1. INTRODUCTION

The significant role communication plays in the office is well recognised in the literature and has been written about by many.\textsuperscript{1,13,14,19,20,48,49,53} It is a truism to state that most office work relies on various groups' abilities to communicate. In addition, as the number of people working in offices increases, and their need to cooperate grows, communication and its supporting technology will take on an increasingly significant role in the future. Indeed, we already note a shift in the emphasis of office automation from personal support to systems that promote group interactions.\textsuperscript{6,7,11,16,22,28} No wonder, then, that concepts of communication and language are so pervasive and that all office modelling approaches are based on some explicit or implicit underlying theory (view) of language.\textsuperscript{33}

Yet, understanding the precise role of communications in the office is not a simple matter. Communications take on many forms: from the simple utterance of a single word or sentence in a casual chat to the complex set of formal interactions which occur in the course of a conversation between two or more organised bodies through forms and associated procedures. It is apparent that in order to capture the richness of communications in the office, and yet keep the analysis sufficiently simple, we need a view of language that is conceptually sound and rich, but which is intuitively appealing and provides a basis for practical methods and tools. It is our claim, in this paper, that one view of language – an interactionist view, which sees language as the basis and outcome of social interactions – can provide such a theoretical foundation and thereby offers a fruitful basis on which to base office models and tools. In fact, several recent office tools are sympathetic to such an interactionist view.\textsuperscript{10,14,21,25,43,46} None, however, has specifically implemented an interactionist view in office modelling nor explored what impact this makes to the analysis of office tasks.

In this paper we pursue this research avenue by attempting to integrate the salient concepts of speech act theory\textsuperscript{3,11,14} with a knowledge of discourse behaviour (conversations) to yield a set of constructs for studying office communications. We refer to the application of these constructs as discourse analysis, which forms the basis of the SAMPO office modelling approach. These constructs act as a vehicle for analysis of complex social interactions encountered in offices. We believe that these constructs provide a firm basis to develop higher-level 'conceptual' models of offices dealing with social goals, intentions and contracts in a way that is theoretically grounded. This contrasts sharply with current models which concentrate on modelling the 'physical' or 'logical' work flow within the office (i.e. the syntax and physical structure of communications). Elsewhere,\textsuperscript{9} this claim is demonstrated by comparing SAMPO with two other models: IC\textsuperscript{12} and OSSAD\textsuperscript{6,8} and by showing that these two models are inherently weaker in dealing with social communications and interactions in the office.

The paper proceeds as follows. Section 2 reviews the broad area of office models/modelling, noting how the existing approaches differ in orientation to our discourse analysis approach. Section 3 presents the key concepts and ideas of speech act theory and discourse behaviour which are necessary for undertaking discourse analysis. Section 4 discusses our particular discourse theory-based approach, SAMPO, to study office communications and presents an example of how it can be applied.

2. BACKGROUND AND RELATED RESEARCH

Tools and approaches for modelling offices are not new. They have been around for more than two decades. Early approaches were largely based on the application of conventional information systems development methodologies to the office domain. Later, researchers such as Zisman\textsuperscript{55} and Ellis\textsuperscript{54} suggested that such approaches were likely to be inappropriate because the office was a somewhat different domain with different needs and functions. Since then, several researchers have developed approaches and models which are specifically targeted on the office and its particular requirements. These are the subject of this section.
It might be argued that the function of an office model (and/or office modelling approach) is to represent an office in some analytic fashion. Newman contends that it is a hypothesis about the way an office functions.\textsuperscript{37} He notes that office modelling has as its aim the 'construction of a single model, or a consistent set of models, that provide an accurate and complete description of office activity'. In most approaches the concept of 'accurate' and 'complete' description has been interpreted as follows: an office model represents a complete and consistent set of 'information flows' in an office, i.e. it models transfer and storage of information objects in an office environment. Consequently, communications are viewed as transfers of 'information objects' between office actors. Modelling of 'communications' takes here a decidedly formalistic approach in the sense that all transfers must be captured (completeness requirement) and they must be represented in a conflict-free fashion (accuracy).

For example, Ellis' Information Control Nets (ICN) model is a mathematical flow model which provides a formal description of the information flow within an office.\textsuperscript{12} It defines an office as a set of interrelated 'procedures' which can be further divided into a set of activities that access and update information stored in 'repositories'. The execution sequence for the activities is determined through 'precedence constraints'. These are simple rules stipulating the immediate successor activity for each parent activity. Upon completion of an activity, one of its successor activities is allowed to proceed. Ellis contends that these four primitives (procedures, activities, repositories and precedence constraints) are sufficient constructs for representing what occurs in an office. (See also Ref. 2, where ICN is described and analysed in more detail.)

Zisman's SCOOP is another 'information flow'-based office model.\textsuperscript{36} Here the office is interpreted as a set of actions which are triggered by events and are represented in the form of augmented Petri nets. It is so named because the system is based on Petri nets augmented by production rules; these are part of a 'production system', which is the formalism for 'knowledge representation'. More specifically, the production system is made up of three parts: a set of rules or productions constituting a condition-action; a database or 'context' allowing state information to be maintained; and a rule interpreter. More recent attempts to include knowledge representation within the office modelling domain can be seen in the work of Kaye and Karam,\textsuperscript{23} and Tueni \textit{et al.}'s Activity Manager System.\textsuperscript{37}

Ladd's and Tsichritzis' Form Flow Model interprets information flow as form flow.\textsuperscript{38} They view an office as a network of stations through which forms flow. Information is collected on 'forms' as structured data, and processed at one of several stations. A 'station' is a term for an abstract entity which relates a person or their role with a physical location and device through which to operate. A form is initiated at a station within the network, processed as it moves through various stations, and ultimately terminated at a station within the network. Gibbs and Tsichritzis,\textsuperscript{13} recognising the need to give the forms more meaning, later refined FFM so as to incorporate data semantics. Several variations of the use of forms as a surrogate for information flow can be seen in Zloof's Office-By-Example (OBE),\textsuperscript{56} and Whang \textit{et al.}'s subsequent refinement,\textsuperscript{34} where the office is regarded as a collection of objects which can be manipulated by office workers. Other examples can be found in OPAS (Lum \textit{et al.}),\textsuperscript{32} FADS (Rowe and Shoens),\textsuperscript{39} and FORMANAGER (Yao \textit{et al.}).\textsuperscript{54}

Sasso's Task Analysis Methodology (TAM) attempts to build a model of the office in terms of three components: agents, operations and information objects.\textsuperscript{40} The model represents an agent who initiates an operation on an information object to cause something to happen: change an attribute of the information object. This is referred to as a 'task'. Task are then aggregated into workflow patterns termed 'tasks structures', which according to Sasso are organisationally recognised sets of tasks through which information objects pass. Fundamentally, TAM models the flow and transformation of information objects from one workstation to another.

Barber's OMEGA models office activities as instances of the more general notion 'problem solving tasks'.\textsuperscript{4} Technically it is a knowledge-embedding language used to embed specific office job descriptions into an office worker's workstation support of problem solving. OMEGA uses what it calls its 'viewpoint mechanism' (a general contradiction-handling facility which stores statements of rules) to reason about change and contradiction. When a contradiction arises, the viewpoint mechanism is utilised to ascertain why it occurred. OMEGA characterises office work by an explicit representation of goals and actions. It also records the activities involved in the performance of specific office tasks.

Konsynski \textit{et al.}'s OFFIS,\textsuperscript{27} while more a computer-based system supporting office analysis and design, includes within it the 'OFFIS model'—a conception of the office specified in terms of objects, attributes and relationships. Designers feed requirements and constraints represented in the 'OFFIS language', which then generates specifications that are used in the development of the OFFIS model. The model depicts the office in terms of '[objects]—a static element describing agents or data (i.e. an entity); [attributes]—descriptions of the object; and [relationships]—depicting interconnections and associations among objects. The model also represents temporal arrangements, conditions and organisational reporting relationships.

A more recent office modelling approach is that of OSSAD.\textsuperscript{8} The approach encompasses three interrelated models: the Abstract Model (AM), the Descriptive Model (DM) and the Specification Model (SM). The AM documents the essentials of an office: its \textit{raison d'etre}. It describes in a normative fashion what the office must achieve to meet its objects. The AM uses the constructs Function/Subfunction/Activity and Packet. Functions are used to describe the division of office/organisation objects, and Packets to describe the data/material objects. The DM is a descriptive model of the office, essentially specifying how the office actually works using constructs such as: roles, operations, tasks, resources, units and facilities. The SM is used for the design of a support system for the office. OSSAD also has associated with it a representational language which is used to generate a formal description of the office. The new language concerns the AM and the DM. SM specifications are suggested to be made using existing
techniques. (See also Ref. 2, where OSSAD is described and analysed in more detail.)

To summarise, all these models focus on the office in terms of information flow. Information flow is modelled as a set of interconnected operations, activities or tasks which manipulate, transfer and store information objects. Communications and other people-oriented aspects are recognised in some of them, but in most cases they are mainly reduced to the transfer and storage aspects of information objects. The role of office communication is discussed in some of the models, but the theory of communication behind them seems to be insufficient. Office communications cannot be captured by models of interrelated mechanistic operations that are sequentially and parallelly performed to support some office goal. As Klein notes, 'an office is not an information factory'. Instead, offices involve human activity whereby office actors recognise each others' utterances as intentional and significant and which they use to initiate, control and coordinate office activity and to make sense of it. Moreover, this view of office communications is the key to understanding and analysing offices because it is only through communication (i.e. discourse) that office workers are able to make sense of their environment. This is not a new idea (cf. Refs 20, 34, 48, 53), but one which continually seems to be overlooked or not given the attention it deserves by office researchers. In this paper, we specifically focus on office communications as the means to analyse offices. And this we call discourse analysis.

3. SPEECH ACT AND DISCOURSE CONCEPTS FOR OFFICE ANALYSIS

The analysis of office communications can proceed on many levels using a variety of classification schemes. For example, one could focus on singular communications or utterances, or alternatively one could study larger units of utterances/communications. The former are referred to as 'speech acts', while the latter are termed 'conversations'. These two broad types of communication are easily found in the office domain; indeed, they are endemic to much office activity. They therefore are the focus of attention in this paper.*

3.1 Speech acts

3.1.1 Basic concepts

Speech act theory is the systematic study of linguistic regularities and the meaning of utterances. The basic notion is that people do things with words. Uttering a sentence is the performance of an act, a speech act. A speech act is the basic unit of human communication,

* In analysing office communications, one might also, of course, wish to know the relationships and dependencies between various conversations that go on in an office; or one might only wish to consider particular parts of conversations, or only those that deal with a specific conversation topic. Whilst these considerations are important, we do not have the space to specifically address them in this paper.

† The term speech act was coined by Austin. When we use the term here, we do not however restrict ourselves to only spoken language. The study of speech acts also covers written texts, and the use of other symbols (gestures, flags). Moreover, linguistic speech acts do not necessarily restrict themselves to sentences; words (Fire!), phrases (Have a nice day!), or complex texts (licence agreement) also count as speech acts.

has been categorised by Searle and Vanderveken in terms of: propositional acts, illocutionary acts, utterance acts, and perlocutionary acts.†

A propositional act expresses the propositional content of a message, such as 'to write a letter'. An illocutionary act is performed whenever a speaker utters a sentence, or a set of sentences, in an appropriate context with certain intentions: for example, one can 'promise to write a letter'. A propositional act always occurs as part of an illocutionary act; it cannot occur alone. An illocutionary act is oriented towards the understanding of a message and can succeed or fail. It succeeds if the expression of the intention is achieved.

An utterance act refers to the simple uttering of an expression. For example the two utterances 'John loves Mary' and 'Mary is loved by John' perform the same illocutionary act. The utterances are usually intended to make something happen. They produce effects on the feelings, attitudes and behaviour of the hearer. The acts which produce these effects are called perlocutionary acts. Perlocutionary acts are not essentially linguistic but emotional, and cannot be analysed in more depth in terms of speech act theory. The conditions for the successful performance of a perlocutionary act are not stated in speech act theory.

3.1.2 The illocutionary act

The most important type of speech act in the office is that of the illocutionary act. The structure of an illocutionary act can be expressed in the form:

\[ \text{illocutionary act} \langle \text{context}, \langle \text{content}, \langle \text{illocutionary force} \rangle \rangle \rangle \]

Simply put, an illocutionary act consists of an illocutionary force and a propositional content performed in some context. All these constituents are important in constructing the meaning of a message, i.e. the illocutionary act performed by the utterance. The relationships of these constituents are also worth considering, e.g. understanding the content can depend on understanding the context and the illocutionary force; sometimes the context can only be constructed by understanding the content.

\[ \text{Content. } \text{Content refers to the propositional content of the message. As noted above, a propositional act is always part of an illocutionary act, e.g. the sentence 'I will come back in five minutes' could be a promise or a prediction. It is important to note that most office models only provide constructs for analysing propositional content. This is a severe drawback, because understanding a message cannot be achieved solely through the analysis of propositional content. Different illocutionary forces can be assigned to the same propositional content, and vice versa.} \]

\[ \text{Context. } \text{Context is defined in terms of: speaker, hearer, time, place, and the world of the utterance.} \]

The first four terms are self-explanatory; they describe a context where a speaker sends a message to a hearer at time \( T \) at place \( P \). Knowing who the speaker is, and the place and time, help in imagining what the speaker might say and mean. For example, a knowledge of the speaker's
position in the organisation and time frame also helps in interpreting his message. The speakers and hearers may be individuals, roles carried out by individuals, or groups.

The last term, 'possible world', refers to the residual features of the context which are relevant to the successful performance of speech acts. A possible world is something which is more than the 'actual world' and it enables us to talk about "what could be" (e.g. the future). Possible worlds include, in addition to the prevailing actual states, considerations such as the presupposed authority of the speaker over the hearer, presuppositions about a common ground of understanding, or presuppositions on the hearer's and speaker's psychological states.

There are a number of other features of possible worlds which may be important in some situations: topic (see Section 3.2.1), channel (speech, writing, etc.), audience (hearers, overhearers), code (language, style of language, etc.), message-form (chat, debate, sermon, conversation, etc.), event (e.g. a sermon in a church service). Many of these are also important in understanding office communications: (1) message-form, because we are studying different types of office communications such as negotiations, decision making, and the like; (2) audience, because in offices there may be overhearers with whom the speakers are not directly communicating but whose roles are important for understanding the flow of the conversation; (3) features of code and channel, because of possible variations in the technology used (e.g. voice/text processing); and (4) topic, because it indicates what is talked about in the speech act and how it relates to what has been said before (see Section 3.2.1).

Illocutionary force. Illocutionary force expresses two notions: (a) a speaker's commitment, and (b) how the direction of fit between the world and word is assigned to the propositional content. For example, a business order has a word-to-world direction of fit as it is intended to change the world, and the speaker commits himself to the future action of paying an invoice in return for receiving some goods or services.

The concept of commitment is important for conceiving of an office in terms of speech act theory. It suggests that offices should be seen as communication networks, which create, maintain, and fulfill commitments. Simply put, commitments are created through office communications. Moreover, various kinds of commitment are implied through different types of illocutionary acts: assertives (speaker notes some actual state of affairs); directives (speaker asks for performance of an act by the hearer); commissives (speaker becomes committed to future performance of an act); declaratives (speaker brings through the utterance a (new) state of affairs); and expressives (speaker expresses his attitudes/feelings about the state of affairs).

In addition to 'commitment' and 'direction of fit', Searle and Vanderveken note three other important aspects of illocutionary force: the illocutionary point; the assertive, commissive, directive, declarative, or expressive point (for example, in business terms an invoice and an offer is a conditional commissive) (see Ref. 25); the propositional content conditions: (e.g. temporal restrictions, one cannot promise to do something in the past); the preparatory conditions: the speaker's presuppositions about the states of the world (e.g. a presupposition for directing is that the hearer is capable of carrying out the action requested).

The illocutionary point indicates the necessary commitments and performatics. A description of the preparatory conditions leads to a structuring of the communication situation by defining in which organisational roles one can perform certain speech acts, and by specifying semantic boundaries for the content. (The analysis of these conditions highlights the integrity and security constraints for computerising office functions.)

3.2 Conversations

Illocutionary acts seldom occur alone, and in many cases they cannot be adequately understood unless they are described as members of ordered speech act sequences. These sequences of speech acts are called 'conversations'. The term 'conversation' is somewhat vague, but it can be interpreted as a generic type of discourse or a message-form (Ref. 5, p. 39). It denotes a specific form of linguistic interaction taking place in an office. A discourse or a conversation type connotes the largest unit of communication that is realised by an exchange of messages and which serves specific office goals (e.g. order processing). When we analyse offices it is important to find such sequences of speech acts (conversation types) which effectively and efficiently support the accomplishment of office tasks.

One important feature of conversations is their systematic, game-like nature; i.e. each illocutionary act creates the possibility of a finite and usually quite limited set of illocutionary acts as replies. Thus, performances of illocutionary acts as members of conversations are similar to game moves. They characterise the function of a speech act for the performance of discourse. Moves can be classified as: initiating (e.g. initiate a theme), reacting (topic-accepting, topic-rejecting, neutral), and continuing moves (e.g. confirmation plus question).

3.2.1 Context and content of conversations

Conversation takes place in some context, and to understand the conversation one needs some knowledge of the context components. The same, as noted above, is true for speech acts. With conversations, however, there are some differences: there are many possible speakers and hearers; the conversation can take place in some extended physical or organisational space; the conversation can extend over some significant time interval, and it concerns some possible world, which may change as a result of the conversation.

All context components are important in the analysis of a conversation type. The specification of conversation participants defines the organisational responsibilities.

* The term 'discourse' as known in discourse analysis concerns language use in general. Hence, discourse analysis studies all sorts of linguistic texts, e.g. books, sonnets, chats, etc. Thus, both the individual illocutionary acts and conversations can be interpreted as discourses.

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and authorities of persons involved in the conversation, i.e. the prevailing social relationships. Specifying conversation time makes it possible to trace the chronological ordering of speech acts in conversations and to anticipate the impact of the speed of message transfer and production. Finally, knowledge about place and constituent helps us to understand the selection of appropriate media for message transfer in the conversation type.\textsuperscript{19}

In conversation, the content of the conversation is called its topic. In general, the topic covers 'what is talked/written about'. Topic includes the things referred to in the speech acts, i.e. the set of the contents expressible through the speech acts. It constitutes perhaps the most important aspect of the conversation topic.\textsuperscript{*} Another part of the topic is formed by successful illocutions; the commitments that have been made and how they have been modified during the course of the conversation. Topic also covers the history of the conversation; i.e. it enables the hearer to interpret what is said in the light of what has been said in the past.

One general feature of conversations is that their topics are not fixed beforehand, but can be negotiated during the conversation. The speakers make contributions to both the existing topic and the speaker's own topic, and may create topic-shifts. A topic-shift marks the shift from one topic to another. An example of this is the shift to clarify what was said before or to question the sincerity of the speaker.

3.2.2 Sequencing of speech acts in conversations

Speech act theory provides some principles on how utterances in a conversational discourse can form coherent sequences. For example, a request 'ask' directs the hearer to perform an assertive (e.g. 'Is it raining?'), or a declarative (e.g. 'Do you take this woman to be your lawful wedded wife?'). Thus the rules for sequencing speech acts help in defining participants' conversation possibilities.\textsuperscript{†}

3.2.3 Properties of conversations

Coherency, completeness, and relevance are three central properties of a conversation. 'Coherency' deals with the success of a single illocutionary act within a conversation; 'completeness' analyses the possible scope and depth of the conversation; and 'relevance' connects the success of speech acts more closely to the evolution of the topic in the conversation.

'Coherency' strives for sorting out unsuccessful speech acts. Coherent conversations contain only those speech acts whose intention and content will be understood. Coherency also deals with how the messages are connected (Ref. 5. p. 224). We evaluate the coherency of conversations in terms of social rules. These rules are related to the social goals of the conversations. Consequently, we can interpret a conversation consisting of a request and an answer to be coherent. 'Completeness'

* Thus the propositional content of the conversation is closely related to the conversation topic: topic generalises the most important elements of the content.
† A similar idea is present in the turn-taking approach of conversation analysis.\textsuperscript{25} Examples of adjacency pairs are greeting–greeting and question–answer sequences.

3.3 Inter-conversational dependencies and conversation parts

Speech acts and conversations form the two most important levels for analysing office communications. However, they may not be sufficient in all situations. One may need other levels for examining ongoing communications.

Often, several conversations are closely related or proceed in parallel and thus need to be synchronised and managed.\textsuperscript{28} One therefore needs some vehicle for describing inter-conversational dependencies in office studies. On other occasions, the conversations form such complicated structures, or they involve so many office actors, that there is a need to provide some overall structure for them. Here single speech acts are combined into larger meaningful chunks – conversation parts – to give a more unified structure to the conversation.

The dependencies between conversations deal with how office actors or groups of actors maintain and synchronise several parallel conversations (within the same or different conversation types). There is thus a need for communication management. More specifically, there are two reasons for conversation management. First, in offices the work flow is extensively characterised by interrupts. People seldom engage in a conversation on one topic from beginning to end. Instead, conversations proceed in a piecemeal and parallel fashion. We can say that many commitments are maintained and modified in parallel all the time. Secondly, conversations may be topically related, despite their different social purpose. For example, a conversation about budgeting may restrict a conversation concerning investments.\textsuperscript{*}

The concepts we suggest for analysing conversation parts are 'staging' and 'thematisation'; both concepts serve the process of linearising the conversation. Thematisation refers to the sequential organisation of conversations. Linguistic elements in utterances (e.g. the title) will affect the interpretation of the following utterances. An example of thematised text is a business letter, where the themes are the contextual elements time, place, addressee, etc. Thematisation can help in classifying speech acts, and in structuring the conversations. For example, we may be interested in a single theme

* The issue of conversation management in office automation is currently a largely unexplored area. Although many communication problems are clearly caused by the growing complexity of conversation management (ignorance, omissions, etc.), we choose not to focus on it as it is largely tangential to our primary analysis. Some office tools, such as electronic calendars and reminders, can help in dealing with some time-critical aspects of conversation management. However, the whole field lacks a coherent framework where various tools and methods can be fitted. Also the issue of modelling inter-conversational dependencies is largely unexplored. A promising approach seems to come from the application of Petri Nets or some of its variants.\textsuperscript{38}
inside the conversation topic and structure the conversation accordingly.

Staging identifies different functional parts of conversations. It revolves 'around a particular element that is taken as its point of departure...some items and elements are brought into greater prominence than the others' (Grimes in Ref. 5, p. 134). Staging helps in expressing the cognitive structuring of linguistic elements, but it also embraces the speaker's strategy of presentation, which may be motivated by his intention (to convince, to shock, to persuade the listener to act, etc.). For example, in negotiations the communicators might add details of different features of the topics in order to influence others.

4. MODELLING OFFICE COMMUNICATIONS IN SAMPO

4.1 The SAMPO approach

SAMPO, is an acronym for Speech Act-based information analysis Methodology with computer-aided tools. It interprets information systems as social, linguistic systems for communication between people to support their action. The SAMPO project has contributed both to developing a theory of information systems and in methods for information systems development. In this paper we draw on the contributions in the systems development methodology area and apply them to the office domain. Here we try to indicate, in a broad fashion, how the SAMPO approach might be applied to a real world problem, but do not go through an entire example of its application. Elsewhere the approach is described in much more detail.*1

SAMPO's methodological support is directed mainly at the information systems specification phase. In SAMPO the specification phase is further partitioned into conversation analysis and information modelling. Discourse analysis attempts to find ways of keeping the speech act sequences coherent and to make the conversation proceed in a rational, rule-governed way. In other words, conversation analysis helps in improving the communications needed in maintaining the commitments of the organisation. It suggests concepts for analysing both linguistic activities (something said), and instrumental activities (something done). The instrumental acts can be interpreted to deal with the perlocutionary acts mentioned above. SAMPO's modelling approach embodies most of the constructs for illocutionary acts and conversations described above.

SAMPO contains a set of graphical tools and tabular presentations for analysing conversations. The symbols used in the graphical descriptions are depicted in Appendix 1. The tools can be applied to find inconsistencies and ambiguities in the coordination of commitments, to find more efficient and effective ways to perform speech acts and to control commitments, to find possibilities for reorganising current conversations or for developing new conversations. In the following we shall suggest through a simple case study how the SAMPO approach can be used to model, and perhaps even improve, office communications.

4.2 A model of a conversation about flight arrangements

The case study involves a university office which was planning and organising a programme for a large business conference. The conference lecturers were invited by members of a programme committee made up of four persons. The committee members selected and contacted the lecturers to see if they would agree to speak at the conference while the conference secretary carried out most of the administrative tasks associated with flights, fees, and the like.

The example has deliberately been kept simple. Connections to other organisational activities (e.g. budgeting and accounting) are ignored. The example shows that the commitments can easily be described, and a formal plan for the conversation can be developed. All this encourages the documentation of the responsibilities and improves the understandability of the messages. Of course, the analysis carried out here only provides guidelines for improving some parts of the conversation. For example, the content of the messages is only partly specified in the example. Thus the analysis carried out here focuses mainly on the pragmatics of the language: what are the messages, who sends them, who receives them, and what purposes they serve. The semantics could be handled by some other means, e.g. LEGOL.44

The SAMPO approach suggests that we first identify the objects of discussion—the discourse entities. These are a part of the topic, and thus a part of the context. The discourse entities include first the actor entities—the participants of the discourse—which are the conference programme committee members, the conference secretary, the travel agencies and the lecturers. Other discourse entities are the tickets and payments. The commitments made through the illocutionary acts are as follows.

(1) The programme committee member makes a promise to the lecturers to pay for their flights.
(2) The programme committee member promises the lecturers to arrange the flight reservation.
(3) The lecturer promises to make the flight reservations himself to the programme committee member.
(4) The lecturer tells how (s)he wants the arrangements to be made (the times and places) to the programme committee member.
(5) The programme committee member requests the secretary to arrange the flights, and informs the secretary of the desired flight.
(6) The secretary requests the travel agency to make the flight reservations.
(7) The secretary promises to pay the travel agency for the flights of the lecturers.
(8) The travel agency gives a promise to reserve the flight (by sending the ticket to the secretary or to the lecturer).
(9) The travel agency rejects the flight reservation.
(10) The travel agency confirms the reservation made by the secretary by sending the ticket (i.e. it gives us authority to allow the lecturers to fly); see also (14) (the travel agency sends the ticket directly to the lecturer).
The secretary confirms that the reservation has been made to committee members.

The secretary confirms that the reservation has been made to lecturers.

The secretary sends the ticket to the lecturer (i.e. we give the lecturer permission to travel at our expense).

The travel agency sends the ticket directly to the lecturer.

These are just a part of the whole spectrum of commitments made while arranging the flights. However, we believe that they form a sufficient subset to illustrate the use of the SAMPO approach. In addition to those commitments dealing directly with the flight arrangements, there are others which enable these commitments to be created, maintained and modified. These include those which permit the secretary to make her arrangements above, and those which make the lecturers committed (commissive) to come to the conference and give their lectures, and so on.

Additionally, the directives which convey the organisational permissions or obligations on how to perform other speech acts need to be considered, as they are important in specifying the communication roles. As was noted above, the success of a speech act, and thus the coherency of the conversation, depends on several conditions being satisfied. Among these are the preparatory conditions which state that the speaker has the appropriate organisational position to perform the speech act. Consequently, if these conditions are not fulfilled, the speech acts may fail.

In defining a SAMPO model, the speech acts producing the commitments listed above can be presented in a graphical form as in Fig. 1. The graphical presentation gives us an overall picture of the discourse by defining parts of the context (the speakers and hearers) and of the speech acts performed in the discourse (the topics, illocutionary points and propositional contents of the speech acts).

However, Fig. 1 depicts only what commitments are made. The next step is to derive the commitments made by the secretary. In so doing, we can also introduce precedence relations which describe partial orderings between the speech acts we presented in Fig. 1. In Fig. 2 we describe with a discourse graph a subset of the commitments made by the secretary.

Note that the graph describes a partial 'script' for communicating about flight arrangements from the secretary's point of view. It defines the necessary and sufficient conversation possibilities for each participant in arranging the flights, i.e. those speech acts which the participants are expected to express in the conversation about arranging the flights. An example of a speech act table supporting the discourse graph is presented in Table 1.

![Diagram](http://example.com/diagram.png)

**Figure 1. Speech acts in flight arrangement discourse.**
The script can also be used to delineate some relationships between different commitments made. For example, the requests made by the programme committee members and the policy of the travel agency (confirmation/rejection) direct the requests made by the secretary, as does the list of confirmed reservations. The secretary's responsibility in this example involves a negotiation process where the rejection by a travel agency directs her to request the flight from another travel agency. This can be defined in more detail in a predicate table (the circle in the graph identifies the predicate number). See Table 2.

The next analysis step is to study coherency of the conversation. Here we must identify the success conditions at each stage depicted in the conversation graph. As noted above, if the travel agency does not commit itself to a flight reservation, the secretary has to contact another travel agency. Thus, a travel agency's rejection of a request for flight reservation keeps the iteration alive. This is clarified in predicate number 1 (see the predicates in Table 2 and the discourse graph in Fig. 2). In Fig. 3 we present an example of how this can be done by a conversation graph. It defines a more detailed picture of the dynamics of the conversation.

In this example we have replaced the performative verbs by more technical terms. So, for example, !(flight-
The analysis of commitments may suggest some possibilities for improving coordination. For example, in ensuring that the travel agency supplies the tickets, and the tickets are sent to the lecturers.

The SAMPO model contains three operations for 'manipulating' commitments: create (+), modify (#), or nullify (−) a commitment. In this case, the commitment about arranging a flight for a lecturer is fulfilled when a ticket is sent to him, he has received it, and it is known that he has received it. This means that the lecturer must make a commitment: to inform the conference people when he has received his ticket (see Fig. 4).

Here the confirmation made by the lecturer nullifies (symbol −) the promise of arranging the flight made by the programme committee member. The understanding of the commitment state is important when one is designing computer support for the coordination of commitments. For example, in the case above the nullification makes the promise fulfilled. Prior to nullification, we are not allowed to mark the promise fulfilled in the office files.

The analysis of communications can be obtained in SAMPO by defining the protocols formally. The conversation graph can be transformed into a reachability tree which describes all possible conversation paths. Further insights into communications can be obtained by designing coherent and finite communications and to restrict the conversation possibilities into well-formed ones.

5. CONCLUSIONS

The purpose of this paper has basically been twofold. First, we have argued that there are deficiencies in current office models/modelling approaches, and have shown that they are founded on an inadequate conceptualisation of communications. Secondly, we have offered some insights into how speech act theory, as part of discourse analysis, can support an understanding of communi-

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**Table 2. Selection predicates**

<table>
<thead>
<tr>
<th>Number/name</th>
<th>Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Handling of travel agency rejections</td>
<td>If the travel agency rejects the arranging of the flight, contact another travel agency</td>
</tr>
<tr>
<td>(2) Arrange the flights for all lecturers</td>
<td>Repeat the request until flights for all the lecturers are arranged</td>
</tr>
</tbody>
</table>

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**Figure 3. A conversation graph (a part of the discourse of flight arrangements).**

reservation (symbol !) tells us that the illocutionary point of a request is directive and the name in parentheses defines the propositional content of the message.

In this example both replies depicted in the passage from the travel agency form an acceptable move in a coherent conversation. Some other replies (e.g. 'maybe', 'no answer') are, however, excluded from the specification (in this example) as they may cause incoherency in the conversation and create unclear commitments (there may be an incomplete answer from the travel agency which makes the commitment 'pending', and which is later clarified).

The connection between speech acts and instrumental acts is another important issue in the study of coherency. The conversation graphs offer a notation for dealing with these connections, e.g. a request for flight reservation creates the commitment to pay the travel agency for the flight tickets: (! (flight-reservation) ⇒ ⊥ (Flight payment)).

The last step in the SAMPO analysis deals with the successful termination of conversations, i.e. conversation completeness. In the example we need to ensure that all necessary flight reservations are made. Thus, the condition for termination of the iteration of request flights is that flight reservations are made for all the conference lecturers. This can be seen through other iteration predicates (predicate number 2) where the control and coordination of the commitments are checked to ensure that all created commitments are fulfilled, and that this will be recognised by all the communication partners. In the example, conference arrangers are interested, for
MODELLING OFFICES THROUGH DISCOURSE ANALYSIS: THE SAMPO APPROACH

This understanding can be used in improving models and methodologies for office system design, and in developing new computer tools for office systems. We have briefly introduced SAMPO as a vehicle for overcoming the limitations of current office modelling approaches. Elsewhere, we compare the SAMPO modelling approach with two other approaches: ICN and OSSAD.2

REFERENCES


7. R. Canning, Spotlight on group services. EDP Analyzer 24 (11) (1986).


APPENDIX 1. THE SYMBOL OF SAMPO DISCOURSE ANALYSIS

- (name) Speech act activity
- (name) Instrumental act activity
- (name) Combined activity
- (name) Speaker/hearer/agent
- Instrumental act
- Simultaneous instrumental acts and speech acts

Speech act
A speech act with a speaker/hearer
Illocutionary point symbols
Assertive
Commissive
Directive
Declarative
Expressive
Trigger

Announcement

23-25 September 1992

International Conference on 'Data Transmission - Advances in Modem and ISDN Technology and Applications', London

The international conference on data transmission is being organised by the Institution of Electrical Engineers and will be held at the IEE, Savoy Place, London WC2 from 23 to 25 September 1992.

The conference will review recent developments in high-speed modem and ISDN technology and their applications. It aims to bring together users, standards experts, manufacturers, software developers and systems integrators to improve the common understanding of the way in which modems and ISDN will evolve and coexist over the next few years.

Much of the discussion involved in the development of these new technologies occurs in standards committees, in which manufacturers rather than users set the requirements. This conference will provide a forum in which a broader audience can understand and comment on these important and topical issues.

The conference will be of particular use for telecommunications managers to develop their data communications strategy and to liaise with suppliers; data communications managers to match their product strategy to users' requirements; and computer hardware and software developers to understand trends in data transmission.

For further information contact:
Conference Services, IEE, Savoy Place, London WC2R 0BL. Tel: 071 240 1871 ext. 222. Fax: 071 497 3633.

REFERENCES

53. E. Wynn, Office conversation as an information medium. PhD dissertation, Department of Anthropology, University of California, Berkeley (1979).