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Fundamental Definitions and Concepts  
for Office Information Systems

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William C. Sasso  
The University of Michigan

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for  
Office Information Systems**

William C. Sasso

Graduate School of Business Administration  
The University of Michigan  
Ann Arbor, MI 48109

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William C. Sasso  
826 W. Huron  
Ann Arbor, MI 48103



The purpose of this working paper is to clarify two issues fundamental to the analysis of "office work," i.e., the information-handling activities carried out in organizations. Section 1 addresses the first issue--the meaning of the term "office" itself. Four related but different current usages of the term are reviewed, and one is suggested as most appropriate for the design of Office Information Systems (OIS). A formal definition of office is then presented, followed by a discussion of certain general characteristics of offices. Section 1 concludes with the presentation and discussion of a definition of the term Office Information System.

Sections 2 and 3 address the second major issue, that of developing a conceptual framework for the analysis of "office work." In section 2 we review the frameworks or models of office activity which have been presented in the previous literature. Section 3 develops a hierarchical framework and an accompanying terminology which integrates many of the concepts discussed in Section 2. The major justification claimed for this framework appears to be its completeness, i.e., it attempts to include all the concepts presented in the various models reviewed in Section 2 which are considered relevant to the design of OIS.

Section 4 concludes the paper with a summary of its major points.

## 1. Basic Definitions

The term "office" can be used in any of four main senses:

1. physically, denoting a place;
2. socially, denoting a group of people;
3. organizationally, denoting a formal unit of an organization; or
4. functionally, denoting a particular function or role carried out on behalf of an organization.

It is worthy of note that researchers studying Office Information Systems have used this term in each of these senses. Moreover, even when an explicit definition is presented, it is quite difficult to remain consistent in usage of the term, as the author can testify. These two factors, in conjunction with the frequent omission of any definition at all, contribute significantly to the general ambiguity and lack of direction which characterize OIS research today.

While there seems little justification for an extensive catalogue of OIS authors and their uses of "office," the presentation of a few examples will serve to illustrate the range of meanings encompassed by the the term. Lape, for example, uses "office" in the physical sense, defining it as "the place or places that house the information and information workers of an enterprise and provide the communication facilities required to operate the business." [Lap, p. 73]. Wynn employs a social definition, stating that

... the office setting is one that typically involves a collection of people who interact mean-

ingly (communicate) and who cooperate in certain result-oriented activities. They share a language and a specialized terminology, codes of conduct that are appropriate to the setting, etc. They dress in particular ways and there exists a clear-cut social organization involving rights and duties. [Wyn, p. 12]

Ellis and Nutt take an organizational view, defining the office as "... that part of the business that handles the information dealing with operations such as accounting, payroll, and billing." [ElN, p. 28]. Hammer and Zisman are probably the strongest proponents of the functional definition, considering an office "... a system designed to realize a business function." [HaZ, p. 14]'.

#### The Definition of "Office"

We follow Hammer and Zisman, and suggest that the "functional" conceptualization of the term "office" is the most appropriate one for use in the development of Office Information Systems, assuming the goal of these systems is to enhance the efficiency and effectiveness with which organizations function. Given that we assume this functional approach a further refinement is possible. We can describe a particular office as a service provided to the organization as a whole, i.e., we can use a goal-oriented functional description. Alternatively, we can use a process-oriented functional description, which depicts the office in terms of

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'Emphasis in the original. Throughout this paper, wherever a direct quotation includes emphasis, the reader should assume that the emphasis was used by the original author(s), unless it is specifically noted otherwise.

the work-processes by which it is accomplished on behalf of the organization. These alternatives are complementary, and both play crucial roles in the OIS development process. The goal-oriented description enables us to relate the office to the organization as a whole, and guides the evolutionary process by which office procedures are integrated and streamlined over time. The structural description delineates a starting point for this evolutionary process, by clarifying the current process(es) with which this office is performed for the organization. The following definition of an office is thus suggested:

Def: An office is a particular information-handling role performed within the context of an organization in order to facilitate the achievement of (at least) one of the organization's goals<sup>2</sup>.

A number of terms used in this definition require further clarification. The term "information-handling" includes any and all activities related to the acquisition, manipulation, storage, retrieval, communication, and disposal/destruction of information in text, numeric, graphic, or other form. The set of tasks comprising a given information-handling role (i.e., a given office) may be performed by many people (or organizational units). Conversely, the component information-handling tasks of many offices may be performed by a given person or unit. The term "information-handling" should not be construed to imply

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<sup>2</sup>Henceforth this paper will use the term office in this sense. Where any other sense is meant, the term will be used inside quotation marks (i.e., "office").



physical contact with the medium on which the information exists, although this may be the case. Finally, we note that the meaning we intend by our use of the term "organizational goals" is that suggested by Cyert and March, who summarize the concept as follows.

... the goals of a business firm are a series of more or less independent constraints imposed on the organization through a process of bargaining among potential coalition members and elaborated over time in response to short-run pressures. Goals arise in such a form because the firm is, in fact, a coalition of participants with disparate demands, changing foci of attention, and limited ability to attend to all organizational problems simultaneously. [CyM, p. 43]

Cyert and March suggest that both the variables present in these constraints and the aspiration levels for these variables will shift over time, in response to changes in the interests, memberships, and power bases of the coalitions. They also consider it common, rather than uncommon, for an organization to have conflicting goals. They state that

... the decentralization of decision making ..., the sequential attention to goals, and the adjustment in organizational slack will permit the business firm to make decisions with inconsistent goals under many (and perhaps most) conditions. [CyM, p. 43]

Consider, as an example of an office, the office of payroll preparation. We contend that payroll preparation is an information-handling role because its component tasks can certainly be classified as information-handling (as discussed above). These tasks typically include time-card preparation by the individual employee, approval by the

employee's supervisor, communication of the approved information to the payroll unit, verification of time-card computations, determination of sick, holiday, and/or vacation pay eligibility (when appropriate), etc. Obviously, payroll preparation occurs within the context of an organization. Performance of the office facilitates the achievement of the goals of several organizational coalitions, e.g., owners and employees. Owners achieve their goal of making a profit on their invested capital only if the appropriate combination of employees are present and carry out their assigned responsibilities. The regular and accurate preparation of payroll encourages this action on the part of employees, and thus (indirectly) facilitates achievement of this goal of the owners. The employees, on the other hand, find their goal of transforming labor into a more widely accepted medium of exchange (money) directly served through the performance of payroll preparation.

It is instructive to note that, while many organizations have a unit formally charged with responsibility for the preparation of payroll, i.e., a payroll section, many of the tasks included in the office of payroll preparation are carried out by organization members who have no formal affiliation with the payroll section. Moreover, almost every individual who executes a payroll preparation task will also execute tasks which have no relation to payroll preparation.

### Characteristics of Offices

An office may be either formal or informal. The component tasks of a formal office will generally be clearly specified in job descriptions and will usually relate in direct fashion to the achievement of published organizational goals. Those comprising an informal office will not be clearly specified in job descriptions, and often will not be specified explicitly at all. Performance of an informal office may contribute to the achievement of the published organizational goals, to the goals of a particular group or coalition within the organization, or to both. As examples of formal offices, we suggest those of customer sales and personnel acquisition; juxtaposed to these are the informal offices of customer relation maintenance and employee socialization. Most positions (i.e., jobs) in an organization entail the performance of tasks associated with both formal and informal offices--in some cases the task associated with the formal office is primarily a "front" for the task associated with the informal one<sup>3</sup>.

Why is this distinction between formal and informal offices relevant? Oftentimes, formal and informal offices are

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<sup>3</sup>For example, consider the appointment of Charles Colson as a Special Legal Counsel in the Nixon White House organization. It is extremely unlikely that the tasks Colson actually performed, which included planning and staffing covert (and illegal) activities intended to sabotage the McGovern presidential campaign, were specified on Mr. Colson's appointment forms. Undoubtedly, these forms specified some tasks which Mr. Colson was to perform as Special Legal Counsel, and these tasks "fronted" for the informal tasks he was actually intended to execute.

closely intertwined. A specific information-handling task may be part of two offices, one formal and one informal. The task of interviewing a prospective employee, for example, is part of the formal office of employee acquisition and the informal one of employee socialization. Unfortunately, many OIS designers focus on the formal offices of the organization to the exclusion of the informal ones. Kunin, for example, describes the work done by a university admissions unit as a set of operations performed on student applications<sup>4</sup>. This work, to be sure, is a primary formal office performed by this unit. On the other hand, tasks related to other offices are simultaneously being executed by this unit's personnel. For example, applicants often request information concerning the status of their applications. The Admissions staff's ability and willingness to provide such information may play an important role in formulating the applicant's impression of the university's "atmosphere." The informal office of developing positive relations with applicants is not considered in Kunin's analysis. This might lead to the "rationalization" of the student acquisition office in such a fashion that less application status information is available, interfering with the staff's performance of its informal but important task of responding to applicant's inquiries.

Similarly, an office may be either primary or secondary. A primary office is an information-handling role whose

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<sup>4</sup>Cf. Ch. 4 and Appendix C. in [Kun].

performance contributes in direct fashion to the service the organization provides society as its own ratio existendi. For example, the office of client auditing in a Big Eight accounting firm, the office of mail delivery in the U. S. Postal Service, and the office of news collection and preparation in a daily newspaper, are all primary offices. A secondary office, on the other hand, entails performance of an information-handling role which enables the organization to perform its basic service to society, but which is not an integral part of the performance of that service. A good example is the office of payroll preparation in the U. S. Postal Service (or for that matter, in practically any organization). Other examples include the offices of resource acquisition and preparation (personnel, purchasing, and finance) and general management. Often, the formal secondary offices performed in an organization are collectively referred to as administration.

While some researchers<sup>5</sup> have suggested that this distinction between primary and secondary offices has important implications for the design of information systems in their support, we take the opposite position. Consider, as a counterexample, the information systems support required by an internal auditor and that required by an external

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<sup>5</sup>Bair proposes this distinction as important for the evaluation of OIS [Bair in LBS, p. 164]. Olson describes the term Automated Office Systems as referring to "... computer and communication technology for supporting administrative procedures in an office environment." [Ols in NYU, p. 1]. Ellis and Nutt's definition of office (above) also restricts itself to the secondary office.

auditor, or that required by a personnel department and that required by an employment agency. Many of the same requirements will be present, because the fundamental nature of the information-handling role is very similar. An important implication of our definition, then, is that no office is inherently either primary or secondary.

Another characteristic of the office is its ongoing, cyclical nature. The tasks whose execution comprises the performance of an office are not performed a single time, for once and for all. Rather, they are repeated over and over again, because the organization continues to require the service provided through performance of the office. The office of payroll preparation, for example, is not performed once, but is performed in its entirety each pay period. Similarly, the mail is not delivered once, but is delivered approximately three hundred times each year. Performance of an office entails the regular occurrence of a pattern of events, or, equivalently, the regular execution of a structure of tasks leading to the occurrence of that event pattern.

#### Is an office an organization?

Is an office, in the sense we have adopted above, an organization? Galbraith offers the following definition of an organization.

... organizations are (1) composed of people and groups of people (2) in order to achieve some shared purpose (3) through a division of labor (4) integrated through information-based decision

processes (5) continuously through time. [Gal, p. 3]

An office, by our definition, fails to meet Galbraith's first criterion, for it is not "composed of people and groups of people." The term as we use it here denotes an information-handling role--a set of information-handling tasks. The execution of any of these tasks, and the performance of any office, to be sure, will require action on the part of people. Consider an example of this distinction. We can train salespeople to complete credit sales forms. The act of sales form completion, an information-handling task, is a component of the customer sales office. The salesperson is not part of this task, but rather executes the task. In general terms, we distinguish the act from the actor'.

Why are we so adamant in our separation of people and offices? There is one basic reason: either the person or the office can be used as a basis for the aggregation of tasks. Each person in an organization has a job, a set of tasks he or she is assigned to execute. Analogously, each office in an organization is performed through the execution of a set of tasks. Our contention here is that task aggregation by office will enable more efficient and effective organizational performance than will task aggregation by per-

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'This distinction should in no way be understood as implying that people are not an important consideration in the design of OIS. People are extremely important! No office is performed without people. Indeed, perhaps the most significant research contributions to OIS design have been made by Human Factors researchers. The approach this research project takes is intended to complement the Human Factors approach.

son (or job), because it will allow us to endow the system with more-specific knowledge based on the task context. Furthermore, we contend that office-based task aggregations are more constant within and between organizations than are job-based or unit-based aggregations. This, in turn, implies that OIS modules supporting the enactment of "generic" task structures may be developed once for use in many organizations, with significant savings in terms of development costs.

If our goal is to support the person, we will design an OIS workstation which provides support for the tasks executed by that individual, e.g., document creation or spreadsheet analysis. While excellent OIS support may exist for that task as a task, the OIS is given no opportunity to apply any knowledge of the office to the support of the task. The possibility of improved support is sacrificed, because the task has been removed from the context of the office, in which it has greater meaning to the organization.

Consider as an example the preparation of a corporation's annual report. Ordinarily, sections of the document will be prepared by different people, including the president, chairman of the board, comptroller, external auditors, etc. These sections are then assembled according to a fairly well-established format. This process of assembly will require human intervention if it is performed by OIS which does not distinguish preparation of an annual report from the preparation of any other document. If the system "knows"



what an annual report "looks like," where to find its component sections, how to assemble them, and the desired physical format, no human intervention in the task of annual report preparation is necessary. After the report has been assembled, it may be automatically routed to the section authors (and other interested parties) for review. The additional support suggested here is made possible by relating the task to the office.

Returning to our consideration of Galbraith's definition, let us ask whether an office satisfies Galbraith's other criteria. It has a purpose, the facilitation of achievement of an organizational goal. As will be seen later in this paper, every office can be decomposed into its component tasks. A structure with certain control and error-handling capabilities allows synthesis of these tasks into the office. Analogous to the ongoing nature of the organization, and indeed derivative from it, is the cyclical or periodic nature of the office.

In a sense, then, if we restrict ourselves to organizations whose societal function is an information-handling one, we can suggest that an organization is fundamentally a set of people plus a set of offices<sup>7</sup>.

#### The Definition of "Office Information System"

Based on our definition of the term "office," we sug-

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<sup>7</sup>This restriction is necessitated by our definition's exclusion of material-handling roles from consideration as offices.

gest the following definition of the term "Office Information System."

**Def:** An Office Information System (OIS) is a particular instance (or example) of the application of information-oriented technologies to a set of offices (or information-handling roles) in an organization in order to increase the efficiency and/or effectiveness with which that set of offices is performed.

Again, clarification of certain terms is in order. The term "office" is used as defined above. The term "information-oriented technologies" encompasses a broad range of technologies, including telecommunications, micrographics, and xerographics. At its center, however, is a set of computer-based technologies: Word Processing, Data Processing, Document Management Systems, Data Base Management Systems, Decision Support Systems, Computer Graphics, and others. There are certainly strong interrelationships between the computer-based technologies and the others--these are manifest in such phenomena as Computer Output Microfilm/Microfiche, teleprocessing, intelligent copiers, and local area networks. It seems reasonable to assume that, in the near future, all these technologies will be regarded as branches of a single technological family.

This is a functional, rather than a structural definition. Given the rapid development of these technologies, the actual hardware and software components and configurations of an OIS may be subject to frequent change. Furthermore, it is our intention to demonstrate that different OIS configurations are appropriate for different types or classes

of offices. For these reasons, a structural definition of OIS, one which defines it by listing its components and their interrelationships, is neither possible nor desirable.

It is important to realize that this definition of OIS is extremely broad one. Indeed, one might well ask whether any computer-based processing done within an organization could be outside its scope! As the definition stands, the only information-handling activities not included are those which support a task (i.e., a component of an office) rather than an entire office. For example, use of an electronic calculator to perform payroll calculations is an application of information-oriented technology to support a task which is part of the payroll preparation office, but is not an OIS.

Thus, we conceptualize an OIS as being a broadly based system integrating the existing Word Processing, Data Processing, and Decision Support Systems which support a given office in the organization. While this may seem a grandiose proposition to some, we may note that some form-based office software packages currently under development or in use are essentially an alternative approach to developing integrated Data Processing Systems. Packages such as Lum et al.'s Office Procedure Automation System (OPAS) and Zloof's Office-By-Example (OBE) are designed to provide these integrated DP systems and include an automatic interface to WP systems, enabling them to trigger generation of "stock" form-letters when appropriate. Further, each in-

cludes a DBMS with interactive query facilities, allowing us to classify it as a primitive Decision Support System.<sup>8</sup> Thus, our claim for a broad definition of OIS is supported by the range of functions provided in existing office software packages.

This claim is further supported by usage of the term (and equivalent terms<sup>9</sup>) in both practitioner and research-oriented periodicals. Emmett, for example, states that "OA ... embraces data processing, word processing, and a number of other disparate functions ..." [Emm, p. 98]. Similarly, Carlisle defines "true [office] automation" as

... the integration of computer and communications technologies with new management policy to reduce the human effort, awareness, calculation, and judgement in performance of repetitive and similar processes necessary to the success of the organization. [Car, p. 48]

Other examples of broad definitions are offered by Kunin [Kun, p. 13], Hammer and Zisman [HaZ, p. 14], and Carlisle [Car, p. 47].

## 2. A Review of Office Activity Frameworks

In order to discuss in a systematic fashion the information-handling work done in the course of performing an office, it is necessary to adopt a complete and consis-

<sup>8</sup>cf. Alter's DSS taxonomy [Alt].

<sup>9</sup>Equivalent terms include the Automated Office, the Office of the Future, Integrated Office Systems, Office Automation, Office Information and Communication Systems, Automated Office Systems, Burotique or Burotics, and various other permutations or combinations of the component words used in the above terms.

tent framework and terminology. Bair, for example, notes that "A model of office information processing is necessary to guide the development of assessment methodology and the assessment process." [Bair in LBS, p. 163]. This framework or model should facilitate the delineation, analysis, and comparison of the work tasks completed in the performance of an office, as well as the integration of research findings on such activities. In this section we review several models suggested by OIS researchers, as well as the relevance of a general framework presented in the context of Management Information System research. The following section will present the framework and terminology which will be used throughout the remainder of this work.

Researchers at Massachusetts Institute of Technology have developed the Office Analysis Methodology (OAM) as a technique for "... conducting research into the nature of office work ..." [BBC in Limb, p. 101]. A complete description of the methodology is found in Sirbu et al. [Sir], and a condensed description in a paper by Bullen et al. [BBC in Limb]. These latter describe the methodology's theoretical framework for office work as follows.

OAM defines several levels of abstraction as a conceptual framework for gathering data. The MISSION of an office support group (e.g., the secretarial staff) is described in terms of purpose and goal (e.g., support the technical staff by preparing documents, handling phones, and managing office work). A FUNCTION (e.g., document preparation) is the aggregate of all the procedures that INITIATE, MANAGE, and TERMINATE the use of office resources to achieve a business goal (e.g., keying, proofreading, printing for review, and revising text). A RESOURCE is an en-

tity (e.g., a document, a word processor) that is managed to meet a business goal. A PROCEDURE (e.g., an outline of the sequence for printing a photo-composed draft) prescribes the tasks needed to complete an activity. A procedure (or the tasks specified within a procedure) will often involve the manipulation of a specific OBJECT or set of objects. An OBJECT (e.g., a typed page, an instruction book) is a tangible entity that is a component of a resource or that provides information about the resource. [BBC in Limb, p. 102]

Further, in this particular study, Bullen et al. distinguish two types of tasks performed by the office support group: other-initiated work and self-initiated work [BBC in Limb, p. 103].

The OAM framework successfully differentiates two major components of information-handling activity: actions and entities. OAM distinguishes the work-process from the resources it consumes and produces. Further, it suggests a distinction between organized sets of information-handling activities (i.e., procedures) and the higher-level activities which control procedure execution (i.e., functions). Perhaps most importantly, OAM attempts to analyze the current set of information-handling procedures within the larger organizational context.

Nonetheless, the OAM framework is not suitable for use within the theoretical construct of offices and organizations developed earlier in this work. First of all, it is clear from the examples presented in the quotation above that the OAM concept of office is an organizational one, rather than the functional one here adopted. A second problem is that the concept of mission is considered only

after the organizational unit (here the office support group) is identified. In the example given, this causes an inadequate definition of the mission. Bullen et al. identify the mission as "... support the technical staff by preparing documents, handling phones, and managing office work ..." [BBC in Limb, p. 102]. This, in our view, is far too narrow a definition of purpose and goal--we hold that the goal of the office support group is indivisible from that of the technical staff it supports. The offices performed by the organization studied, the IBM San Jose Research Laboratory, are the production and dissemination of new knowledge and the adaptation of new and existing knowledge to meet the information-handling requirements of our society. These are the missions the office support staff members are engaged in. From this analysis, it appears clear that OAM, contrary to its claim, does not analyze the current information-handling procedures within the larger organizational context.

At a more technical level, other criticisms may be made of the OAM framework. While actions and entities are distinguished, the elements subsumed under the term "resources" are not a homogeneous class. This is clearly demonstrated by the examples presented, documents and word processors. As Hammer and Zisman suggest, a word processor is a tool; it facilitates the performance of certain information-handling activities [HaZ, p. 15]. A document, on the other hand, is an expression of information in text format. It may be an

input to an information-handling activity, or an output from one, but it does not facilitate the performance of any particular information-handling activity. A distinction between tools and information-products seems valuable for our purpose.

Hammer and Zisman suggest the following important distinctions concerning the process and means of office work.

A task is a narrowly focused activity, usually performed by a single worker. A function is an end to be realized by means of task performance. A given function may be realized in different ways, by means of different task structures. The second distinction is between tool and system. A tool is a mechanism used by a worker in performing a task; a system is a combination of components that together realize a function. [HaZ, p. 15]

Furthermore, Hammer and Zisman note that some tasks are structured, i.e., they are so well understood that automated, self-controlled systems can be constructed to perform them. Many other tasks are not so well understood; in this case, our goal is to improve the tools used by humans in the performance of these tasks<sup>10</sup>.

Hammer and Zisman also differentiate generic tools from high-level tools and automated facilities.

A generic tool (such as a typewriter or word processor) is not tailored to the specifics of the application<sup>11</sup> for which it is being used or the environment in which it is placed. A custom or application-specific facility derives additional power and capability from the fact that knowledge

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<sup>10</sup>This distinction was, of course, first noted by Simon, who differentiated programmed and non-programmed decisions.

<sup>11</sup>Here the term application may be understood as equivalent to Hammer and Zisman's definition of function or our definition of office.



about the specific activity is embedded directly into the facility. This diminishes its range of applicability while increasing its utility for the application(s) within its range. [HaZ, p. 15]

So far as the Hammer and Zisman framework goes, we find it extremely useful. One reservation we note concerns its apparent failure to provide terminology for the inputs and outputs of information-handling tasks and functions. Hammer and Zisman also fail to differentiate control activities from general work activities; both are apparently subsumed under the term "task."

Conrath defines a task as "... a well-defined piece of work or responsibility which is assigned to a given individual ..." [Con in LBS, p. 140]. This definition is similar to that presented by Hammer and Zisman, except for Conrath's addition of the adjective "well-defined." He proceeds to define a job as "... a set of tasks assigned to a given person." [Con in LBS, p. 140]. One problem with Conrath's definition of task is its failure to deal with work which is not well-defined, of which a great deal exists. Secondly, Conrath's aggregation of tasks based on people and groups rather than on office obscures the appropriate task aggregation which should be used as a basis for OIS design<sup>12</sup>.

Bair also proposes a model of office processes [Bair in LBS, pp. 163-166]. The building block of his model is the discrete work process, a segment of uninterrupted

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<sup>12</sup>cf. Section 1 (above).

information-handling activities performed by the same individual or organizational unit for one particular purpose. He elaborates the model as follows.

Processes occur in parallel, and clustered together represent the various functions of the office. Functions are the organizational roles of offices, indicated by traditional labels such as accounting, contract processing, and research. Office functions support the mission of an institution, for example, archive maintenance, banking, and air defense. Processes subsume several activities, which are the specific behaviors occurring within processes, including composing, writing, talking, and typing. [Bair in LBS, p. 164]

Bair suggests two possible classifications of processes. The first is very similar to distinction made above between primary offices and secondary offices. The second involves classification according to the location of the audience or recipient of the product produced by the process. His implication appears to be that information products (e.g., reports) can be classified according to the audience for whom they are intended, and that certain characteristics of the documents can be derived from this classification. Bair does not elaborate either the specific characteristics or on the value of this classification.

In their paper describing the OPAS system, Lum et al. distinguish four related concepts: activities, procedures, tasks, and jobs [LCS]. They define an activity as "... an elementary operation that is normally handled by a single human or machine processor at one place to perform a homogeneous function that has an identifiable objective." [LCS, p. 337]. Examples of activities include filling

in a form or revising a memo. A particular instance of the execution of an activity is called a task.

Lum et al. define a procedure as " ... a set of structurally related activities to be executed in a certain manner so as to accomplish a particular office function." [LCS, p. 337]. They term a particular example of the invocation or execution of a procedure a job. The important contribution they make is that of distinguishing between an abstract description of the sequence of activities required to achieve a certain end and a particular, real-world execution of those activities to produce a specific, concrete information product.

Perhaps the most rigorously defined framework for the analysis of organizational information processing is that presented by Blumenthal [Blu]. After synthesizing Forrester's information-decision-action model, Simon's distinction between programmed and non-programmed decisions, and Anthony's hierarchy of planning and control, Blumenthal presents an integrated set of sixteen definitions which constitute his general framework. Several of the points he makes in his discussion are relevant here.

First, he distinguishes between individuals and the information processing roles they perform.

Some or all of the people in a decision center at a certain "decision-time" may be part of another decision center at another "decision-time." For example, a production planning committee may meet quarterly to promulgate a production plan for the forthcoming period; its individual members may also have day to day production-scheduling responsibilities. Therefore, certain groups of people

are not to be confused as being identical to certain decision centers, even though they may constitute a decision center at a certain time for a certain purpose. [Blu, p. 31]

Further, he notes that a given organizational unit may carry out activities related to the performance of several offices. Thus, while an unambiguous hierarchy may be constructed from the activities whose performance comprise any given office, the majority of organizational units will be located in several of these hierarchical structures. "A single focus of control is often difficult to find ..." [Blu, p. 33]. He suggests that multiple foci of control will exist for any organizational unit which participates in the performance of more than one office.

In the next section we present the conceptual framework and terminology to be used in this work. The contributions made by the research discussed in this section will be evident.

### 3. A Framework and Terminology for Office Work

Our framework includes three types of information-related concepts: actions, products, and information resources. After an overview of the relationships between and within classes, we discuss the action class in detail.

As noted above, we consider an office to be composed of alternate structures of tasks. In some cases, performance of an office requires enactment of a particular, unique task structure, i.e., the office can be performed in only one fashion. In this case, there is only one sequence of task

execution that will result in the performance of the desired office. In other cases, alternative task structures may exist. These alternative task structures may share certain tasks and sequences of tasks. A sequence of tasks which is not a complete task structure will be referred to as a task substructure. Alternative task structures for an office may share task substructures. Moreover, just as the same task may appear in task structures associated with distinct offices, similar task substructures may appear in these task structures. These "information action" terms (task, task structure, and task substructure) are defined and discussed at greater length below.

Information products are the "milestones" signifying completion of the successful execution of a task<sup>13</sup>. We distinguish three major information product classes--the text product class, the data product class, and the graphics product class. Members of the text product class include letters, memos, reports, and procedures. Members of the data product class include invoices, purchase orders, time-cards, and machine-readable data files. Members of the graphics information product class include charts, blueprints, and pictorial representations. Each of these product class members we will term a specific product. A sales invoice or a memo is a specific product. A particular example of an specific product will be referred to as a specific product instance. Thus, Jones Company sales invoice 1072 and the Rus-

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<sup>13</sup>cf. [Mac, p. 58].

sell Ackoff paper "Management MISinformation Systems" are examples of specific product instances'<sup>4</sup>.

Information processors (which includes processing aids) are used in the performance of an office. Following Hammer and Zisman we will consider a combination of processors which together enact a task-structure a system. A system will generally include human, mechanized, and computerized components. These mechanized and computerized components will be called tools. Where an integrated set of tools facilitates or enacts a task substructure, we will term that set of tools a facility. We further distinguish custom (or office-specific) tools from generic tools. Finally, an actual example of a system, facility, or tool will be referred to as a system, facility, or tool instance. Thus while a typewriter is a tool, the particular typewriter on Sam Smith's desk is a tool instance.

#### The Definition and Characteristics of "Task"

The atomic unit of office activity in our framework is the task.

**Def:** A task is the smallest division of (logical and/or physical) work meaningful to the organization.

Commonly we find jobs described in terms of tasks or sets of tasks, while we never find jobs described in terms of actions, the subdivision of work we use as subordinate to

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<sup>4</sup>One of the difficulties in analyzing informal offices is that frequently their component tasks do not produce concrete, tangible information products.

task. For example, revision of a document is a task, the execution of which includes such actions as reading, writing, and critical appraisal of content. The action of critical appraisal of content does not, per se, accomplish any result of value to the organization. Within the context of document revision (and within other contexts, as well) this action acquires meaning and potential value to the organization.

Any particular task can be defined to the extent that we can completely and unambiguously specify:

1. the set of conditions which cause the task to be initiated;
2. the set of logical or physical materials the task requires as inputs;
3. the sequence of logical and physical actions to be carried out in execution of the task;
4. the set of objects or states produced as outputs of the task, whose completion causes normal termination of the execution of the task's component actions; and
5. the set of error-conditions which may be encountered in the course of task performance, as well as a corresponding set of corrective actions to be taken in response.

We will classify tasks as well-defined, semi-defined, and ill-defined in accordance with the degree to which the above task components can be specified. When the five components of the task can be completely and clearly specified, the task is said to be well-defined. When all the task components except the set of initiation conditions have been unambiguously and completely stated, the task is semi-defined. When any two (or more) of the five components cannot be clearly determined, the task is considered ill-

defined.

True automation of a task entails both execution of its component actions and control of the execution process itself by machine'<sup>5</sup>. This can only be accomplished for well-defined tasks. In the complex modern organization, well-defined tasks are few and far between. Nonetheless, we see a great number of "automated" devices, performing both material-handling and information-handling tasks. Examples range from the prosaic automatic door and the vending machine to rather sophisticated devices such as the optical character recognition point-of-sale terminal and the automated teller machine (ATM). Have these tasks been truly automated?

In essence, these tasks have not been automated, but rather have been computerized or mechanized. When a task is semi-defined, these task transformations become viable options. Some of the tasks performed by the ATM, for example, are semi-defined. These include disbursing cash, answering account status inquiries, and transferring funds between accounts. On the other hand, the actual execution of certain tasks is clearly beyond the capabilities of the ATM. Consider, for example, the deposit verification task. While these machines do commonly collect deposits (in a very literal sense), they are unable to process them beyond the simple action of logging them as claimed. With respect to deposits, at least, the ATM is little more than a glorified

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<sup>5</sup>cf. [Die, p. 25].



night deposit chute. Thus the ATM computerizes only some of the tasks performed by a human teller, while mimicking others for the convenience of the customer.

It is also instructive to note how initiating conditions are handled by these machines. For example, while the ATM left to its own devices cannot determine that a withdrawal should be made from account 123, it has been given a specific initiating condition for such a transaction, such as "Initiate a withdrawal from any account when an authorized customer associated with that account so requests." In this fashion, the semi-defined task can be supported with information-handling technology, generally to the mutual benefit of both the customer and the organization.

The design of computerized or mechanized tools for use in the performance of ill-defined tasks is far more problematic. Nevertheless, some generalized support possibilities may be suggested. When inputs, actions, and outputs can be specified, tools can be developed, but their use must be restricted to actors competent to (1) certify the results produced by the tool as correct and (2) engage or activate the tool in response to appropriate stimuli. When inputs and initiating conditions can be specified, tools can assist the actor by monitoring the relevant universe for the occurrence of initiating conditions, alerting the actor to their occurrence, and locating and gathering the required inputs. When an action (or a set of actions) is well-defined,

a tool may be developed which facilitates execution of that particular (set of) action(s). Use of a hand-held calculator to perform pre-programmed statistical computations is an example of this type of support. Tools may also be developed which can monitor an ongoing process for the occurrence of certain types of error conditions, and suggest (or activate) appropriate corrective strategies (or procedures) when they are detected. An example of this type of support could be a computer system's systems software monitoring the sectors of a magnetic disk pack for the occurrence of too many parity errors, and avoiding allocation of those storage sectors in which excessive errors occur, as well as logging this information for maintenance personnel.

The degree to which we are able to develop computerized or mechanized support for a particular task is directly related to the degree to which we can completely and unambiguously delineate the components of that task.

#### The Definition of and Characteristics of Task Structures

Tasks are not executed randomly in the organization, but rather are observed in certain patterns. These patterns of tasks include the organization's task structures.

**Def:** a task structure is a set of tasks and a corresponding set of rules or judgements controlling the sequence of task execution whose successful enactment results in the performance of an office.

The term "task" is used as defined in the previous section. Performance of an office requires the execution of tasks in a logical order, and the task structure provides

rules or judgements to assure that execution occurs in the desired order. In our payroll preparation office, for example, we find a task execution rule which specifies that the employee must fill out his time-card before his supervisor can approve it, and that the supervisor's approval must precede its transmission to the payroll section for further processing. Certain tasks executed by the payroll section, on the other hand, are not logically constrained to occur in any particular order. If we consider the verification of sick pay eligibility, holiday pay eligibility, and vacation pay eligibility as three distinct tasks, we may find ourselves indifferent to the particular order in which they are executed. Generally, we would prefer that they should all occur after transmission of time-cards to the payroll section and before the generation of paychecks. Nonetheless, the task structure must impose some order on the execution of these tasks, even if this order is one derived in a purely arbitrary fashion.

Although the successful enactment of a particular task structure will result in the successful performance of its associated office, the performance of that office will not, in general, require the enactment of that particular task structure. In other words, quite commonly an office may be performed through the enactment of any one of several task structures. Consider the office of student acquisition at a University. First, we note that the university handles graduate applications in a different fashion than it does

undergraduate ones, with the schools or departments playing a far more active role in evaluation of graduate applications. Moreover, some undergraduate applicants request "early admission," and their applications are handled differently than regular applications. Furthermore, applications submitted by foreign students frequently require additional processing steps, e.g., an evaluation of English language competence and a more exhaustive evaluation of educational background. Thus we can distinguish five<sup>16</sup> task structures used to perform the office of student acquisition:

1. Graduate, non-foreign
2. Graduate, foreign
3. Undergraduate, non-foreign, regular
4. Undergraduate, non-foreign, early admission
5. Undergraduate, foreign<sup>17</sup>

Similarly, we can observe different task structures used to perform the payroll preparation office in many organizations. For example, a large retail food chain may pay clerical and supervisory store personnel each week on the basis of hours worked. Each Friday, pay vouchers are delivered to the store and distributed to the employees. Store management personnel, on the other hand, may be paid on a salaried basis, with their checks mailed to their home or deposited in specified bank accounts on their behalf. Clerical personnel at the corporate and division head-

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<sup>16</sup>At least four more task structures can be generated by considering transfer students (graduate and undergraduate, foreign and non-foreign).

<sup>17</sup>Here we assume that foreign students are not eligible to apply for early admission.

quarters may be paid with checks on a bi-weekly basis. In each of these cases, the office of payroll preparation is performed using a distinct task structure.

### The Definition and Characteristics of Task Substructure

As we observe work in an organization, we see tasks executed in certain configurations, over and over again. Some of these configurations indicate the existence of task structures, but this is not the only possibility. Consider two task structures, A and B. Suppose A consists of the ordered set of tasks {a,b,c,d,e} and B consists of the ordered set of tasks {a,b',c,d,e}. The ordered subset {c,d,e} occurs in both task structures. In our terminology, a partial task structure will be referred to as a task substructure. Here we will say that task structures A and B share a common task substructure, the ordered set {c,d,e}.

Def: a task substructure is a set of (at least two) tasks and a corresponding set of rules or judgements controlling the sequence of task execution, where both the set of tasks and the set of rules are proper subsets of the set of tasks and set of rules of at least one task structure.

The task substructure is a fragment of a task structure. It is a useful concept because certain tasks occur almost exclusively in combination with others, e.g., the tasks of document creation, review, and revision. We can combine these three tasks (and rules or judgements concerning their execution) into a document production task substructure. Alternatively, we may wish to decompose a task structure into its component task substructures enacted by

different organizational units. Finally, we may note that the different task structures enacted in performance of a particular office frequently include similar task substructures.

Let us return to consideration of the student acquisition task structures mentioned above. We note that there is a particular task substructure enacted whenever the applicant is foreign. Furthermore, the addition of this task substructure to the standard (graduate or undergraduate) task structure transforms the standard structure into the foreign student structure. Similarly, all five of the student acquisition task structures include some common task substructures, e.g., one which handles notification of the student and the Registrar concerning the student's admission to the university as a whole.

In closing this section, we note that the concept of office gives us a goal-oriented description of an information-handling role, while the office's associated task structures provide a set of process-oriented descriptions. The development of new ways to accomplish an office is essentially a process of streamlining and integrating the existing task structures of the organization. Moreover, the design of implementation strategies based on phased change of task structures may be facilitated by this framework.

#### 4. Summary

This paper has attempted to answer two questions fundamental to the design of Office Information Systems:

-- What is an "office"?

-- How can we describe what happens in an "office"?

After noting that the word "office" is commonly used to convey four related but distinguishable meanings--physical, social, organizational, and functional--we have suggested that the functional meaning is most appropriate here. We define an office as a particular information-handling role performed within the context of an organization in order to facilitate the achievement of organizational goals.

Offices may be formal or informal. The tasks comprising a formal office are generally explicitly stated in job descriptions and produce tangible information products. Informal offices are not so clearly specified, although they may be equally important. All too frequently, OIS designers focus on the concrete, formal office to the exclusion of informal office. The ongoing, cyclical nature of office activity was demonstrated.

We have differentiated offices and organizations by noting that an office, under our definition, fails to meet a major criterion of the organization--it does not include people. This position results from our contention that office-based task aggregation should be preferred to job-based task aggregation for the design of Office Information Systems. Two arguments support this position. First,

office-based task aggregation allows us to build systems providing more powerful support because we can endow the OIS with greater knowledge concerning the task context. Secondly, we contend that office-based task aggregations vary less widely between organizations than do job-based ones, suggesting that "generic" task-oriented systems will be applicable in more organizations.

In response to the second fundamental question, this paper has attempted to develop a consistent, complete, and useful framework for the analysis of information-handling activity in offices. This framework distinguishes three types of office phenomena: actions, products, and processors. Very simply, we say that products are the outcomes of actions implemented by processors.

Corresponding hierarchies of actions and processors are developed. A task is the elemental unit of work meaningful in the organizational context, and is the building block out of which task substructures and task structures are constructed. The successful enactment of a given task structure results in performance of its associated office. The task structure is enacted by a system, composed of human and machine processors. A machine supporting the enactment of a task substructure is called a facility, and one supporting the execution of a specific task is called a tool. Humans are considered humans, regardless of the breadth of their involvement in the performance of the office.



## References

- [Alt] Alter, Steven; "A Taxonomy of Decision Support Systems"; Sloan Management Review 19(1):39-56 (Fall 1977).
- [Bair in LBS] Bair, James H.; "Productivity Assessment of Office Information Systems Technology"; in Landau, R. M., J. H. Bair, and J. H. Seigman, eds.; Emerging Office Systems; Ablex Publishing Company; Norwood, NJ: 1980 (pp. 159-186).
- [Blu] Blumenthal, Sherman C.; Management Information Systems: A Framework for Planning and Development; PH; 1969.
- [BBC in IBM] Bullen, C. J., J. L. Bennett, and E. D. Carlson; "A Case Study of Office Workstation Use"; IBM Systems Journal 21(3):351-369 (1982).
- [BBC in Limb] Bullen, C. J., J. L. Bennett, and E. D. Carlson; "A Case Study of Office Workstation Use"; in Limb, J. O., ed.; Proceedings of the SIGOA Conference on Office Information Systems (Philadelphia, 1982), pp. 101-107.
- [Car] Carlisle, James H.; "How Can Office Automation Improve Administrative Productivity and Managerial Effectiveness?"; Olson, M. H., ed.; NYU Symposium on Automated Office Systems; (New York, 1979), pp. 47-51.
- [CyM] Cyert, Richard M., and James G. March; A Behavioral Theory of the Firm; PH; 1953.
- [Die] Diebold, John; "Congressional Testimony"; in Morris Philipson, ed.; Automation: Implications for the Future; Vintage Books; NY: 1962.
- [Gal] Galbraith, Jay R.; Organization Design; Addison-Wesley Publishing Co.; Reading, MA; 1977.
- [Emm] Emmett, Ralph; "NBI Expands Horizons"; Datamation 29(7):98+ (July 1983).
- [HaZ] Hammer, M., and M. Zisman; "Design and Implementation of Office Information Systems"; in Olson, M. H., ed.; NYU Symposium on Automated Office Systems; (New York, 1979), pp.13-23.
- [Lap] Lape, William A.; "Office Automation"; Proceedings of the Twelfth Annual SMIS Conference (1980) (pp. 67-76).

- [Kun] Kunin, Jay S.; Analysis and Specification of Office Procedures; MIT/LCS/TR-275; Cambridge, MA: 1982.
- [LCS] Lum, V. Y., D. M. Choy, and N. C. Shu; "OPAS: An Office Procedure Automation System"; IBM Systems Journal 21(3):327-350 (1982).
- [Mac] Mackenzie, Kenneth D.; A Theory of Group Structures, Volume 1: Basic Theory; Gordon and Breach Science Publishers; New York: 1976.
- [Ols in NYU] Olson, M. H.; "State of the Art of Automated Office Systems"; Olson, M. H., ed.; NYU Symposium on Automated Office Systems; (New York, 1979), pp. 1-6.
- [Per] Perrow, Charles; Complex Organizations: a Critical Essay (2nd ed.); Scott Foresman; Glenview, IL: 1979.
- [Sir] Sirbu, M., S. Schoichet, J. Kunin, and M. Hammer; "OAM: An Office Analysis Methodology"; MIT Laboratory for Computer Science; OAM-15; October 1980.
- [Wyn] Wynn, Eleanor H.; "Office Conversation as an Information Medium"; Ph.D. dissertation, Dept. of Anthropology, U. of California (Berkeley); 1978.
- [Zlo] Zloof, M. M.; "Office-by-Example: a Business Language That Unifies Data and Word Processing and Electronic Mail"; IBM Systems Journal 21(3):272-304 (1982).