Personal Mobility in Space, Time and Media: An Empirical Study of Communication Patterns and the Design and Development of Software for Advanced Telecommunications Services

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ABSTRACT

The advanced telecommunication service of Universal Personal Telecommunications (UPT) may be constructed using a context of communication following the Systemic-Functional model of the social semiotic (Halliday, 1978; Halliday and Hasan, 1985). UPT has the potential to enable users to achieve mobility in space and time through the deployment of various media. The theoretical model enables the contextual factors of Field, Tenor and Mode to be identified and modelled for their contribution to the communication patterns enabled by the UPT technology.

Empirical findings show that the dialogue of communication patterns in a modern work organisation is united by purpose and correlated with participant continuity. What changes in response to the demands of time and location is the selection of media. The finer analysis of the empirical findings reports data on the communication unit of organising meetings and identifies the ideational meanings –the propositions– that are negotiated through such exchanges.

If the data are compared with decision making conversations with the same purpose, the decisions in the conversations are negotiated, repetitive and redundant. Where the data is spread across a number of communication events, that is, a communication unit, the decisions are still negotiated but have less redundancy. In software which attempts to model the decision making processes for such applications, the phases have been kept quite distinct and part of the negotiation is handled by the system and part pushed back to the user.

Estudios Ingleses de la Universidad Complutense, 3, Servicio Publicaciones UCM, Madrid, 1995

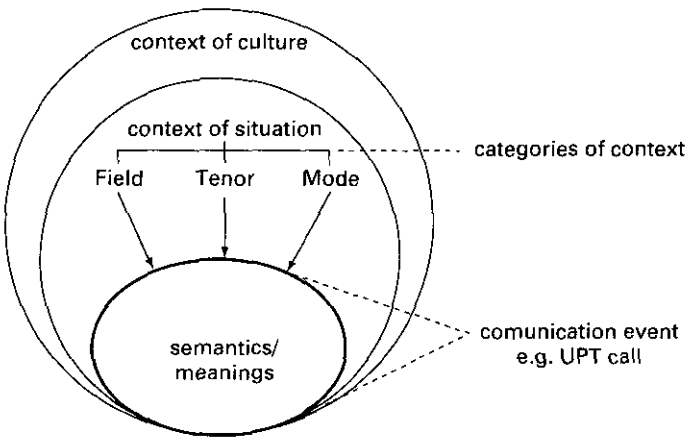
INTRODUCTION

1. *Casting UPT in a Sociolinguistic Context*

Within the social context of an organisation, the UPT call is a communicative event, an event that is essentially linguistic and social, that is, sociolinguistic. It is feasible, therefore, to cast UPT in a sociolinguistic model of communication. Such a perspective has an affinity with Winograd (1988) who identifies people acting through language, viz «language/action» as the primary dimension of human cooperative activity and takes that dimension as the framework for the design of cooperative computer based systems.

Casting UPT in a sociolinguistic model of communication (Cross and O'Brien, 1992a) provides a framework with identified dimensions. The values and calibrations of those dimensions then motivate the UPT events. That framework is the sociolinguistic context of linguistic communication, also known as the 'context of situation'. That context of situation is itself located in the culture of the participants. The sociolinguistic context in its turn motivates the semantics of the communication event. Treating communication as a semiotic system, that is, a set of systems of meaning, the context of communication can be organised according to the categories of Field, Tenor and Mode, if one takes the approach of Systemic-Functional theory (Halliday, 1978; Halliday and Hasan, 1985). The model is represented in figure 1.

Figure 1: The Sociolinguistic Context of UPT Communication



Field refers to what is happening, to the nature of the communicative event that is taking place. As such, this component includes the circumstance of the event, that is, location in time and space, its purpose or goal and its subject matter.

Tenor refers to who is taking part, to the nature of the participants, their statuses vis a vis each other, for example, hierarchical and their roles (O'Brien and Cross, 1992). The Mode refers to what part communication is playing, what it is that participants are expecting communication to do for them in that situation.

Mode includes the role of communication, whether it is constitutive of, or is ancillary to, the situation; the medium –whether the process of discourse is shared or not cf. spoken versus written; and the channel– whether the message is received in graphic or phonic form. With the latter, there is also a choice between visual contact or no visual contact. The various media technologies, such as telephony, facsimile, video conferencing, may be classified in terms of Mode. Thus a UPT call to check on the time of a meeting that is conducted via telephony, is *constitutive* of the situation, is shared viz spoken, is phonic viz audio form and without visual contact.

Being conservative, the dimensions for UPT that emerge from the categories of the model of context include:

from Field - time, space, purpose and subject matter
from Tenor - roles of the participants and status of the participants
from Mode - relation to the situation, medium, channel and visual contact

The variables described thus far for UPT are what O'Donnell (1990, p. 309) has described as «global contextual variables». In addition to the context of communication and the derived dimensions, the interactive nature of UPT communication requires a dialogic model somewhat akin to that required for a conversation in which the exchange structure consists of coordinated conversational moves (Eggins, 1990). It is noted that in order to capture the dynamic nature of the context of exchange structures a dynamic model of context is also required [cf. O'Donnell (1990)].

Unlike the dialogic model that underpins a linguistic event such as a conversation where the moves in the conversation are contiguous in time, location and medium, the events of a *communication unit* may be asynchronous in time, location and medium. A communication unit may be defined as one or more communication events that contribute to the same discourse goal(s).

2. *Network of Communication*

The model of communication that underlies advanced telecommunications services such as UPT (CCITT, 1991) must extend beyond the current

model which is based on a single event, that is, the single call model. One of the most interesting findings from empirical data gathered to examine the context of communication in which UPT would operate, was that communication does not consist of an isolated event, but communication events are tightly linked together into communication units which are more loosely tied into communication chains (Cross and O'Brien, 1992 a, b). In the next section empirical data will be presented that will contribute to the development of software for advanced applications of UPT.

3. *Empirical Data*

Three sets of data will be summarised:

i. diaries for network of communication
ii. extended two person interaction
iii. meeting organisation data

For the first two sets a brief summary of key points will be presented as this data has been covered elsewhere (Cross and O'Brien, 1993). For the third set, the data will be presented in greater detail.

3.1. Diaries for Network of Communication

In the first set of data, the diaries for the network of communication, the findings showed that the events were linked by purpose and a common core of participants. The media selected was various and it was not possible to suggest any hypothesis why a certain media was chosen. One tendency that emerged was that the events of a communication unit tended to select the same media, so that, for example, a telephone call was followed by another telephone call, an email by another email.

3.2. Extended Two Person Interaction

Breaking out the sum of the data from the second data set, the extended two person interaction, the communication unit whose purpose was to organise a meeting extended over a 16 day span. Two types of media were deployed: electronic mail (email) and telephony. The emails extend over a 16 day period. The telephonic events spanned less than 24 hours. Table 1 details the events of the communication unit. A key to the headings is presented in the appendix.

What were the factors that changed and may have motivated the choice in media? There was a change in the location of the participants. During the

Table 1: Extended Two Person Interaction

No.	Date	Start Time	Ty	Inc/ Out	In/ Rs	Cm/ InC	Ong Non	LPn	LNn	Participants	Subject
8	Day 1	10.55	e	i	0	0	1	7	9	R.S., M.C.	CRC, WRL, ComRes, Mon Visit
9	Day 1	1.38	e	o	0	0	1	8	10	R.S., M.C.	CRC, Funding, WRL, Mon Visit, ComRes
10	Day 2	4.50	e	i	0	0	1	9	11	R.S., M.C.	Mon Visit
11	Day 3	8.44	e	o	0	0	1	10	12	R.S., M.C.	Mon Visit
12	Day 16	10.32	e	i	0	0	1	11	13	R.S., M.C.	Mon Visit
13	Day 16	9.30p	t	i	0	0	1	12	14	R.S., M.C.	Mon Visit
14	Day 17	10.30	t	i	0	0	1	13	15	R.S., M.C.	Mon Visit
15	Day 17	10.32	t	i	0	1	1	14	16	R.S., M.C.	Mon Visit

email exchange, the participants were some hundreds of kilometres distant; in the Australian context, the participants were in different states. However, despite the distance, the use of telephony would have been entirely possible. During the telephonic exchange, the participants were within 20 kilometres of each other. Again, it would have been possible to communicate using other media, such as email or fax. Thus change in location is a factor, but not one that can be convincingly argued as predictive of the choice in media.

Let us examine the characteristics along which the two media of telephony and email can be differentiated. Telephony that is not extended by voicemail or answering machine requires synchronous communication, that is, the participants communicate together in time. Because of this synchronicity, the participants are able to elicit and receive virtually immediate feedback. In contrast, email is asynchronous and does not permit simultaneous and immediate feedback. Feedback is possible but it is delayed rather than immediate. There are other differentiating characteristics, for example, audio versus graphic form, but these are not significant for the question.

Let us return to the context of the communication unit. The purpose of the unit was to plan the location and timing of a face to face meeting. At the point at which the media changed, the date had been constrained to within two days and the location narrowed. So that by the time of the telephone call on day 16, the date of the meeting had been determined as day 16, 17 or 18 at the latest. What remained to be done was to choose the specific day and particular time and determine the specific location. Thus there was a tempo-

ral urgency in pinning down the time and location. It may be hypothesised that the temporal urgency necessitated a medium which presented the participants with immediate feedback and enabled *negotiation* of time and location. As will be shown below, negotiation is possible using electronic mail rather than telephony, but it requires less strict time constraints.

3.3. Meeting Organisation Data

The third set of data, the meeting organisation data, consists of two communication units with the same purpose of organising a meeting. However, in the first communication unit the media for all the communication events was email. The second communication unit is composed of one event which is a face to face conversation. The common purpose of the two communication units enables the identification of shared propositional goals that are negotiated within the two units. The two types of media give a qualitative difference to the negotiation.

The email exchange is summarised in table 2.

Table 2: Email Exchange - Organising a Meeting

No.	Date	Start Time	Ty	Inc/ Out	In/ Rs	Participants	Subject
1	29-6-93	11.26p	e	o	0	**B.H.**, A. F..	Organising meeting to discuss critique, suggest date, time, loc
2	30-6-93	10.07a	e	i	1	B.H., **A. F.**.	Confirm and detail location, suggest alternative dates
3	30-6-93	12.05p	e	o	0	**B.H.**, A. F..	Confirm date, suggest time
4	30-6-93	4.35p	e	i	1	B.H., **A. F.**.	Confirm date, time and location

Key: Bold participant = initiator.

The first observation that may be made is that the communication unit has an exchange-like structure that is comparable to moves in a conversational exchange (Berry, 1981). In the email exchange, the first participant takes a turn which is followed by a turn from the second participant. Then the first participant takes the floor, followed by the second participant. The exchange is not completed until the fourth and final email. The final email concludes with a confirmation that the meeting will take place at a certain time on a certain day at a certain location. The exchange will be examined in detail to determine the propositional structure of the exchange. The full exchange is as follows where each turn has been numbered by clauses:

Email exchange

Email 1; Speaker 1:

1. We would like
2. to respond to your comments here,
3. but feel
4. that a meeting would be more valuable.
5. Regarding a meeting,
6. we are fairly flexible-
7. we are happy
8. to come up to Sydney Uni any day (preferably not Fridays)-
9. and would prefer
10. to have a meeting this week or next.

Email 2; Speaker 2:

1. I can see you
2. if you come to Sydney
3. either Friday this week (2nd July) or Monday next week (5th July).
4. My office is in the Madsen building (just near the City Rd entrance), room G24a.
5. Please let me know
6. when you will be here.

Email 3; Speaker 1:

1. Monday 1:30 pm is all right by us
2. if it's OK by you.

Email 4; Speaker 2:

1. See you at 1:30 on Monday, at my office.

Key:

1:1 email 1 clause 1 i.e. *We would like*

The propositional structure establishes the ideational meanings, those meanings that reflect the Processes, Participants and Circumstances of the event. Clauses 1:1 to 1:4 propose the meeting (1:3 and 1:4) and establish its purpose and the participants as *we* and you. (1:1 and 1:2). Clauses 1:5 to 1:8 up to and including the spatial Circumstance *to Sydney Uni* determine the location. The latter part of 1:8 *any day (preferably not Fridays)* through to 1:10 suggest a timing for the meeting. That the meeting will take place and the participants are confirmed in 2:1. The location is confirmed in 2 :2 and detailed in 2:4. The timing is negotiated in 2.3. In 3:1 the timing is negotiated and in 4:1 the meeting, timing and location are confirmed. There are other meanings present in the text, for example, the interpersonal meanings that govern the negotiation. Clause 1:6 *we are fairly flexible* which shows that the

initiating participant is open to negotiation of the propositional content of the exchange.

From the analysis of the exchange, it may be hypothesised that the propositional goals are as follows:

(i) that there be a meeting
(ii) that there be a purpose for the meeting
(iii) that the participants be identified
(iv) that the timing be decided
(v) that a location be determined

It is important to note that these propositional meanings are negotiated in a turn taking structure. If a clausal count of propositions is taken then the most highly negotiated proposition is that of timing (clausal count = 6) which runs across all four events, followed closely by location of the meeting (clausal count = 5), which again runs across all four events. Establishing the participants runs across three clauses and two events, establishing the meeting occurs in two clauses and across two events and identifying the purpose takes place in one clause in the first event. The findings are summarised in table 3.

Table 3: Negotiation of Propositions in Email Exchange

Propositions	Count of Clauses	Count of Events/Turns
meeting be held	2	2
purpose	1	1
participants	3	2
timing	6	4
location	5	4

The second communication unit of the face to face conversation will be examined to see whether the same propositional goals are negotiated and what is the relevant weight of each goal. The exchange is as follows:

Meeting Transcript

1. Speaker 1:
1. What about the next meeting?
2. Speaker 2:
1. Er hold on.
‹omitted exchange›
3. Speaker 2:
1. Well hold on.
2. Thursday fortnight.

3. That's all right.
4. You won't be there.

4. Speaker 3:

1. Um Thursday fortnight.
2. I won't be here.
3. I'll be here next week.

5. Speaker 2:

1. I'll be here...

6. Speaker 3:

1. You won't be here next week.

7. Speaker 2:

1. ... Thursday fortnight.
2. I'll be here Thursday fortnight.
3. Yeah.
4. Which is ...
5. That's the 22nd isn't it.
6. Yeah.
7. 5 o'clock?

8. Speaker 1:

1. Yeah 5 o'clock's good.

9. Speaker 2:

1. All right.
2. That's fine.
3. I'll be back and in my right mind.
4. Sort of by then.
5. I think.

10. Speaker 4:

1. That's week one of second session.

11. Speaker 2:

1. Yeah week one of second session.
   2. I've got my first lecture on Monday.
   3. Great.

Numbering Key

3:2:1 turn 3, speaker 2, clause 1

The first turn 1:1:1 in this exchange establishes that there be a meeting which is determined as the next meeting in what has been a series of meetings *What about the next meeting?* By connection with the previous meetings some of the propositional goals do not have to be reset but are a given. That some of the propositional goals are a given underlines the intertextuality of communication in a modern work organisation (Cross and O'Brien, 1993). What has tended to stay constant for this particular series of meetings are the

purpose, participants and location. In fact it turns out that when the exchange is examined, purpose and location are a given but there is some negotiation about the participants. The participants are negotiated across six clauses and five turns (3:2:4, 4:3:2, 4:3:3, 5:2:1, 6:3:1 and 7:2:1) and the timing across 12 clauses and seven turns (3:2:2, 4:3:1, 4:3:3, 6:3:1, 7:2:1, 7:2:2, 7:2:5, 7:2:7, 8:1:1, 10:4:1, 11:2:1 and 11:2:2). There is no negotiation over location or purpose. The findings are summarised in table 4.

Table 4: Negotiation of Propositions in Face to Face Conversation

Propositions	Count of Clauses	Count of Events/Turns
meeting be held	1	1
purpose	0	0
participants	6	5
timing	12	5
location	0	0

In the negotiation of time for both sets of data the negotiation begins with a day or range of days within a constraint of one or two weeks. Only after a firm date is determined is the time negotiated. In the CU composed of email events, the negotiation of time is less redundant and repetitive than in the face to face conversation. If the time expressions in both are compared, there is more repetition in the face to face conversation with six unique expressions repeated over 12 tokens as follows:

Negotiation of Time: Face to Face Conversation

1. Thursday fortnight →
2. Thursday fortnight →
3. next week →
4. next week →
5. Thursday fortnight →
6. Thursday fortnight →
7. 22nd →
8. 5 o'clock →
9. 5 o'clock →
10. week one of second session →
11. week one of second session →
12. on Monday

In the email exchange CU there are six unique expressions:

Negotiation of Time: Email Exchange

1. any day (preferably not Fridays) →
2. this week or next →

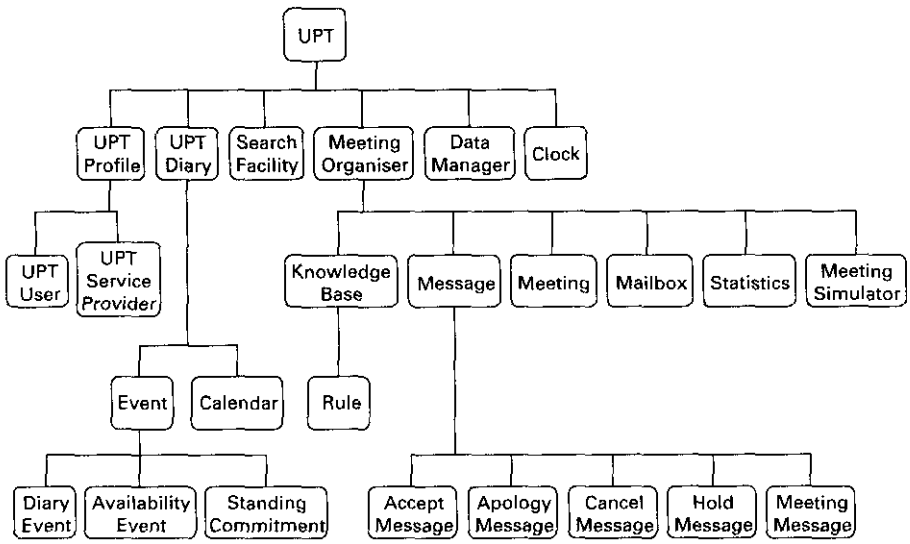
3. either Friday this week (2nd July) or Monday next week (5th July) →
4. when →
5. Monday 1:30 pm →
6. 1.30 on Monday

Thus there is greater redundancy in the conversational exchange which leads to a greater subjective impression of fragmentation and less redundancy in the CU which may give the impression of stronger phasing.

4. *Software*

The MORGAN system for capturing the functionality of organising meetings was designed and implemented using an object-oriented approach (Henderson-Sellers, 1992). The overall design is represented in figure 2.

Figure 2: Object-Oriented Design of Morgan



4.1. MORGAN: Experiential Meanings

The objects of MORGAN may be categorised in terms of the experiential meanings that they encapsulate, namely, participants, processes and circumstances.

4.1.1. Participants

The UPT profile is part of the recommended standard (CCITT, 1992) and stores information about the UPT user and the UPT service provider. The identified participants are:

UPT user
UPT service provider

4.1.2. Processes

The UPT User has available the following processes:

- Schedule a meeting;
- Review a meeting;
- Accept to a meeting;
- Apologise to a meeting;
- Cancel a meeting;
- Place a meeting on hold;
- Reschedule a meeting;
- Display messages from the mailbox;
- Send mail messages to other UPT users.

In terms of the design, these processes are part of the Meeting Organiser. The rules of scheduling meetings are also part of the Knowledge Base.

4.1.3. Circumstances

The temporal and spatial circumstances for the system occur in various places in the MORGAN system. These objects include:

1. the UPT diary
2. Meeting
3. the UPT profile

The UPT diary includes the following functionality to encapsulate circumstances:

- Upt diary;
- GMT;
- Upt diary preferences;

- Diary event screen;
- Diary standing event.

The UPT Diary handles the display of the Diary window. Diary entries are displayed in a selection table with a list of times down the left hand column. A menu is linked to the diary display table which provides the means of adding and updating the diary entries.

The GMT class is used to convert the diary event times to and from GMT according to the user's current location.

The UPT Diary Preferences handles the display of the Diary Preferences window. The window consists of a list of fields, upon which the user can type the diary preferences that they would like to use.

The Diary Event Screen handles the display of the diary entry window which enables/ provides:

- the user to select the times for the diary entry;
- a text editor so text for the diary entry can be entered;
- a multi selection in list which lists the user's communication types so the user can add an availability entry at the same time;
- a text field for the location for the availability event;
- a check box to indicate that the event is a standing commitment;
- a numeric field so the repeat duration can be set for a standing commitment;
- buttons to allow diary entries to be added or updated, deleted and one to cancel the updates.

The Diary Standing Event provides accessing methods for the standing commitment details of a diary entry.

The Meeting object stores the details of the scheduled meeting.

The UPT profile also contains location information in terms of the User's base city and base country.

One circumstantial element that is available in MORGAN which did not appear in the email and face to face texts is *the user's communication types.* This element describes the means by which the user may communicate, viz. :

face to face
video conferencing
tele conferencing
facsimile
electronic mail

In addition to the experiential meanings encapsulated through the participants, processes and circumstances, the purpose of the meeting can be set from within the Meeting Organiser.

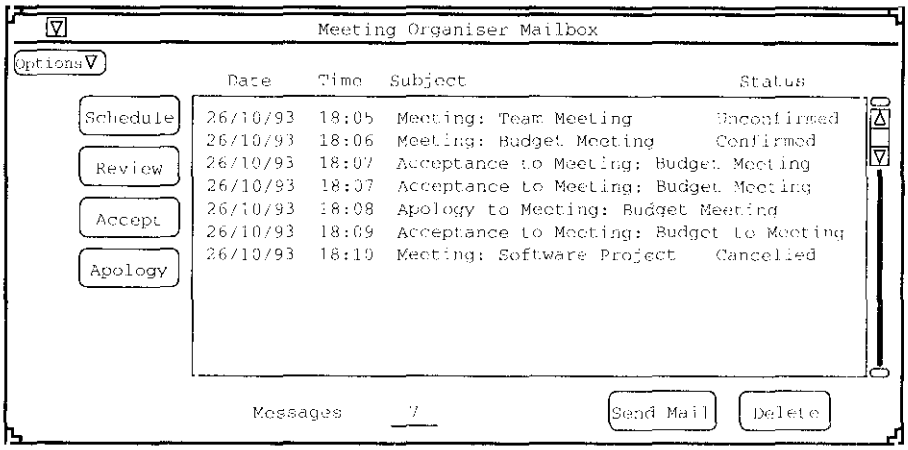
A summary of the experiential meanings is given in following table 5.

Table 5: Experiential Meanings in Email, Face to Face and MORGAN Texts

Experiential Meaning	Email Exchange Text 1	Face to Face Text 2	MORGAN Text 3
meeting be held	yes	yes	yes
purpose	yes	no	yes
participants	yes	yes	yes
timing	yes	yes	yes
location	yes	no	yes
media	no	no	yes

It has been suggested that the interface is the place to examine the realisation of the logical, interpersonal and textual meanings. Only the interpersonal and textual meanings will be discussed here.

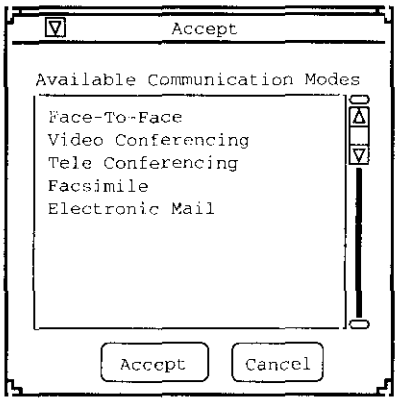
Figure 3: MORGAN Mailbox



4.2. MORGAN: Interpersonal Meanings

The dialogic or turn taking functionality is achieved through the facility of electronic mail messages. When a meeting has been scheduled, a mail message is sent to all participants of the meeting. The participants interact with the system and the reviewer through a window which provides the capability to review, accept or apologise to a meeting as the following figures

Figure 4: MORGAN: Accepting an Invitation to Attend



show. Figure 3 provides participants with a mailbox of incoming messages on the status of meetings in which they are involved.

The speech functions of review, accept or apologise are available via the labelled buttons which lead to further screens with interactive capabilities. The screen for accepting a meeting is given in figure 4.

The procedures (methods) internal to the system are responsible for carrying out the interaction between the requestor of the meeting and the users invited to the meeting. Thus the dialogic capability is incorporated into the screens and the user's interaction with the screens and into the way in which internal messages are passed between the objects of the system itself. It is of interest to note is that the system is more akin to the email text than the face to face text in that it allows an asynchronous mode of communication rather than a synchronous or immediate mode.

4.3. MORGAN: Textual Meanings

The aspect of textual meanings examined here will be that of repetition as a device for lexical cohesion. Repetition of lexical items does occur in MORGAN. However repetition is not used for confirmation as in the face to face text but rather as a means for logical connection between the screens. A lexical item on a button on a screen in MORGAN may lead through to another screen which includes that item as a header and also on a button as a speech function that may be carried out. For example the mailbox screen in figure 3 has an *Accept* button. In the Accept screen, figure 4, that item is repeated as a heading on the screen and on its own *Accept* button. Thus repetition is available as a lexically cohesive device but also as a means of logical connection in the system.

5. *Conclusions*

It has been argued that putting the advanced telecommunication service of Universal Personal Telecommunications (UPT) into a context of communication opens up the parameters through which the service may be explored. That context also demonstrates the essentially dialogic nature of the call model that governs applications of these technologies. Taking one such application area, that of organising meetings, it has been possible to identify the ideational meanings or propositions that underlie such exchanges and to describe their negotiated nature. Using that knowledge it has been possible to build application software that encapsulates those meanings and which has a comparable texture to the natural language texts.

APENDIX

Key for tables 1 and 2:
insert file key–data.wd5
Ty - type of communication
t - telephone
e - electronic mail

Inc/Out
i - Incoming
o - Outgoing

In - Initiate
1 - initiate
0 - respond

Complete/Incomplete
1 - complete
0 - incomplete

Complete or incomplete refers to the short-term unit of interaction. For example, the organisation for a meeting is a unit of communication which will be complete when everybody who will attend the meeting has responded in some way and the meeting has been scheduled.

Ongoing, Non-Ongoing
1 - ongoing
0 - nonongoing

A unit of interaction is usually linked through to an ongoing pattern and in that sense it is ongoing. In the examples, the scheduling of the meeting is linked through to the meeting itself.

LPn
linked to previous number i.e. the number of a previous communication event

LPn
linked to next number i.e. the number of a future communication event

Success:
1 - successful
0 - unsuccessful

Participants:
participants in the communication event - initials.

Subject:
Subject matter and/or purpose of the communication event

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