Artificial Intelligence in Medicine: Preparing for the Confirmed Inevitable. Theoretical and Methodological Considerations

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ABSTRACT

The AI in Medicine project began with a simple yet complex and multilevel question. In late 2017, prompted by direct experience of researching human-machine interchanges, we asked whether the traditional principles of interaction between a physician and a patient in the time of technological and computer revolution had changed. That, in turn, led to other questions. Was the very concept of principles of doctor-patient interaction, as an interaction between 'Subject' and 'Object', still relevant in the 21st century? While such principles are not deterministic, in the past they were followed meticulously. Whether they still wield their original instructive power is an intriguing question. But it is not our immediate purpose. We do not intend to replace one set of principles, locked up to time and place, with another set equally constrained. We acknowledge that there would be no quick and easy answers. As an initial move we simply seek to elicit the right questions.
We hope our paper will offer a mechanism for constructive engagement, discussion and discovery. The broadest possible engagement is crucial to meeting the kaleidoscope of irregular issues in interactions between medical professionals and general public that characterizes our time of Internet dominance.
More importantly, the paper extends an invitation to think anew, across the traditional barriers of scholarly disciplines, policies and habits.

Keywords: Artificial Intelligence, Medicine, Life Sciences, Artificial Sociality, Medical Education

1. SETTING THE PROBLEM

Most of the professional literature written about medicine in the last decades or so concerns the dramatic transformation of health care and the conduct of medical procedures [2], [5], [6], [7].
The fundamental claim is that throughout the history of medicine major changes in technology and science have altered the way medical treatment was offered. For example, the authors of The Western Medical Tradition, 1800 to 2000 [1] report that in the 21 century "human expectations of medicine and its practitioners will change" [p.535]. Moreover they argue that the future of the Western medical tradition "may at times seem uncertain, its ability to deliver human expectations and fulfill human hopes doubtful, its authority in question" (p.535). They are not alone; the same outlook is central to the argument in Linda M. Harris (ed.) Health and the New Media. Technologies Transforming Personal and Public Health. Lawrence Erlbaum Associates, 1995. In the Foreword to the book C. Everett Koop and Michael D. McDonald underline that "present day concepts of what determines health and disease and our methods of intervening will be dramatically different in the not too distant future." [5, p. ix].
Although each of these authors, and many other theorists and practitioners, differ as to the precise ways in which they believe health care system and medical profession will develop, all agree to three central claims. First, that the medicine in the 21st century will be and should be different from that of the industrial age of the 20th century. Second, that the medicine and health care system that we had previously and to a great degree still have, are not completely the ones people need today. Business as usual in health care with a few adjustments here and there simply will not do. Only fundamental changes will suffice. Third, and most important for the goals of this paper, "it also appears that the emergence of an intelligent network will be central organizing mechanism in the transformation of the health system" [ibid.].

2. QUESTIONS TO BE ASKED AND ANSWERED BY MEDICAL PROFESSIONALS TODAY

Health care professionals today have fundamental issues to work out, difficult issues that get at the heart of transforming the ways in which medical systems man, administer, apply, sustain, teach, and provide medical treatment in the age of Internet and technological revolution. In the following paragraphs we introduce merely a sample of hard questions the professionals must ask themselves in conjunction with new scientific, economic and societal developments.
The curriculum in medical schools today is still based completely on studying the structure and functions of the human body. Shall anatomy, biochemistry, physiology and other disciplines that concentrate on human body, continue to play a dominant role in the medical schools of the Internet age? Will it be possible for a surgeon to do some routine surgery with a minimum of theoretical knowledge in anatomy and physiology if she/he has the necessary technical skills and advanced 'technological consultant'?

The patient's history is essential for diagnosis and treatment. To obtain an objective history doctor has to be a master of interviewing and to have skills to remember countless information. Will such skills be in need when Internet and computers already substitute much of the work preliminary to diagnosis? Can human beings compete with computers and technology in collecting, preserving, and transmitting information about the patient's health? The slogan of 'lifelong education' is very popular among those who organize today teaching and schooling. "Medicine is a lifelong study" has not to be just a slogan but a commonly accepted practice. However, what means for effective continuous medical education should be established? What is the direction of a continuous medical studying? How 'self- education' and 'self-instruction' can be understood in continuous medical education? Is it how to use the medical literature effectively? Is it to learn when and when not to use computers in medicine?

Traditional boundaries among doctors and nurses training programs are also in flux. Current medical profession must accommodate training for all components of the health care education system.

How does an information age medicine reconcile the ease with which physicians can go online for peer collaboration and to get current best practices with the benefits that derive from "a doctor' and 'a nurse' education program/system? Expert knowledge is migrating from schoolhouses and manual writers to the field, so how does an information age medicine bring the power of this near real time, online learning into the classroom? How can peers in non-medical agencies that support medical professionals keep up with the pace of this learning? What changes in the overall medical (health care) and other professional education systems are needed to acknowledge that human diseases are fought by a combination of medical, non- medical, interagency, and multinational organizations? Should an information age medicine make a distinction between 'skill improvement schooling' and 'culture changing education'? If it is the case, how to do that? What new learning methods should the medical and non-medical partners use to increase the experience base of junior doctors in less time? Do infrastructures that serve doctors' families support and readiness requirements have the same importance as that which serve training needs?

Online simultaneous staffing, virtual teaming, distributive collaboration are all becoming commonplace in the net-centric and globalized world. These methodologies are becoming common in medicine on the higher level of management. The hierarchical, bureaucratic methodology reigns supreme, however, on the local levels. How should in an information age medical profession be administered? How can health care systems take advantage of collaborative tools to make decisions faster and more effectively?

Some of these questions have been asked already, some answers have been suggested. Others, especially those related to AI, however, at the best case scenarios are still being worked as experiments or pilot programs. There is no lack of desire to do something almost on the every level of medical sciences echelons. That's not the issue. Rather, the issue is the lack of new theoretical and methodological frameworks to answer new questions about necessity and reality of AI inclusion into the medical profession. What is the coherent approach to learn new way toward answers and solutions that go beyond tweaks of the past visions, organizations and methods and get to fundamental change? What set of principles should medical professionals use to generate and sustain an information age medicine? What are the necessary experiments to be conducted in order to make interim decisions quickly? How to adapt from them and to do what is called 'learning on the move'?

3. PRINCIPLES OF WESTERN MEDICINE, MEDICAL PROFESSION, AND HEALTH CARE TREATMENT

The most important aspect of the fundamental change in the organization of the health care system and medical treatment concerns the principles of Western medicine, principles that guide medical profession. We are not able to discuss here in details the very meaning of "western" as it is applied to medicine. We agree with the reasoning in using this term that was developed in W.E. Bynum, Anne Hardy, Stephen Jacyna, Christopher Lawrence, E.M.Tansey [1, pp.1-6].

The Western medical tradition is based on a set of concepts, on a system of medical ideas and systems of explanations. One of the first principles of the western medicine is that interaction between doctor and patient are built on the basis "Subject-Object" relationships. It means that a doctor is the 'Subject' of all activities and a patient supposed to be an 'Object' to be treated. This principle makes a situation when a surgeon has to operate her/his relative or an intimate friend almost impossible because a physician has to deal with un-personlized/ dis-subjectivated object. S/he has to be emotionally free while conducting an operation and to see in front of her/him not a human being but rather an object that consists of such and such amount of flesh and blood. The second principle, ensuing from the first, implies that the physician has complete authority over the patient. The doctor's words are final certainty for the patient who has to abide obediently and to execute all the prescriptions. The third principle implies that the medical treatment is based on scientific knowledge and laboratory experiments or in other words there is no such thing as a medicine without science and it is more appropriate to call medicine as 'medical science'. The set of principles and ideas that governed medical professionals in the past and still continue to do so can be developed further. However, we would like to concentrate here on these three basic principles and to correlate them to a new "artificial sociality" in which nowadays doctors and medical science meet its patients. Again, as we have already mentioned, it is not our intention to formulate new set of principles and to substitute the old ones. We want to raise right questions and to see in what direction medical profession will changed because of AI is entering into everyday life of the people and new forms of sociality – 'artificial sociality' – become reality of life.

4. ARE PRINCIPLES OF WESTERN MEDICINE INCOMPATIBLE WITH ARTIFICIAL SOCIALITY?

Even a cursory look at professional literature about AI today (both hard and social sciences) reveals serious contradictions in understanding what AI brings to society. Part of the problem lies in methodology. The trick of many theorists is to recognize (and to detect by some measurements) a trend or the beginning of the trend of AI development in the present, work out the full implications of that trend, and then extrapolate to a future picture built around those implications. Thus, we have visions of technological advancement that are rooted in present-day trends; all are put forward as probable, sometimes inevitable. That was quite popular in the time of debates about 'postindustrial society', 'globalized world', 'communication revolution', and such.

The problem with a 'trend analysis' is that it is both a-theoretical (un-attached to explicit theory) and devoid any

sense of comparative-historical analysis. Instead of explicit theories in their explorations researchers are guided by one of two very distinct orientations/perspectives. The first orientation is pessimism of AI involvement into societal development; it's an orientation that appears to dominate literature with background in the social sciences. The second orientation, optimism, appears to dominate the engineering and natural sciences literature. Their optimism is based and predicated on the further 'successful' development of science and technology (particularly bio-genetic) which will solve all of the current problems. Indeed, both optimism and pessimism serve much the same goal as a social theory. These perspectives or 'value burden' orientations somehow provide an overall worldview that directs researchers' attentions and activities to a few core issues of investigation. The difference from social theory, however, for both optimism and pessimism, lies in that they are rather implicit orientations and not structured in rational arguments; they often rest on unstated assumptions.

We believe that in order to be accurate in explaining the future of AI scholarly visions must be based on strong theoretical constructions and firmly rooted in a comparative historical analysis.

The purpose of this section of the paper is to introduce readers to the basic social sciences approaches of studying artificial intelligence and artificial sociality in conjunction with medical profession.

Let us start with classical Weber's theory of rationalization – the increasing role played by rational-scientific thought. Weber's theory of rationalization refers to increasing mastery of Homo Sapiens over the natural and social environment. He proved that as the industrial mode of production intensifies, the rationalization of personal and social life continues apace. The basic tools for humans to master natural and social life are the following: observation, experiment, and reson/intelligence. These are the tools human behavior is guided to achieve desired goals. While rationalization throughout most of human history led to the growth of population, an advanced industrial society reveals somewhat different interests and needs. Marvin Harris, cultural anthropologist, who most systematically developed principles of cultural materialism, has shown in his research that rapid population growth in advanced industrial society stopped but the sociocultural activities used to achieve this stability were totally consistent with rationalization [3,4].

Karl Marx, another patriarch of social sciences, showed that in industrial societies people have become alienated from nature, from work, from other human beings, and from themselves. The source of alienation is the extreme division of labor and specialization. Workers in the industrial societies have a specific, very restricted role that makes it impossible to apply the full human capacities of mind and emotions to work. In fact, work becomes the means for maintaining existence. It becomes an enforced activity, not a creative or satisfying one. Specialization has been called the disease of modern man. Specialization makes society more and more intricate and interdependent but with less and less common purpose. In an advanced industrial society everything, including human beings, becomes a component of the expanding machinery.

Another matter that has been detected by classical sociological thinking concerns the evolution of science as a specific human activity. Modern science has progressively becoming 'techno-science' where pure instrumentality is confused with exploratory research. Indeed, contemporary science is not so attached to the "truth" as once it was, but more to immediate 'effectiveness'. However, as sociology of knowledge stresses, operational reality of the technical instrumentality and purposeful truth of scientific thought are completely different aspects of knowledge.

Paul Virilio put it this way, "we cannot but notice today the decline of that analogue mental process, in favour of instrumental, digital procedures, which are capable, we are told, of boosting knowledge." [8, p.2. Italics added by the author, PV] After having been for some time with Copernicus and Galileo, continues Virilio, "the science of the appearance of a relative truth, techno-science is once again becoming a science of the disappearance of that same truth with the coming of a knowledge which is not so much encyclopaedic as cybernetic, a knowledge which denies all objective reality" [8, p.3].

Thus, the situation with an appearance of AI at the scene of societal development has its own logics and legitimacy.

5. CONCLUSION

The information age has shifted the very foundations of interactions and interchanges between people in a society, and there is an argument to be made that this shift extends to the very foundation of the set of institutions and structures associated with medical profession and health care system of a society. The framework that guided regulations, decisions and actions in the past is just that, past.

Society dissatisfaction with medicine has always existed. People need to recognize that although the new developments might bring new appearance of medical profession, it has never been lost and has always needed fixing.

The fundamental nature of health care system is indeed changing as Internet and artificial sociality enters into everyday life of doctors and their patients. Technological changes are again reshaping medical profession – not withering it. Social media is fostering supportive, persistent, and pervasive relationships among those who participate in the health care processes. Obviously, there is a need to understand what kinds of relations between physicians and their management, between doctors themselves, between doctors and patients flourish in this emerging restructuring.

Given that the future is still unfolding, only time will show us whether the medical profession "got its capabilities and style right" or rather "didn't get it completely wrong". Only in hindsight people will be able to judge fully whether health care structures and medicine could bring themselves to the complete set of fundamental change called by the new framework of the AI era.

But in facing the transformation medical professionals must temper the recurrent nostalgia for the supposed 'good old days' and the unease that often comes with new times. The medical profession is an action-oriented profession of practitioners. It is obvious that if it were to make final decisions only by medical professionals they could do it quickly, right or wrong – it's another matter. However, the players and decision makers on issues about the new face of medicine in the age of artificial intelligence and artificial sociatlity are not all medical professionals. The issues at stake are very serious and the changes to be made will have a long-lasting impact across society, not just within medicine.

Sociologists convincingly prove that making quick changes and experimenting is much more difficult in the period of hyper-change – this is the period of time we live now – but no less necessary. The point is always to remember that medical profession is very specific 'action-oriented practice', the specificity is that it is scholarly, scientific action-oriented

practice, i.e. based on experiments, natural laws, and the search of truth.

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