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**Video-Mediated Communication: Psychological and Communicative
Implications for Advice on Good Practice.**

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Abstract

This thesis investigates whether certain practices improve the use of video-mediated communication; specifically video-mediated gazing (the act of looking directly into the camera) and face-to-face familiarisation prior to video-mediated meetings. This is done through comparisons of conditions where such practices are employed and control conditions. The successful adoption of these practices is assessed using a multi-level approach: investigating the communicative process, participant perceptions and task outcome. Participant perceptions are directed towards assessing the media, assessing other participants using the media, perceptions of task performance and communicative success, and perceptions of social co-presence. In cases where task outcome is assessed, an objective measurement of performance is taken. Communicative process is assessed through investigating participants use of gazing behaviour and verbal aspects of process: for example turn length, dialogue length and the number of interruptions. Verbal aspects of process are also measured using Conversational Games analysis, where the functions of participants' utterances are assessed.

The results show that participants who gaze at the camera are perceived more favourably. Accompanying speech with video-mediated gazing also results in improved recall of information. Face-to-face familiarisation alters participant perceptions of others using the media and feelings of social co-presence. It is concluded that for certain applications (specifically social tasks) and with an appropriate level of training (specifically with the use of video-mediated gazing) the use of such strategies benefits video-mediated communication.

Contents

Introduction	16
Chapter 1: Literature Review: Summary of Human Communication	23
<u>1.1: Introduction: Chapter and thesis aims</u>	24
<u>1.2: What is communication: A definition</u>	25
<u>1.3: Oral communication</u>	29
1.3.1 Introduction	29
1.3.2 Functions of oral communication	31
A: Making contact and availability cues reference	31
B: Turn-taking and interaction management	32
C: Feedback cues: Monitoring understanding and attention	33
D: Verbal indicators of interpersonal information	37
E: Supporting deixis	38
<u>1.4: Non-verbal communication</u>	38
1.4.1 Introduction	38
1.4.2 Gazing behaviour	39
A: Making contact and availability cues reference	40
B: Turn-taking and interaction management	42
C: Feedback cues: Monitoring understanding and attention	43
D: Gaze as an indicator of interpersonal information	44
E: Cognitive effects of gaze	46
1.4.3 Gesture, facial expression and posture	48
A: Making contact and availability cues reference	51
B: Turn-taking and interaction management	52
C: Feedback cues: Monitoring understanding and attention	53

D: Interpersonal information	54
E: Supporting deixis	56
<u>1.5: Sharing a visual environment: Information about shared events objects and people</u>	56
<u>1.6: Summary: Verbal and non-verbal communication</u>	59
<u>1.7: What is successful communication?</u>	60
<u>1.8: Experimental and theoretical evidence for the differences between audio-only and face-to-face communication.</u>	61
1.8.1: Introduction	61
1.8.2: Experimental evidence	62
1.8.3: The non-verbal hypothesis	68
1.8.4: Argyle and Dean's 'equilibrium theory'	69
1.8.5: Media richness	72
<u>1.9: Chapter summary</u>	75
Chapter 2: Literature Review: Research on Video-mediated Communication	77
<u>2.1: Introduction and chapter aims</u>	78
<u>2.2: Effects of system quality and set-up</u>	80
2.2.1 Introduction	80
2.2.2 Audio quality	82
2.2.3 Delay	83
2.2.4 Image size and quality	87
2.2.5 System set-up	88
A: Experimental research on different methods for viewing partners in V.M.C	89
B: Video data vs. video links	89

C: Experimental evidence for the effectiveness of shared whiteboard in V.M.C	93
2.2.6 Discussion of system quality and set-up	95
<u>2.3: Experimental research: Evidence for the differences between V.M.C when compared with audio-only and face-to-face communication</u>	95
2.3.1 Introduction	95
2.3.2 Task outcome measures	97
A: Collaborative problem solving and simple exchange tasks	97
B: Negotiation tasks	101
2.3.3 Process measures	105
A: Making contact and availability information	105
B: Interaction management	108
C: Monitoring understanding and attention	116
2.3.4 Non-verbal responses	119
2.3.5 User perceptions	124
<u>2.4: Real world applications: Evidence for the differences between V.M.C when compared with audio-only and face-to-face communication</u>	130
<u>2.5: Advice on good practice</u>	144
<u>2.6: Chapter conclusion</u>	145
Chapter 3: User Perceptions of Video-mediated Communication and Expert Analysis of Videoconferencing	148
<u>3.1: Introduction</u>	149
3.1.1 Aims and objectives	149
3.1.2 Previous research on V.M.C	149
<u>3.2: Study 1a: Questionnaire</u>	152
3.2.1 Design	153

3.2.2 Participants	153
3.2.3 Materials	152
<u>3.3: Results</u>	155
3.3.1 Question 1: Under what circumstances would V.M.C be most beneficial?	155
A: Discussion of question 1	160
3.3.2 Question 2: Do you believe that V.M.C has advantages over communication by telephone? What are these advantages?	162
A: Non-verbal communication	164
B: Social factors	167
C: Other visual signals	169
D: Comments concerning video not having advantages over audio-only communication	170
E: Discussion of question 2	171
3.3.3 Question 3: Do you believe that videoconferencing systems can replicate face-to-face communication? Why?	174
A: Comments by users who believe that V.M.C cannot replicate face-to-face communication	174
B: Comments by users who believe that V.M.C can replicate face-to-face communication	176
C: Comments by users who agree that V.M.C may be able to replicate face-to-face communication	177
D: Discussion of question 3	178
3.3.4 Question 4: Did you note any problems when using video-mediated technologies?	182
A: Technological considerations	184
B: Social / communicative differences	185
C: Discussion of question 4	187
3.3.5 Question 5: If you could make any changes to conferencing systems for the purpose of more successful communication what would they be?	189

3.3.6 Question 6: Please add any further comments	194
3.3.7 General discussion	195
<u>3.4: Study 1b: Expert analysis of videoconferencing</u>	198
3.4.1 Experience / confidence	199
3.4.2 Importance of audio	203
3.4.3 Quality of images	206
3.4.4 Importance of familiarity	207
3.4.5 Advantages / disadvantages of V.M.C	210
A: Advantages	210
B: Disadvantages	213
3.4.6 Body language / non-verbal communication	214
<u>3.5: Chapter summary</u>	216
Chapter 4: Closing Intimacy Distance in V.M.C Through Participation in Preliminary Face-to-Face Meetings	221
<u>4.1: Introduction</u>	222
4.1.1 Aims and objectives	222
4.1.2 Previous research on social co-presence and establishing equilibrium	224
<u>4.2: Study 2: Face-to-face familiarisation and person perception across a video link</u>	228
4.2.1 Introduction and aims	228
4.2.2 Participants	228
4.2.3 Design	229
4.2.4 Materials	229
4.2.5 Procedure	230
4.2.6 Results	232

4.2.7 Discussion	234
<u>4.3: Study 3: The effects of closing intimacy distance on collaborative task performance</u>	237
4.3.1 Introduction and aims	237
4.3.2 Participants	238
4.3.3 Design	238
4.3.4 Materials	238
4.3.5 Collaborative Map Task	239
4.3.6 Procedure	239
4.3.7 Dialogue coding	241
4.3.8 Scoring	243
4.3.9 Results	243
4.3.10 Discussion	251
<u>4.4: Chapter summary</u>	257
Chapter 5: Investigations into the Effects of Video-mediated Gazing	259
<u>5.1: Introduction</u>	260
5.1.1 Aims and objectives	260
5.1.2 Previous research on gaze	261
<u>5.2: Study 4: The effects of video-mediated gazing on recall and user perceptions of a salesman and product</u>	263
5.2.1 Introduction and aims	263
5.2.2 Participants	264
5.2.3 Design	265
5.2.4 Materials	265
5.2.5 Procedure	269

5.2.6 Scoring	270
5.2.7 Results	271
5.2.8 Discussion	274
<u>5.3: Study 5: The implementation of video-mediated gazing with normal participants</u>	277
5.3.1 Introduction and aims	277
5.3.2 Methods section for recall task	278
A Participants	278
B Design	279
C Materials	279
D Procedure	280
E Scoring	281
5.3.3 Methods section for task on perceptions of salesman and product	282
A Participants	282
B Design	282
C Materials	283
D Procedure	283
5.3.4 Results	284
5.3.5 Discussion	288
<u>5.4: Study 6: Participant evaluation of most suitable level of video-mediated gazing</u>	290
5.4.1 Introduction and aims	290
5.4.2 Participants	292
5.4.3 Design	292
5.4.4 Materials	293
5.4.5 Procedure	294

5.4.6 Results	294
5.4.7 Discussion	297
<u>5.5: Chapter summary</u>	299
Chapter 6: Thesis Conclusions	302
<u>6.1: Introduction</u>	303
<u>6.2: Investigations into users perceptions of V.M.C</u>	304
<u>6.3: Investigations into the effects of face-to-face familiarisation</u>	309
<u>6.4: Investigations into the effects of video-mediated gazing</u>	312
<u>6.5: Conclusion</u>	314
References	316

List of Appendices

Appendix 1: Interview with Bill Howell and Donald West of 'Worldwide Videoconferencing.'	353
Appendix 2: Example of completed map used in 'Collaborative map reading task.'	374
Appendix 3: Accompanying list used in 'Collaborative map reading task.'	375
Appendix 4: Instructions given to participants in 'Collaborative map reading task.'	376
Appendix 5: Story on 'Vernon the very old wolf' with list of important points from story	378
Appendix 6: List of advice given to participants in study 5.	381

List of Tables

Table 3.1: Frequency of suggestions made for circumstances under which video-mediated communication would be most beneficial	156
Table 3.2: Frequency of suggestions made for advantages that video-mediated communication has to offer over telephone	163
Table 3.3: Total responses for whether videoconferencing can replicate face-to-face interaction	174
Table 3.4: Frequency of suggestions for problems associated with videoconferencing	183
Table 3.5: Frequency of suggestions for proposed solutions to videoconferencing problems	190
Table 4.1: Questionnaire data: Independent t-test scores for differences between video meeting and face-to-face meeting conditions	233
Table 4.2: Between-groups analysis of variance for video meeting, face-to-face meeting and no-meeting conditions	245
Table 4.3: Questionnaire data: Between groups analysis of variance for video meeting, face-to-face meeting and no-meeting conditions	250

Table 5.1: Independent t-test scores for correct answers, intrusions, and for questionnaire questions 1-10 for gaze and no-gaze conditions	272
Table 5.2: Independent t-test scores for correct answers on recall test and user perceptions of salesperson, product, equipment and social co-presence between advice and no advice conditions	255
Table 5.3: Independent t-test scores for total time spent speaking, total time spent gazing, number of gazes in speech and proportion of total speech spent gazing for advice and no advice conditions	287
Table 5.4: Between groups analysis of variance for questions 1-10 on questionnaire for different frequencies of gaze (0%, 25%, 50%, 75%, & 100%)	295

List of figures

Figure 3.1: Three levels of communication **180**

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Declaration

I declare that this work is my own and was completed under the normal supervisory conditions.

Introduction

Research on Video-Mediated Communication

Human communication is a major area of interest in the field of psychology. It has been argued that successful communication is an integration of linguistic and non-verbal processes. Furthermore, human communication traditionally takes place in a co-present, face-to-face context. Technological developments in the 20th century however have introduced new ways for humans to communicate. The telephone for example allows humans to communicate from geographically dispersed locations. The recent development of video-mediated technologies has also introduced a new means of remote communication. It has been suggested that the ability to relay visual images in addition to an audio-channel to communication offers the possibility of being able to more closely replicate face-to-face interaction. The manner in which video-mediated communication (V.M.C) affects our ability to communicate successfully is therefore a major academic question.

Many researchers have focused on what makes video-mediated communication different from face-to-face interaction. There is now a huge literature on the use of video-mediated technologies in applied settings. Much of this research has focused on how well humans adapt remote communication technologies to real world applications. Experimental research has also compared V.M.C with face-to-face and audio-only communication on a number of different types of tasks, for example negotiation and problem solving. Furthermore, various measures of communicative success have been investigated, for example task outcome, communication process measures and participant perceptions. Once more, a common theme in such research is the identification of the ways in which

V.M.C differs from face-to-face and audio-only communication. Far less work has been done on developing practices to improve user use of video-mediated technologies.

A number of ingenious systems have been developed which allow V.M.C to replicate many face-to-face processes. For example eye-tracking systems have been developed to facilitate gaze awareness. A problem with many of these systems however is that they are not always readily available to the user. Therefore, the aim of this thesis is to facilitate user use of the technology that is currently widely available.

This thesis seeks to investigate the effects of two specific practices, which aim to improve the use of existing technology. The effects of face-to-face familiarisation and video-mediated gazing (looking directly into the camera) will be investigated.

One major problem associated with the use of video-mediated technologies is the loss of social co-presence. Essentially, because V.M.C does not take place in a co-present environment, users often report feelings of isolation. This is partly due to the attenuation of visual cues and partly due to physical remoteness. It is therefore expected that reducing psychological distance through face-to-face familiarisation and allowing individuals to use gazing behaviour (and therefore projecting their images more effectively) will result in a number of communicative and psychological benefits. Such research will also contribute to our understanding of the psychology of social relationships and the role that visual signals play in them.

This thesis reports analyses using a multi-level approach. Participant perceptions concerning the successful adoption of video-mediated gazing and face-to-face familiarisation are assessed. These perceptions reflect participant evaluations of the media

and others using the media. They also reflect perceptions of communicative success and feelings of social co-presence. It is expected that participant evaluations will be higher when familiarisation takes place face-to-face and when participants adopt video-mediated gazing behaviours.

This thesis also reports analyses of the verbal and non-verbal channels. Verbal aspects of process are investigated through making global linguistic assessments, for example turn length, dialogue length, and the number of interruptions made by users. Such analyses will indicate whether communication is more efficient and successful. It is expected that face-to-face familiarisation and video-mediated gazing behaviours will result in a more efficient use of language. Verbal aspects of process are also measured using Conversational Games analysis, where the functions of participants' utterances are assessed. In particular, the number of times participants check their partner has understood a message, and the number of times participants check their understanding of a partner's message. This will help to identify how well participants monitor understanding and attention in conversation. It is expected that participants will be better able to monitor understanding and attention when face-to-face familiarisation occurs and when participants employ video-mediated gazing behaviours. This assumption can be justified in terms of an increase in perceived levels of social co-presence.

Communicative process will also be assessed through an investigation of participant use of gazing behaviour. Specifically, the number of gazes to the camera, the amount of time spent gazing at the camera, and the proportion of time spent gazing at the camera. This analysis will give useful insights in to whether participants adopt video-mediated gazing behaviour successfully. Furthermore, gazing behaviour plays a number of crucial roles in

communication. Therefore, an analysis of gazing behaviour will attempt to identify whether gaze can be used in V.M.C to fulfil the same roles as in face-to-face communication.

In cases where task outcome is assessed, an objective measurement of performance is taken. Measures of task performance will help to identify whether video-mediated gazing and face-to-face familiarisation aid users to complete tasks more successfully. A number of different types of tasks will therefore be assessed, including negotiation and problem solving. It is expected that face-to-face familiarisation and video-mediated gazing behaviours will help participants to complete tasks more successfully. If these expectations are met this illustrates that the use of video-mediated technologies can be improved with the use of simple practices that do not require technological alterations or advancements.

Conclusion

In conclusion, there are a number of problems associated with use of video-mediated technologies. One problem in particular concerns a loss of social co-presence, accredited to the attenuation of visual cues and physical remoteness. This thesis addresses these issues by investigating the effects of face-to-face familiarisation and video-mediated gazing. This is achieved through a multi-level analysis of participant perceptions, task performance, and communicative process (both verbal and non-verbal).

Chapter 1 of this thesis reviews literature in the area of human communication. The roles which non-verbal signals, for example gaze and gesture, play in human communication are discussed. The roles that verbal information play in human interaction are also discussed.

The aim of this chapter is to identify whether human communication is more satisfactory and successful when it takes place in a co-present environment and with access to both visual and non-verbal cues.

Chapter 2 covers a review of the literature in the area of video-mediated communication. An introduction to V.M.C, covering background information and the effects of differing qualities and set-ups of systems takes place. Field studies and experimental studies are also reviewed. A review of such studies helps to identify whether video-mediated communication is as successful as face-to-face interactions on a number of different measures, for example task outcome, user satisfaction, and communicative process. The purpose of this chapter is to ascertain whether access to visual information in a remote conferencing environment results in similar benefits as access to visual information in face-to-face interactions.

Chapter 3 reports analysis of questionnaire data and an expert analysis of video-mediated communication. The purpose of this chapter is to identify whether users of current technology view V.M.C as a viable alternative to face-to-face communication. Perceptions from users of the technology and experts in the field of video-mediated communication will also be used to help validate the focus of this research. User perceptions will help to identify the problems that exist in the use of video-mediated communication and methods that can be used to improve the use of the technology.

Chapter 4 reports findings from investigations into the effects of face-to-face familiarisation. Participant evaluations of the media and others using the media are made, comparing face-to-face familiarisation and control conditions. The effects of face-to-face

familiarisation on task performance are also assessed. Comparisons are made between face-to-face familiarisation on negotiation and problem-solving tasks. Finally, an analysis of conversational process takes place, ranging from global linguistic assessments (for example turn length, number of turns, and number of interruptions) to a more detailed coding of utterance function using the Conversational Games analysis.

Chapter 5 reports findings from investigations into the effects of video-mediated gazing. Once more participant evaluations of the media and others using the media are key. In particular, participant evaluations of other participants employing video-mediated gazing behaviours. This is compared to assessments of participant performance when no gazing behaviour is employed. Task performance is assessed in terms of recall of information. Finally, an analysis of gazing behaviour is reported. In particular, the number of gazes made to the camera, the amount of time spent gazing at the camera, and the proportion of speech spent gazing at the camera.

This thesis is therefore an examination of the effects of video-mediated gazing and face-to-face familiarisation on video-mediated communication.

The basic questions addressed in this thesis are:

- 1) How does video-mediated communication differ from audio-only and face-to-face communication?
- 2) What types of communicative difficulties arise in the use of video-mediated technologies?
- 3) Can certain practices be employed to improve user use of current technology?

- 4) Can face-to-face familiarisation reduce psychological distance and in turn improve communication via video-mediated technologies?
- 5) Can video-mediated gazing reduce psychological distance and allow participants to project their images more effectively, and in turn improve communication via video-mediated technologies?

Chapter 1: Literature Review:
Research on Human Communication

1.1: Introduction: Chapter and thesis aims

This thesis will consider whether video-mediated communication is as successful a medium of communication as face-to-face interaction. The purpose of the thesis is to consider the psychological and communicative effects of using video-mediated technologies, with an aim to determine whether certain practices can improve the use of existing technology.

In order to achieve this aim it is necessary to evaluate the functions of verbal and non-verbal communication as well as definitions of 'successful' communication. Successful communication will be considered in relation to performance measures (e.g. task performance and user satisfaction), process measures (e.g. the surface structure of conversation and non-verbal responses) and the effects of different tasks on communication. Experimental evidence will also be reviewed for the differences between co-present face-to-face interaction and remote audio-only communication. This will help identify whether human communication is more satisfactory and successful when it takes place in a co-present environment and with access to both visual and non-verbal cues. Psychological and communicative differences between face-to-face co-present interaction and audio-only communication will be explained using theories such as the 'non-verbal hypothesis' (Whittaker, 1995; 1996), Argyle and Dean's (1965) 'equilibrium theory,' and 'media richness theory,' (based on the work of Daft and Lengel, 1986).

1.2: What is communication? A definition

Cherry (1966) noted that the word communication derives from the Latin 'Communico,' meaning 'to share.' Cherry therefore postulates that communication is primarily concerned with the sharing of information. Parsons and Hughes (1970) describe communication as "the process of imparting ideas and feelings" (pg. 1). "Communication can have many purposes – to entertain, to inform, to persuade – but it is basically concerned with producing a change in the attitudes or behaviour of the receiver" (pg. 1). All of the following terms form a regular part of the communication situation.

The 'transmitter' is the individual who attempts to convey something to someone else. Communication begins when the transmitter formulates a message (Parsons & Hughes, 1970). When communicating verbally the transmitter is also referred to as the speaker. The 'message' is the material that the transmitter wishes to communicate (Parsons & Hughes, 1970). The 'medium' is the mode of communication; the channel through which the message is communicated (Parsons & Hughes, 1970). Finally, the 'receiver' is the person who receives and understands the message (Parsons & Hughes, 1970). When communicating verbally the receiver is also known as the listener.

Researchers such as Parson and Hughes (1970), Grice (1969) and Harding (1983) allude to the intentional nature of human communication. According to Grice (1969), the transmitter voluntarily sends a message with the explicit understanding that the receiver is also capable of voluntary action. The transmitter also understands that the receiver is aware that there is an intention to the transmitter's message. Harding (1983) suggests that communication takes place when the receiver reacts to a message (i.e., the message has an effect), at least one of the conversational participants views the situation as

communication, and there is an intentional element to the communication. Communication therefore takes place when the transmitter intentionally imparts a message to the receiver and this message is understood and reacted to. The message can be conveyed through any number of mediums: for example face-to-face, telephone, or video-mediated communication.

Human communication takes place on a number of different levels. Humans can communicate both verbally and non-verbally. Many researchers agree that communication is an integration of non-verbal and linguistic processes (for example, Beattie, 1980; Clark and Brennan, 1991; Goldin-Meadow, Wein and Chang, 1992; McNeil, 1985; Weiner, Shilkret and Devoe, 1980). According to Doherty-Sneddon et al this would indicate that although communication lacking visual signals (audio-only communication) is possible, it is likely to be different, or perhaps in some cases even inferior (Doherty-Sneddon, Anderson, O'Malley, Langton, Garrod & Bruce, 1997). In face-to-face communication there are two different types of visible information. The first is information about the behaviours of other conversational participants and the set of non-verbal communicative actions that they perform (such as hand gestures, eye gaze and facial expressions). The second type of visible information concerns the visible environment that conversational participants share, including access to shared objects, shared events, and information regarding the movements and activities of other people (Whittaker and O'Conaill, 1997).

So, communication is about the sharing of information or meaning. This occurs through multiple communication channels and involves speech and a variety of visual communication cues. The following sections will address the importance of these cues in human communication and the functions that they perform. Human communication

(verbal and non-verbal) can be categorised by two separate functions: those that co-ordinate content and those that co-ordinate process (Whittaker and O'Conaill, 1997). Content refers to the actual subject matter of the conversation, and therefore co-ordination of content is concerned with how participants arrive at, and maintain, common understanding in conversation (Clark and Brennan, 1991). Process refers to the actual mechanisms of the conversation itself, and therefore process co-ordination involves "the set of procedures by which participants agree to begin and end entire conversations and the rules that allow participants to switch roles between speaking and listening" (Whittaker and O'Conaill, 1997, pg. 25).

What must be considered, however, is that although emotional information can be considered content (for example yawning for effect to signal that 'I am bored'), if there is no intended communicative function for emotional information (for example yawning because you are tired), then such examples cannot be considered content. Although such information can be interesting and may be reacted to, according to Parson and Hughes' (1970), Grice's (1969) and Harding's (1983) definitions of communication cannot be considered communication due to a lack of intentionality. It should also be noted that although there is a distinction between content and process co-ordination, they are not necessarily mutually exclusive. Normally, good process feeds in to good content. Further to this divide, the importance of visual and auditory cues will be related to the needs of human interaction, as outlined by Daly-Jones, Monk and Watts (1998). These are: to make contact, to allocate turns during conversation, to monitor understanding and attention, and to support deixis.

In the following section a review will take place concerning the functions of oral communication. A distinction here should be made between oral and verbal

communication. Oral communication includes verbal information (i.e. language), and non-verbal vocalisations. Although non-verbal vocalisations can be considered non-verbal behaviour, a review of such behaviour will take place in section 1.3 on oral communication. The reason for this distinction concerns the fact that this thesis concentrates on the differences between information that can be transmitted with access to visual signals and information that can be transmitted without access to visual signals: non-verbal vocalisations do not require a visual channel in order to be transmitted. This will be followed by a review of the functions of non-verbal communication (in section 1.4). This will include gaze, gesture, facial expressions, posture and information concerning the environment: all of which require a visual channel in order to be transmitted. The aim of these sections is to discover whether visual information adds value to communication over and above oral communication. Whereas non-verbal and verbal processes are intricately linked, for the purpose of the following sections they will be considered separately.

1.3: Oral Communication

1.3.1 Introduction

Human language has evolved as a mouth-to-ear system of communication. Taylor (1976) indicates that such a method of communication is advantageous for a number of reasons. Oral communication requires no line of sight for it to take place; it can be used day and night; it requires little energy; and it is flexible (many different sounds can be combined in a vast number of ways). Typically, verbal information has been considered more important than non-verbal information with non-verbal behaviour viewed as a rudimentary predecessor or redundant associate to verbal information (Weiner, Shilkret, & Devoe, 1980). The validity of this view will be discussed in further detail later in the chapter. The use of language is what separates us from non-human primates. Non-human primates also depend on visual communication more than the oral-auditory channel. In fact, it has been estimated that only five percent of non-human primate social messages are expressed in the vocal channel (Altman, 1967). Further to this, animal communication has been noted to be limited to directives, commands and expressions of emotion (Taylor, 1976), and attempts to teach animals human language have been met with limited success (for example Hayes, 1951). Humans on the other hand use words as symbolic representations to stand for events and objects in the real world.

The number of phonemes (speech sounds) that a human being is capable of producing is far greater than those used in a given human language. Although humans are capable of producing several hundred phonemes, each language is typically built from approximately 20 to 50 phonemes (Parry, 1970). There are a number of exceptions however, and Hawaiian, for example, only uses 12 speech sounds, whereas Abkhaz uses 70 distinct sounds (Taylor, 1976). Languages also differ in how these sounds are combined to form

'morphemes,' "the minimal unit of grammatical analysis" (Taylor, 1976, pg. 51) and the basis stems of words. A word can be a representation for persistent or recurrent elements, for example an object or person. Words are also symbols for an entire class of rather different objects, for example 'father' can stand for all male parents. Words can also be applied to events, ideas and processes (Parry, 1970). Lyons (1968) emphasises that words tend to be internally stable. In other words the order of phonemes tends to be consistent, for example 'book-s' is acceptable, whereas 's-book' is not. Lyons also indicates that words are positionally mobile, in that they can come in a number of different positions in any sentence (for example 'that *ball* is red' and 'that is a red *ball*'). In all human languages, words are combined together to form sentences, and further to this all languages have universal rules concerning grammar, syntax, semantics, and phonology (Chomsky, 1957). Verbal behaviour can be further categorised as utterances, which may consist of the verbal equivalent of a sentence. The smallest utterances used by humans consist of grunts, for example the use of verbal agreements such as 'mhm-hmm,' or 'uh-huh.' (Argyle, 1969).

Utterances can be classified in many different ways. For example, an utterance can be classified in relation to its intended function (described more fully in relation to speech acts later in the chapter). Bales (1950), for example, found that verbal utterances could be classified into 12 distinct categories. These include agreement, disagreement, asking for opinion, asking for suggestion, giving suggestion and giving opinion. A further distinction can be made concerning whether the utterance is about something external to the conversational partners or whether the utterance is directly related to conversational participants or the interaction that is taking place between them (Lennard and Bernstein, 1960). Different classes of utterance may have different effects on the interactors, for

example, a question should lead to an answer (whether it be right or wrong) or an order may lead to an action. Such sequences form what has been called ‘adjacency pairs’ (Schegloff & Sacks, 1973). Utterances may be further categorised by the topic of conversation. Topics can be personal, impersonal, abstract or remote, for example (Argyle, 1969). While vocal communication can be considered on many levels, the primary focus of this thesis is at the level of communicative function.

1.3.2 Functions of oral communication

Oral communication serves many functions. Oral communication can be used to co-ordinate conversational content (for example monitoring understanding, feedback cues and interpersonal information cues) and co-ordinate conversational processes (for example making contact and interaction management) (Whittaker and O’Conaill, 1997). All these functions are discussed in the following sections.

1.3.2A Making contact and availability cues reference

Communication is a joint activity that requires both co-ordination of process and content (Clark & Wilkes-Gibbs, 1986). The first necessity of human interaction is to identify a conversational partner and then establish contact with him/her. Linguistic behaviour is particularly useful in initiating an interaction with another person, for example through explicit vocal greetings such as “hello” or specific questions such as “how are you doing?” The recipient is not a dormant partner in this exchange, however, and may indicate a willingness to be contacted by providing a vocal acknowledgement, or indeed may signal vocally that they do not want to be contacted (Daly-Jones et al, 1998). Schegloff (1968) has coined this co-operative process a ‘summons-answers sequence.’ In other words, the process through which the caller attempts to make contact with a recipient, who in turn

signals whether or not they are available for communication. This process however, does not necessarily have to take place face-to-face, and indeed Schegloff (1968) points out that a telephone ring and the subsequent answering share many similar characteristics. As will be noted in section 1.4 on non-verbal communication, a number of researchers consider visual cues to be particularly important for making contact with others (for example, Heath 1984; Suchman and Wynn, 1984; Schegloff, 1968; Frolich, 1995).

1.3.2B Turn-taking and interaction management

Once an exchange has been set-up it also has to be managed. One important aspect of this is the negotiation of conversational turns between speakers. In order to attain a high level of interactivity, switches between speaker turns should be smooth and should not disrupt the overall flow of conversation. In order to achieve this speakers can use a number of devices (for example intonational, syntactic and pragmatic) in order to signal that they are about to finish their turn. The fact that listeners are able to predict when speakers are about to finish means that pauses between speaker switches are usually very small. Jaffe and Feldstein (1970), for example, found that pauses usually varied between 620 msec and 770 milliseconds. In many cases pauses do not occur at all, with an actual, but typically not perceptual overlap in speech being evident. Turn-taking is also regulated in the linguistic domain through the use of overt cues. In order to select the next speaker, individuals can aim direct questions at others for example.

Several aspects of speech contribute to the co-ordination of turns within a conversation. Duncan and Fiske (1977), note that transitions from one speaker to the next are co-ordinated by the completion of a grammatical clause, the rise or fall in voice pitch at the end of an utterance, any drawl or expansion of the final syllable and the use of stereotyped

expressions such as 'you know.' These behaviours have been referred to as 'regulators' (Ekman and Friesen, 1969) of talk and help to structure turns and guide the flow of conversation. Other aspects of spoken delivery for example restarts, hesitations and pauses in speech can also serve in aiding the transition from one speaker to another. An example of this comes from Schegloff (1987), who described 'recycled turn beginnings.' A 'recycled turn beginning' occurs when a conversational participant pauses and then restarts immediately. This device is used to keep hold of the conversational floor through claiming another turn and holding onto the floor even if this turn is interrupted by other conversational participants.

During conversation speakers can also formulate messages that define the possible responses of the listener. Thus a question begs an answer. For example, asking someone directly "what is your opinion on this?" requests another individual to take a turn, but limits the response to the topic indicated by the speaker. This particular resource identifies clearly the potential points of entry into the conversation, and in turn provides a means by which to judge the how appropriate the response is (Sacks, Schegloff, & Jefferson, 1974).

1.3.2C Feedback cues: Monitoring understanding and attention

The communication process is more complex than the expression of predefined sentences at suitable moments. Rather, communication is a dynamic process in which the composition and delivery of our utterances are linked to the responses and actions of those with whom we are conversing. In other words the manner in which we communicate is affected by the responses, both verbal and non-verbal, of those we are talking to (Daly-Jones et al, 1998). According to researchers such as Clark and Schaefer (1989), Goodwin (1979) and Garfinkel (1967) speech is not predefined but rather is formed to a large degree

