pseudo" could still be found in theological publications of the 20th century as a discursive echo, cf. Wirsching, *Kirche* 1990.
45. ^ Cf. Ziche / Driel, *Wissenschaft* 2011.
46. ^ Magendie, *Précis élémentaire de Physiologie* 1825, vol. 1, p. 202.
47. ^ *Ibid.*, p. vi.: "Like history, the natural sciences had their mythic period. Astronomy had its beginnings in astrology; chemistry was alchemy not so long ago" transl. by N. Williams.
48. ^ *Ibid.*
49. ^ *Ibid.*, p. 202.: "Phrenology, which I would like to identify as a *pseudoscience* just as alchemy and necromancy were, has attempted to locate the different types of memory; but these attempts, which are in themselves laudable, do not stand up to scrutiny up to this point" transl. by N. Williams.
50. ^ "La Phrénologie, pseudo-science de nos jours, comme étaient naguère l'astrologie, la nécromancie, l'alchimie, prétend localiser dans le cerveau les diverses sortes de mémoires; mais ses efforts se réduisent à des assertions qui ne soutiennent pas un instant l'examen. Les cranologues, à la tête desquels est le docteur Gall, vont beaucoup plus loin". "Phrenology, the *pseudoscience* of our day, just as *astrology*, *necromancy*, *alchemy* were in the not so distant past, claims to locate in the brain the different types of memory; but its efforts can be reduced to assurances which do not for a moment stand up to scrutiny. The Craniologists, who are led by Dr Gall, go much further", transl. by N. Williams. *idem*, *Précis élémentaire de Physiologie* 1833, p. 247.
51. ^ *Idem*, *An Elementary Treatise* 1844, p. 150.
52. ^ *Idem*, *Précis élémentaire de Physiologie* 1833, p. 248. His American translator put it like this: "There is some show of reason in this, for they thus amuse themselves, while the truth would only cause them ennui." Magendie, *An Elementary Treatise* 1844, p. 150.

53. ^ [Anonymous], Last of Gross Popular Delusions 1844, pp. 377–398.
54. ^ Ibid., p. 384.
55. ^ Ibid., p. 385.
56. ^ Ibid., p. 387.
57. ^ Ibid., p. 385.
58. ^ "And here we discover an exact test by which to ascertain whether the founder of a new system belong or not in the strictness to the medical profession. There is a broad distinction between that kind of innovation which adds to a department of knowledge, or remodels the facts before accumulated under such or such a head, and that opposite kind of innovation which pronounces what had been before recognized as a branch of science, to have been a pseudo-science, composed merely of so-called facts, connected together by misapprehensions under the disguise of principles." Ibid., p. 387. Hagner misinterprets this passage, cf. Hagner, Bye-bye Science 2008, p. 24. He propounds the view that in the modern period the expression "pseudoscience" has only been used by the established sciences against more unconventional positions – and never vice versa (see *ibid.*, p. 23, footnote 4), a view which does not stand up to scrutiny (see note 66 below).
59. ^ [Anonymous], Last of Gross Popular Delusions 1844, pp. 397–398.
60. ^ Huxley, Scientific and Pseudo-Scientific Realism 2011, pp. 59–88; *idem*, Science 2011, pp. 90–125.
61. ^ *Idem*, Scientific and Pseudo-Scientific Realism 2011, p. 79.
62. ^ Cf. *ibid.*, pp. 78–79; cf. Hagner, Bye-bye Science 2008, p. 44.
63. ^ Huxley, Science 2011, pp. 90–125.
64. ^ Hagner speculates that occurrences of the terms "pseudoscience" and "pseudoscientist" were rare before 1840 because the reductionist understanding of science in the physical-experimental sense only became established with the foundation of the British Association for the Advancement of Science in 1831 and the term "scientist" was only introduced in 1840; cf. Hagner, Bye-bye Science 2008, p. 24. In the case of the term "pseudoscientist", which was in general rarely use, one must concur with Hagner. In the case of the term "pseudoscience", however, cf. Magendie, Précis élémentaire de Physiologie 1825, p. 202; *idem*, Précis élémentaire de Physiologie 1833, p. 247; *idem*, An Elementary Treatise 1844, p. 150. Additionally, it must be stressed that protecting *scientia* (in the singular) against deviations was also a central aim of the scholastic sciences.
65. ^ Cf. Hagner, Bye-Bye Science 2008, p. 31.
66. ^ Cf. Foucault, Archäologie 1995, pp. 253–279.
67. ^ There are three prominent examples which demonstrate the more than problematic use of the term pseudoscience in the 20th century: "*Judenforschung*" in the Third Reich sought to discredit the liberal "Wissenschaft des Judentums", in which Jews played a prominent role, as "Pseudowissenschaft", cf. Rupnow, "Pseudowissenschaft" 2008, p. 289. In the GDR, the accusation of "pseudoscience" was an instrument commonly used in science politics to denounce one's opponent; for example, in the 1950s "scientific" Pavlovian behaviour theory was contrasted with the "pseudoscientific" psychoanalysis of Sigmund Freud, cf. Thiel / Walther, "Pseudowissenschaft" 2008, pp. 320–328. In the Soviet Union, supporters of Neo-Lamarckism directed the accusation of "pseudoscience" against the discipline of genetics, cf. *ibid.* pp. 314–316. The in some cases unjustified use of the term "pseudoscience" is also emphasized by Lakatos, Science 1978.
68. ^ For example, "pseudo-science" was employed as a concept in the Nuremberg Doctors Trial in 1946/1947, cf. Schleiermacher / Schagen, Medizinische Forschung 2008, pp. 253–255.
69. ^ Cf. Rupnow, "Pseudowissenschaft" 2008, pp. 279–307.
70. ^ A trend towards the phenomenon of "no, you're pseudo!", which was primarily initiated by opponents of the metasciences, is apparent here. For example, in his article *The Pseudo-Science of Science?*, the philosopher of science Larry Laudan raised the question whether the sociology of science – like hermetic, mesmerism, etc. – is a pseudoscience. This question was directed against the sociologist of science David Bloor, who in his *Knowledge and Social Imagery* (1976) and elsewhere had called into question the scientific validity of the philosophy of science. Cf. Laudan, The Pseudo-Science 1984, pp. 173–198. Other examples could be mentioned. Amazingly, in a reference to Popper the theorist of science Otto Neurath referred to the "pseudorationalism of falsification" in 1935, cf. Neurath, Pseudorationalismus 2006.
71. ^ Cf. Albrecht, Art. "Polemik" 2013, pp. 306–310.
72. ^ In the academic literature, the justified criticism has been voiced that Sokal's concept of "postmodernism" allows him to discount the most varied theories in an undifferentiated way. For example, cf. Gieryn, Cultural Boundaries 1999, pp. 336–362.

73. ^ Cf. Sokal, Pseudosciences 2005.
74. ^ Cf. idem, Pseudoscience 2010, p. 333.
75. ^ Cf. ibid., pp. 263–370.
76. ^ Ibid., p. 344; cf. ibid., p. 291; cf. Kuhn, Die Struktur 1997.
77. ^ Cf. Ross, Science Wars 1996.
78. ^ Cf. Sokal, Pseudoscience 2010, pp. 336–337.
79. ^ Ibid., p. 265, italics in original.
80. ^ Cf. ibid., pp. 267–268. In my view, the term "pre-scientific" is sufficient to convey the idea of a graduated difference. However, Sokal implies that (at least the post-structuralist) humanities, social sciences and cultural sciences are pseudosciences of the natural sciences – and this view does not become more acceptable by replacing "pseudoscientific" with "prescientific". Cf. ibid., pp. 267–268.
81. ^ Cf. Gieryn, Cultural Boundaries 1999.
82. ^ Cf. Fleck, Entstehung 1980.
83. ^ Such a discussion of the work practices at universities is conducted, for example, in Frietsch, Über die Praxis 2013.
84. ^ For example, they can be defined in a legally binding way in the relevant university statutes and are thereby themselves subject to a process of internal-academic discussion.

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Eingeordnet unter:

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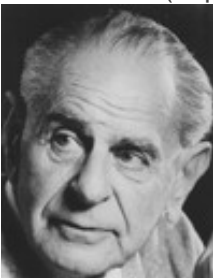
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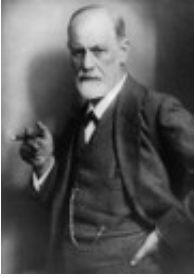
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