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EVALUATION
OF AN
OFFICE ANALYSIS METHODOLOGY

OAM

Juliet Sutherland and Marvin Sirbu

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545 TECHNOLOGY SQUARE, CAMBRIDGE, MASSACHUSETTS 02139

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Juliet Sutherland

Marvin Sirbu

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Abstract

We have developed a model of the office that describes semi-structured office work. This model underlies an office analysis methodology and an office specification language. An evaluation of the usefulness and practicality of the model, the specification language, and the methodology has shown that the model is clearly a useful approach to understanding offices, the specification language is interesting but not as useful in practice as we had hoped, and the methodology is useful but could be improved. We have developed a new methodology that addresses the issue of diagnosis as well as description. This new methodology is still being evaluated, but early results show that it is as useful for training new analysts as the old methodology.

Key Words and Phrases: office automation, automated office systems, office analysis, understanding office work, office model, methodology evaluation

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1. Introduction

The term "office automation" is usually taken to mean the introduction of technology into an office to "automate" it, an analogy taken from the automation of factories. This basic conception is correct, but by no means complete. Simply placing a word processor in the middle of a busy office does not constitute automation. The technology must be used, and, in order to fit the factory analogy, must somehow improve the *productivity* of the office. Figuring out how best to use the available technology, and determining the value of any benefits derived therefrom, are current research topics.

The automation process for a particular office often starts with the decision to consider automation. The office is examined to obtain the information necessary to decide whether or not to automate. This decision often requires that a system be designed and cost justified. System design includes choosing the technology, choosing a vendor, and deciding specifically how the new system is to work. Once the system has been designed and justified, it must be purchased and installed in the office. This is usually known as implementation. Implementation includes a variety of activities that range from installing the hardware and software to training office personnel to use the new system. The system will continue to change after implementation as individual users find new uses for it that are adopted by the rest of the office. In addition, the office may change, resulting in changes to the system which require repetition of all or most of the process.

The tools whose evaluation will be discussed are intended to aid in the understanding and analysis of current office operations that leads to the automation decision and system design. Many approaches to the automation process have been suggested, the most common of which include forms flow analysis, information flow analysis, and analysis of job descriptions. We have taken the functional approach, as described by Hammer and Sirbu in [4].

2. Background

We have developed an Office Analysis Methodology (OAM) [12, 11, 15] that is used to collect information about current office operations. OAM uses a functional model of the office to structure data gathering interviews and the resultant description of current operations. OAM suggests who to interview, what kinds of data to collect, and how to perform an interview. The methodology is purely descriptive and its final product is a document that clearly describes the details of current operations within the context of the office model. Closely related to OAM is the Office Specification Language (OSL) [6, 3], a formal language that provides constructs and a carefully defined vocabulary for describing office work.

2.1 Office Analysis Methodology

An OAM study begins with an interview with the office manager to lay the ground work for the study, outline the time and effort required from office personnel, define the scope and purpose of the study, and ask about the office itself: the mission, internal structure, places in the organization, etc. The next step is to interview appropriate office personnel. These interviews are guided by the functional model. The analyst records the results of the interviews in a draft description whose format is specified. When all of the interviews are finished, the analyst asks the interviewees to read the draft description, then interviews them again to complete gaps and to correct mistakes in the description. When a consensus is reached that the description is complete and correct, the analyst gives it to the manager to read. The analyst meets with the manager to obtain any corrections that he may have and to discuss further steps in the automation process.

OAM is much more than a specification of who to interview. It provides clear instructions about how, from an organizational behavior perspective, to establish an appropriate "contract" with the group being studied. It contains extensive information about interview techniques. It provides detailed instructions about the types of information, and the level of detail, that should be gathered to result in a useful product. And finally, OAM uses a high-level model of office operations to provide a framework for asking questions and organizing responses.

2.2 Office Model

We have developed a model of the office based on the premises that an office has a mission, has control over some parts of its environment, has structure in terms of functions and procedures, and can be understood in simple, high-level terms. A complete description of this model can be found in [6]. Rather than focusing on paper flow or job descriptions, the model describes an office in terms of functions, procedures, and objects. An object is an abstraction that may have associated with it one or more documents or other physical items and that is central to a series of activities. For example, in ordering supplies, the object would be the request for supplies, and might be represented physically by a requisition form, a verbal request, or an electronic message. A function is the life history of an object, consisting of at least three parts: the object's origination, its management, and its termination. The supply function might start with the recognition of a need, continue with ordering, purchasing, payment, and receipt of supplies at the loading dock, and terminate when the original need is filled. The parts of a function are performed by procedures.

The procedure is the primary descriptive tool of the model. It describes the activities performed to move an object from one stage to the next in an idealized case where everything goes right. It also describes exceptions that occur when something goes wrong. The idealized series of operations are known as the mainline, and are usually quite simple. The complexities in an office arise from the exceptions. The mainline is described in terms of events, steps and states. An event is anything that triggers action and can be a date, receipt or non-receipt of a document, etc. A step is everything that can be done without having to wait for another event. When the step has been completed, the object enters a state to wait for the next event.

We believe that in order to automate an office effectively, one must understand how the office works. OAM and OSL are designed to help the analyst with this stage of the automation process. In addition, by providing a model for understanding and by systematizing the data collection process, we hoped to reduce the need, at least at this stage of the automation process, for highly trained specialists. Using these tools, almost anyone who has at least some experience with office work can perform an office study. Although improvement of the automation process, and the training of new personnel were

our primary goals, we anticipated that OAM and OSL descriptions could have other uses ranging from the use of a single description as a training or procedure manual to the use of a collection of descriptions by system designers to identify new automation products.

3. Evaluation

3.1 Basis for Evaluation

In 1979 and 1980 we studied several MIT and non-MIT offices [7, 5] in order to gain experience in performing studies and to educate ourselves about office work. Based on these studies and those of other researchers [8, 18], early versions of the office model, the specification language, and the methodology were developed. Additional studies were performed using these tools [10, 13, 14, 17, 16], the results of which were used for further modification. By the fall of 1980 we were ready to start formal testing of OAM, OSL, and the model.

We invited a number of companies to attend a free 3-day course teaching OAM and OSL. This course had two purposes: the first was to determine whether or not OAM and OSL were easy to teach and learn; the second was to persuade the attendees to use and provide feedback on OAM and OSL. The course covered background information, the office model, OAM, and reading and writing OSL. The teaching methods included lectures, workshops, and homework. The course was taught twice,[1] to people from 7 companies and from 5 different parts of MIT. At the end of each course, the participants completed questionnaires about their evaluation of the teaching methods and their understanding of the material presented.

Of the seven companies that participated in the OAM/OSL courses, four companies performed a total of seven office studies. These companies were an insurance company ("A"), a research laboratory ("B"), a consumer products company ("C"), and a chemical company ("D"). The companies provided us with evaluations of their experience in using OAM and OSL along with the results of the studies.[2] In 1982, a year or more after the studies had been completed, the four companies were contacted again to determine whether automation or any other changes had occurred as a result of the studies.

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[1] In November, 1980 and January, 1981

[2] A detailed evaluation of OAM and OSL based on these results can be found in [6].

3.2 Results

OAM, OSL, and the model can be evaluated based on the evidence from three points in time, the results of the course, the immediate results of the studies, and the long term results of the studies. Different types of conclusions can be drawn at each point and we will examine them in order.

Responses to a questionnaire administered at the end of the course showed that OAM and the office model--presented in the course as a part of OSL--were easy to teach and understand. Course attendees were somewhat less comfortable with the details of OSL and indicated that they did not feel comfortable writing it. Understanding of OSL details correlated with the attendee's analysis experience and familiarity with formal languages. All of these findings are supported by the instructors who felt that, based on the participant's questions and their responses in workshops, most of the people had understood the model and OAM well but had had some difficulty with the details of OSL.

The next point for evaluation came after the office studies had been completed. We received OSL descriptions of all seven offices, English descriptions for some offices, and an overall evaluation from each company. From this data we drew several conclusions. The data confirmed our previous conclusion, that people without much experience in studying offices were able to learn OAM, OSL, and the model. The studies that they performed were, within the constraints of the methodology and language, as complete and useful as those performed by more experienced analysts. {}The evaluations from the companies made clear, however, that OSL required too much time and effort to learn and use. While the analysts found the process of writing an OSL description useful, the incremental benefit over a carefully completed OAM study did not justify the effort involved.

The final point of evaluation comes after sufficient time has passed for the completion of changes that may have occurred as the result of the studies. This stage provides the best test of whether the tools improve the automation process and are practical to use. We will describe those offices where changes took place along with the resulting changes, then draw conclusions about OAM and the model.

Of the four companies that did office studies, company "A"'s were not available for

further inquiry. Companies "C" and "D" performed studies in their engineering divisions and each had at least one case of change resulting from a study. An employee from company "B" studied a graduate admissions office and a volunteer organization's membership management function.

Company "C" was in the process of introducing automation equipment into its engineering division. The standard approach was to do simple automation of the current operations without doing a functional analysis or looking for other than the most obvious improvements. One office was studied using OAM and OSL. According to the office manager, the study permitted the office to look at itself to see areas that needed improvement and provided enough information to indicate that the office should make changes to the standard system that would otherwise have been installed. The changes included the use of different equipment, primarily dictation equipment in this case, and the use of the standard word processing equipment for more complex tasks than would have otherwise been implemented. In addition, the process of doing the study showed that many of the procedures were unnecessarily cumbersome. The difficulty encountered by the analyst in understanding the procedures and the complexity of the description clearly illustrated the awkwardness. Changes were implemented over a period of time, ranging from the immediate introduction of a standardized travel arrangements request form to the eventual centralization of most files. Finally, the English description that resulted from the study was used as a training manual for some time after the study. The office had a high turnover and the office manager found the description particularly useful in explaining to new personnel what the office did. Unfortunately, as more and more changes accumulated, the description became less and less useful until it was finally abandoned altogether.

Company "D" did several pilots studies using OAM and OSL. The intention of these studies was not to automate the offices, but simply to try the methodology and the specification language and have some analysts gain experience in using it. One of the studies, however, caused the office in question to decide to automate. Apparently the study did not provide enough information to decide exactly what should be automated, but it did provide enough for everyone involved to realize that automation would be helpful. Additional data collection efforts were necessary before automation could begin. The

analyst concluded, however, that the written description was useful throughout the automation process, since it provided a common reference that could be used as a tool for discussion. The analyst also felt strongly that the results of the automation effort were influenced by the study. In particular, the analyst felt that it was only by automating the office in a functional way that the automation could be cost justified.

The first study by the employee of company "B" was of a graduate school of management. The school of management study was undertaken to determine whether or not it should make use of computer technology. As a result of the study, the analyst and the Dean concluded that while there were some functions that could be automated, there were not any affordable and available hardware and software packages that would meet the school's current needs. In other words, automation could not be cost justified at the time. The analyst felt that OAM and OSL were extremely useful in this process, and provided enough information to make the decision.

The second study performed by the employee of company "B", of a volunteer organization's membership unit, identified several areas where automation would be useful, but, due to budgetary and organizational restrictions, no changes were implemented. The analyst felt that the study provided enough information to make decisions about what should and could be changed. That nothing resulted was apparently due to outside circumstances and was not a response to the study. When, sometime after the study, the national headquarters of the organization suggested that the local groups purchase a particular system, the analyst was able to refer back to the original study to determine that the proposed system would not meet the needs of that particular local group.

This analyst has used a slightly modified version of OAM and OSL to study military command and control operations. One study has recently been completed in this area. The description, in a modified OSL format, of how the operation works has been extremely valuable. The military personnel have found it useful since it provides a common set of well-defined terms that they can use in their everyday work. The military command likes it because reading it has ensured that all of the staff are working from the same model, so that different people will have similar reactions to the same situation. The military training institutions find the descriptions valuable since they can use it as a training manual for new

personnel. Two different training institutions now use the description in this manner.

These experiences show that OAM/OSL studies provide an output that is useful in the automation process. As a result of these studies, decisions were made about whether or not to automate, systems were designed, and procedures were redesigned. However, the number of cases presented here is limited. We believe that the specific results are accurate reflections of the results that would be obtained in wider practice but we can only state factually that the results have been observed at least once. In an attempt to achieve an overall assessment, analysts and their supervisors were asked what they liked best, what they liked least, and whether they would use OAM, OSL, and the model again.

None of the analysts or supervisors said that they would use OSL again. This confirmed the previous conclusion that while the constructs and vocabulary of OSL are of academic interest in providing a taxonomy of office work, the language itself is too cumbersome for practical use. The analyst from company "B" is using a derivative of OSL, but other use seems unlikely. OSL will continue only in the use of the function/procedure model.

The most common criticism of OAM was the lack of quantitative data. This was almost always mentioned in conjunction with a comment about the lack of a questionnaire. Many of the users requested that methodology gather more quantitative data, and questionnaires were often suggested as a useful tool for this purpose. In addition, a few people thought that some of the data gathered in the interviews could be obtained more easily by using a questionnaire.

Another criticism, although not a common one, was that writing the description, with its several drafts, is too time-consuming. One analyst, however, said that while writing the descriptions was time consuming, it was very necessary since it allowed the delegation of effort. One analyst performed the study, while another worked with the office to find and implement a solution. Without the detailed description, this would have been much more difficult. In addition, the description allowed the same analyst to pick up the project again after a period of time when the details of the project might have been forgotten. Given the importance of the description in system design and work redesign, and the necessity of providing feedback to the office staff, the time required to produce a description seems

justified.

On the positive side, all of the people who used the methodology liked the function/procedure and step/event/state ideas. They almost all commented that the idea of abstraction, rather than looking just at tasks, had been very valuable. This was certainly one idea that each analyst seemed likely to use in doing almost any study. In addition, most of the people said that they liked the step/event/state model because it provided a way to structure the interviews. One analyst in particular said that by using that model she was able to structure interviews in ways that produced useful results, rather than random data. She said that she has successfully used this idea in interviews for other types of studies, and was particularly pleased to have added the concept to her repertoire.

Company "D" will probably will not use OAM, exactly as it was presented, again. The model, however, has been incorporated into already existing corporate methodologies. Company "C" has just completed its first, non-functional, stage of automation. The results of the test of OAM there were so positive that OAM, or its successor, will be the analysis tool used in the next, functional, stage of automation. The analyst from company "B" has left the company and is now working independently, using the model, and variations of OAM and OSL among his tools.

The model, then, would seem to be a success and a valuable contribution to the automation process and our understanding of offices. OSL is of academic interest but, in its current form, has little practical use. OAM has had mixed results. On the basis of the experience presented here it is easy to learn and, in combination with the model, can be used as a training tool for new analysts. The descriptions that it produces have proven useful as training manuals. It has been used to gather the data required to decide whether or not to automate, to design automated systems, and to redesign work procedures. However, our experience in doing studies with OAM, along with the experience in the companies, suggests that OAM could be improved in several ways.

OAM does not collect enough data in certain areas. The two most important kinds of missing data are quantitative data and data about intention. Quantitative data are required primarily for system design and for cost justification. Data about intention, or the reasons

why procedures or steps are performed, are required for system design and for work restructuring. One cannot determine whether or not to change a procedure step or eliminate a document without knowing why the step is performed or the document is kept.

Another problem with OAM is that it provides only descriptive information. When we first designed OAM we thought that a purely descriptive methodology was ideal for the first step of the automation process. However, we have found that when one is studying an office for the purpose of changing it in some way, the usual goal is to "improve" the office. This implies that at some point judgments must be made about what constitutes improvement. The process of making these judgments about what can be improved is often known as diagnosis. OAM's purely descriptive approach can make diagnosis difficult in all but the simplest cases.

4. A New Methodology

In response to the criticisms of OAM, we have developed a new methodology, the Office Analysis and Diagnosis Methodology (OADM) [15]. This methodology uses the function/procedure model and builds on OAM. The most fundamental change is that it is no longer purely descriptive. OADM provides guidance to the analyst in collecting data about problems and opportunities.

OADM integrates several other changes as well. It makes use of a questionnaire, tailored by the analyst to fit the situation, to collect quantitative data for system design and cost justification. OADM integrates the concept of Critical Success Factors [9, 1] as applied both to office personnel and the office as a whole, to identify leverage points for automation. OADM also emphasizes the importance of collecting data about why functions, procedures, and steps are performed. Finally, OADM incorporates changes that are the results of our additional experience such as ways of approaching a large office and ways of integrating several studies within the same organization.

A course in OADM was taught to employees of a major Central American bank who then taught it to summer students who performed the several studies. Five studies have been completed at the bank but not enough time has passed for any changes that may result from those studies to be apparent. We cannot, therefore, perform an external evaluation of OADM's usefulness in the automaton process. The office descriptions that we received, however, confirm that OADM and the office model can be easily taught and are useful tools for training office analysts. That the major principles of OADM were communicated across languages and through one repetition by nonusers seems to be a major validation of the premise that OADM and the model can be easily taught and learned. The descriptions that we received were difficult to evaluate due to poor translation, but appeared to be equivalent in quality to those produced by users of OAM. Since OADM addresses many of the problems found in OAM, we believe that it will prove to be a valuable automation tool.

5. Limitations of OAM and OADM

One of the most severe limitations of both OADM and the model is that they do not address the issue of understanding managerial work.[3] OADM is best suited to understanding semi-structured procedures. It has been used successfully in both clerical and professional offices. Attempts to use OADM in a senior manager's office showed it to be unsuitable. New office models appropriate to the pure managerial function need to be developed.

OADM does not provide guidance in collecting data regarding the social structure of the office. Ideally, changes accompanying automation should be made in a way that recognizes the importance of interpersonal interactions. A complete automation methodology should provide guidance in collecting this type of information.

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[3] As opposed to professional work which they handle well.

6. Summary

We have developed a model of the office that describes semi-structured office work. This model underlies an office analysis methodology and an office specification language. An evaluation of the usefulness and practicality of the model, the specification language, and the methodology has shown that the model is clearly a useful approach to understanding offices, the specification language is interesting but not as useful in practice as we had hoped, and the methodology is useful but could be improved. We have developed a new methodology that addresses the issue of diagnosis as well as description. This new methodology is still being evaluated, but early results show that it is as useful for training new analysts as the old methodology.

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References

[1]

Bullen, C. V. and Rockart, J. F.
A primer on critical success factors.
69, Massachusetts Institute of Technology Center for Information Systems Research, June, 1981.

[2]

Bullen, C. V., Bennett, J. L., and Carlson, E. D.
A case study of office work station use.
IBM Systems Journal 21(3), 1982.

[3]

Hammer, M. M. and Kunin, J. S.
Design principles of an office specification language.
In *AFIPS Conference Proceedings, 1980 National Computer Conference*, Volume 49, pages 541-547. AFIPS Press, Arlington, Va., May, 1980.

[4]

Hammer, M. M. and Sirbu, M. A.
What is office automation?
In *Proceedings of the National Computer Conference Office Automation Conference*, pages 37-49. AFIPS, March, 1980.

[5]

Karkula, S.
Information flow in a television station.
Memo OAM-002, Massachusetts Institute of Technology Laboratory for Computer Science, Office Automation Group, January, 1979.

[6]

Kunin, J. S.
Analysis and specification of office procedures.
Technical Report 275, Massachusetts Institute of Technology Laboratory for Computer Science, February, 1982.

[7]

Kunin, J. S. and Hammer, M. M.
Case studies of office procedures: I.
Memo OAM-001, Massachusetts Institute of Technology Laboratory for Computer Science, Office Automation Group, January, 1979.

[8]

Newman, W.
Studies of office procedures and information flow.
Internal Memo, Office Research Group, Xerox Palo Alto Research Center, May, 1976.

[9]

Rockart, J. F.
Chief executives define their own data needs.
Harvard Business Review , March-April, 1979.

[10]

Schoichet, S.
Case studies of office procedures: the office of sponsored research.
Memo OAM-022, Massachusetts Institute of Technology Laboratory for Computer Science, Office Automation Group, October, 1980.

[11]

Sirbu, M.A. *et.al.*.
OAM: an office analysis methodology.
In *Office Automation Conference Digest*. AFIPS, 1982.

[12]

Sirbu, M. A., Schoichet, S., Kunin, J. S., Hammer, M. M., and Sutherland, J. B.
OAM: an office analysis methodology.
Memo OAM-016, Massachusetts Institute of Technology Laboratory for Computer Science, Office Automation Group, October, 1980.

[13]

Sutherland, J. B.
Case studies of office procedures: the student loan office.
Memo OAM-023, Massachusetts Institute of Technology Laboratory for Computer Science, Office Automation Group, May, 1981.

[14]

Sutherland, J. B., Schoichet, S. and Hammer, M. M.
Case studies of office procedures: the office of facilities management.
Memo OAM-032, Massachusetts Institute of Technology Laboratory for Computer Science, Office Automation Group, September, 1981.

[15]

Sutherland, J. B.
An office analysis and diagnosis methodology.
Technical Report, Massachusetts Institute of Technology Laboratory for Computer Science, February, 1983.

[16]

Zarmer, C. L. and Kunin, J. S.
Case studies of office procedures: the industrial liaison office.
Memo OAM-020, Massachusetts Institute of Technology Laboratory for Computer Science, Office Automation Group, October, 1980.

[17]

Zarmer, C. L. and Schoichet, S.
Case studies of office procedures: the work control center.
Memo OAM-013, Massachusetts Institute of Technology Laboratory for Computer Science, Office Automation Group, July, 1980.

[18]

Zisman, M. D.
Representation, specification and automation of office procedures.
PhD thesis, The Wharton School, University of Pennsylvania, 1977.