Looking at Medical Data From an Ancient Perspective: Medical Research Between its Benefit for the Human Being and Economic Interests

Part 1:
1.1 Historical-ethical perspective
1.2 Information-technological and historical notions of data[1]

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Preliminary note

This article attempts to approach the topic of "medical data and the handling of medical data" from a historical-ethical perspective and on the basis of a preliminary analysis of and answer to the question: "What is data?". It becomes clear that the concept of data in this context is essentially dependent on what we understand by medicine. Two distinct guiding concepts of medicine emerge: on the one hand, the technical-scientific concept of medicine, which, while primarily supporting the implementation of modern medicine in economic contexts, takes into account the well-being of the human being, insofar as this is possible and useful in these contexts; on the other hand, the so-called "hospitable" concept of medicine, which, while primarily supporting the well-being of the human being, does not disregard economic contexts, insofar as these serve the well-being of the human being.

The article is divided into four parts: (1) The analysis of a historical-ethical perspective on the topic will be explained in general terms; this is followed (2) by a section which deals with the question: "What is data?", both from a modern perspective and from a historical perspective. In a further section, (3) the two aforementioned concepts of medicine will be explained, and it will be shown how this dual modern understanding determines our view of what may and could be considered "medical data" and how medical data is and can be handled. In the final section, (4) a

[1] The article is based on a lecture given by the author on Sept. 22, 2023 at the workshop on "Digital Technologies and Responsibility" at the Università degli studi di Trento. The author would like to thank the organizers of the workshop, Robert Simon (Academy Meran) and Joseph Wang-Kathrein (University of Innsbruck), for the invitation, as well as Ivo De Gennaro for the critical reading and correction of the English text of this publication. At the same time, the lecture and contribution form inaugurate a research program on the topic, which is to be further deepened by other upcoming publications and lectures. In the following, reference is therefore repeatedly made to obvious conceptual and systematic gaps, which are to be filled in the context of the mentioned program.

short mapping will be given (i) of what, today, is understood as medical data from the standpoint of modern medicine and medical research, and (ii) of what could be understood as medical data in the future from the standpoint of the history of medicine and medical research.

The first part of this article, published here, deals with the first two sections. The second part of this article, which will contain the third and fourth section, will appear in an upcoming publication.

1. The methodological approach to the topic of "medical data": On the historical-ethical perspective on the humanities, science and medicine

The starting point and basis of this article is a reading of ancient philosophical, scientific, medical, historical and literary texts, which make it possible to supplement modern discourses on medical data and the handling of medical data in a perspective that does not play a central role, if any, within modern medical research and medicine. This perspective is referred to here programmatically as a "historical-ethical" one, and will be explained in the following first section.

In the area of the history of medicine, it has already been pointed out that the task of this field of research is "zum Nachdenken über ganz grundsätzliche Fragen zur Struktur und Zielsetzung auch aktueller medizinischer Tätigkeiten anzuregen [to stimulate reflection on fundamental questions regarding the structure and scope also of present-day medical activities]" and thus ultimately, in various ways, "zu einer systematischen Selbstreflexion in der Medizin bei[zu]tragen [to contribute to a systematical self-reflection in the domain of medicine]."[2] However, it has become apparent that modern medicine and medical research ultimately merely grant the history of medicine the potential to look into the past and not, as modern medical research does, to focus on and form and solve the questions and problems of the present and the future.[3]

This perspective on the history of medicine is symptomatic of both the view of modern sciences in general on the humanities, and the self-image of the humanities in particular, which largely see themselves as providers of a historical narrative in and for the present and the future.[4] In contrast,

[2] See V. Roelcke, "Warum beschäftigt man sich mit Medizingeschichte?" (June 2003), URL: https://www.uni-giessen.de/de/fbz/fb11/institute/histor/ueberuns/warum (accessed on Sept. 21, 2023).

[3] Cf. K. Bergdolt, "Warum Medizingeschichte?", in: Deutsches Ärzteblatt 95/14 (1998) 812-816, here: 812f.

[4] Cf. clearly so M. Heidegger, Besinnung. Ed. by F.-W. v. Herrmann (Gesamtausgabe, Vol. 66), Frankfurt a. M.: Klostermann, 1997, 179-184 (XII. "Historie und Technik [ἱστορεῖν - τέχνη]"), here: 182 ("Geschichte und Historie"): "*Historie* im weiten Sinne das vorstellende Herstellen der "Geschichte", der vergangenen und je heutigen für das Heute und die Zukunft, die Vergegenständlichung des Vergangenen in das Zuständliche des Gegenwärtigen."

modern, particularly technically oriented natural sciences and science-based forms of knowledge, processes and skills are today being institutionalized more and more clearly and exclusively, including at universities, in such a way that they have to shape, form and control the present and the future of humanity.[5] Thus, in essence, the historically working forms of knowledge produce the past for the present and the future, while those based on natural science and technology produce the present and future themselves.[6] It is immediately apparent that dealing with the past hardly seems necessary in order to cope with the present and prepare for the future. The historical humanities are therefore today at most a supplement to the technical natural sciences.

However, we often lose sight of the fact that both forms of knowledge ultimately do what they do for human beings and their current and future well-being. This is both a particular claim and a problem, especially in the field of science- and technology-based medicine and medical research, because medicine and medical research are not just indirectly, as in the humanities, but directly obliged to work towards the health and the physical and mental well-being of the human being, whose life is marked by the boundaries of birth and death and by a conscious understanding of those boundaries. Human existence and self-image is thus determined by its finiteness and mortality, in a medical context as well.[7] Thus, the specifically human relationship to and understanding of his

[5] Cf. so: Wissenschaftsrat, Anwendungsorientierung in der Forschung | Positionspapier (Drs. 8289-20), Berlin 2020, URL: https://www.wissenschaftsrat.de/download/2020/8289-20.pdf?__blob=publicationFile&v=2 (accessed on Sept. 21, 2023) 8: "Wissenschaft steht in der Verantwortung, einen Beitrag zum Umgang mit dem beschleunigten gesellschaftlichen Wandel, zur Bearbeitung großer Herausforderungen und zur Gestaltung einer zukunftsfähigen Gestellschaft in einer globalen Wettbewerbssituation zu liefern." In light of this, the distinction between basic and applied research is becoming increasingly obsolete, as even basic research as such can only be considered eligible for funding and therefore to be understood as scientific in a university context (even if this is or may be seen differently in the scientific community itself), if it contributes to applied research in the short, medium or long term, i.e. if it is application-oriented or at least open to application, cf. e.g. *ibid.*, 5: "Eine starre Gegenüberstellung von Grundlagenforschung und angewandter Forschung erweist sich als nicht länger förderlich, um dem gewandelten Innovationsverständnis und den zunehmenden Relevanzerwartungen gerecht zu werden. Der Wissenschaftsrat möchte mit dem Konzept der Anwendungsorientierung in der Forschung das Kontinuum zwischen beiden Polen von Grundlagen- und angewandter Forschung in den Vordergrund rücken, um Neu- und Umorientierung in Forschungsprozessen zu erleichtern und ihre Dynamik zu befördern." See also *idid.*, 47: "Die öffentliche Forschungsförderung sichert die Unabhängigkeit von Forschung und bereitet zugleich den Boden für die langfristige Innovationstätigkeit wissenschaftsbasierter Gesellschaften. Sie ist ein Schlüsselfaktor für die Zukunftsfähigkeit der Gesellschaft." See further: Wissenschaftsrat, Anwendungsorientierung in der Wissenschaft – offen und sourverän! Forschende, Hochschulen und Forschungseinrichtungen sollen sich mit gesellschaftlichen Akteuren austauschen, kooperieren und strategische Partnerschaften aufbauen, Berlin 2020, URL: https://www.wissenschaftsrat.de/download/2020/pm_0420.pdf?__blob=publicationFile&v=1 (accessed on Sept. 21, 2023).

[6] Cf. Heidegger, Besinnung (cf. n. 4) 183: "Historie – das Her-stellen des Vergangenen. Technik – das Herstellen des Zukünftigen. Beide: Einrichtung der Gegenwart als Gegenstand und Zustand."

[7] Cf. M. Boss, Grundriss der Medizin und Psychologie. Ansätze zu einer phänomenologischen Physiologie, Psychologie, Pathologie und Therapie und zu einer daseinsgemäßen Präventiv-Medizin, Bern et al.: Verlag Hans Huber, ^{3}1999, 309-313 ("Der Tod und das Sterblich-sein des Menschen"), here: 312: "Wie mannigfaltig aber auch die festellbaren [...]

mortality is based on man's historicity, which enables him to refer to his own life story through his ability to remember.[8] The reference to the finiteness, mortality and historicity of human existence must therefore also determine the limits of specifically human well-being.[9] The technology-based form of today's medicine and medical research can therefore never fully correspond to its ultimate goal, the well-being of man, as long as it does not keep in mind and define the finiteness and historicity of man as elements of specific well-being for its own research activity.[10]

The historical perspective on the world — which comprises the past, present and future of humanity — is therefore not only a methodological peculiarity of the humanities, but also an expression of the task of human existence that is inherent in this existence itself.

The history of medicine can in a peculiar manner fulfill this task and thus its responsibility towards human existence if it does not interpret what it considers to be medicine exclusively and from the outset in a technical-scientific sense. If, however, it sticks to the hypothesis that medicine can only be considered medicine in the scientific-technical sense, it loses just as many possibilities to help shape the present and future of humanity, as does medicine itself if it only understands itself in the scientific-technical sense and does not remain open to an examination of the limits of its scientific-technical perspective.[11]

Verhaltensweisen dem Tode gegenüber sind, sie alle, nicht zuletzt das hartnäckigste Fliehen vor ihm, bezeugen doch immer nur ein und dasselbe. Sie geben zu erkennen, dass das Sterblich-sein des Menschen nicht bloß ein jetzt noch ausstehendes, erst später einmal hinzukommendes Vorkommnis ist. Sie machen vielmehr offenkundig, dass Sterblich-sein eine dem Da-sein ursprünglich zugehörige Seinsmöglichkeit ist, die seine Existenz als eigenster Wesenszug ständig und von Anfang an durchwaltet."

[8] *Ibid*., 299-309 ("Das Gedächtnis und die Geschichtlichkeit des Menschen"), here: 308f.: "Geschichtlich ist das Da-sein des Menschen aber auch insofern, als es sein ganze Lebensgeschichte ist. Deshalb erstreckt sich menschliches Existieren immer von der Geburt bis zu seinem Tode. Von diesen beiden Geschehnissen wird das leibliche Da-sein, als das uns das Mensch-sein bekannt ist, begrenzt. Ist jedoch der Tod die äußerste und letzte Grenze des geschichtlichen menschlichen Existierens, gehört er in einem ausgezeichneten Sinne diesem selbst an […]."

[9] Conversely, a person's illness can be marked by the absence of a corresponding reference, cf. *ibid*., 524: "Es zeigt sich, dass bei jeder Art des menschlichen Krank-seins bestimmte Verhaltensmöglichkeiten gegenüber dem in der Welt Begegnenden mehr als andere Weltbezüge der freien Verfügung eines Menschen entzogen bleiben. Die Gesamtheit der einem Menschen gegebenen Verhaltensmöglichkeiten, deren freier Vollzug in pathologischer Weise beeinträchtigt sein kann, — und nichts sonst — macht aber das menschliche Da-sein, sein In-der-Welt-sein aus. Dieses seinerseits lässt an medizinisch bedeutsamen Wesenszügen das Frei- und Offen-sein, das Räumlich-sein und Zeitlich-sein, das Miteinander-sein in einer gemeinsamen Welt, sein Gestimmt-sein und seine Geschichtlichkeit, sein Leiblich-sein und sein Sterblich-sein erkennen."

[10] *Ibid*., 309: "In der Medizin kommt dem Tod eine so zentrale Bedeutung zu, dass sich diese Wissenschaft recht eigentlich immer schon auf ihn ausgerichtet hat. Ihre ständige Ausgerichtetheit auf den Tod geschieht in der Gestalt der Absicht, ihn abzuwehren oder ihn doch möglichst lange hinauszuschieben. Deshalb darf die Erörterung der Frage nach dem Sinn und dem Wesen des Sterblich-seins des Menschen in keinem Grundriss der Medizin fehlen."

[11] Cf. *ibid*., 567f.

Regardless of how the reference of the history of medicine and of medicine itself to their respective historical limits is experienced, it becomes clear that, in light of the historicity and mortality of human existence, both medicine and the sciences in general – insofar as they are practiced by humans and at the same time relate to human well-being – have an *ethical* mandate.

This means that the humanities in particular also have such an ethical mission, or a related one. Although this mission can only be revealed in the fact that the humanities point out to the natural sciences what they are ultimately conducting their research for, namely for man and his well-being, it can also lie in helping the respective scientific research to recognize its own historical and systematic limits and to make its knowledge usable for this research itself, which can lead to changes in the latter. The ethical mandate understood thus goes hand in hand with the possibility of not only defining man and his well-being as a goal for the non-historical sciences from outside of these same sciences, thereby retrospectively giving them an ethical superstructure or substructure; that mandate also consists in clarifying for the non-historical sciences to what extent all knowledge itself and as such, if it ultimately to be considered a form of knowledge that serves man, needs to be informed by this goal from the very outset.

There are many ancient sources, both Greek and Latin, which possess the remarkable ability to allow us to view our modern scientific discourses and their problems from a different, more fundamental perspective than we could ever do today, a perspective which, as previously mentioned, can be characterized as historical-ethical. The temporal distance of the ancient discourses and insights and the resulting distance to concrete questions and problems of modernity proves to be by no means a disadvantage, but rather a potential, first and foremost because the outlined historical-ethical dimension of knowledge can become more immediately apparent in these texts than in modern sources. Thus, despite, or rather precisely because of their historical distance from modernity, those ancient sources can potentially also establish a proximity to the actual and original objective of medical research, namely the well-being of human beings and their historicity and finiteness.

In view of this, the historical-ethical reading of ancient sources, which should make it possible to contribute to the benefit of the present so as not to merely form a historical addendum to modern discourses, requires a preliminary distinction between two perspectives of history: on the one hand, one that views history as something past, on the other, one in which history is explicitly developed

and realized as a space of possibility of human existence itself (which can be indicated by the German term "Geschichte"). In this second sense, the examination of history or "Geschichte" not only establishes a reference to the past and brings a more or less objectively imagined past back into the present, but history in this sense is the facilitation of a reference to the historical and historically developed basic assumptions and basic conditions of human understanding and comprehension of past, present and future.

The first part of the title of this article, "Looking at Medical Data from an Ancient Perspective", concerns precisely this second sense of history as "Geschichte", and is based on it. In this sense, the central question here is: What can ancient Greek and Latin source texts tell us specifically about medical data in the modern sense, and about how to deal with this data, which could help us today not only to solve the related problems, but also to discover the actual questions and basic assumptions underlying these problems in the first place? This question therefore forms the guiding question of this article.

One of these questions and basic assumptions of modernity relates directly to what today we call "medical data" and to the fact that we accept medical data as a given. Therefore, as a first approach to explicate the above-stated guiding question and the more specific question of medical data in the present context, the following preliminary question must be considered: What is data?

Before the topic of "medical data and how to deal with it" can take center stage, it must therefore be adequately clarified what data actually is and what we understand and can understand when we speak of data.

2. What is data?

Even if we only look at our own time, this question causes us confusion. Today, we are faced with the problem that we cannot clearly answer the question "What is data?", even though mankind now works with data in all areas of knowledge and activity. We often assume that we do not even have to ask ourselves this question, if we want to deal with data,[12] or that we only have to ask it when it

[12] The question as to why this is the case today, that we, generally speaking, consider ourselves exempt from these and similar questions about objects that we deal with scientifically, is a question that cannot be asked and answered specifically in this article; nevertheless, it is of fundamental importance for the present project on medical data and will therefore be dealt with in another publication.

comes to the protection of personal rights, for example, that is, to problems relating to the use and handling of data.

Although we find different definitions of data in different areas in which data is handled, there seems to be a lack of a uniform concept of data in the sense that the boundaries of this question are obviously also marked by the actual objects and the information that can be derived from them, which can appear as data. And since these objects and information that can and should operate as data are potentially infinite and the existing ones can constantly change, there can be no uniform concept of data from this perspective.

At the same time, the term data can be clearly defined in terms of information technology. It means a "reinterpretable representation of information in a formalized manner suitable for communication, interpretation, or processing" with the addition that "data can be processed by humans or by automatic means."[13] In computer-based contexts, data corresponds to representations of information that can and must be translated into machine language, i.e., ultimately into a binary code, in order to be processable and communicable on an electronic level. This does not mean, however, that the above definition is limited to data that only represents electronically processable information. Nevertheless, this is the predominant unterstanding today when we speak about data and information.

The most commonly used coding standard worldwide today for writing and other characters, which are also used to record medical data and store and process it as information, is UTF-8, i.e., the 8-bit "Unicode Transformation Format", or "Unicode" for short. The character set encoded by this standard and in this standard according to ISO 10646 and thus machine-readable is the UCS ("Universal Coded Character Set") and comprises in the latest version almost 150,000 characters.[14]

It is important to note that data as such does not yet constitute information in this sense; rather, data only *represents* information, provided it is interpreted as information by humans or machines.

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[13] This definition and the addition correspond to the standard ISO/IEC 2382:2015(E) formulated by the Geneva-based "International Organization for Standardization", founded in 1947, in conjunction with the "International Electrotechnical Commission", which is also based in Geneva today and was originally founded in London in 1906, see: International Standard ISO/IEC 2382. first edition 2015-05-11. corrected version 2022-10. Information technology — Vocabulary / Technologie de l'information — Vocabulaire, Vernier, Geneva: ISO, 2022, s.v. 'data' (2121272), URL: https://www.iso.org/obp/ui/en/#iso:std:iso-iec:2382:ed-1:v2:en (accessed on Sept. 21, 2023).

[14] Last updated version 15.1.0 of the "Unicode" from Sept. 12, 2023, URL: https://www.unicode.org/versions/Unicode15.1.0/ (accessed on Sept. 21, 2023). The latest version of the UCS is standardized in ISO/IEC 10646:2020/Amd. 1:2023(E), URL: https://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_IEC_10646_2020_Amd_1_2023_ed_6-id_83362_Publication_PDF_(en).zip (accessed on Sept. 21, 2023).

The mere interpretability of data, i.e., the pure potential of data to be interpreted as information, does not yet make data information. This distinction between data as information and pure data is as fundamental as it is often not clearly seen in everyday or legal language.[15]

Another distinction to be considered here is the following: that which data represents electronically in order to be processable, namely a machine-readable code, can itself be described as the sum of information units, insofar as electronic processing as such and itself ultimately provides for the breaking down of data to the information units or information values 0 and 1.

At the same time, however – and this is fundamental to the computer science-based understanding of data – what realizes the processing of data, i.e., the programmable command, is itself encodable as information, which is encoded by certain computer languages and their respective syntax; i.e., it is itself ultimately a binary data set. Therefore, on an electronic level, data-technical entities, and operating with those entities, correspond to the same thing, because both ultimately represent the sequence of information values 0 and 1 that is to be processed. Therefore, a computer program, in the sense of a sequence of commands, is ultimately nothing more than a sum of data that becomes information as soon as it is interpreted as such. In other words, "a thing" and "the use of a thing" are "the same thing" on an electronic level, which implies that, in this context, there is nothing that is not used or cannot at least be used. It must be said, however, that data are not things, but can only represent things, albeit only to the extent that these things are ultimately either already operable, i.e., ultimately codable, or can at least be modeled for possible operability in order to be coded. All things and circumstances that are neither operable nor can be made so are not recordable on an electronic level.

In this context, the dual nature of being already operable and being potentially operable corresponds entirely to the concept of "information", as it is defined today in two ways: on the one hand, in the information-theoretical, probabilistic sense information is defined as "knowledge which reduces or removes uncertainty about the occurrence of a specific event from a given set of

[15] Cf.. e.g. the German version of the "Datenschutz-Grundverordnung" (DSVGO), Art. 4 ("Begriffsbestimmungen") Nr. 1: "[Im Sinne dieser Verordnung bezeichnet der Ausdruck:] 'personenbezogene Daten' alle Informationen, die sich auf eine identifizierte oder identifizierbare natürliche Person [...] beziehen [...]." See URL: https://eur-lex.europa.eu/legal-content/DE/TXT/PDF/?uri=CELEX:32016R0679 (accessed on Sept. 21, 2023). § 202a Abs. 1 of the German "Strafgesetzbuch" (StGB) is even more misleading: "Wer unbefugt sich oder einem anderen Zugang zu Daten, die nicht für ihn bestimmt und die gegen unberechtigten Zugang besonders gesichert sind, unter Überwindung der Zugangssicherung verschafft, wird mit Freiheitsstrafe bis zu drei Jahren oder mit Geldstrafe bestraft" und Abs. 2: "Daten im Sinne des Absatzes 1 sind nur solche, die elektronisch, magnetisch oder sonst nicht unmittelbar wahrnehmbar gespeichert sind oder übermittelt werden."

possible events,"[16] i.e., in short, as knowledge for the elimination of uncertainty, and thus for the establishment of absolute certainty and operability in a certain context; on the other hand, in the operable sense, information is defined as "knowledge concerning objects, such as facts, events, things, processes, or ideas, including concepts, that within a certain context has a particular meaning,"[17] i.e., as knowledge in which all uncertainty has already been eradicated and which is thus already operable. The dual concept of information is structurally similar to a self-fulfilling prophecy since information that is ultimately intended to create operability must always be operable from the outset. And since ultimately nothing is operable in the real world that has not already been made operable, data and its function of representing information – i.e., from the perspective of the real world: things or entities – depend on the processing and modeling of the things themselves, which must be transformed into operable information in order to be captured by data technology.

In view of the fact that "data" in general and "medical data" in particular today increasingly refer only to data that can be processed electronically using information technology, the electronic processing of medical data should not be seen as a supplement or aid for people who want to handle this data more efficiently, for example; rather, this processing already tells the doctor, medical-pharmaceutical researcher, pharmacist or patient what can and what cannot be understood as "medical data".[18]

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[16] See ISO/IEC 2382 (cf. n. 13) s.v. 'information' (2123204).

[17] *Ibid*., s.v. 'information' (2121271).

[18] This aspect of "(medical) data", which already determines how it is handled and understood, will be examined in greater depth in a separate publication. It also concerns what is meant by "open science", because the openness that is sought here is determined by a concept of knowledge that means already only knowledge that can be captured by data technology, processed electronically, is information-based and operable, but suggests that it can be any form of knowledge. This problem is still seen in the older literature on "medical data", cf.. e.g. J.F.V. Deneke, "Entstehung medizinischer Daten", in: W. Kilian/A.J. Porth (Hrsg.), Juristische Probleme der Datenverarbeitung in der Medizin. GMDS/GRVI Datenschutz-Workshop 1979 (Medizinische Informatik und Statistik, Bd. 12), Berlin et al.: Springer, 1979, 1-8, here: 1f.: "Erst in dem Augenblick der Aufnahme einer Aufzeichnung solcher massenhaft in den medizinischen Berufstätigkeiten anfallenden Beobachtungen über "Lebensdaten" in eine Datei im weitesten Sinne des Wortes, in ein Dokumentations-, Datenverarbeitungs- und Inforamtionssystem entstehen Daten im Sinne der hier zur Diskussion stehenden Thematik "Info-Daten". Die bloße Aufzeichnung zum Zwecke der Aufbewahrung (Konservierung) oder Tradierung von Bewußtseinsinhalten an Dritte (z.B. Brief, Testament, Buchmanuskript) lässt noch kein Datum im Sinne eines Dateibestandteiles entstehen. In diesem Sinne trägt die Vokabel "Datenträger" z.Zt. noch ebenso wie der undifferenzierte Gebrauch des Wortes "Daten" zur Begriffsverwirrung bei, wenn alle Materialien bzw. Produkte, die zur Aufnahme von Aufzeichnungen beutzt werdne, nur deswegen schon als "Datenträger" statt etwa als Bild-, Ton- und Schriftträger bezeichnet werden. Mit dieser Unterscheidung zwischen Lebens-Daten und Info-Daten stellt sich das erste Grundproblem aller Datenschutzdiskussion als Aufgabe und Verantwortung bei der Auswahl von Info-Daten aus der Fülle von Lebens-Daten. Das entsprechende Thema müßte etwa lauten: Zweckmäßige und verantwortliche Auswahl von Daten für medizinische Dokumentation und Informatik in medizinischer Forschung und Praxis. Das Feld der Konflikte liegt zwischen dem welchen Zwecken auch immer Dienlichen und der Persönlichkeitsrechte achtenden Verantwortung." What is interesting about this perspective is that it is not "medical data" that is specified in order to

Even if, on the one hand, data *cannot* be defined, because it refers to a constantly growing and changing amount of information, while on the other it *can* be clearly defined in the information technology sense, the question "What is data?" can be understood and asked in an even more fundamental sense.

In this respect, it has already been shown that the unambiguous electronical concept of data presupposes that, in principle, data must and can bear no responsibility towards the things and phenomena that they record and make processable. The concept of data outlined above is thus characterized by a lack of responsibility towards today's humanity, which in turn seems to be the common feature of this concept of data.[19] This irresponsibility does not simply appear as a flaw or deficiency, but as the perspective possibility of gaining a uniform, not merely electronical, concept of data.[20]

In order to prepare a uniform understanding and concept of data, the question "What is data?" should first be analyzed and the potential of its specific question-character examined. In this respect, this question is made up of three components: (1) the "what" of data, (2) the "is" or "being" of data and (3) the data itself or what is referred to here by the term "data".

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then regulate how it is handled, but only the responsible handling of "medical life data" determines what we should understand as "medical data" in the modern electronical sense. The understanding of data protection, which grants the electronic processability of all medical data without restriction, in order to subsequently exclude some of this data from communication that contradicts the protection of personal rights, (thins understanding) transfers the aforementioned responsibility first and foremost to those who handle and should handle this electronic data, and only subsequently and secondarily to those who must regulate the handling of data. This suggests that responsible data protection is essentially linked to the question of what data is in the first place, since data as such in the electronic sense does not presuppose its responsible handling, but, on the contrary, is exempt from and neutral to any responsibility.

[19] Therefore, i.e., in order to re-establish this responsibility, subsequently various "area ethics" are needed, within which it is necessary to examine and formulate the extent to which this or that handling of this or that data is or is not ethically justifiable in this or that area. However, this kind of supplementary ethical character is not only evident in digital contexts but is a fundamental problem of all contemporary ethics. It should be noted, nevertheless, that these ethical discussions are increasingly receding into the background or even disappearing, since ethical questions, such as questions about responsibility in dealing with data, stand in the way of rapid technological progress and ultimately slow it down. Therefore, if the production and use of digital technologies is the driving force behind our current production and actions, pausing and reflecting on what we are doing, and asking ourselves whether what we are doing is responsible towards people (ourselves, our children and grandchildren), towards our environment, etc., impairs this progress. The concept of responsibility plays a central role here. In view of this, handling this or that data can be called ethical if this handling can be proven to be responsible. Of course, this does not say anything about what responsibility means. The question of responsibility in digital contexts will therefore be explored in a separate publication.

[20] This approach to a uniform data understanding will also be pursued further elsewhere. In the present publication, only some preliminary questions and problems are discussed.

If we first turn to (1) the “what” of data, it is noticeable that this “what” calls for a definition of what data is and thus contains an invitation. At the same time, however, this “what”, which invites us to ask this question and refers us into the boundaries and perspective of this question, forms the goal of this question and thus of what data should ultimately appear as. Once we have found an answer to this question, we can replace this “what” with a corresponding determination or definition. We can then still ask this question, but at that point it is actually obsolete, because it asks for something that is answered by this determination. If we can clearly define the “what” in the above question, then this question ceases to be a question in the true sense, i.e., this question loses its question character. It is then only a substitute for an unambiguous answer already floating in the room or world. The aforementioned definition of “data” by the ISO and IEC can be considered an example of such an answer that resolves the question concerning data.

If we look further (3) at “data” itself, which is in question here, we can consider what already applies or has to apply to data in the present. From this perspective, the said ISO/IEC definition (and ultimately all definitions based on it) can also be regarded as (a) paradigmatic example(s). The fundamental thing about this perspective on data, however, is that we already know (or think we know) what data is by looking at today’s real, that is, effective, data determination and definition; as a consequence, we merely take a closer look at what can be considered to belong to the category of “data” today and what cannot.

Data is then, as said before, precisely that for which data may and must be valid today. The "validity" of data then in turn answers (2) the question of their being in the present, current reality and effectiveness. However, this also implies that what data will be in the future will change the answer to this question: while we may still define the electronical concept of data in more or less the same way, seeing that it is attached in content to information that data represents, the question of what data is will have to be answered differently from today; in fact, data will probably apply to something different in the future than it does today, since it will represent other domains of efficacy and reality. consequently, the being and validity of the question “What is data?” implies not only the effectiveness and reality of data, but also the actuality of the concept of data, which is in a state of constant change.

However, in the context of the question at hand we do not necessarily have to understand the “is” or "being" of data in the sense of the *reality* of data and data definitions but can also interpret

that being as a *possibility* or a *necessity*. However, if we first look at necessity, then, based on the above explanations, this direction of meaning of the "is" is provisionally answered through the operability of data: today, data must necessarily be operable, less they must capture all those things and facts that could also be represented by data in a non-operable sense.[21]

If we now look at the possibility of data, we can discover a completely different dimension of what data "is": for instance, we can ask what data is not as yet, but could be one day; we can then also interpret this possibility quite differently by asking about the capacity and the actual principles and basic assumptions of our modern real concepts of data; in other words, by asking what makes our modern data capable of being data and of being valid for data. This sense of the "is" of data can in turn be grasped in two different ways: (1) by interrogating the functionality and operability of data and thus tapping into their information-bound capacity to exclude uncertainties and ambiguities of knowledge, which direction of questioning has already been provisionally explained; (2) by asking more fundamentally about the things, facts and phenomena and their specific possibilities that at present cannot or are as yet not supposed to be captured by data technology. The phenomena, things and facts form the actual source of what today can be regarded as data assets in this sense. In this second sense, we ask the question "What is data?" in such a way that the "is" of a thing, fact or phenomenon is revealed to us, which at the same time constitutes the actual potential of data to be or not to be data.

The history of the concept of data proves to be extremely helpful in further exploring this line of questioning. Here it also becomes clear that this consideration of history does not serve to create a historical substructure or superstructure to the question "What is data?", without which this question could also be asked and answered; rather, the history (in the sense of "Geschichte" introduced above) of the concept of data in the first place can help to reveal the direction and dimension of this question and thus to unearth the as yet unrevealed present and future potential of data.

In the context of this article, the focus will be restricted to two aspects of the history of the concept of data: (1) an analysis of the word "data" as such, i.e., its meaning and etymology, and (2) the ancient Greek precursors of what we call "data" today.

[21] Although there is also the possibility of a different interpretation of necessity in the present context, this presupposes the extraction and explanation of the sense of possibility of the question at hand and should therefore in turn be explored in more depth elsewhere, in the context of a more detailed treatment of the question "What is data?".

2.1. Analysis of the word "data"

The word "data" is derived from the Latin verb "dare" ("to give"). It forms the plural of the neutral form of past perfect passive participle to this verb, i.e., "datum". The word "datum" literally means "the given" or "that which is given", whereas the plural "data" means "the given things/issues/phenomena" or "the things/issues/phenomena that are given". In this sense, the word "data" serves as a substantive participle and can be distinguished from today's use of the word for a time indication ("date"), which goes back to the letter or document formula "datum", i.e., "given on (following time indication)", which was also common in antiquity. In the latter case, the participle serves as a participium coniunctum respectively as part of a full verb.

The difference between the two etymologies of the terms "data" or "date", which derive from the same participle (one in the sense of "that which is given" and the other in the sense of "given (on)"), also lies in the circumstance that "data" in the former sense makes a singular seem less permissible, whereas "date" in the latter sense makes a plural seem less meaningful in the first place. If we apply this to the respective content of the meaning, this implies that the factual indication "data" inherently focuses on something rather plural, whereas the time indication "date" indicates something rather singular. The fact that these are different phenomena is also indicated by the fact that different singular and plural formations exist in English: The plural "data" belongs to the singular "datum", whereas the singular "date" forms the plural "dates". This means that we are dealing with two forms of facts and their specific factuality: a plural fact that relates to the factuality of things/issues/phenomena; and a singular time-related fact that relates to the factuality of time.

The term "data" appeared more frequently as early as the in the 18th and 19th centuries and meant something like the indications given or to be found (on a topic or fact), or the indications that can be provided on a fact. The term really took off in the 20th century in the context of the birth and establishment of computer and information technology. Here, data is defined as characters or character sequences that represent information (see above), both for the purpose of processing and as the result of information technology processing. This understanding of data corresponds entirely to how the context of a computer can be represented, in that there is first an input, then a processing, and finally an output of data.

Thus, the term “data” originally referred to the given thing or the given facts in their givenness, without it being decided what this givenness would be based on. From the 18th and 19th centuries on it refers to the indications that can be provided about these given things and facts, without it being clearly defined defining what should be labeled as such indications. Finally, in the modern information technology context and in those contexts that presuppose information technology, it only refers to data that can also be processed and operated electronically. This development shows four tendencies: (1) that a *narrowing* of the concept of data is taking place in the historical development, (2) that this development is *shifting* the focus as far as the origin of the data itself is concerned, namely, away from things and facts and towards data as such and their processability; this is then accompanied by (3) a *transformation* of the "suffering" point of view for what can be understood as the source of data, insofar as initially the things and facts themselves still serve as the guiding sources of indications about them, whereas in modernity it is the processability of data that becomes the guiding factor for how we may and must experience things and facts; and finally (4) a *darkening* and *unquestionableness* of what can be understood as the givenness of data becomes noticeable, insofar as the term “data” still originally reveals this givenness itself and as such, and discovers it as a basic feature of a thing or a fact itself, whereas the modern term “data” presupposes as self-evident and increasingly unquestionable that the givenness ultimately consists in mere processability and operability, without this processability and operability having (or even being able) to reveal themselves as problem areas in the development and handling of data in an information-technological perspective.

The historically posed question “What is data?” seems to indicate a presuppositional relationship between things and facts on the one hand and data in the modern sense on the other: the processability and operability of data still seem to rely on the givenness of things and facts: for, if there were no things and facts that were given independently from operable data contexts, there could still be information-based data, but this data and information would not be traceable to something that was not itself data and information. The total amount of information-based data would then only be able to grow by existing information-based data appearing as new data in ever new combinations. Hence, if there were no new things and facts or new aspects arising from the existing and future things and facts, technical progress would eventually come to a standstill, as

every data-based development would already be exhausted or would merely represent a new combination of old information-based and non-information-based data.

However, even if there were to be no new things and facts in the future about which new information-based data could be formed, the new non-factual data complexes would still originally be those that were derived from things and facts. This would only be forgotten at some point because nobody would remember that information-based data, and thus information, originally had things and facts as their sources.

In order to prevent today's data technology developments, hence thus also those in the field of medical research, from coming to a standstill in the long term, it will be fundamental to ask how new data derived from objects and facts can be obtained that cannot already be traced back to non-factual derivations of objects and facts.

2.2. Ancient precursors of modern data terms: σημεῖα, τεκμήρια, ὑποθέσεις

In order to pose and answer this question, it is advisable to first analyze those data concepts which, while not implying operability and processability from the outset, nevertheless are open to such operability and processability. Ancient Greek texts can give us an essential clue for those data concepts. As Greek equivalents to the term "data", we find three expressions in particular in ancient Greek philosophical, sophistical, scientific, medical and other theoretical literature, to wit: σημεῖα, τεκμήρια, ὑποθέσεις.[22]

While the first expression, "σημεῖα", refers to how and as what a thing or issue shows itself (namely, as a "sign" or "symbol"), the expression "τεκμήρια" refers to those things and issues themselves, insofar as they serve as "testimonies" and "evidence" for a thesis or assertion; finally, the expression "ὑποθέσεις" refers to the extent to which things and facts can form the basis for formulating theses and assertions in order to gain knowledge based on them. "σημεῖα" are things and

[22] An in-depth analysis of these expressions with a view to their potential to shed light on our modern data concepts as such with regard to their sense of givenness, and thus to promote modern developments in data technology, to my knowledge has not yet been undertaken. This analysis is the subject of a separate work to be published next year, which will specifically examine the occurrence of these expressions in the Corpus Aristotelicum and Theophrastus, as well as in the Corpus Hippocraticum and Corpus Galenicum, thus in particular with regard to ancient scientific and medical contexts. Comprehensive preliminary work on Aristotelian scientific contexts has already been done by the author; a central contribution in this respect is: S. Kazmierski, "Sache und Grund. Zur Atmung bei Aristoteles im Ausgang von 'De respiratione'", in: J. Althoff, Aristoteles, *Parva naturalia.* Akten der 18. Tagung der Karl und Gertrud Abel-Stiftung vom 30. September bis 2. Oktober 2015 in Mainz (Philosophie der Antike, Bd. 39), Berlin et al.: De Gruyter, 2021, 187-243.

issues insofar as we encounter them as signs and sequences of signs, in other words, as phenomena; "τεκμήρια" are things and issues insofar as they can bear witness to those phenomena and serve as evidence for those phenomena; finally, "ὑποθέσεις" are things and issues insofar as they can form a basis for making assertions about things and issues. In this way, the three Greek expressions each open up the reality of data differently and potentially highlight new modern aspects of data and the handling of data. For example, where data in the information technology sense primarily works towards the processability and operability of information, i.e., of things and issues, in order to gain secure, unambiguous and informative knowledge, the Greek terms for data instead refer to the potential of data to work towards gaining a kind of knowledge which in its turn provides the possibility of seeing what knowledge itself actually is and can be. The ancient and modern concepts of data thus differ in that the modern ones generate something that we can call knowledge today, but without at the same yielding a knowledge about the limits of that knowledge; the ancient concepts of data, on the other hand, allow for a knowledge that also knows that it knows, and to what extent it does not know; in other words, they refer to the limits of what shows itself as knowledge. Thus, the ancient concepts of data simultaneously involve those who deal with them with a responsibility towards knowledge in general, whereas the modern concepts of data exclude human beings from this responsibility towards knowledge; as a consequence, they educate man to a lack of responsibility towards knowledge, which (that responsibility) must therefore be established retrospectively through ethical measures and legal regulations. This aspect of the historical consideration of data concepts must therefore be the guiding principle when it comes to gaining a modern ethical perspective on "medical data and the handling of medical data", if the aim of medical research and the handling of medical data in the field of medicine is primarily the well-being of human beings and not primarily the implementation of medicine and medical research in information technology and economic contexts.[23]

The historical consideration of the question "What is data?" shows that an ethical, responsible and thus primarily human well-being-oriented handling of medical data in the modern context can only be possible if the focus is on what determines this handling itself, i.e., medicine, also because

[23] Cf. on this problem and research situation with further publications e.g.: Gesine Richter et al. (Hrsg.), Datenreiche Medizin und das Problem der Einwilligung. Ethische, rechtliche und sozialwissenschaftliche Perspektiven, Berlin: Springer, 2022, passim; Roswitha Jehle et al. (Hrsg.), Medizinische Informatik kompakt. Ein Lehrbuch für Mediziner, Informatiker, Qualitätsmanager und Epidemiologen, Berlin et al.: De Gruyter, 2015, here esp.: Part II: "Organisation und Regulation im Gesundheitswesen" (85-128) and Part V: "Anwendungen der Medizinischen Informatik" (347-474).

an ethical or legal regulation of the handling of medical data cannot decide what may be considered as medical and not medical, if this insight does not come from medicine itself.

In this respect, we can distinguish between two forms of medicine: (i) one that intentionally or unintentionally primarily supports the implementation of medicine in economic and information technology contexts, and in so doing serves in the best possible manner the well-being of the human being; and (ii) one that primarily serves the well-being of the human being while not disregarding the implementation in economic and information technology contexts.

In order to make this difference more clearly visible, once again it can be helpful to look at ancient sources – for example the Corpus Aristotelicum, the Corpus Hippocraticum and the Corpus Galenicum – which display a kind of medicine and of medical research hat primarily serves the well-being of man.[24]

[24] Cf. as preliminary work on this topic: S. Kazmierski, "Zur spezifischen Geruchswahrnehmung des Menschen bei Aristoteles", in: eudia. Yearbook for Philosophy, Poetry and Art 14 (2020) 1-42 passim, here esp.: 21-25.