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# Commentary

# *Evaluation of a Field Test of Computers for the Doctor's Office*

Reflections on P.L. Reichertz et al.'s paper:
*Evaluation of a Field Test of Computers for the Doctor's Office*

## Introduction

On re-reading the paper "Evaluation of a Field Test of Computers for the Doctor's Office", 20 years after it was written, I am struck by the amount of clarification and explanation that seems necessary. So much of the experience, on which the paper is based, is not said. So much of what is expressed is obscured by the obstacles of bridging language and cultural barriers – an issue rarely appreciated enough and even less reciprocated by those lucky enough to grow up and work in the language and culture dominating scientific communication. I will, therefore, attempt to summarize the key points of this paper, provide some context, and try to point out what may have been a lasting merit of the paper.

## Summary of the Paper

This early account of computer use in private physicians' offices is preceded by publications from Belgian and Dutch colleagues who had devised and used their own systems in their medical practices [1,2]. Our setting differs from these earlier experiences, in that it tested an industrial product intended for widespread use rather than describing a system developed by the authors for their own purposes. The system was designed to support predominantly administrative chores, which in Germany are centered on billing documentation, including patient demographics, and codes for diagnostics services, which were at that time transmitted on legally mandated forms .

The system was an early microcomputer with 16-bit architecture, mounted in a pleasing wooden desk. It boasted a 2.5 MB hard disk (almost infinite capacity in the perspective of that time!), a 256 KB floppy drive, keyboard, CRT display, a small printer that allowed one to feed the many forms in use in doctors' offices as single sheets, and a reader for mark-sense forms. The mark-sense reader and the way it was used was one of the most appropriate features of the system for the German fee-for-service environment. The system would generate mark-sense sheets bearing a patient identification number. These could be inserted in a tablet which was fitted with flaps that folded in a scale fashion over the mark-sense sheet. These flaps allowed one to identify the meaning of marking positions on the sheet. Specifically, they provided lists of up to 90 diagnosis codes and 90 procedure codes. By customizing the code selection for every practice using the system, rather than using a "standard" for all practices, the limited number of 90 codes for each category was able to cover a large percentage of all codes required. The tablet, fitted with a patient's sheet, enabled the provider to mark diagnoses and related procedures pertinent to an encounter. It was thus possible to have an efficient, mobile data acquisition device which could be used independently of the computer's location in treatment rooms or on house calls. The conditions not covered by the 90 x90 choices could be documented in writing and entered using the CRT.

The system had limited functionality beyond recording patient demographics, capturing and producing billing documentation on the legally mandated forms for communication to the appropriate agencies. Electronic transmission of the reimbursement documentation was not possible for legal reasons. Therefore, a major opportunity for efficiency improve-ments could not be exploited—no scheduling, no spreadsheets or statistical analysis support, no word processing. The system was somewhat unreliable and slow, without multi-tasking capability. In summary, the system combined very efficient, with very inefficient and even ineffective features. The evaluation of the system had to account for these unrealistic inadequacies of an early prototype.

If the system tested was not what it should have been, neither were the practices in which it was tested. These were selected according to their

willingness to participate in the test. Participation was no minor undertaking. It required training of staff, availability of personnel to the investigators before, during and after the period of computer use, and considerable office reorganization, not only in preparation for introduction of the computer, but also when the computer was removed again after the test, mostly to the regret of staff[1]. In summary, the main challenge of the investigation was to reach valid, generalizable conclusions despite the many poorly or misrepresented features of both the tested system and the setting in which it was tested.

The investigation was conducted in 1977/78. The results were first comprehensively published in German in 1980 [3], and the paper in question is a summary of key aspects, written in 1978.

The trial relied on several years of preparatory work. Collaboration with some of the practitioners had actually started with analyses in 1971. Some of the results were published at the first MEDINFO Conference in 1974 [4]. Most of the preparatory work, however, was published in German only [5-10], with a few excerpts presented at various conferences in English [11-15].

This earlier work unearthed a number of important insights at the time:

1. Practitioners, in particular general practitioners, work on a very tight time schedule, mean contact duration with patients being in the order of less than three minutes [6]. This puts very high demands on the efficiency of computer interaction.
2. Since the doctor knows the patient from years of mutual exposure, there is very little diagnostic effort, but always therapeutic action [6,13]. Also, in Germany, practitioners, particularly general practitioners, rarely had admitting privileges in hospitals, which are staffed by employed physicians. Therefore, they had scant access to sophisticated diagnostic equipment. For all these reasons, it appeared that diagnostic decision support - a favorite topic for computer application at the time - had low priority in this context.
3. In the German fee-for-service environment, the only common denominator in widely varying styles of practice procedures and medical sub-specialization are the administrative procedures. We concluded that automation should therefore start with these administrative procedures [7, 9,10].
4. Within General Practice, several different types of practices can be discerned. These were determined "objectively" by submitting comprehensive data on over 3,000 practices to factor analysis, and by then clustering the practices on the basis of factor loading [7,15]. In this investigation eight practice types were identified. We hypothesized which of these would be easy to support with computers and could benefit from this support, and which were less appropriate, and endeavored to test these hypotheses during the field test.

The field test itself consisted of three phases: investigations before, during, and after computer use. These investigations concentrated on time and frequency characteristics of office procedures to assess the impact of the system on practice operations: How long does it take to admit a patient — manually, or with computer? How long does this take for a new patient? Who is involved in the process? What percentage of patients are new versus known ones? How frequently do demographics have to be updated in known patients?

The data obtained on such questions were then aggregated to come up with totals for the clientele of a practice, or average numbers per patient in a given practice. These data were then translated into coarse operating cost figures, taking into account salaries of the persons involved, as well as expendables.

The cost of the computer system was borne by industry. Instead of using the real costs for assessment of cost effectiveness, we worked with average rental costs that physicians had deemed tolerable for the benefit of a service that would have been more comprehensive than that actually provided by the field test system. At this time, even the maximum tolerable cost (roughly DM 6,000 or US$ 3,000 — not for purchase of the system, but for rent per month!) was only a fraction of what industry considered necessary given the cost of the system[2].

In addition, a detailed analysis of subjective satisfaction of practice owners and their recommendations concerning functionality and benefits of the system was carried out.

The investigation produced ample results [3]. Our hypothesis that administrative functions should be the core of the system was supported by the results and by the recommendations of practitioners. One revelation was that objective performance of the system did not affect the perceived value very much. Further, our hypothesis that well organized practices are most amenable to computer support turned out untenable. To our surprise we found the contrary: The best organized practice, which we had predicted as most favorable, with a near maximum "EDP score" of 11 (maximum 12), rejected the system most violently (-2), because the system was perceived as a foreign body in a lovingly organized environment. The other extreme, a practice with an

[1] This had not been part of the plan, but resulted from the industrial partner's decision to abandon development.

[2] The discrepancy between the cost deemed tolerable by the physicians and the charges deemed necessary by the company led eventually to discontinuation of the project by the company.

"organically grown" organization and the lowest EDP score of 5 (minimum 1) rated the system highest (+2), because the introduction of unexpected law and order was perceived as a relief. This finding in particular encouraged us to be less tense in the future about introducing computers into new environments [16,17].

## Context

Reichertz' paper was written at the end of almost a decade of dedicated collaboration after the team that did the work had largely dissolved, pursuing different career paths. While this impeded production of an optimal paper, it did not terminate the work on the issues tackled. A few additional remarks on the history, as well as subsequent phases of the work may therefore be of value for assessing the potential legacy of the contribution.

The project had several motives. On the surface it served to support that branch of the health care system that has the greatest share in patient contacts and, therefore, potentially the largest influence on patient welfare.

But under this surface were political issues in medical informatics. When Peter Reichertz took up his position at Hannover Medical School in October 1969, it was a position as chair of an "Abteilung Klinische Informatik", translated as "Division of Clinical Informatics". The author took evening classes in programming offered by Dr. Reichertz at that time and distinctly recalls a remark after class in late November 1969, to the effect that "this field will probably soon be called something like Medizinische Informatik (Medical Informatics)" This was, at the time when the German Gesellschaft für Informatik", the learned society for computer science, had just been formed.

In subsequent years, this issue resurfaced constantly. We had endless discussions in English with our colleagues from computer science in the context of preparing for the first "Advanced Course on Informatics and Medicine"[3] [18], in 1972-75. Was it justified to talk of "medical informatics"? M. Griffiths, in particular, a British computer scientist teaching at that time in Grenoble, France, expressed discomfort with the English term despite being very familiar with the French term "informatique médicale". John Anderson, London, and François Grémy, at the time from Paris, supported the term, while the German "Informatiker", G. Goos and P.C. Lockemann argued that if anything, it should be "informatical medicine". Reichertz' application to have the designation of his division changed from "clinical informatics" to "medical informatics", proposed in 1972, met with suspicion at the Medical School before it was eventually granted in the late Seventies. In this context it was of strategic importance to be able to point to actual work not merely supporting clinical needs at the university, but investigating real-life issues of "medicine and informatics" in general. It was this particular battle for medical informatics that provided a lot of additional incentive for the project and ensured its importance over time.

And there was yet another motive - one which can only be fully appreciated from the perspective of the late 1960s, when students revolted in the reflection of a distant much larger revolution in China, and of an escalating war in Vietnam. It was a time of "new thoughts", not all of them of lasting value.

The author had been educated in medicine in the early Sixties in an atmosphere where the end of the country doctor was proclaimed from the pulpits of universities. H.E. Bock in particular, an eminent internist and hematologist, had proclaimed the "hiatus scientificus" [19] that allegedly separated the world of the general practitioner from that of medicine as it really should be practiced, that is, within the full support of the technological armamentarium that is available in the fortresses of medical establishment, at universities. This had awakened the interest, and then passionate opposition of R. N. Braun, then a "lonesome doc" in the same university town in central Germany: Marburg. Braun painstakingly collected statistics - without computer support - of the problems that he had to deal with in general practice [20,21]. He proved not only that the complexities of university medicine are almost non-existent in general practice, but also that universities do hardly prepare their graduates to deal with the mainstream of demands that general medicine faces. Braun countered the notion of the "hiatus scientificus" with a call for attention to the realities of a practitioner's life, and for representation of general medicine at universities. Given this dispute, the collaboration with a group of creative general practitioners provided not only an opportunity to scratch at the patina of academic establishment, but also to contribute to the democratization of medicine. In this way the work fitted into the Zeitgeist. If the "hiatus scientificus" deserved attention, then computers should probably be used to bridge this gap, for instance through diagnostic decision support. If R.N. Braun's position that general medicine was a species distinct from university medicine was correct, then simple "knowledge transfer" might be less appropriate than different support functions geared specifically to this environment.

The question was, however, what these functions might be. The alternatives discussed at the time were many. This was the reason for us to embark on an exploration of the world of general practice without prejudice, an ambition facilitated by K.D. Haehn, who eventually became the first uni-

[3] The title was a compromise.

versity chair for General Medicine in Hannover and Germany. On the basis of several years analysis we concluded that support of administrative functions was to be the most effective start to the support of general practice in Germany. Later developments in other countries with fee-for-service systems followed largely the same track and provided further support of the correctness of our assumptions, in addition to the field test.

## Is there a Legacy?

The work was carried on beyond the stage reported in 1979. An IMIA Working Conference on "The Computer in the Doctor's Office" was organized and held in Hannover in 1980. It summarized much of the relevant work accomplished at the time around the world [22]. The conference made abundantly clear that practice patterns, and, hence, computer functions, are determined by the societal context. Societies with fee-for-service reimbursement benefit from systems that support billing-related documentation and communication, and other administrative office functions, such as scheduling, payroll, etc. These systems are characteristic for many countries in central Europe and North America. Other reim-bursement systems, such as capitation fee systems, as in the UK and the Netherlands, lead to totally different information systems that include epidemiological and surveillance functions [23]. And, of course, we can expect that, when the societal environment changes, as currently in the USA, the functionality and architecture of information systems have to follow suit, if they are not able to lead or anticipate the changes.

These kinds of considerations led to a subsequent IMIA working conference which provided a systematic overview of health care systems and their relation to information systems for practices [24,25]. The capabilities of such systems have in the mean time become one of the bases of major health reforms in many countries.

The approach presented in the paper in 1979 was, however, carried on by some of us in a different way as well. We never had been quite comfortable with the rather coarse attempts to assess the effects of computers on work flow and work load, used in the time before 1979. Therefore, we developed computer models of doctors' offices, which allowed one to incorporate the characteristics of various conditions of operation, such as with or without computer. And we were then able to demonstrate the effects of computer use in substantial detail on the basis of simulations [26]. Unfortunately, these investigations were again only rudimentarily reported in English [27]. But they seem to have been the first investigations of this kind.

This brings me to an important aspect of the paper that we were not conscious of at the time. In our preoccupation with making computers beneficial to general practice, with the rehabilitation of general medicine, and with making a case for medical informatics, we overlooked that, as an aside, we had embarked on a rather novel and comprehensive approach to evaluation in medical informatics, one which dealt in a variety of ways with typical constraints encountered in medical informatics, such as the lack of representativeness of both supported and supporting systems. The originality and appropriateness of what we did was driven home a few years back, when I studied the excellent text on evaluation approaches in medical informatics, provided by J.G. Anderson and J.J. Aydin [28], and more recently that of C. Friedman and J. Wyatt [29], respectively. Our approach precedes these texts substantially. It was not a summative evaluation, but a holistic, systems-oriented approach, spanning a continuum from systems analysis, to quantitative analysis, to the formulation of specifications for information system support, and on to assessment of the system. Methods for information gathering were very varied and suited to whatever problem we were facing. Observation and measurement, surveys and Delphi approaches, as well as automated logging were all used where appropriate. The evaluation of data was similarly suited to the purpose and ranged from simple descriptive statistics to demanding numerical analyses, to modeling and perceptive interpretation. Subjectivist and objectivist approaches [29] were used in a manner complementing each other, with subjectivist methods dominating in the early stages and guiding use of objectivist methods. Where the rigors of objectivist approaches were violated, we invented novel solutions. We realized that, given the preliminary nature of the early prototype system, we had to project our findings towards a more adequate and comprehensive system. We knew that we could not strive for a randomly selected sample of practices, but worked consciously with a biased sample. Rather than missing the opportunity to gain insights by making unrealistic demands, we tried to compensate for the shortcomings of our sample. The experience that some of our core hypotheses were proven utterly wrong, such as the postulate that well organized practices benefit most from computer introduction not yet fully appreciated by many of the current protagonists of evidence-based medicine. While evidence-based practice is intellectually attractive, the practical challenge to fit it into a rhythm of less than five minutes per encounter may prove daunting.

In retrospect, the paper leaves a sense of pride to have participated in an early project leading to valuable insights and methodological advances, as well as a sense of regret that what we intended to express ended up veiled by translation

difficulties and that some important insights did not even occur to us.

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