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Abstract

Ludwik Fleck is known mainly for his pioneering studies of science as a social activity. This text investigates a different aspect of Fleck's epistemological thought—his engagement with normative aspects of medicine and public health and their political underpinnings. In his sinuous professional trajectory, Fleck navigated between two distinct thought styles: fundamental microbiological research and practice-oriented investigations of infectious diseases. Fleck's awareness of tensions between these two approaches favored the genesis of his theoretical reflections. At the same time, his close observation of medical and epidemiological practices led him to the conclusion that collectively produced scientific facts are situated and fragile. Thought collectives, Fleck explained, can err or yield to external pressures, with potentially disastrous consequences. While Fleck the reflexive experimental scientist has been creatively translated into the science

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studies idiom, Fleck the reflexive practical microbiologist and public health expert still awaits inspired translation.

Keywords
Ludwik Fleck, thought collective, microbiology, human experiments, public health

Displaced Knowledge, Displaced People

Ludwik Fleck is known today mainly for his pioneering studies of the collective production of scientific facts in the laboratory. Bruno Latour starts his postface to the French edition of Fleck's best known study, the 1935 book *Genesis and Development of a Scientific Fact*, with the statement:

> What a surprising book! One can compare it to Moby Dick. It appears from time to time, with tens of years of interval, then disappears without making any noise before re-emerging suddenly, fresh, foaming, covered with mussels, dangerous for its novelty, perfectly able, like the famous white whale, to sink ("faire sombrer") more than one ship loaded with historians of science, with a single big blow of his obstinate head. It even has its Ahab—Thomas Kuhn, who always wished to domesticate it, but never really succeeded in doing it. (Latour 2005, 251)

Latour's opening lines are an intriguing, thought-provoking, poetic, and—at least in one possible reading of Latour's intention—inaccurate description of Fleck's ideas. Far from being a "white whale"—a mysterious and strange creature that suddenly emerged from unfathomable depths of the ocean, Fleck's thought was firmly rooted in his professional practice and in a specific period and place: interwar Poland in a period described by the writer Victor Serge as "midnight in the century" (Serge [1939] 1971).[1]

During his formative years, Fleck moved between positions and sites, participated in several professional thought collectives, and navigated between their distinct thought styles (Löwy 1988). Later, he was caught in the turbulence of European history. Accordingly, Fleck can be described as a "nomadic subject" who, as a result of his unstable status and biographical discontinuities, is endowed with a transversal, fragmented, and fluid identity (Braidotti 1994). His nomadic status, multiple marginalities, and insider/outsider status, may have enhanced his ability to "think elsewhere/otherwise" (Lapierre 2004; Fehr, Jas, and Löwy 2009).[2] The first

part of this text analyzes the connections between Fleck's professional experience as a—partly frustrated—fundamental researcher and the director of a routine analysis laboratory, and his fine-grained analysis of the collective production of scientific facts. The second part links Fleck's views on the fragility and pitfalls of the collective production of scientific facts with this historically situated experience. The specific context in which Fleck evolved—the practice of microbiology in Mitteleuropa in stormy times, as seen by an individual at the epicenter of that storm, resonated with his insights into the limits of the scientific enterprise.

A Scientist's Meandering

In the 1920s and 30s, when Fleck wrote his main epistemological texts, he worked in a relatively marginal scientific discipline, occupied relatively marginal institutional positions, and defended relatively marginal theoretical views. Fleck specialized in microbiology and serology, "service specialties" endowed with a relatively low status within medicine. Fleck started his career as an assistant of one of the few internationally recognized Polish microbiologists, Rudolf Weigl. He failed, however, to secure a research/academic position and was obliged to work in practice-oriented microbiology laboratories.[3] In spite of this setback, Fleck did not give up his scientific aspirations and published numerous research articles in Polish and German medical journals. He failed, nevertheless, to join the inner circle of professional scientists. At that time, Fleck believed that bacterial species could be modulated by interaction with the host, a theoretical position at odds with the dominant understanding of the fixity of bacterial species (Fleck 1930; Löwy 1986). Fleck developed a unique ability to act as a "para-ethnographer" who reflects, to an unusual degree, on his own patterns of practice (Kontopodis, Niewöhner, and Beck 2001, 601). His triple professional marginality might have favored this ability, or to be more accurate, created the conditions of possibility for its development. (Löwy et al. 1988, 2009). An additional element that might have favored his reflexive epistemology was Fleck's encounter with dissonances between knowledge produced in a research laboratory, a routine analysis laboratory, clinics, and the field.

In the interwar era, Fleck's professional marginality was magnified by his status as a Jew in an increasingly anti-Semitic Poland (Kielanowski 1983; Schnelle 1986; Groër 2009). His Jewish origins might have been one of the reasons for his difficulty in entering academia in the early 1920s. In 1935, a Polish right-wing government fired Jews from all official positions, and Fleck lost his job in a municipal microbiology laboratory. In September

1939, when Lwow was occupied by the Soviet Army and annexed to the Ukraine, Fleck was named the head of a Municipal Bacteriology laboratory and "docent" (associate professor) of microbiology at Lwow University. Fleck's professional ascent ended in June 1941, with the German occupation of his town. The brutal persecution of Jews by the Nazis led Fleck from the Lwow ghetto to the concentration camps Auschwitz and Buchenwald. He survived Buchenwald mainly because he became a member of a prisoners' team that produced antityphus vaccine for the German army—and sabotaged this production.[4] After 1944, Fleck successfully resumed his academic career, first at Lublin University and then in Warsaw, where he headed the microbiological laboratory of the Mother and Child Institute. The latter job allowed him to conduct fundamental research in addition to his routine tasks.

In 1957, Fleck immigrated to Israel where he obtained a research position at the Institute for Biological Research at Ness Ziona, thanks to the support of its director Marcus Klingberg. Fleck worked there until his death in 1961 (Klingberg and Schnelle 2009). Fleck's complicated life story has a posthumous twist. The Ness Ziona institute had two sections: an open one, dedicated to fundamental and applied research in microbiology, and a closed one, dedicated to bacteriological warfare: Klingberg directed both. Fleck befriended Klingberg and named him as the executor of his will. After Fleck's death Klingberg kept all Fleck's papers in his office. In 1983, Klingberg was secretly arrested by the Israelis as a Soviet spy and condemned to twenty years in prison. It transpired later that from the 1950s on he had transmitted information on Israeli and US programs of bacteriological warfare to the Soviet Union (Cohen 2001). When Klingberg was arrested, all his documents—including Fleck's papers—were confiscated by the Israeli security services. In spite of repeated appeals by scholars, Fleck's papers have never surfaced, yet another way in which Fleck's life has become entangled with twentieth-century history (Rappaport 2005).

The Laboratory and the Clinic

Fleck started his lectures at Lublin University with the introduction: "I am Ludwik Fleck, Jew, microbiologist" (Magierska and Tuszkiewicz no date). Fleck's self-presentation as a Jew—highly unusual in postwar Poland—might have been a defiant response to his surroundings. Fleck was neither a Zionist nor a religious Jew. On the other hand, his Judaism was the cause of his pre–World War II professional difficulties, his dramatic fate during the Nazi occupation of the Ukraine and Poland, and the extermination of the majority of his

family. After the war, when many Polish Jews changed their family names to Polish-sounding ones, Fleck kept his "foreign sounding" name. There is no reason whatsoever to assume that Fleck wished to "pass" as a Pole, but at any rate this was not possible because he could not change the way he looked. Marked Semitic traits, which, as a Polish anti-Semitic expression goes, were a "joy for a caricaturist," often meant the difference between survival and death during the Nazi occupation. Only the lucky owner of an "unmarked" face could hope to go into hiding with faked "Arian papers." In postwar Poland, the traditional anti-Semitism was exacerbated for some by the identification of Jews with the hated communist regime ("Zydokomuna").[5] People with a typical Jewish physiognomy were at risk of attracting negative reactions. Fleck's self-presentation as a Jew might have been a preemptive strike.

Fleck's second element of self-presentation—microbiologist—brought to the fore the importance he attributed to his professional identity. Fleck started his professional career in a research laboratory, but his failure to secure an academic position obliged him to leave the sheltered world of scientific investigations for a succession of practice-oriented jobs, public and private. He continued his research activities, however. It is possible that Fleck at first believed that it was possible to maintain at the same time the outlook (later named by him a "thought style") of a fundamental researcher and a practitioner but then found out that such double allegiance was problematic. The knowledge of a laboratory worker is not identical to the knowledge applied in a clinical setting. A "chemical" focus, necessary for successful study of the physiological properties of bacteria, was not fully commensurable with the more overall point of view necessary for understanding what is wrong with a given patient.

In his 1939 polemics with the physician and historian of medicine Tadeusz Bilikiewicz, Fleck argued that:

> the same statement cannot be true for A and false for B. If A and B share the same thought style the statement is either true or false for both. If they apply different thought styles one cannot really speak about the "same statement", because neither one of them can understand the statement made by the other, or he understands it in a different way. (Fleck 1939b, 169)

This is a persuasive argument if we assume that A and B belong to distinct thought styles and consistently use different cognitive frameworks. But what happens if A applies in the morning a thought style in which a given statement is seen as true and in the afternoon shares with B a thought style in which this statement is seen as false?

In *Genesis and Development of Scientific Fact*, Fleck affirms that it is easier for the same individual to adopt two very different thought styles than two very close ones. For example, it is easier for a physician to study a disease from a clinical point of view together with that of the history of civilizations, than from a clinical-medical one together with a purely chemical one (Fleck [1935] 1979, 111).[6] This intriguing statement might have originated directly in Fleck's oscillation, in the 1920s and 30s, between fundamental research and applied science.

Fleck's earliest epistemological article, of 1927, "Some specific features of the medical way of thinking," mirrors the tension between different ways of conceptualizing human pathologies. Diseases, Fleck argued, do not exist "out there" but are ideal types produced by medical classifications. Accordingly, different medical specialties construct different and often incommensurable ways of viewing pathological states (Fleck 1927). Moreover, the biological reasoning of a fundamental scientist is very different from the clinical reasoning of a medical practitioner. Scientists, especially when they work with well-controlled experimental systems, can divide the studied problem into smaller and more manageable segments and then study each segment in isolation. Clinicians, who treat sick human beings, frequently grapple with complex phenomena, difficult to reduce to small, manageable units. As a consequence, when looking at a medical problem:

> it becomes ever and ever necessary to alter the angle of vision, and to retreat from a consistent mental attitude. (. . .) The result is that a uniform understanding of morbidity is not possible. Neither the cellular nor the humoral theory, nor the functional understanding of diseases alone, nor their 'psychogenic' conditioning, by themselves, will ever exhaust the entire wealth of morbid phenomena. (Fleck 1927, 43)

There is no "point of view from nowhere" (Shapin 1998) from which one can grasp the totality of phenomena related to human disease. Knowledge about pathologies is always situated. A point of view developed by one group of experts is often at least to some extent incommensurable with the point of view of another group of experts. Medical knowledge is partial, fragmented, and incomplete.

The Circulation of Incommensurable Facts

In the 1930s, Fleck became interested in the patterns of knowledge production by scientific and medical thought collectives. During their socialization,

he noted, members of a given scientific thought collective learn to perceive specific elements of observed entities and disregard others and to link the observations perceived as relevant to a given inquiry with the corpus of accepted knowledge in their domain. As a consequence, physicians trained in different medical specialties literally do not see their patients in the same way. A bacteriologist is unable to perceive changes in the patient's skin which seem "evident" to the dermatologist, a dermatologist is incapable of recognizing a "typical" image of pathological bacteria in the patient's blood, and both will fail to observe changes in the patient's mood, "obvious" to a psychiatrist. The question is not merely of having enough time to master additional skills. Following the insights of Gestalt theory, Fleck argued that since the human brain has a finite capacity for learning to recognize meaningful patterns, acquisition of the capacity to perceive one set of phenomena is frequently linked with a loss of capacity to perceive other phenomena. Shared socialization produces shared patterns of observation and interpretation (Fleck 1934).

Scientific facts, Fleck explained in his 1935 book, are initially generated within a relatively homogenous thought collective that shares the same thought style: similar theoretical and practical training, agreement on legitimate scientific questions, methods that should be used to answer these questions, and criteria for the validation of results. Such agreement makes possible the collective production of knowledge, through which:

> a set of findings meanders through the community; becoming polished, transformed, reinforced or attenuated, while influencing other findings, concept formation, opinions and habits of thought. (Fleck [1935] 1979, 42)

Migration through a uniform thought collective reinforces and homogenizes observations, until they coalesce into a stable scientific fact. The fate of such a scientific fact changes dramatically, however, when it leaves the thought collective that originally elaborated it and is adopted—and at the same time transformed—by a different thought collective:

> In chapter 1 we described the passages of the syphilis concept from one community to another. Each passage involves a metamorphosis and a harmonious change of the entire thought style of the new collective arising from the connections within concepts. The change in thought style, that is, the change in readiness for directed perception, offers a new possibility for discovery and creates new facts. (Fleck [1935] 1979, 110)

Fleck's description of the fate of circulating scientific facts may have been directly related to his professional experience. His 1927 text brought to the fore the incommensurability of knowledge produced by different medical disciplines. On the other hand, his work as director of a microbiology laboratory in a hospital in all probability taught him that clinicians frequently discuss with colleagues from different medical specialties, as do public health experts. Fleck's apparent inconsistency—in 1927, he focuses on incommensurability among groups of medical experts and in 1935 on the circulation of facts among such groups—may indicate a lack of coherence in his writings. It may also reflect an evolution of his thought. Fleck's growing experience of "meandering" between distinct thought collectives might have been at the origin of his unique ability, described by Deborah Coen, to learn to see incommensurability as a contingent outcome of a specific historical situation (Coen 2012, 112). Moreover, such contingent incommensurability can be modulated and adapted to specific situations. An expert socialized in one thought style—for example, of bacteriology—communicates with a professional socialized in a very different thought style—for example, that of general medical practice—through "stylized partial translations." And more than communication takes place: such translations are an important source of change in science and society:

> Even the simple communication of an item of knowledge can by no means be compared with the translocation of a rigid body in Euclidean space. Communication never occurs without a transformation, and indeed always involves a stylized remodeling, which intracollectively achieves corroboration, and which intercollectively yields fundamental alteration. (Fleck [1935] 1979, 111)

A routine diagnosis of diphtheria illustrates such a "stylized partial translation." When a bacteriologist writes to a general practitioner (an intercollective communication), he provides only the information directly relevant to a clinical diagnosis, for example, "the microscopic specimen shows numerous small rods whose shapes and positions correspond to those of diphtheria bacilli. Culture grown from them produced typical Löffler bacilli." When the same bacteriologist writes to a colleague who shares his thought style (an intracollective communication), he provides a more complex description of the observed microorganisms and arrives at a more tentative conclusion. His observations merely indicate an elevated probability that the observed microorganisms are Löffler bacilli. The origin of the specimen, a swab from a throat of a sick child, reinforces this probability (Fleck

[1935] 1979, 113-15). A diagnostic certainty—this child has diphtheria—is produced through an incomplete translation from a microbiological to a clinical thought style. An imperfect translation can produce perfectly functional applied knowledge.

Fleck and Collective Experimentation

Genesis and Development of a Scientific Fact attracted a modest amount of attention when it was mentioned in the introduction of Kuhn's *Structure of Scientific Revolutions* of 1962; it became influential following its publication in English in 1979. At that time, social studies of science was already a visible domain of inquiry. Accordingly, some of the reviewers of the English translation of *Genesis and Development of a Scientific Fact* praised Fleck's pioneering insights but doubted that his ideas could bring new insights for scholars who investigate the nature of scientific knowledge (Shapin 1980; Harwood 1986). Other reviewers argued that the growing interest in the social aspects of the production of scientific knowledge created the right conditions for an appreciation of Fleck's important insights, especially about the nature of scientific practice (Stent 1980; Rosenkrantz 1981; Pickering 1982). Fleck, the historian of science Jan Golinski explained, had produced a detailed and illuminating account of the toil and trouble of experimental work, frustrations linked with such work, and practical ways of overcoming such frustrations. His description of the genesis and development of the Wassermann reaction displays the essential complexity of science and demonstrates that epistemological problems arise with more urgency and regularity in science than in everyday life (Golinski 1990).

One of the most influential promoters of Fleck's thought, Bruno Latour, became especially interested in Fleck's description of the collective production of scientific knowledge. Fleck's main theoretical innovation, Latour states in his postface to the French translation of *Genesis and Development of a Scientific Fact*, was the development of a "collective empiricism" (Latour 2005). Latour stresses the highly innovative character of Fleck's description of laboratory work as a dynamic collective endeavor (Latour 2005, 255-58). Fleck "is able for the first time (and perhaps for the last in science studies!) to take the social, collective, practical elements positively and not negatively or critically" (Latour 2007, 93). Fleck is not burdened by a meaningless (for him) dichotomy between the "real" and the "social," because his aim is to produce a social ontology, not a social epistemology. His main goal is to show how a chain of collective experimentation, which

includes successive rectifications, revisions, and then institutionalization and "black boxing" of specific elements, produces truth (Latour 2007, 94). Latour's creative interpretation of Fleck's epistemology focuses on the important achievements of collective empiricism. The thought collective tinkers, make mistakes, but it gradually acquires more experience ("gagner de l'experience") and therefore more certainty. Facts become facts through a collective process of producing them ("facit").[7]

Medical Facts in Context

Latour's interpretation of Fleck's thought accentuates the positive aspects of gradual acquisition of experience by the collective. Fleck's own practice-grounded understanding of science—or rather of the sciences—is more guarded. It is attuned to the effects of power relationships and open to the possibility of serious errors. It is reasonable to assume that in the 1920s and 30s Fleck's critique of the dominant point of view within his scientific discipline may have sharpened his critical view of facts produced by thought collectives. At that time, Fleck defended a dynamic (in today's terms, "ecological") view of interactions between an organism and its environment and applied this view to host–parasite interactions (Fleck [1935] 1970, 60). His opposition to "chemical" approaches adopted by the majority of his peers, focused on investigation of (presumably) stable chemical structures such as specific antigens and antibodies, may have sensitized him to the possibility that a collective, even a large one, can err (Löwy 1986).

The controversy on the nature of host–parasite relationships was conducted inside a single thought collective, that of fundamental researchers in microbiology. Divergences between scientific facts produced by distinct professional groups do not belong to this category. Facts produced in a given investigation, Fleck argued in 1929, are strongly dependent on the aims of that investigation. Biochemists who study the physiological properties of a given microorganism will include in their definition of such a microorganism only "typical" specimens and will exclude all borderline cases. Epidemiologists, fearing the spread of an infectious disease, and focused on the development of infectious diseases in populations, will by contrast include all the borderline and doubtful cases in their definition of a given bacterial species (Fleck 1929). Both biochemists and epidemiologists are faithful to their respective disciplinary thought styles. Divergent scientific facts produced by each one of these two thought collectives (e.g., different estimates of the prevalence of a given bacterium in a population) are therefore equally true. Facts produced by epidemiologists have,

however, direct practical effects. Epidemiologists do not possess superior knowledge, but they have an additional responsibility. In the example proposed by Fleck, a stringent definition of *Streptococcus heamolyticus*, the etiological agent of scarlet fever, however satisfactory from a cognitive point of view, may produce unchecked epidemics of scarlet fever among children, with—especially in the pre-antibiotic era—potentially catastrophic consequences.[8]

One of the events that might have shaped Fleck's epistemological thought in the 1930s, the historian of medicine Christian Bonah has proposed, was the disastrous vaccination against tuberculosis in the German city of Lübeck. Seventy-seven babies vaccinated in Lübeck between February and April 1930—a third of all the vaccinated children—died, and nearly all the others became sick—an especially dramatic case of botched "translation" between laboratory and clinics. The Lübeck catastrophe, and then the trial of the doctors responsible for production and diffusion of the faulty vaccine, led to extensive public debate on the limits of bacteriological knowledge and the scope of doctors' responsibility.[9] This debate, prominent in the German-speaking world in the early 1930s, may have stimulated Fleck's desire to develop a general theory of scientific knowledge (Bonah 2002). Such a theory, Fleck argued, would promote a better understanding of science by the general public and by the scientists themselves and would therefore limit the power of narrow groups of experts, which needed to be kept in check:

> the elite panders, as it were, to public opinion and strives to preserve the confidence of the masses. This is the situation in which the thought collective of science usually find itself today. If the elite enjoys the stronger position, it endeavors to maintain distance and to isolate itself from the crowd. Then secretiveness and dogmatism dominate the life of the thought-collective. (Fleck [1935] 1979, 106)

Genesis and Development of a Scientific Fact investigates the role of the thought collective of serologists in transforming an initially problematic serologic test for the diagnosis of syphilis into an entity that could be used in the clinics. However, the extraordinary collective effort of serologists that made possible the development of the Wassermann test did not take place in a void. The final form of this test, seen in the 1930s as an established "scientific fact," was shaped, Fleck argued, by international scientific competition, popular perception of syphilis, and public health considerations:

> from the very beginning the rise of the Wassermann reaction was not based upon purely scientific facts alone. A rivalry between nations in a field that every layman considers very important, and a kind of vox populi personified by a ministry official, constituted a social motif for the work. The effort expended on this scientific project was correspondingly great. (Fleck [1935] 1979, 68-69)

The "collective experimentation" that led to the genesis and development of the scientific fact studied by Fleck started with political considerations. It ended with political decisions. The scientific fact studied by Fleck was not only an intriguing piece of new scientific knowledge but also a development that directly affected people's lives. "Wasserman-positive" individuals were told that they were carrying dangerous germs that put at great risk their own physical and mental health, and the health of their sexual partners and children. This information, coupled with the persistence of a stigma attached to syphilis (at least until the advent of penicillin) often changed the ways they saw themselves and were perceived by others. In the 1930s, syphilis was a major public health and political issue. Accordingly, syphilis together with another important infectious disease—tuberculosis—were at the origins of the concept of screening: a search for "invisible" people affected with a given condition (Armstrong 1995, 2012). The screening campaigns for tuberculosis employed X-ray machines. Only at the second stage did physicians who observed a suspicious shadow on an X-ray film confirm the diagnosis of tuberculosis in the bacteriology laboratory. Screening for syphilis was, by contrast, grounded in the massive diffusion of laboratory tests to reveal the presence of the hidden pathology.

Fleck's study of the origins of the Wassermann reaction did not explicitly deal with one key aspect of the introduction of this reaction: early debates on its clinical and epidemiological significance. At first, it was not clear whether a positive serological reaction merely indicated that the tested individual had once been in contact with the etiological agent of syphilis, *Treponema pallidum* (specific antibodies can persist in the blood long after the person is cured), or denoted the presence of an active infection (van den Belt 2011).[10] The two interpretations have very different practical consequences. A reaction that does not differentiate between past and present infections may be interesting for an epidemiological survey, but has a limited practical value, especially when dealing with a highly prevalent microorganism. By contrast, spotting people with an active infection, who can spread the disease in populations, is extremely important from the epidemiologists' point of view. The view that a positive Wassermann reaction

displays an active infection with *Treponema* prevailed in the 1910s. Fleck's insistence on collective effort (in his terms, "an avalanche"), which led to publication of thousands of articles on the Wassermann reaction, might have reflected the importance he attributed to the transformation of a reaction found to be efficient in the laboratory to one that was effective in the clinics and the field.

> Collective experience has thus operated in all fields related to the Wassermann reaction, until, with disregard for theoretical questions and the ideas of individuals, the reaction has became useful. But this rewarding and tedious work of the collective was carried out only as a consequence of the social importance of the syphilis question and of the problem regarding the change in syphilitic blood. (Fleck 1979, 73)

In the late 1930s and 40s many countries introduced mandatory prenuptial testing for syphilis and obligatory testing of other social groups, such as soldiers or pregnant women (Brandt 1987). The idea that healthy people should be tested for the presence of a hidden disease was an important conceptual innovation that radically modified public health policies.[11] The thought collective of serologists also produced—or rather coproduced—regulations and laws. The scientific fact at the center of Fleck's book rapidly became a political fact (Löwy 1993, 2004).[12]

Typhus Vaccine and the Buchenwald Thought Collective

Fleck was acutely aware of the entanglement of science and politics. In 1939, he openly warned against the dangers of the political misuse of science (Fleck 1939a). His experience during the Second World War was shaped by his being a Jew and a microbiologist. The historical accident of his birth placed him in a discriminated and persecuted group, while his membership in his professional thought collective partly attenuated this persecution. Fleck was condemned to death as a Jew, and survived as a scientist (Weindling 2001, 2009).

Fleck, his wife, and son stayed in the Lwow ghetto from December 1941 to December 1942. Fleck worked in the microbiology laboratory of the ghetto's hospital. The combination of famine and overcrowding in the ghetto rapidly led to a devastating typhus epidemic. Fleck and his collaborators devised a method of production of antityphus vaccine from the urine of sick people (Fleck 1945, 1958; Weindling 2000; Leszczynska 2009; Weisz

2010). In December 1942, Fleck, together with his family and several of his collaborators, was sent to work on the production of a typhus vaccine in the pharmaceutical company Laokoon near Lwow. In January 1943, the whole group was deported to Auschwitz, where Fleck worked in the camp's hospital laboratory (Fleck 1958; Weindling 2001). In December 1943, Fleck was transferred to Buchenwald concentration camp, to participate in the production of antityphus vaccine for the German army conducted by prisoners in block 50.

Block 50 was in the immediate vicinity of the infamous block 46, where Nazi doctors conducted murderous experiments on human beings. In spite of this vicinity, and the fact that prisoners from block 50 could have been executed at any moment with no reason whatsoever, they led a relatively privileged life. They were free to organize their work, were allowed to borrow books from Jena University's library, received letters and Red Cross packages, were able to supplement their camp food rations with stew from rabbits used in their experiments, and were free to move around the camp. The block 50 laboratory was supervised by the Hygiene Institute of the SS in Berlin, as were the experiments on humans conducted in block 46. Nazi doctors used prisoners who worked for them on the production of antityphus vaccine as a way to accumulate publications, to acquire a reputation as scientists, and to advance their academic careers.

In his testimony for Yad Vashem, Fleck stated that the antityphus vaccine was prepared in block 50 in rickettsia-infected rabbits, using the method developed by Paul Giroud at the Pasteur Institute. The laboratory's director, Erwin Ding Schuler, had trained under Giroud before the war but had only limited knowledge of typhus. Fleck described him as an "ignoramus" (Fleck 1958). Ding Schuler's incapacity to understand the details of the production of antityphus vaccine made possible a large-scale sabotage of this production. The prisoners fabricated large quantities of worthless vaccine sent to the German army and a small quantity of an efficient one sent for control tests and distributed to prisoners inside the camp (Schnelle 1986; Weindling 2001, 2009). After the war, Fleck explained that his arrival at Buchenwald was at the origin of the sabotage action. Before he came to Buchenwald, the group in block 50 did not include a typhus expert, and its members did not realize that the supposed infection of rabbits' lungs by rickettsiae was in fact produced by an unrelated germ. Fleck revealed the error to his fellow prisoners who then decided to continue the manufacture of a worthless preparation (Fleck 1958).[13] According to the testimony of Eugen Kogon, a prisoner in block 50 and an important leader of the resistance movement in Buchenwald, Fleck was not a "conspiratory" kind of

person and was not involved in the camp's complicated political games (Schnelle 2007). After the war, Fleck proposed a typology of prisoners in a concentration camp. He divided them into four categories: "organizers"—able to "organize" for themselves food and other means of subsistence; "Muslims"—resigned, indifferent, and leading a vegetative existence; "prominents"—open and hidden leaders; and "civilians"—people who maintained in the camp the same attitude they had held before their arrest (Fleck 1947–1948, 295). Fleck probably saw himself as a "civilian" who successfully maintained his posture as a scientist in the insane universe of the concentration camp. He made observations on typhus among prisoners and published them after the war (Fleck 1946a, 1946b).[14] He also used his experience in Buchenwald to forward his epistemological thought.

In a stylized retelling of his Buchenwald experience, Fleck attempted to demonstrate that a thought collective can produce a "harmony of illusion," that is, collective production of inaccurate scientific facts (Fleck 1946c). One of Fleck's main conclusions was that a wide consensus (*consensus omnium*) is not the touchstone of science, because such a consensus is only relevant within a given collective. Moreover, the fact that each collective considers people who do not belong to it as incompetent opens multiple avenues for errors. Practical applicability, Fleck added, also cannot be used as a touchstone of science. An approach perceived today as entirely false, such as the production of the "alchemists' gold," was viewed for centuries as a reliable applied science (Fleck 1946c). One may add that Fleck's acquaintance with the history of medicine familiarized him in all probability with past medical practices such as bloodletting and purging, seen by numerous generations of physicians as highly efficient, and later perceived as useless and sometimes harmful. Collective empiricism can also produce long-lasting errors.

Fleck and Experiments on Human Beings

One of Fleck's first actions after liberation from the camp was to write a report on the Nazi's murderous experiments (Fleck 1945). In 1948, Fleck testified at the Nuremberg trial, concerning experiments that involved deliberate infection of healthy people with typhus (Fleck 1948). After the war Fleck taught microbiology at the University of Lublin. At that time, Lublin's university medical school was a small, poorly staffed, and scantly equipped institution, the only goal of which was rapid training of medical practitioners. The dean of the medical school of Lublin University, Tadeusz Kielanowski, who befriended Fleck, remembered Fleck's difficult living

conditions, his permanent struggle to keep his laboratory afloat, his inventiveness in overcoming bureaucratic obstacles, and his dedication to his work and his students. Fleck, Kielanowski concluded, was an exceedingly capable, original, and creative man who achieved much but could have achieved much more, "if the times he lived and worked in had been less stormy, and fate less unjust" (Kielanowski 1983).

Kielanowski and Fleck shared an interest in the ethical dimensions of medicine. In 1948, Fleck wrote an article on experimentation with human beings in Poland's main medical journal. Kielanowski commented on this text. It is reasonable to assume that Fleck was asked to write about experiments on humans because of his Buchenwald experience. Fleck elected, however, to focus on problematic aspects of "normal" medical research. A stringent regulation of experiments on human beings, he argued, is important not only because of the recent horror of Nazi experiments on prisoners but because immoral experiments on human beings are far from being exceptional: "some classical heroes of modern medicine made such experiments: on colored natives in the colonies, in orphanages, in psychiatric hospitals and asylums for the incurably ill, in prisons." Moreover, such experiments are frequent today too. Between April and September 1947, the journal *Science* published five studies that described questionable experimentation on humans. The authors of these studies did not explain whether the participants were informed, knew about the risks involved, or even if they consented to these experiments. Fleck was especially concerned by experimentation on populations unable to provide a truly free consent, such as prisoners and psychiatric patients. Further development of medical science, such as grafts of organs and tissues, progress in genetics or in the science of the mind, Fleck explained, will increase even more the need for an efficient regulation of experimentation on human beings (Fleck 1948).

Kielanowski agreed with Fleck's proposals but added that they were too restricted. Fleck focused on the need for a stringent regulation of experimentation on human beings. He assumed nevertheless that physicians who conduct such experiments (excluding criminals like the Nazi doctors) are motivated by a sincere desire to help suffering people. Kielanowski questioned this assumption. The ability to obtain an MD degree is not a statement about a given person's moral qualities. Doctors can conduct experiments on their patients because such experiments serve their professional interests or because of their hubris. He had met ambitious physicians who devised new, risky therapies and rushed immediately to test them on sick people. The supervision of experimentation on humans, Kielanowski concluded, should not be limited to activities clearly labeled "therapeutic

experiments" but should be extended to regular medical practice, a much more frequent site of scientifically unsound and morally doubtful experimentation (Kielanowski 1948).

Fleck's insistence on the need to regulate the thought collective of medical scientists who experiment on humans resonated with his commitment to a democratic control of scientific activity. All his life Fleck maintained an unwavering faith in the potential of science to improve the fate of humanity, but he did not equate it with a naive belief in the infallible wisdom and benevolence of scientific thought collectives. Scientists can labor under a "harmony of illusion," doctors can conduct unethical experiments on humans, and experts can abuse their power. A collective, he explained near the end of his life, is at the same time creative, refractory, and dangerous, like an elementary force. The communal mode of a scientific thought collective can make people more clear-sighted but can also blind them (Fleck 1960).

Fleck's commitment to the critical study of science stemmed from his awareness of the concrete dangers of the excessive power of scientists, especially visible in the modern state (Borck 2004, 453). He believed that the true robustness of science came from its democratic, self-reflexive structure and accordingly saw the exclusiveness of the thought collectives of modern science (the esoteric circle) as a problem, not an advantage (Coen 2012, 119). In order to prevent an excessive accumulation of power in the hands of a small group of experts, it is important to make scientists accountable and their actions transparent. The best way to achieve this goal, and to strengthen public opposition to an unchecked technoscientific power, is to demystify it through a better understanding of science by the public and by the scientists themselves (Bonah 2002, 205-7). Fleck's theory of "scientific thought styles" was a tool for making science transparent, reflexive, and accountable to society.

Conclusion

Medical facts, Fleck argued, have an especially great individual and social meaning because they deal with the most precious possession of a human being—his health and life (Fleck 1935, 1255). Medicine, the French philosopher of science Georges Canguilhem explained, is by definition a normative endeavour, because it is grounded in the distinction between the normal and the pathological (Canguilhem 1968[1964]). Ian Hacking, an attentive reader of Fleck and Canguilhem, claims that facts that arise in the natural sciences are radically different from those that arise in the human sciences—a category that for him includes clinical medicine, psychology,

and psychiatry—because only objects studied by the human sciences can make claims to authoritative knowledge about themselves. Moreover, an atom, a chemical compound, or an enzyme is indifferent to scientists' pronouncements about its nature, but a diagnosis of coronary heart disease, asthma, or schizophrenia can deeply affect the person receiving this diagnosis, via a "looping effect" (Hacking 2002). This type of fact can also affect public health policies and the well-being of populations.

Fleck's epistemological thought was rooted in his direct engagement with the untidy world of the microbiological laboratory and with the health of individuals and populations. The scientists he studied were firmly situated in society, embedded in history, and constrained by institutions, regulations, and laws (Jasanoff 2012, 437). Fleck's statement that "communication never occurs without a transformation (. . .) which intercollectively yields fundamental alteration" employs the neutral terms "transformation" and "alternation" rather than the more positively connoted term "innovation" (Fleck [1935] 1979, 111).[15] Things can be altered for better or for worse. In clinical medicine and public health, the "worse"—the Lübeck disaster, unethical experimentation on humans, murderous Nazi experiments—can be very bad indeed. It may be important to examine carefully what is being altered, how it is done, who is making the alteration, and what its consequences are.

In an insightful review of the English translation of Fleck's book, the historian of medicine Barbara Rosenkrantz proposed that Fleck's epistemological thought had two sources: the intellectual context of interwar central Europe and Fleck's direct contact with public health, an area with an irreducible social dimension. Fleck's professional experience favored his observations on the messiness and contingency of scientific work and the bumpy road to the production of scientific facts (Rosenkrantz 1981). Rosenkrantz's statement that "most of his life [Fleck] labored in a public health laboratory" is accurate (p. 96). All the positions occupied by Fleck in prewar and postwar Poland were directly linked with the control of transmissible diseases. Only his last job, at the Ness Ziona institute, did not include practice-related tasks (Klingberg and Schnelle 2009). One of the reasons why Fleck's engagement with public health questions escaped the attention of many scholars interested in his thought may have been the fact that in his writings Fleck promoted the self-image of a fundamental researcher (Freundenthal and Löwy 1988). Such a self-image was strengthened by the fact that after the Second World War, Fleck achieved recognition for his contributions to basic immunological studies (Leszczynska 2009). On the other hand, in that period Fleck also investigated in parallel

practical questions such as the epidemiology of diphtheria, the efficacy of childhood vaccination, or the improvement of routine diagnostic techniques (Gröer 2009).

Fleck's situated epistemology, this article proposes, was firmly rooted in his professional experience, which included a strong practical dimension. Fleck might have agreed. He stressed the importance of careful attention to the specificity of the scientific enterprise in a given area, place, and time: "the only touchtone of science is in the specific features of scientific cognition: the structure of thought collectives, the historic singularity of their development, the characteristics of the scientific thought style" (Fleck 1946c, 336). The production of scientific facts in microbiology and immunology shares many traits with the production of such facts in, for example, crystallography or astrophysics, but the consequences of the application of such facts to medicine and public health may be very different. Context matters. To paraphrase slightly Jan Golinski's statement on the importance of Fleck's thought for the present-day social studies of science, Fleck's close and pensive account of the *medical scientist's experience* continues to set a challenge and to impose a responsibility (Golinski 1990, 505).[16]

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Notes

1. An alternative—or parallel—interpretation of Latour's statement may be that the surprise is not the genesis of Fleck's work, but its reception.
2. In her insightful comparison between Kuhn's and Fleck's ideas, Debora Coen independently relates Fleck's epistemology to his "multiculturalism" and "multilingualism" (Coen 2012). Fleck spoke Polish and German (and read English and probably French) but while Coen thought that Fleck spoke Hebrew too, he not only did not speak any Hebrew before he came to Israel, but was totally unable to learn it, in spite of his efforts (Klingberg and Schnelle 2009).

3. Fleck opened this laboratory in 1923, initially probably to supplement the income from his public job.
4. The journalist Arthur Allen has recently written a popularized account of this story (Allen 2014).
5. Thus, there were several anti-Jewish pogroms in postwar Poland, and numerous murderous anti-Semitic incidents. On anti-Semitism in the post–World War II (WWII) period, see for example, Gross (2007).
6. The "chemical" point of view on disease would today be called "biochemical" or "molecular," while the "medical/clinical" point of view probably corresponds to the physiological understanding of pathological phenomena.
7. The French philosopher of science Gaston Bachelard summed this up in his formula: "les faits sont faits" (roughly, "facts are produced").
8. Fleck refers to the understanding of the etiology on scarlet fever such as it existed in 1929. In 2015, the links between this disease and the production of hemolytic enzymes by streptococci are seen as much more complex.
9. The tribunal in Lübeck, Bonah explains, evaluated three possibilities: the physicians responsible for the disastrous vaccination deliberately altered the production of the vaccine and conducted unauthorized experiments on children; the contamination was an accident rooted in sloppy laboratory practices; and the bacteria changed their virulence spontaneously, and thus nobody was at fault. The court retained the second hypothesis and condemned the physicians responsible for the vaccination for deliberate negligence.
10. van den Belt attributes this omission to Fleck's erroneous interpretation of the nature of the controversy between Wassermann and his coworker, Bruck.
11. Another example of such screening was the use of X-rays to detect pulmonary tuberculosis.
12. This stable "scientific fact"—that is, the link between the Wasserman reaction and syphilis, was however destabilized after the WWII, when scientists found that the Wasserman test was positive in numerous pathological conditions unrelated to syphilis (Löwy 1993).
13. The precise sequence of events in block 50 is not entirely clear. Fleck's son Richard, who also worked in block 50's laboratory, reported in his Yad Vashem testimony that the sabotage of the vaccine started before Fleck's arrival (Allan 2014, 247). Paul Weindling's careful reconstruction of events in block 46 points to the key role of the Polish bacteriologist Marian Cieplowski in the sabotage of vaccine production (Weindling 2009, 53).
14. Fleck's wartime observations on typhus were the basis of Eva Hedfors's accusations that Fleck collaborated with the Nazis (Hedfors 2008). These accusations have been categorically rejected by Fleck scholars (Amsterdamska et al. 2008).

15. The German terms used by Fleck are *Transformation* and *Veränderung* (literally "making different"), not *Neueinführung* or *Neuheit*.
16. In the original, "Fleck's close and pensive account of the research scientist's experience continues to set a challenge and to impose a responsibility."

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