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Abstract:

This report integrates previous Eye-2-Eye findings obtained by the project's in-depth interviews, laboratory experiments and field study. It also describes the rationale, procedures, results and conclusions of three focus group studies performed on key issues identified from the previous Eye-2-Eye results. These are: 'The relationship between medium preference, task performance and medium choice', 'The rationale for medium choice' and 'Medium dependent social presence and person perception'. Results are provided for each focus group and general conclusions are drawn regarding the validation of the project's previous findings, the generalisation of the project's findings to other user groups and future applications of real-time communication services. It is concluded that project findings in general have been validated by the focus group participants. Regarding generalisability, the results from the field study seem to apply to other user groups as well, such as youths and professional users of communication technology. Precision in prediction of the Eye-2-Eye project findings seems to be dependant on user's experience with communication technologies. It was found that videoconferencing was valued for informal conversations with friends in contrast with multimedia conferencing which is thought of in terms that are very work-task oriented. There was no real enthusiasm for avatar telephony or real-time text. Next steps of the project are outlined.

Keyword list:

Telephony, audio conferencing, avatar telephony, videoconferencing, multimedia conferencing, face-to-face, quality of service (QoS), fitness-for-purpose, Human Factors, laboratory experiment, field study, focus group study

Table of Content

Executive Summary

This report is a deliverable of the Eye-2-Eye project that runs from April 2000 to March 2003. The main objective of Eye-2-Eye is to produce, disseminate and exploit fitness-for-purpose guidelines, a cost-benefit analysis tool and a fitness-for-purpose evaluation toolkit for real-time person-person communication services. The primary target audience organisations for these three exploitable results are network providers, service providers, equipment manufacturers and standards bodies.

The deliverable provides the background and scope of the report by describing the problem addressed by the project and the context of the current focus of the report. Three aims of the report are to:

- collate previous empirical results from the project that have been collected using different complementary research designs, tests with users and potential users of real-time communication services using depth interview, laboratory experiment and field study techniques
- describe three focus group studies that were performed on key findings from the previous in-depth interviews, laboratory experiments and field study in order to address the validity and generalisability of these findings using either different techniques or user groups
- identify future possible applications for real-time communication services by employing the advantages of a focus group approach and purposively sampled participants.

The report summarises the results from the previous empirical phases of Eye-2-Eye. Both in-depth interview techniques and laboratory experiments were used in the project's early baseline tests. The baseline tests were followed by laboratory experiments and a field study of long-term use in a real-life situation. Findings were obtained on user preference, user choice, user task performance, user communication process and user opinion including person-perception, task perception and social presence. The findings are summarised in relation to other previous research and key issues identified for further study in terms of validity and generalisability. The focus group technique was chosen to address validity and generalisability and also to explicitly research future possible application areas. The methodological approach is described for two focus group studies performed in Norway and one study performed in the UK.

The target of each focus group study was to explore:

- the relationship between medium preference, task performance and medium choice (study 1)
- the rationale for medium choice (study 2)
- social presence and reaction to different medium qualities (study 3).

Results are provided for each focus group and general conclusions are drawn regarding the validation of findings, generalisation to other user groups and new applications. It is concluded that project findings in general have been validated by the focus group participants. Regarding generalisability, the results from the field study seems to apply to other user groups as well. Precision in prediction of the Eye-2-Eye project findings seems to be dependant on user's experience with communication technologies.

Regarding future application areas, it was found that videoconferencing was valued for informal conversations with friends in contrast with multimedia conferencing which is thought of in terms that are very work-task oriented. There was little enthusiasm for mobile videoconferencing and no real enthusiasm for avatar telephony or real-time text.

Next steps of the project for finalising the Eye-2-Eye guidelines, cost-benefit analysis tool and evaluation toolkit are outlined.

1 Background and Scope of this Report

This report summarises and discusses key findings from the Eye-2-Eye baseline tests, laboratory experiments and field study. It describes focus group studies that were designed to further assess the validity and generalisability of key findings from the project's tests. The report makes conclusions regarding new applications and services for real-time person-person communication technologies from an end-user perspective.

For the reader of the present report to understand the framework in which the Eye-2-Eye tests and focus group studies were conducted, this section is dedicated to the problem area that the Eye-2-Eye project addresses, the main goals of the project and the role of the current report in achieving these goals .

1.1 The problem area

Current and emerging real-time person-person communication services provide complex choices regarding the most appropriate technologies, services and media that are suitable for different communication situations. Communication service groupings are real-time text, audio telephony, avatar telephony, videoconferencing and multimedia conferencing. These service groupings offer users the opportunity to interact using the communication media of text, audio, video and data. Furthermore, there are numerous existing and up-coming communication services which employ qualitatively different communication media of different Quality of Service, such as Videoconferencing via a desk-top terminal and a mobile terminal (Figure 1) and with different demands placed on the communication channel (Figure 2).

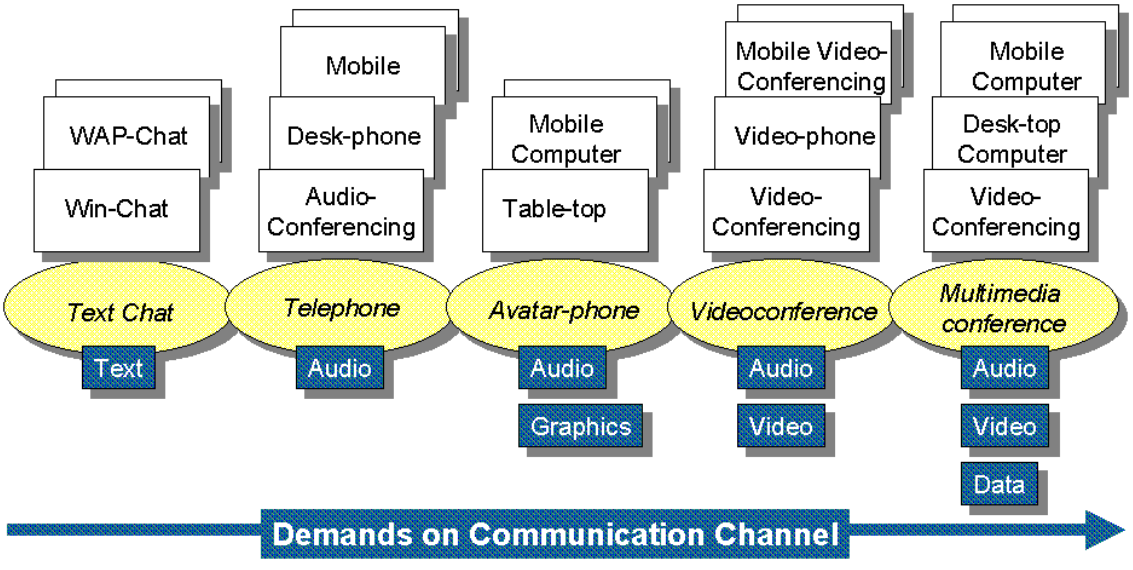

Figure 1. Real-time person-person communication media, services and service groupings

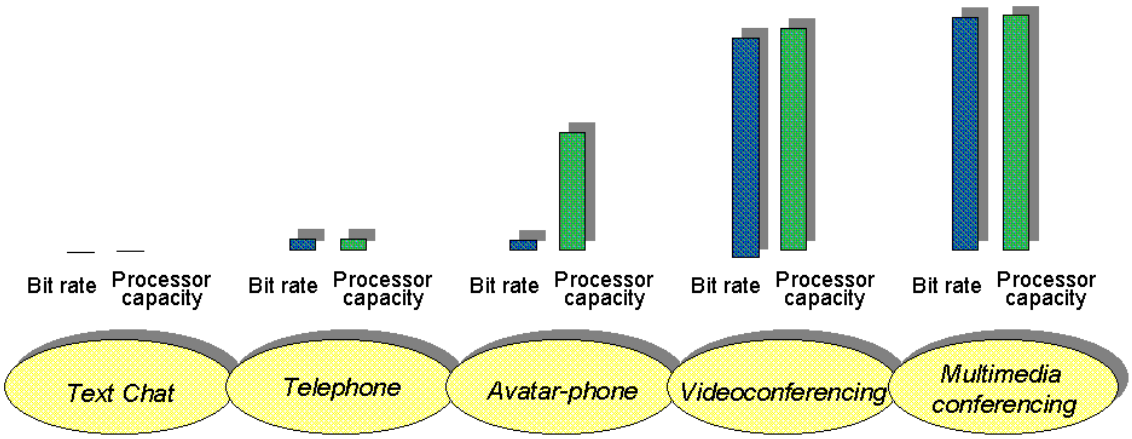

Figure 2. Generalised demands on communication channels placed by different communication service groups

1.2 Main Eye-2-Eye goals, approach and exploitable results

The communications industry needs to know which technologies have different utility, the set-up requirements for different users & tasks and how rational business & service decisions can be made. Fitness-for-Purpose testing is required to assess requirements for the Quality of Service of terminals and networks and the effects on human communication efficiency and user satisfaction. This is the need to which the Eye-2-Eye project responds.

The Eye-2-Eye project provides fitness-for-purpose information based on empirical testing and translates its results into formats accessible to the communication industry. To achieve this the primary objective of the project is to produce, disseminate and exploit:

- Fitness-for-Purpose Guidelines
- a Cost-Benefit Analysis Tool
- a Fitness-for-Purpose Evaluation Toolkit.

The main target audiences for these three exploitable results are specific individuals within network provider organisations, service provider organisations, content provider organisations, equipment manufacturers and standards bodies. For the Guidelines and the Cost-Benefit Analysis Tool they are people with direct knowledge-based decision-making responsibility, such as a director of Research and Development. The Evaluation Toolkit is intended for persons who require additional test results and have the responsibility or

opportunity to collect data, such as system and service developers. The Guidelines are also intended for developers as well as more senior management.

These three results are therefore complementary for the needs of industry. Their different roles in within a problem-solving process are illustrated in Figure 3.

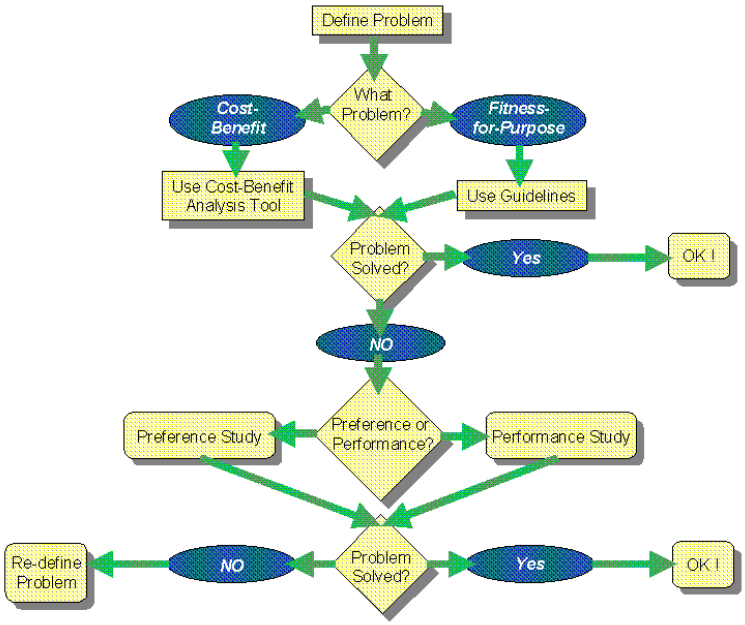

Figure 3. Simplified decision flow for using the Guidelines, Cost-Benefit Analysis Tool and the Evaluation Toolkit.

1.2.1 Fitness-for-Purpose Guidelines

The purpose of the Guidelines is to communicate fitness-for-purpose knowledge to target audiences in an effective way for exploitation. They are primarily intended to support system and service design.

The Guidelines are represented at three fundamental levels:

- **Intermediate Guideline Format**: A representation of knowledge as a rule-based, semi-formal *If-Then* format. The aim of the Guideline Intermediate Format is to be explicit and comprehensive of potential guideline information. It consists of Attributes, Sub-attributes (where relevant) and Values, with core attributes:
  IF <communication situation>
  AND <service prescription>
  WITH <technical parameters>
  THEN <user behaviour>.
- **Intermediate Guideline Set**: The individual guidelines expressed by the Intermediate Guideline Format together form an Intermediate Guideline Set. This set is intended as *internal* data for the Eye-2-Eye consortium rather than for an external target audience.

- **Guideline Presentation Format(s)**: Guidelines for presentation to the target audiences are extracted from the Intermediate Guideline Set in order to make them more easily accessible to persons *external* to the project team. Specific Presentation Formats of key guidelines are developed for identified target audiences (e.g., codec manufacturer).

1.2.2 Cost-Benefit Analysis Tool

The purpose of the Cost-Benefit Analysis Tool is to analyse the utility of different communication services from end-user perspectives. End-users include both individuals and organisations.

The tool is a computer-based implementation designed to model non-financial data in addition to more traditional financial cost-benefit data. In particular, the tool models users' subjective ratings of service and media utility.

The project adapts the Multi-Attribute Utility Technique (MAUT) developed within the field of decision analysis and applies it to determine comparable metrics for different communication services and end-user tasks.

1.2.3 Fitness-for-Purpose Evaluation Toolkit

The purpose of the Evaluation Toolkit is the collection of fitness-for-purpose knowledge. It enables the collection of empirical data for technical parameters and communication situations for which results are not yet available within the Fitness-for-Purpose Guidelines and the Cost-Benefit Analysis Tool.

The fitness-for-purpose evaluation toolkit is being designed for a target audience that includes system developers who do not have a formal background in psychology, ergonomics or human factors and the evaluation method that it prescribes is intended for interest groups including standards bodies. The toolkit contains recommended procedures, test materials and equipment for collecting valid and reliable data to answer fitness-for-purpose questions. As a handbook, it provides instructions for use, examples and paper versions of generic test materials. As a Website and CD-ROM, it provides electronic versions of forms and test materials and online instructions on how to set up and use the toolkit.

1.3 Role of the focus group study in the project

The project has performed three phases of user tests as the empirical basis for its data, methods and tools. Baseline tests are followed by laboratory experiments and a field study with key elements as follows:

- the baseline tests examined users' preferences for communication services and user behaviours when using communication services having optimal Quality of Service qualities
- the laboratory experiments focused on varying technical parameters for the communication services

- the field study examined user choice for different communication services over time and in realistic settings.

It is the results of these three phases of end-user tests that are being implemented as the Guidelines and as data modelled by the Cost-Benefit Analysis Tool. The empirical methodologies designed for the laboratory and field tests provide the basis of the project's evaluation toolkit (Figure 4).

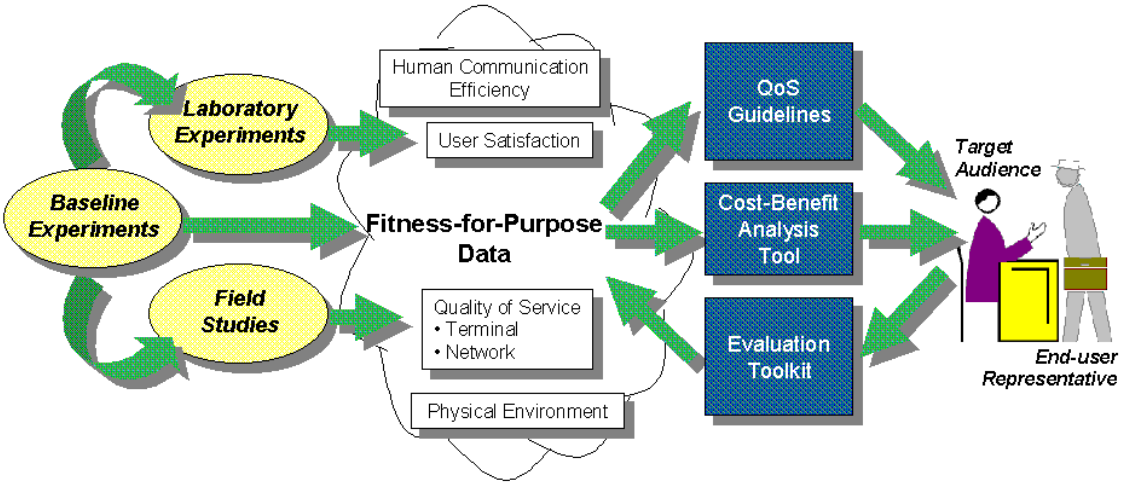

Figure 4. Translation of empirical results from three phases of tests to the Eye-2-Eye Guidelines and Tools.

As the reports of the baseline tests, laboratory experiments and field study were produced at different time periods during the project, the current report integrates the separate findings obtained. Furthermore, it examines the main results in terms of their validity, generalisability and implications for new applications and services. The empirical basis of this examination is a series of focus group studies that form the core of the current report.

Thus, the consolidation of previous project results have been done through extracting main results from a set of previous deliverables (listed below). Focus groups were considered the best way to collect further qualitative information on the validation and possible generalisation of key project findings.

Table 1 summarises the existing Eye-2-Eye reports that were sources for the current report.

Table 1. Main Eye-2-Eye Public Deliverables that input to the current report

No.	Title	Date
D1.1	Initial verification of real-time communication requirements	July 2000
D2	Results of baseline experiments of communication media	July 2001
D1.2	Final verification of real-time communication requirements	October 2001
D4	Results of Field Experiments of Communication Media	October 2002
D3	Results of Laboratory Experiments of Communication Media	December 2002

The project time schedule and these deliverables are illustrated in Appendix 1 and the main future deliverables are summarised in Table 4, Section 9.

1.4 Terminology

A glossary of Eye-2-Eye terms and concepts is included at the end of this document.

In particular, this report uses the term "communication media" and "communication services" according to the following Eye-2-Eye definitions:

Communication media: Types of information with which humans communicate. Examples are text, audio and moving image (graphics and video). This is consistent with the "Nature of information" component of the ETSI definition of a *representation medium,* which has various possible coded forms (ETSI ETR 160, 1995).
Communication services: Services that are provided via a telecommunication network. Examples are audio telephony, email, videoconferencing, avatar telephony, audio conferencing.

Another distinction that is made throughout the document:

Audio telephony refers to "ordinary" use of telephone or mobile phone
Audio conferencing is a telephone service that does not rely on amplification of the voice signal in very close proximity to the recipient's ear. It practice it refers to the use of a loud-speaking phone with hands-free interaction.

Most communication services are qualitatively different from the other on the basis of the communication media employed. This is summarised in Table 2.

Table 2. Mapping of communication media and real-time communication services

Communication media	Communication service
Text	Real-time text
Audio	Audio telephony and Audio conferencing
Audio + Graphics (Virtual Reality)	Avatar telephony
Audio + Video	Videoconferencing

Audio + Video + Data	Multimedia conferencing

The term **"medium/media"** is used as an abbreviation of 'communication medium/media' and also to include physical face-to-face communication.

Because comparative data for face-to-face communication is included throughout the project, the term "media" is often used as the more general term and to incorporate reference to communication services.

The term "**conference**" is used as follows:

- From a technical orientation it was always a point-to-point connection (i.e., there was no multipoint connection)
- From a service orientation it was always person (or group)-to-person (or group) communication.

2 Overview of previous Eye-2-Eye results and other related research

The Eye-2-Eye project has collected a wide variety of results regarding the fitness-for-purpose of real time person-person communication. The current report investigates key findings across the different research approaches of the project with respect to validity and generalisability to new user groups. These research approaches are: in-depth interviews, laboratory experiments and field study.

In addition, new possible application areas will be discussed, such as leisure-oriented contexts, and anticipated future applications for the different services.

The data collection of the present investigation was done through focus groups. Three focus groups were conducted, involving different user groups. Two focus groups aimed at extending project findings to new user populations (youths and business professionals), while the third focus group aimed at validating project findings with the same user population (university students) in new communication situations.

Each focus group was conducted with the purpose of in-depth discussions regarding selected findings of the Eye-2-Eye project. A summary of the key findings are presented below, and discussed in relation to other previous research.

2.1 Summary of results from the Eye-2-Eye user tests

2.1.1 Eye-2-Eye Baseline studies

The Eye-2-Eye baseline studies (Schliemann & al, 2001) focused on the following issues:

- medium preference (Study 1)
- medium effects on
  - task performance (Studies 2, 3, and 4)
  - person perception (Studies 2, 3, and 4)
  - communicative behaviour (Study 3)

Medium preference was investigated by demonstrating the following services to the participants: Videoconferencing, Audio telephony, Avatar telephony and Real-time text. Following the demonstrations, the participants were presented a set of hypothetical scenarios, and were asked to rate their preference for the different communication media demonstrated (including face-to-face communication) for each scenario. Additional results were generated through in-depth interviews.

Medium effects were investigated by having pairs of participants solve tasks, communicating through one of the following services: Face-to-face, Videoconferencing, Audio telephony and Real-time text. The tasks included a persuasion task (Study 2), a negotiation task (Study 3), and "non-personal" information transfer (Study 4).

- Task performance was measured on the quality of the task outcome, as well as the time used.

- Person perception was investigated by letting the participants of Studies 2, 3, and 4 fill in a questionnaire after solving the required task. In the questionnaire the participants rated each other on a set of different scales describing personality attributes of their communication partner. They were also ask to report how strongly they believed to have an accurate perception of their communication partner.

- Communicative behaviour was investigated by transcribing the dialogues between communication partners, and analysing the transcripts with respect to content, length of dialogue, length of utterances, interruptions, backchannels etc..

See Eye-2-Eye deliverable D2 for full description of the four baseline studies.

A summary of the findings from the baseline tests are presented below.

Study 1: Preferences for communication media and services

- Face-to-face is generally preferred as the best "medium" for communication. When face-to- face is not feasible, the general priority is Video. There is a general pattern of preferences for the different media across all user groups.
- Preferences are dependent on the scenario/communication situation.
- The elderly users show a tendency to vary from the other user groups[1] in some scenarios, and in certain situations they have a greater preference for real-time text.
- The scenario involving a "white lie" (Discussing with the bank) is the only scenario where Video is not preferred by the majority.
- All services except avatar telephony have identified advantages and disadvantages for communication situations (avatar telephony is considered only negative).
- Knowledge of partner seems to be an essential parameter for preferences indicated.
- Prior technological experience does not affect media preferences.
- Depth interviews indicate very clear preferences for certain task-media combinations, but this is not reflected in the actual preferences data.

Study 2: Media effects on persuasion and opinion change

- There is a significant effect of media in the negotiation outcome, indicating that richer media favour arguing a consonant[2] case, and/or the audio favours arguing a non-consonant case.
- Real-time text shows the same pattern as Video and face-to-face for negotiation outcome; these results are not consistent with Media Richness Theory.

[1] The other user groups in the baseline study 1 were: Youths, University students and Business professionals
[2] A consonant case refers to a case where the users personal opinion matches his "assigned" point-of-view

- There were no media effects on opinion change, indicating that the medium might affect who is "winning the argument", but it will not affect the actual persuasion of the other partner.
- No media effects were found for negotiation climate (i.e. whether negotiation was found to be competitive or co-operative).

Study 3: Media effects on trust

- Participants lied more often with the 'leaner' media, and tell the truth more often with 'richer' media.
- The negotiation outcome depends on both media-related behaviour and the context:
  - when the seller tells the truth in the negotiations, it leads to less profit
  - variations of task outcome (profit) is dependent on the stated initial value of the company.
- The results show trends only; a larger sample size is needed to further test significance.

Study 4: Media effects on "non-personal" information transfer

The task employed was the joint problem solving "Map task" by Boyle & al (1994). The task was performed twice, with swapping of roles between participants.

- Audio seems to be the better medium for transfer of "neutral" information
  - Audio is better than all other media for the first trial
  - Audio is better than real-time text and face-to-face the second time.
- Performance in the video condition improves significantly from the first to the second trial.

Person perception

- Participants report a generally more positive perception of the other person with richer media; the main difference is between real-time text and the other media.
- Task effects were found: There is a generally more positive evaluation of the partner in the map task (information transfer) than in the negotiation task.
- There are many significant media effects on single person perception parameters.
- Strength of belief does not seem to vary with media.

2.1.2 Eye-2-Eye Laboratory experiments

Extension of baseline results

The objective of *Experiment 1* was to increase the sample size for the study involving trust or negotiation and to include a comparison avatar telephony condition. (The reason for increasing the sample size was to enable starting prices for the negotiation task to be fixed and therefore comparable across conditions, rather than variable as they were in Baseline Study 3.)

The results showed a significant difference in the frequency of mutual benefit between the video condition and the face-to-face condition. There were fewer instances of 'winner's

curse'[3] and more instances of mutual benefit in the conditions where participants could see each other (video, avatar and face-to-face), compared with audio-only conditions (with the exception of the face-to-face condition when the starting price was constant). There was also a trend for greater buyer profit and subsequently less seller profit when participants could see each other. All of these trends were very similar to those reported in Baseline Study 3.

In terms of communication processes, there were fewer turns and turns were significantly longer in the avatar condition compared with all the other conditions. There were also significant differences between the video condition and the face-to-face condition in the number of turns, with more turns in the video condition. Finally, there were significant differences in the numbers of interruptions in the video condition compared to audio-only and face-to-face. These trends in communication processes in the different media conditions are also very similar to those found in Baseline Study 3. It seems in general that participants with high-quality video tended to say more in order to agree on the negotiation outcome, and their discourse was more interrupted, compared to face-to-face and audio-only conditions. These patterns are similar to findings obtained with problem solving tasks such as the map task (see, e.g. O'Malley et al., 1996).

Development of social presence and cost-benefit measures.
The objective of *Experiment 2* was to pilot candidate alternative tasks for investigation of media effects on task outcomes and to develop measures of social presence and cost-benefit data to feed into the Evaluation Toolkit and the Cost-Benefit Analysis. Three pilot experiments were conducted with two media: high-quality audio and high-quality video. Experiment 2a compared of communication with audio-only or video links in a simple consensus making task. Experiment 2b also included a consensus-making task but it was slightly more complex and communication in this task was compared with two other tasks: an easy version of the 'map task' and a simple card game of bluff. Experiment 2c built on these two pilot experiments by using the map task, the card game and a negotiation task to test out the measures of social presence, task and person perception and cost-benefit measures.

The consensus making and negotiation tasks did not seem to be affected by the media used. The results from the Map Task seemed to replicate findings from the Baseline study, showing a slightly better performance for the Audio condition. However, the results from the 'easy map task' were more in line earlier findings with the original map task (no media effect on task performance). The most promising task was the card game, but two pilot experiments with this task produced conflicting results.

The main findings from this experiment were in the form of the Cost-Benefit data which showed interaction effects between media and tasks, and indicated the importance of assessing and scoring the use of media in "realistic, but simple" task-scenarios. These results will be presented and discussed further in D5.2.

[3] *Winner's Curse*: The fact that the buyer ended up paying more for the company than it was worth to them.

Effects of asynchrony

Experiment 3 compared problem solving with the Map Task under two different video-mediated conditions: synchronised audio-visual signals (delay 200ms) and asynchronous signals (audio 200ms; video 400ms). The data were also compared with data from Baseline Study 2 which used the same task.

The results for task outcome showed that asynchrony produces less accurate task performance. The analysis of communication processes suggested that in general, when audio-visual communication was asynchronous, participants tended to behave as if they were using an audio-only link. Dialogues showed more turns and words in this condition, and the pattern of dialogue was also affected: information givers said less in asynchronous conditions and information followers said more, compared with synchronous conditions. However, speech was less interrupted in the asynchronous condition, possibly because participants could detect the asynchrony and therefore avoided interrupting one another. These findings were validated by the effects on attitudinal measures, since even with a lag of only 200ms, participants were able to detect that the signals were not synchronised.

Effects of variation in screen size

Experiment 4 compared large screens (29") of the kind used for corporate videoconferencing and small screens (3.5") of the kind envisaged for mobile videoconferencing. The task used was the negotiation task used in Experiment 1: the Acquiring a Company game.

The results showed that participants were less likely to agree on a negotiation with small screens. In addition, with a smaller screen sellers made less profit and buyers made more profit. Negotiations were also slightly shorter.

In terms of communication processes, speaking turns were longer and less interrupted with smaller screens. However, the audio-visual signals in these conditions were both delayed (650ms) relative to the Baseline audio and video conditions. As a consequence, compared with Baseline video for the same task, task times were shorter and there were fewer turns and words, irrespective of screen size.

Finally smaller screens had a negative impact on feelings of social presence, as expected. Participants in the large screen condition rated much higher than those with a small screen items concerning how like a face-to-face meeting the interaction was.

Effects of variation in resolution with small images

Experiment 5 also focused on small screens and compared two kinds of video resolution (CIF and QCIF) and avatar communication, using the same software as in Experiment 1.

There were no differences in task outcomes or communicative processes between CIF and QCIF, although both conditions were significantly different to Baseline video conditions (where monitor size was 17"), in terms of numbers of turns. Generally, as was found in experiment 4, the smaller screen size tended to produce dialogues which were more similar to the audio only condition, with the exception of interruptions. There were more interruptions in the small screen video conditions relative to the audio only condition, but there were still twice as many interruptions in the Baseline video condition compared with the small screen conditions. There were no differences of any significance between the Baseline avatar condition (17") and the small screen avatar condition. Finally, in the questionnaires the avatar was consistently rated worse than video on a number of items, with no differences between CIF & QCIF.

Effects of delay

Experiment 6 looked at the effects of delay when the monitor size was large (29"). An audio-visual lag of 650ms was compared with a delay of 200ms. The task was the Acquiring a Company game.

In terms of task outcome there was a significant effect due to delay. Buyer profit was reduced in the delay condition compared with the no-delay condition, and seller profit was increased in the delay condition. Negotiations also tended to be shorter with delay. It seems as if the delay made participants change their buying and selling strategy so that it became more like the strategy used by participants in the audio condition. This effect was similar for communicative processes, with the exception of interruptions. There were fewer turns and words, and turns were shorter with a delay. Also, the delayed video led to fewer turns and shorter turns relative to no delay.

Validation of social presence and cost-benefit measures

The aim of *Experiment 7* was to compare participants' responses to measures of social presence, person perception and cost-benefit for the same communication service (and the same technical parameters) across two different tasks – the problem solving task and the negotiation tasks used in the other experiments. As such, the experiment served to validate the instruments and measures developed in Experiment 2.

The Map task was rated as less formal compared to the negotiation task. In addition, the ratings of the importance of making a good impression and creating a sense of trust were higher for the negotiation task compared to the Map Task. These perceived task differences seemed reflected also in the person perception ratings. The perceived formality of the task mirrored the differences in the perceived formality of the other participant depending on the task. Similarly consistent differences in ratings appeared for attributes such as 'coldness' and 'friendliness'. In other words, just as the Acquiring a Company game was rated as more formal than the Map Task, so the other participant in this task was rated as more formal, colder and less friendly than partners in the Map Task were rated.

The element of potential cheating and withholding information inherent in the Acquiring a Company game led to ratings of the other person as less fair, more competitive and less trustworthy than the ratings for the Map Task.

Simulation of mobile videoconferencing applications
The objective of *Experiment 8* was to simulate likely future applications of mobile videoconferencing and investigate variations in technical parameters likely to affect communication in such application contexts. In particular, the experiment investigated the effects of delay and of variations in packet loss and burst packet loss in a remote inspection task.

There were no significant effects on task performance due to delay. Differences in packet loss did seem to affect task performance, however there were also task order effects. Unfortunately the sample size was not large enough to control for these task order effects fully so further data are needed to verify and validate these findings concerning packet loss.

2.1.3 Eye-2-Eye Field study

In the Eye-2-Eye field study, five persons in a distributed organisation were provided a set of new communication services for point-to-point real time communication. This in addition to their 'old' services. The following communication services were provided:

- Avatar telephony
- Audio conferencing
- Videoconferencing
- Multimedia conferencing.

'Old' desktop communication services included e-mail and audio telephony. All communication services were equally accessible on the participants' desktop. The five persons had an already established pattern of communication between them. The communication between the five persons was monitored by automatic logs, interviews and questionnaires for five months. The design included a matching control group. Media choice was analysed on the basis of log data on frequency of use. Reasons for media choice were analysed on the basis of interview- and questionnaire data, as well as log data on call duration. The participants' subjective experiences with the different services were analysed on the basis of interview data. Suitability scores and weight scores necessary for cost-benefit analysis were also collected for reporting in Deliverable D5.2 specialising on cost-benefit analysis.

The main findings were:

- Multimedia conferencing and videoconferencing were the two new communication services that were really integrated into the participants' day to day work life (in addition to the participants 'old' communication services: Audio telephony and e-mail).

- The most important criteria for communication service choice were the urgency and assumed duration of the communication.
- There are group differences in communication service choice. This is probably a consequence of different user-groups generally being involved in different communication tasks.
- **Face-to-face communication** was regarded as the best way to perform many of the identified communication task. However, face-to-face-communication was regarded as too costly to actually choose for some communication tasks. Also, if the communication was short and urgent, or required substantial distribution of documentation, face to face was *not* chosen.
- **Multimedia conferencing** was ranked as the most useful new communication service by all the participants. In particular *'easy and immediate set-up'* as well as *'both persons see the same part of the same document'* were critical success factors.
- **Videoconferencing** was regarded as a good way to perform many of the identified communication task, given that face-to-face-communication was not available (for practical or cost-effective reasons). However, videoconferencing was not seen as a substitute for face-to-face meetings, but an improvement relative to using audio telephony or travelling to a dedicated video conference facility.
- **Audio telephony** was regarded as the best way to conduct short and urgent communication. For these kind of communication tasks, audio telephony was chosen rather than face-to-face-communication and video.
- **E-mail** was regarded as the best way to perform communication tasks involving distribution of prepared documentation. In particular if this information was for further distribution. Also the quality of asynchrony was appreciated for certain kinds of communication tasks, in particular tasks with low urgency.
- **Avatar telephony** was, by the participants of the project, not regarded as good for *any* work purposes. The main reasons for this were: *'Cumbersome communication given that the real time avatar required push-to-talk'* and *'the visual representations of the participants were regarded as grotesque and caricature-like'.*
- All available communication services (except avatar telephony and audio conferencing) were chosen for different kinds of communication tasks. This had the following consequences:
    - Audio telephony and E-mail were the two most frequently used communication services
    - Videoconferencing and audio telephony were used for about the same amount of time in total
    - The mean duration of calls made by videoconferencing and multimedia conferencing was substantially longer than calls made by audio telephony.

Face-to-face communication and videoconferencing were given the highest ranking in the Media Choice Patterns (MCP) of most of the communication task categories.

2.2 Summary of findings across the in-depth interviews, laboratory experiments and field study

Integrating the key findings of the different research designs, the following summary key findings are identified:

2.2.1 There is no obvious relationship between medium preference, medium effects on task performance and medium choice

Medium preference based on hypothetical scenarios is a poor predictor of task performance and actual medium choice. The general pattern of preference was that the participants preferred face-to-face and video for most of the communication scenarios. At the same time the results on medium effects on task performance indicates that audio is the better medium for arguing a non-consonant case and impersonal information transfer. The medium choice patterns of the field study seem to be in compliance with the results on medium task effects, as the participants chose videoconferencing for longer, process-like communication, and audio telephony for short, factual communication.

2.2.2 The rationale for medium choice is based on “medium specificity” rather than medium richness

The results of the field study indicated that medium choice is based on medium specificity (Følstad & al, 2002) i.e., participants' medium choices were based on an evaluation of the communicational needs of the situation, and then a communication medium was chosen with regard to the situations specific criteria. Which situation criteria are regarded as important may differ from situation to situation. This finding is consonant with the finding of the depth interviews of Baseline study 1, where the participants indicated very clear preferences for certain task-media combinations.

2.2.3 Perceived social presence and person perception varies with medium, task and communication service parameters

Perceived social presence and person perception varies with communication service parameters. In the case of videoconferencing, small screens (the approximate size of current PDAs) had a negative impact on feelings of social presence. Delays of around 650ms also have an impact on feelings of social presence and person perception, even with large screens. Perceived social presence and person perception also varies with medium. Avatar telephony was rated consistently worse than videoconferencing with respect to feelings of social presence. Finally, the task has an effect on person perception but not social presence. The problem solving task was rated as less formal compared to the negotiation task. In addition, the ratings of the importance of making a good impression and creating a sense of trust were higher for the negotiation task compared to the problem solving task. These perceived task differences seemed reflected in the person perception ratings. The perceived formality of the task mirrored the differences in the perceived formality of the other participant depending on the task. Similarly consistent differences in ratings appeared for attributes such as ‘coldness’ and ‘friendliness’. In

addition, the negotiation task led to ratings of the other person as less fair, more competitive and less trustworthy than the ratings for the problem solving task.

2.3 Key findings in relation to other previous research

When discussing the key findings presented above, it is necessary to be aware of relevant research conducted outside the Eye-2-Eye project, that may shed light on the discussion. In the present section, relevant research will be presented under the headings of the three identified key summary findings.

1. There is no obvious relationship between medium preference, medium effects on task performance and medium choice

Substantial inconsistencies exist in the literature regarding the concepts of medium preference, medium effects and medium choice. In particular there is often no clear cut difference made between medium preference and actual medium choice. For this report however, preference is to be understood as an attitude, whereas choice is to be understood as behaviour. An example of medium preference investigation includes Fulk (1990), who argues the importance of existing norms in the social environment as determinants of the individual's media choice. Carlson (1994) argues the importance of experience with the medium for the development of media perceptions and thereby media preferences.

With regard to medium effects on task performance, Williams (1977) reviewed experiments comparing two or more of the media face-to-face, audio and video, video only, audio only and text. The conclusion was that the outcome of co-operative tasks with an objectively right or wrong solution is not media sensitive. On the other hand, tasks involving conflict of various kinds seem to show media effects. Later reviews (e.g. Rao, 1995) have concluded that tasks high in socio-emotional content are sensitive to media differences, while emotionally neutral cooperative tasks are not. Quite a few studies have found audio telephony to be superior to videoconferencing for certain tasks. Morley, (1969; 1970) found that in a negotiation task the person with the stronger case did better when arguing with audio telephony than face-to-face. Another example is Short's (1974) study, where one of the participants was arguing their own opinion, while the other argued a brief. The person who argued a case in which they believed did relatively well in a face-to-face meeting, whereas the person who was arguing a brief did better over an audio only link.
Other studies indicates that videoconferencing may involve more preferable task effects than audio telephony e.g. for building trust (Valley et al., 1998).

The Eye-2-Eye project's key finding of the relation between medium preference, medium task effects and medium choice is difficult to discuss relative to the literature, because few studies involve all three elements. However, in consonance with the effect of experience argued by Carlson, it seems reasonable that a difference exists between preference and actual choice. Also, the relative positive effects of audio telephony on several of the tasks investigated in the Baseline studies may be consistant with the

literature in that videoconferencing is beneficial for the task outcome for situations high in socio-emotional content.

2. The rationale for medium choice is based on "medium specificity" rather than medium richness

Medium richness theory (MRT) asserts that individual's choice of communication media is done according to a set of criteria set for good matching between task and medium (Daft, 1984; Daft, 1986), In simple terms the theory claims that "rich" media are needed for equivocal tasks, while "less rich" media are suited for less equivocal tasks. A task is considered "equivocal" to the extent that all potential task outcomes are of equal value to the person performing the task. For an in-depth review of MRT, the Eye-2-Eye project report D1.2 is recommended (Heim et al., 2001).

Later findings have made the MRT a highly debated issue (see e.g. Huang et al.,1998; El Shinnaway and Markus,1997) and has sparked the development of alternative theoretical explanations of users' media choices. It is suggests that task equivocality may not be unidimensional, and that the richness of media is perceived as multidimensional in terms of the information-carrying capacity of media (D`Ambra, Rice and O`Conner, 1998). This perspective is taken further in stating that medium choice conducted in response to multiple factors or dimensions (Trevino et al., 2000; Wijayanayake and Higa, 1999). Thus, media choice may be based on the perceived match between information needs and media characteristics (Van de Wijngaert, 1999).

Within the Eye-2-Eye Deliverable D2 (Schliemann et al., 2001) the concept of *media specificity* was developed. Media specificity refers to the interpretation of the results from the Baseline studies, where the different investigated media (face-to-face, video, audio, and text-chat) were found to have qualities that were fundamentally different from the others and with consequences for their fitness-for-purpose. For example, the difference in fitness-for-purpose between two communication services like videoconferencing and e-mail may be explained with regard to the fact that video conveys a moving image of the communication partners (and thus provides greater social presence) whereas e-mail may serve documentation purposes.

In the Field study it was found that medium choice may be explained along the axis of medium richness, for quite a few communication situations involving only two persons wanting to communicate verbally, and not via text. However, when the requirements of the communication task involves the need for document sharing, drawing figures, exchange of textual documentation and the like, explanations of medium choice in terms of media richness seem to break down. This is quite consistent with findings presented in the literature. However, the Eye-2-Eye concept of medium specificity should be investigated further as an explanation complementing that of medium richness theory.

3. Perceived social presence and person perception varies with medium, task and communication service parameters

The term “social presence “ or “telepresence” has been conceived of as a quality of the communication media, a single dimension representing a synthesis of various factors such as the capacity to transmit visual non-verbal cues such as facial expressions, gaze direction awareness, and the apparent distance and “realness” of others (Short, Williams and Christie (1976). More recent studies have argued (Muhlbach et al, 1995) that telepresence is mediated by spatial, and communicative presences, operating independently. Spatial presence being the transferability of spatial audio and visual cues. Communicative presence being the transferability of reciprocal communicative cues. Media vary in their degree of social presence and this affects the nature of perceptions and relationships of interacting parties. Users are aware of the social presence of a medium and as such are likely to vary their behavious accordingly, choosing behaviours that are appropriate for the medium and media that are appropriate for the communication task. The complex interaction of these factors is determined by the user and is therefore a subjective not objective feature of the communication medium or technology. Social presence has been demonstrated to have effects on performance in a number of communicative situations. There is evidence that the effects are differential, that is, performance in some situations is improved by using media with higher social presence, but some communications are more effective when using media with lower social presence. For example, Werkhoven et al (1999) found that that persuasive force (the ability to change another person’s opinion) was significantly stronger under conditions of high social presence (including face-to-face) than with lower social presence. However, they found that the ability to influence group solutions by dominant behavior was similar between all conditions the conditions.

There are several studies showing an effect of media on how the communicative partner is perceived. Previous studies have found that people tend to rate each other more positively when communicating through richer media. Williams (1975) had participants meet two strangers via two different communication modes. The communication modes were either audio only, audio-video and face-to-face. Communication tasks were either to have a free discussion about problems of modern life or prioritising eight listed problems of modern life. After the two conversations, participants rated their partners on forced choice scales with evaluative content. Results indicated that partners met face-to-face were preferred to partners met via communication services, and that audio-video conversations were preferred to audio-only ones. However, only the preference for people met via audio-video over people met by audio-only reached significance. There was also a task effect, showing higher ratings of the other person’s intelligence in the free discussion condition. Consistent with this is Williams' (1975, in Williams, 1977) finding that people communicating in a brainstorming experiment tended to like people with whom they had face-to-face communication better than when the communication was audio only. There was no difference between face-to-face and audio-video communication.

Drolet & Morris (2000) had participants talk for five minutes, either face-to-face or over the phone, about positive experiences at Stanford University. Individual level positive

affect for the other person was higher in the face-to-face condition than when talking on the phone.

Jensen (2000) found that voice communication had strong effect in fostering trustworthiness, intelligence and likeability compared to text or no communication during the “Prisoners dilemma” game. LaPlante (1971, in Williams, 1977) found similar results.

The review presented in Eye-2-Eye deliverable D1.1 (Heim & al, 2000) shows no clear evidences of the association between liking and the use of real-time text communication. Walther (1994) has suggested that both the duration of contact and expectations for future contact influence communication patterns in electronic groups. These are therefore factors to take in to account when assessing the influence on liking and friendliness in an electronic context.

In general, face-to-face and the “richer” media results in higher interpersonal liking than the “less rich” media. However, this finding has exceptions and the findings show the complexity of interpersonal perception.

3 Objectives and research questions of the focus group studies

3.1 Main objectives

The main objectives for the current focus group studies were:

- Validate key findings from the baseline tests, laboratory experiments and field study
- Extend project findings to new user groups
- Identify new possible application areas, including leisure-oriented contexts
  - Give special attention to future applications for avatars and video communication

The main motive was therefore to validate and generalize the Eye-2-Eye project findings by addressing the empirical findings from a different perspective. To put it differently, we wanted to investigate:

- Is it true what we have found so far?
- Why is it so (or not so)?
- Can we use our results to predict future use of and preference for communication services?

3.2 Key Focus Issues

The Key findings described in Section 2.2 are:

- There is no obvious relationship between medium preference, medium effects on task performance and medium choice
- The rationale for medium choice is based on "medium specificity" rather than medium richness
- Perceived social presence and person perception varies with medium, task and communication service parameters

Elaborating on these, three main issues of interest for investigation in the focus groups has been identified:

1. Medium preference is not a sufficient predictor of medium performance and medium choice (and audio seems to be the "better" medium for a surprisingly great number of communication tasks and -situations)
2. The rationale for medium choice is based on users' perception of communication task requirements. The rationale may follow "concept of medium specificity" as well as "medium richness concept", depending on the properties of the communication task at hand
3. The experienced social presence of communication partner as well as general perception of partner attributes varies, depending on the communication task at hand and technical configurations of the communication service.

4 Methodological approach of the focus group studies

A focus group approach was selected in order to address the above research questions. This method allows for collecting user feedback on key findings, and discussions related to their validity and generalisability. Also, a group discussion of key findings provides a good foundation for having the same users discuss future application areas with regard to their particular context of use.

Three separate focus group studies were held to address each of the three Key Focus Issues (Section 3.2). Each focus group was designed as a separate session with separate goals and approaches. Focus groups 1 and 2 aimed at extending existing project findings to new user groups, as well as identifying new possible application areas for future use. Focus group 3 aimed at validating existing findings with the same user population as the laboratory experiments in order to confirm or question the findings obtained.

4.1 User groups

Three different user populations were chosen for the three focus groups:

1. Business professionals experienced with the use of videoconferencing and different communication services in general.

The intention was to gather users with long term experience in the use, and hence the advantages and disadvantates, of the different services in question. Discussions were expected to be based on practical experience, rather than “novice” impressions of the services.

2. High-school students from media classes.

This group was expected to relate to the findings from the field study, where the original users was business professionals. We wanted a “second opinion” on the real-life context the Field study represented, but with users expected to have more than an average interest in the field. Youths were chosen because they are the future users of these services, typically early adopters of new technologies and hence expected to have interesting perspectives on possible future applications of communication services.

3. University students

The main intention in the third focus group was to validate laboratory findings within the same user population. The focus group participants had all been participating in one or more experiment, and hence were familiar with the services.

4.2 Two test sites - Three foci

Focus groups 1 and 2 were run at SINTEF in Norway. Focus group 3 was run at Nottingham University in the UK.

Each focus group was conducted with a detailed methodological approach particularly suited for its combination of user group and Key Focus Issues. Details of the different approaches are presented in their respective focus group report in the following chapters.

The two focus groups at SINTEF were concerned with extending and generalizing to new user groups followed the same general pattern, while the focus group at Nottingham, concerned validation of actual findings and therefore followed a slightly different pattern.

Focus groups 1 and 2 followed the general structure:

- Introduction and 'setting the scene'
- Demonstration of services
- Discussion of expected project findings
- Presentation and discussion of project findings
- Discussion on future application areas

Focus group 3 followed the general structure:

- Introduction and 'setting the scene'
- Demonstration of services, through acting a set of scenarios for different media conditions
- Discuss appropriateness of media conditions for a given scenario
- Presentation and discussion of project findings.

4.3 Material and technical set-up

4.3.1 Technical set-up at SINTEF

The technical set-up for the hands-on demonstrations included an office desktop with a user PC and the Eye-2-Eye field set-up as described in Eye-2-Eye Deliverable D4 (Følstad et al. 2002). The demonstrated communication services included:

- Audio conferencing
- Video-conferencing
- Multimedia conferencing

The original field set-up also included an avatar-phone, but this service was not demonstrated due to the fact that the company delivering the service (LipsInc) has ceased trading, and the server required for using the service was not available.

4.3.2 Technical set-up at Nottingham

The technical set-up for the hands-on demonstrations was the Eye-2-Eye laboratory set-up as described in Eye-2-Eye Deliverable D3 (O'Malley et al. 2002). The demonstrated communication services included:

- Videoconferencing
- Audio conferencing

The original laboratory set-up also included an avatar-phone, but this service was not demonstrated due to the fact that the company delivering the service (LipsInc) has ceased trading, and the server that was required for using the service was not available.

5 Focus group 1 - The relationship between medium preference, task performance and medium choice

5.1 Context and focus issues

The focus group was conducted at SINTEF 26.11.2002

Key Focus:

- Medium preference is not a sufficient predictor of medium performance and medium choice
  - and audio seems to be the "better" medium for a surprisingly great number of communication tasks and -situations.

Focus group goals:

- Discuss key findings on 'preference-performance-choice relation'
- Why are users bad at predicting their own medium choice and performance
- Why is audio telephony so good?
- Extend key findings to experienced business users
- Discuss application of multi-point conferencing.

5.2 Methodological approach

5.2.1 Structure of the focus group

To reach the goals of the focus group, the following procedure was employed

1. Introduction of the project and 'setting the scene'
2. Identify the common mediated communication situations in the work day of the participants; including factors such as sender, receiver, communication task, used services.
3. Discuss expectancies for, and experiences with, technology that the participants have started using in the last 10 years. This was to enable a discussion on the relation between preferences for future services and actual service choice in a work context.
4. Hands-on demonstration of the communication services
5. Discussions of selected results from the Eye-2-Eye baseline, field and laboratory studies.
6. Discussion of issues regarding preferences and choice with regard to multi-point video communication.

An agenda was presented to the participants, addressing these issues sequentially. Time was allowed to discuss issues "on the side" of the main agenda, as the participants sometimes initiated new, interesting angles to the theme.

The presentation of the focus group agenda and themes for discussion was done in Microsoft PowerPoint. The focus group session lasted approximately two hours.

5.2.2 Participants

The participants were six business professionals with prior experience of videoconferencing. Age: 25-40 years. Four men, two women. Three were videoconference system developers, one worked with sales and promotion of videoconference systems, two were regular users with jobs involving extensive networking. All except one used videoconferencing systems at least weekly.

Participants were recruited among employees and customers of TANDBERG and Telenor.

5.2.3 Setting the scene

A short presentation of the Eye-2-Eye project was given, followed by an introduction to the theme of the focus group. Participants were asked to identify the communication services they used in their everyday life, and their patterns of use for these services.

5.2.4 Demonstration of services

In order to get hands-on experience with the different communication services, the participants were separated so that three persons were at one end of the Eye-2-Eye field set-up, three persons were at the other. Two participants at a time, one at each side, were co-operating to complete one task for each service. The persons not actively solving tasks were spectators.

- Using audio conferencing, the participants were required to solve a negotiation task.
- Using multimedia conferencing, the participants solved a co-operation task. The aim of the task was to find out whether the negotiators in Task 1 had reached the optimal result.
- Using videoconferencing, the participants completed a discussion task. They were asked to discuss reasons why the negotiators of task 1 had not reached the best possible result in their negotiations.

The demonstration lasted approximately 30 minutes.

5.3 Results

5.3.1 Identification of usual communication situations

The following services or applications for communication at the work place were identified by the group:

- E-mail
- Text Chat
- File sharing applications/NetMeeting
- Telephone
- Videoconferencing
- Audio telephony meeting (multi-point telephony)

The common communication situations identified by the group are summarised in the table below.

Receiver	**Task**	**Service**	**Rationale for service choice**
Customers and business partners	Networking	Telephony	Initial contact and updating
		E-mail	Formalising and explication intentions
	Formal meeting	Face to face	First meeting
		Audio telephony meeting	Not for first meeting. Lower cost than videoconferencing. Videoconferencing not available. No great loss not to have visual presentation
		Videoconferencing	More formal than telephony meeting
	Help and support	Telephony	Fast and accessible
		NetMeeting and telephony	If sharing of documentation is required. Does not have easy access to videoconferencing with information sharing
	Collaborate work on documentation	NetMeeting and telephony	Does not have easy access to videoconferencing with information sharing
Colleagues	Department meetings	Videoconferencing	Distributed organisation
	Help/requests etc.	Telephony	Immediate reply wanted
	Creative process	Face to face and whiteboard	Drawing of concepts
		Electronic whiteboard and telephony	Drawing of concepts

There was some disagreement within the group on the actual value of using videoconferencing instead of audio telephony meeting. Some participants hardly saw any added value in video communication as compared to telephony meetings, others argued for increased personal contact. In particular when you don't know the other person that well.

There was total agreement within the group on the added value of shared applications (like NetMeeting) used together with telephony. The opportunity to look or work at the same document or application, both for presentation and collaborative work, was highly valued within the group.

5.3.2 Expectations and experiences with new communication services

The participants were asked to identify the communication services they had started using in the last 10-year period. Then it was discussed what expectations one had to the different services when starting to use them.

Following the discussion on the participants' expectations regarding the new services, they were invited to discuss their experiences with the same services. And why the expectations some times differed from their expectations.

The identified services, and the corresponding expectations and experiences are summarised in the table below. Also the participants' explanations for the gap between their expectations and experiences are presented.

New medium	**Early Expectation**	**Experience**	**Explanation**
E-mail	"Just for fun"	Extremely useful in many work related issues	It was necessary to discover by experience that e-mail could be useful
SMS	Hardly any	Somewhat useful	Fulfils certain communicative needs
Videoconferencing	Hardly any	Positively surprised Almost like sitting in the same room	
	Better communication with customers	Less used than expected	Need registry of existing videoconferencing phone-numbers
	Flexibility with regard to travelling	As expected	

Additional points from the discussion:

- Videoconferencing is usually regarded as a good thing by those travelling a lot. However, it is not necessarily regarded as a good thing by those who do not travel.
- People travelling a lot to meet others may feel a real need for videoconferencing.

5.3.3 Discussion of main Eye-2-Eye findings

In the process of discussing the key findings for validation purposes, the participants of the focus group were presented the research questions and some explanation of how they were investigated. The moderator of the group did not reveal the research findings to the participants until they had discussed this sufficiently, and provided sufficient rationales for their expectations.

The designs of the baseline, laboratory and field studies were outlined to the participants. The different designs were presented according to the following structure:

- Preference of different services with regard to given scenarios
- Communication task performance with different services, for the following tasks
  - Negotiation
  - Persuasion
  - Information sharing
- Service choice with regard to examples of identified communication tasks of the field study
  - Discussions
  - Thinking and process
  - Contracts and projects
  - Messages and yes/no questions
  - Information sharing
  - Administrative reporting
  - Market and strategy.

When the participants of the group had thoroughly discussed their expectation with respect to the findings, the findings were presented and mismatches between expected findings and actual findings were discussed.

Service preference

The participants predicted the preference studies to show that face-to-face communication and videoconferencing would be preferred for communication with high personal involvement. For communication requiring quarrelling or bartering, audio telephony was suggested as the most preferred service, whereas real-time text was suggested as most preferred for simple agreements.

- Predictions from the focus group were in line with the results on task performance (Baseline studies) and to some extent - the medium choice findings (Field study). This is not in accordance with findings in the Baseline preference study. This suggests the fact that long term experience with use of the media might affect users' preference for a given service.

Service effects on performance
Service effects were discussed with regard to negotiation, persuasion, and information sharing tasks.

Most of the participants assumed that for tasks involving negotiation, videoconferencing or face-to-face would be the better media. However, some participants suggested that the laboratory results may be different than assumed due to the fact that the users were unfamiliar with videoconferencing. It was also noted that for building relations, videoconferencing is superior to telephony, whereas for quarrels and heavy arguments, audio telephony may be the better service for most people.

With regard to the persuasion task, the participants suggested that videoconferencing would be the better medium if you had nothing to hide. In other words, if you argue for something you believe in - videoconferencing should be the more effective medium. On the other hand, if you have to hide your intentions - audio telephony should be the most effective service.

With regard to the information sharing task, the participants suggested that videoconferencing probably was the better service.

- again, predictions from the group are quite in line with actual findings on performance and choice. And again, this is probably due to their experience of using the services, and hence knowing which media suits a specific communication situation.

Service choice in field setting
The participants were presented the field setting, and examples of identified communication tasks. They were told that in the field setting, the users could choose between the following services

- E-mail
- Office phone for telephony
- Audio conferencing
- Videoconferencing
- Multimedia conferencing
- Avatar telephony

The participants' suggestions with regard to service choices are represented in the table below.

Communication task	**Assumed service choice**
Discussions	Videoconferencing or face to face
Thinking and process	Face-to-face or multimedia - whiteboard probably required
Contracts and projects	Multimedia for presentations
Messages and yes/no questions	Audio conferencing or e-mail

Information sharing	Face-to-face meetings, multimedia or e-mail
Administrative reporting	Face-to-face meetings, multimedia or e-mail
Market and strategy	Videoconferencing

None of the participants had any faith in the avatar telephony being used. Also, they believed that the ordinary audio telephony would be used a lot less than audio conferencing.

- The assumptions of the participants were quite consistent with the actual results from the field study, with the major exception that audio conferencing was actually chosen less than ordinary telephony. This was discussed in the group, and suggested explanations included "habit strength" as well as the overhead in setting up the call for audio conferencing.

5.3.4 Multipoint videoconferencing

The final item on the agenda was an open discussion on the practical use of multipoint video-conferencing. Unfortunately, time was running out, so the discussion was not exhaustive. All focus group participants were familiar with the multipoint service. Some of them used it regularly, while some had only tried it once or twice. The comments can be summarised as follows:

Positive comments
- Good for exchange of ideas
- More useful than point-to-point, due to the fact that the benefits are greater (compared to meeting face-to-face)

Negative comments
- Not all videoconferencing terminals have an option for multipoint conferencing[4]
- Few users know it is possible to use multipoint conferencing
- Technical challenging to set up. It usually requires assistance from an operator.
- The delay is significantly longer than for single-point.

The multipoint functionality was not considered an essential feature. Potential practical challenges were considered more weighty than the few obvious benefits.

[4] This is a statement from the focus group participants, but it is not correct. All videoconferencing terminals can participate in a multi-point conference. However, not all videoconferencing terminals have the option to be a Multipoint Control Unit, connecting *other* participants to a multi-point conference.

6 Focus group 2 - The rationale for medium choice

6.1 Context and Focus issues

The focus group was run at SINTEF 24.11.2002

Key Focus:
The rationale for medium choice is based on users' perception of communication task requirements. The rationale may follow 'concept of medium specificity' as well as 'medium richness concept', depending on the properties of the communication task at hand.

Focus group goals:
- Validate the Eye-2-Eye field study regarding findings on rationale for service choice
  - Perspective: What is the added value of the different media, compared to telephony?
- Extend key finding to youths' school and home/leisure environment
  - What can they different media be used for in these contexts
- List of future and possible application areas.

6.2 Methodological approach

6.2.1 Structure of the focus group

To reach the goals of the focus group, the following procedure was applied:
1. Identify the common mediated communication situations in the daily life of the participants. Including factors such as sender, receiver, communication task, used services.
2. Hands-on demonstration of the services of interest for the focus group
3. For each medium demonstrated in Step 2: (a) Identify the participants perceived advantages and disadvantages with the different media relative to ordinary audio telephony and (b) identify which mediated communication situations (identified in Step 1) for which the participant would want to use this service.
4. Present selected Eye-2-Eye results and discuss these on the basis of the discussion in Step 3.
5. Discuss home/leisure context and future applications.

The issues on the agenda were addressed sequentially. Time was allowed to discuss issues "on the side" of the main agenda, as the participants sometimes initiated new, interesting angles to the theme.

The focus group session lasted approximately two hours.

6.2.2 Participants

Focus group participants were recruited from a media class at a nearby high-school in Oslo. The media teacher at the school was contacted and given a written overview of the Eye-2-Eye project and the focus group process, together with an invitation to participate. Six students (three boys and three girls) - age 17 - were chosen for participation. They were familiar with each other, but from three different study groups.

The theme for the focus group was relevant to their study curriculum, and the results will be provided to the participants.

6.2.3 Setting the scene

A short presentation of the Eye-2-Eye project was given, followed by an introduction to the theme of the focus group. Participants were asked to identify the communication services they used in their everyday life, and their patterns of use for these services.

6.2.4 Demonstration of services

In order to get hands-on experience with the different communication services, the participants were separated in two groups. Three persons were at one end of the Eye-2-Eye field set-up, three persons were at the other. Two participants at a time, one at each side, were co-operating to complete one task for each service. The persons not actively solving tasks were spectators.

- Using audio conferencing, the participants were required to solve a negotiation task.
- Using multimedia conferencing, the participants solved a co-operation task. The aim of the task was to find out whether the negotiators in Task 1 had reached the optimal result.
- Using videoconferencing, the participants completed a discussion task. They were asked to discuss reasons why the negotiators of task 1 had not reached the best possible result in their negotiations.

The demonstration lasted approximately 30 minutes.

6.3 Results

6.3.1 Communication situations of the participants' everyday life

Communication media were defined by the group to be "different types of media that can convey information from sender to receiver". The following media were initially identified by the group:

- Web
- Phone
- SMS
- MSN /Chatting
- TV/ Radio broadcast
- Printed books and materials

- Commercial boards

As the focus was specified to concern person-person real-time communication, the scope of relevant media was narrowed down to regard real-time services. The most used service among all the users was mobile audio telephony.

There was a general agreement that patterns of communication, as well as reasons for communicating, did to some extent differ between sexes:
- "Girls chatter more"
- "Boys have something they want to sort out"

The identified communication situations were generally related with to whom they speak. The group was, however, also encouraged to describe *what* they were communicating about, as well as a general motive for initiating a call. Results are sorted under three different headings, but a lot of the points made are overlapping.

Who do they communicate with?
- close friends
- "less close" friends
- remote friends and acquaintances
- parents
- grandparents
- work
- "fool-calls" to people they don't know

What do they talk about?
- rarely about school (outside the school context)
- Share information and problems regarding computer games/ play station etc.
- Discuss web-sites and web-design
- What happened last week-end, and what's happening next week-end
- "Body-related problems"

Why do they communicate?
- Just to chatter/kill time
- To exchange information
- To update each other on "what's going on"
- To have fun and laugh
- To make appointments on where and when to meet later
- To thank grandma' for the present they just received
- To "annoy" strangers and laugh about it (making "fool-calls")

Putting this information together, identified the following "situations" (defined as a combination of partner, task and motive) that was pursued in the remaining discussions:

Identified communication situations
Chatting with close friends
Talking to more "remote" friends
Discussing school work with class-mates
Calling grandma' to thank her for the present
"Fool-calls" to people they don't know, just to annoy/confuse them
Appointments and updating with parents
Discussing games and web-sites with friends
Updating each other on what has happened lately
Have fun/kill time
Discuss "body-related problems" with close friends
To make appointments on where and when to meet later

6.3.2 Observation during the demonstration session

Observations during the hands-on demonstration revealed some issues of interest to the users' perception of the demonstrated services:

- Some users seemed to "put their face" down into the microphone when speaking. They explained it as uncertainty to whether the other person would hear properly.
- Some of them also put their face close to the screen when communicating over video. Consequently, eye-contact got very bad, as the camera was placed on top of the monitor screen. Again, this is due to lack of experience with using videoconferencing services.
- Some of the users got "embarrassed" by showing their own picture. Others again reported that they didn't think of this at all, and were mainly aware of the other person, rather than their own image being transferred.

6.3.3 Advantages and disadvantages of the communication services

After the demonstration the group gathered again, and discussed the different services, one by one, with respect to:

- What differs from ordinary telephony?
- Which advantages does this service have compared to telephony?
- Which disadvantages does this service have compared to telephony?
- For which communication situations would this service be preferred?

Results from the discussions are summarised in the following table:

Service:	**Audio conferencing**
Advantages	• free to do other things while speaking • more people can participate
Disadvantages	• feel you have to shout (but you'll get used to it) • other people in the room can hear your conversation

Other differences	
Relevant communication situation	• Work/school. More people can participate • Grandma. You can play a computer game at the same time.. • When having long talks with friends (the cellular phone goes "hot")

Service:	**Videoconferencing**
Advantages	• you can see the other • close contact - can see facial expressions • can verify the "realness" of the other person • can register if someone else "enters" the conversation or situation
Disadvantages	• cannot make "fool-calls" • sometimes you are not "presentable" (e.g. nude) • Embarrassing to show yourself • You may non-deliberately "reveal the truth" • More "complicated" than a mobile phone. You have to sit down, rather than move around.
Other differences	• Cool and Fun • ..or only "new".. • "I forget that I can be seen - I'm only concentrating on the image of the other"
Relevant communication situation	• talking to close friends • depends on the mood..
Other issues	• Bad eye-contact. Eye contact is essential in order to get extra information

Service:	**Multimedia conferencing**
Advantages	• Sharing documents
Disadvantages	None identified
Other differences	
Relevant communication situation	• in work context / school work • could be used when helping each other to design web-sites

6.3.4 Reasons for service choice

After discussing advantages and disadvantages with the different services, the participants were asked to identify which media would be chosen for the different communication situations identified in section 6.3.1. The exercise was to choose situations suitable for a

given medium, rather than the other way around. Hence, all identified situations have not been mapped to a specific medium. The table below show a summary of the results.

Media	**Situations**	**Rationale**
Face-to-face	To thank grandma' for the present they just received	Easier to express feelings when meeting face-to-face
Audio telephony	"fool-calls" to people they don't know	"It wouldn't work if they could see who calls
Mobile phone	Friends in general	The easiest way. And all their friends have one..
e-mail	Remote friends. Friends abroad	Calling long distance is too expensive
MSN chat	People you met on holiday.	To save money, but still keep in touch.
SMS	Boyfriend/Girlfriend	Less embarrassing than audio calls

6.3.5 Discussing results from the Eye-2-Eye field study

A brief summary of objectives and methodology from the Eye-2-Eye field study was presented. The participants were invited to guess the relation between the identified communication tasks, as identified in Eye-2-Eye deliverable D4, and the field study participants' choice of service for the different tasks.

The focus group moderator did not reveal the research findings to the participants until they had discussed this sufficiently, and provided sufficient rationales for their expectations.

When the participants of the group had thoroughly discussed their expectation with respect to the findings, the findings were presented and mismatches between expected findings and actual findings were discussed.

Focus group participants were surprisingly good at anticipating the most chosen service, although most of them expected the audio conferencing to be frequently used. The arguments for their suggestions being:

Communication task	**Suggested service**	**Rationale**
Generally most used	Ordinary telephony + Audio conferencing	"The phone can be used for everything"
Generally least used	Avatar	"There is no point in using it…"
Information sharing	ordinary phone	Video seems "unnecessary"
	e-mail	For sharing with several people
Simple help	Audio conferencing	Quick and easy

	e-mail	Sending to several at the same time
Yes/no-questions	Text chat	It's the quickest way, unless you need an answer directly
Scientific/ profes-sional discussions	Video	These discussions might depend on body language and non-verbal cues
Meetings with several people	Audio conferencing	An easy way to talk to several people at the same time
Thinking and creative processes	Multimedia	Showing each other plans and suggestions
	e-mail	In addition to video: Can make relevant information available instantly

6.3.6 Future use of communication services in a home/leisure context

After closing the discussion on the project findings, the participants discussed the use of the services in a future context of their own situation. The scenario was:

- Imagine in the near future that more than half of the people you know will have general access to the same choice of communication services.

Video was generally thought of as useful in many situations. Most participants thought they would use it in many home contexts, including talking to friends. It is a drawback, though, that you are somewhat "confined" by having to be seated in front of the camera.

Audio conferencing was very "popular". Most of the youths thought this to be a good service. The mistaken idea about having to "shout" into the microphone would not be a problem, as you get used to the service. Audio conferencing would typically be used for talking to friends and acquaintances, as well as in work and school situations.

Multimedia was considered useful for sharing data files. It is a possible good way of co-operating about designing web-sites etc.

Avatar technology was discussed on a general level, as we could not demonstrate the actual avatar telephony used in the field study. The group was familiar with the concept, but didn't believe it was very useful. A typical statement was "Why would you want to see an animated image of the person, while hearing his voice?"

Chatting was not a very popular activity in the group, though well known, and the group did not even see a use for avatar in a chat context. Avatars could be fun to use once or twice, but was not considered useful at all.

7 Focus group 3 - Medium dependent social presence and person perception

7.1 Context and focus issues

Focus group was held at Nottingham 06.12.2002

Key focus

The experienced social presence of communication partner as well as general perception of partner attributes varies, depending on the communication task at hand and technical configurations of the communication service.

Focus group goals

- Validate results on user attitudes from the baseline and laboratory experiments.
  - Perspective: Can users tell the difference between different technical settings for audio and videoconferencing. If they can, how do these impact upon their perceptions of the other person and the media.

7.2 Methodological approach

7.2.1 Structure of the focus group

To reach the goals of this focus group, the following procedure was employed:

1. An overview of the Eye-2-Eye project was given, with reference to the data collected in the baseline and laboratory experiments. Participants were introduced to the concepts of person perception, social presence and communicative processes, and the scenario approach to be used was explained.
2. Participants were presented a scenario, and asked to act it out using the defined media condition, followed by a general discussion of the scenario.
3. Discuss the appropriateness of the media for the scenario and participants' general feelings in relation to the experimental measures.
4. Asking structured questions to validate the laboratory findings, followed by unstructured discussions.

The focus group lasted approximately 2,5 hours.

7.2.2 Participants

The focus group consisted of 5 females and 2 males either staff or students from the University of Nottingham ranging in age from 20 to 40 years. All except 1 male had participated in previous experiments for Eye-2-Eye

7.2.3 Setting the scene

Participants were given a verbal overview of the Eye-2-Eye project with reference to the data collected in the baseline and laboratory experiments. They were introduced to the concepts of person perception, social presence and communicative processes.

Participants were read an example scenario and told that they would be given different scenarios to discuss while using various configurations of media and were asked to consider the media in terms of person perception, social presence and communicative processes.

7.2.4 Scenarios and conditions addressed

The choice of scenarios was based on the media preferences study from the Baseline Experiments (see D2). The conditions were chosen on the basis of key findings from D3 – reported in Section 2.1.2.

The media conditions, configurations and evaluation scenarios used were presented in the order shown below.

Condition	**Configuration**	**Scenario**
1 – video conferencing	3.5" screen, QCIF resolution, 160ms synchronised audio and video delay	You've seen an advert for an antique Ming vase for sale and it seems like just what you've been looking for. The vase is very expensive so you want to be sure that you're buying the real thing and not a fake. The trouble is, it's at the other end of the country. You decide to get in touch with the seller to see if you can find out enough about the vase to make a long journey worthwhile.
2 - video conferencing	3.5" screen, CIF resolution, 160ms synchronised audio and video delay	Fran, your best friend from University, has emigrated to Australia. You're sad that it won't be as easy to meet her, as you always had excellent conversations about how you were feeling about life, your career, relationships and just about anything else. You've just started a new job and you're keen to tell her all about it and find out what she's been doing.
3 - video conferencing	29" screen, QCIF resolution, 160ms synchronised audio and video delay	You've been studying as a mature student on a part-time computer technology course at the local college. The practical examination is coming up and is completed in pairs. Your partner is one of your classmates who you've been working with on a few projects. You need to have a meeting to discuss strategy for the exam and make some plans for sharing out the preparation work. You're concerned about making sure you're both properly prepared and you suspect that they've not been doing very much work.

4 - video conferencing	29" screen, CIF resolution, 160ms synchronised audio and video delay	The government has just changed the tax rules, and you're hoping that you're entitled to a reduction and perhaps even a refund. Written information is due out next month, but you want to talk to a tax consultant straight away
5 – video conferencing	29" screen, CIF resolution, 200ms audio delay, 400ms video delay	You have arranged an evening out at the pub with a good friend, Julia. She's been a little down in the dumps recently but you're looking forward to seeing her. You've just found out though, on the same evening your favourite band is playing a concert at the local venue. She hates the band and won't want to come along, so you've decided to get in touch with Julia and postpone your night out by telling a white lie.
6 – Audio conferencing	160ms audio delay	You've been feeling ill for some time and have been to the doctor to take some tests. The results are due back today and you suspect that you might have a serious disease. You have to talk to the laboratory specialist to get the results and are not sure how you will take the news if it's bad.

Table 3: Media conditions and configurations for focus group 3

Results to be verified were addressed by presentation of the conditions shown below

Conditions	**Results to be verified**	**Experiment phase obtained**
1 & 2, 3 & 4	Do individuals rate measures of social presence – (attention, reactions and realness of their partner, like a face-to-face meeting) more highly with better screen resolution?	Laboratory experiments
2 & 3	Are measures of social presence – (real size, like a face-to-face meeting) rated higher with bigger screens?	Laboratory experiments
2 & 3	Are measures of person perception – (formality) rated more highly with small screens?	Laboratory experiments
All	Do people rate each other as more friendly in "richer media"?	Baseline tests & Laboratory experiments
All	When do people notice changes in the quality of service, when do they feel it affects their communication?	Baseline tests & Laboratory experiments
All	Are individuals aware of any dialogue differences when comparing media, for example, more interruptions when using	Baseline tests & Laboratory

	video compared to audio only?	experiments
All scenarios	Are there effects on individuals' perceptions of the other person when engaged in different tasks ?	Baseline tests & Laboratory experiments

7.2.5 Hands-on demonstration

In order to get hands-on experience with the different communication services, the participants were divided into two approximately equal groups. One group in each test room. Two participants at a time, one in each room, were given the scenario to act out. The other participants were asked to watch the interaction closely but not to join in. Each scenario was read aloud and acted out by a different person.

7.3 Results

The following sections refer to conditions 1-6 in Table 3 above.

7.3.1 Summary of condition 1

Participants kept leaning forward peering at the screen. They felt the size of the screen detracted from the communication, one participant felt it encouraged "over looking" at the video which distracted from the audio. The medium was felt to be totally inappropriate for the task scenario (buying a Ming vase). They didn't feel they had a good impression of any of the attributes of social presence or person perception. It was considered useful only for viewing the other person's general appearance.

7.3.2 Summary of condition 2

Again, participants kept leaning forward peering at the screen. They felt the size of the screen detracted from the communication. Specifically participants noted that the video was distracting them from the audio communication. They felt that given a small screen on a mobile device they might use the medium given a friendly, informal scenario (communicating with a friend in Australia). Just to see their face not as an aid to the communication in any specific way. Participants mentioned that they would be more likely to want to show their communication partner their surroundings rather than their face with a mobile video device. Participants felt it was like a long distance telephony conversation as they noticed the long (160ms) delay.

7.3.3 Validation of project findings related to conditions 1 and 2

Do individuals rate measures of social presence (e.g. 'attention', 'reactions and realness of their partner', 'like a face-to-face meeting') as being much higher the greater the screen resolution?

- Participants were unable to detect any difference between the screen resolution in conditions 1 and 2.

7.3.4 Summary of condition 3

Participants immediately noted the difference between a 3.5" screen and the 29" screen. They were much more positive towards the 29" screen saying "it's just like being face-to-face" and " they're a much more natural size". With respect to the scenario (preparing for an exam and the other participant hasn't done enough work), some of the participants felt that the medium was good because it allowed them to see if the other person was lying. However, the other participant (who hadn't done enough work) was trying to avoid confrontation and felt that they would prefer, given the scenario, to use the telephone.

The low level of resolution (QCIF) was noted, but participants said it didn't make any difference to their communication. They felt the biggest effect on their communication was the screen size. One participant actually correlated the screen size to distance between the individuals. Stating, a small screen makes them look far away whereas a big screen makes them feel like they're in the same room.

7.3.5 Summary of condition 4

Participants instantly noted the difference in resolution. Surprisingly, this was considered annoying insofar as it meant that they could tell if the other participant wasn't providing the appropriate amount of eye contact. But lying would be more obvious. Participants noted that for this reason it would be good to have an understanding of what the other person was seeing. When asked about attributes of social presence the participants thought they had a good understanding of when the other person was paying attention, when it was their turn to speak, how the other person was reacting, etc. Given the scenario, (giving advice on tax issues) participants noted that video might not be the best medium because " they wouldn't want to see people shuffling papers around". The information they needed to know could be gained from a audio telephony conversation.

7.3.6 Validation of project findings related to conditions 3 and 4

The following issues were addressed:

a) Does a larger screen (29") allow an interaction that is more like a face-to-face meeting? (findings reported in Eye-2-Eye deliverable D3).
b) Does a larger screen (29") make the other person in the interaction appear a natural size? (findings reported in Eye-2-Eye deliverable D3).
c) Are interactions on small screens considered more formal than those on a large screens? Previous work (Monk & Watts, 1995) suggests that this is the case. However, this finding was not supported by the Eye-2-Eye laboratory experiments (deliverable D3).

The focus group validated these findings of the Eye-2-Eye laboratory experiments reported in D3. Participants in the focus group commented that the large screen made the interaction much more like a face to face meeting and that the other person appeared a more natural size. The participants did not suggest that the interaction was more formal with a smaller screen, and when asked specifically if this was the case, they did not believe it was.

7.3.7 Summary of condition 5

Participants did not notice any difference between condition 4 (synchronous audio and video) and condition 5 (asynchronous audio and video – video delayed) and were unable to tell which if any technical parameter had changed.

7.3.8 Summary of condition 6

Participants were divided in their opinions as to whether this was the most appropriate medium for the task scenario (getting results back from a doctor). One participant, a trainee nurse, felt face-to-face or video communication would be better for the task because both media allowed participants to show empathy. The other participants (non-medical professionals) felt that they would prefer to receive and give bad news via audio only communication because they wouldn't want to see other people being upset.

8 Main results and Discussion

In the present chapter, the results from the focus groups are summarised and discussed in relation to the three main objectives of the focus groups:

1. Validation of key findings of the Eye-2-Eye project
2. Possible generalisation of the findings to other user groups
3. Identification of future application areas.

8.1 Validation of project key findings

Results from focus groups 1 and 2 indicate that the discrepancy between users' preference ratings in a hypothetical situation and actual choice in a real-life situation, probably depends on user experience with using the technology. The experienced users were very good at predicting project findings on task performance and medium choice, and hence to this extent validated the project findings.

The groups' predictions of the preference study in-depth interview results were less accurate, as they suggested a more differentiated pattern of preference than found in Baseline study 1 (general media richness trend). Anticipating that the group suggested the findings to be in line with their own preferences, it can be concluded that:

- media preference for hypothetical communication scenarios will depend on users' long-term experience with using the different media or services at hand.

Focus group 1 offered plausible explanations to why users in general choose ordinary audio telephony for many communication situations. It is probably due to 'habits' and perceived ease of use. Their own pattern of use was quite in line with the project findings from the field study.

8.1.1 Specific conclusions regarding validity of the laboratory results

Focus group study 3 had a specific purpose of validating experimental findings reported in Eye-2-Eye deliverable D3 – i.e., can users tell the difference between different technical settings for audio and video conferencing, and how do these impact upon their perceptions of the other person and the media?

The main issues from focus group 3 can be summarised as follows:

Asynchrony
The findings from Experiment 3 (effects of asynchrony) were partially validated. Participants did not really notice the asynchrony, however the results of the objective behavioural measures of effects on communication had shown there to be significant effects on behaviour.

Screen size

Participants felt that a small screen (as with a mobile device) detracted from communication, and that it was useful only for viewing the other person's general appearance or to show their communication partner their surroundings. They were much more positive towards the large (29") screen and felt that it made their partner seem like they were in the same room. The findings from Laboratory Experiment 4 (effects of screen size) were validated in that participants felt that a larger screen made the other person seem more natural and the interaction more like a face-to-face meeting. However the finding about perceived formality was not validated.

Resolution

The findings from Laboratory Experiment 5 (differences in resolution with small screens) were validated in that participants were unable to detect any difference between the screen resolutions CIF and QCIF when the screens were small. However, when the screens were large (29"), participants noticed the difference. Interestingly, they found the higher quality CIF more annoying because they could tell that they did not have direct eye-contact with their communication partner.

8.1.2 Eye Contact issues

Both focus group studies 2 and 3 identified concern about eye-contact in video-conferencing. In focus group study 2 lack of eye-contact was identified and considered a problem because of the belief that eye contact is essential in order to convey and perceive extra information. In focus group study 3 participants instantly noted the difference in resolution between CIF and QCIF and considered this annoying insofar as it meant that they could tell if the other participant was not providing the appropriate amount of eye contact.

In the one-to-one situations of the baseline, laboratory and field tests distance from the monitor was either controlled or recommended according to ETSI ETR 297 (1996). This was so that the difference between the camera axis and the image display's eye-level axis did not exceed 8° at the closest point of the viewing distance. This ensures a situation where users should not notice the lack of eye contact or be negatively effected by it in either subjective or objective outcomes. The distance from the screen and camera was not strictly controlled in the focus group demonstrations. Some participants were leaning towards the monitor when speaking, and this led to lack of eye contact that was considered negative.

8.2 Generalisations to other user groups

Participants in focus group 1 showed a different pattern of preference for services than found in the baseline media preference study by in-depth interview. Their preferences were more in line with findings on medium effects on performance in the baseline studies, as well as actual medium choice in the field study. Results from this group

indicate that the discrepancy between users' ability to predict their own use of communication services probably depends on experience of use.

This is in line with findings from the Eye-2-Eye field study. Here, most users showed a general tendency to a "slow uptake" of the new services, and slowly adapted to a new pattern of differentiated service choice for different communication tasks. Even users who expressed explicit aversion to having 'all these new services' available at their desk, adopted a new pattern of use, and towards the end of the study expressed positive experience with the use of both videoconferencing and multimedia conferencing.

Participants in both focus groups 1 and 2 were surprisingly good at predicting project findings on media choice in the field context. With the exception that youths thought the audio conferencing would be more popular (field results shows hardly no use at all), both groups could foresee the general patterns of use for most of the identified tasks. This is taken as an indication that findings from the field study can apply to other populations as well. The focus groups 1 and 2 represent quite different populations, but still showed similar perception of suitable task-media combinations. It is of course not possible to say whether this holds for *all* user populations (probably not), but it suggest that the field study results apply to a broader audience. Again, it is suggested that users' preference- and choice patterns mainly depend on their knowledge of, and experience with, using the different communication services.

8.3 New application areas

Communication tasks identified by the particular user groups are summarised for each communication service below.

At a general level is it concluded that videoconferencing was valued for informal conversations with friends and is a finding in contrast with multimedia conferencing that was thought as very work-task oriented. There was little enthusiasm for mobile videoconferencing and no real enthusiasm for avatar telephony or real-time text.

8.3.1 Future application of Multimedia Conferencing services

Multimedia conferencing was uniquely a work context aid to communication. The table below summarises the key communication tasks identified.

User Group	**Communication task**
Mature, Business	Thinking and process
	Contract and project work
	Information sharing
	Administrative reporting
Youth, Student	Work and school context
	Collaborative working with artefacts
	Thinking and creative processes

8.3.2 Future applications of videoconferencing services

Although both leisure and work-oriented uses of videoconferencing were identified, this was particularly apparent for the youths who saw a value for 'just talking'.

User Group	Communication task
Mature, Business	Discussion
	Market and strategy
General adult	Communications that require showing empathy
Youth, Student	Informal situations: talking with close friends
	Work situations: discussing complex topics to communicate

In the small screen (mobile) simulation of videoconferencing more informal communication with social acquaintances was also emphasised by the older participants.

User Group	Communication task
General adult	Viewing other person's general appearance
	Showing surroundings
	Informal situations: talking with friends

Multi-point conferencing was not considered an essential feature, with the potential practical challenges out-weighing the few benefits identified.

8.3.3 Future applications of avatar telephony services

No future application of avatar telephony services was identified. Even an avatar addition to real-time text was rejected as an interesting or useful communication service.

8.3.4 Future applications of audio telephony services

Adults tended to value the potential of audio telephony as a preferred alternative to videoconferencing when the video image either had little value (e.g., messages, simple questions) or when the video image might be distracting (e.g., seeing other participants 'shuffling paper' or 'upset').

The youths also identified these types of situations but also saw the potential for 'just talking' when conversation involved several people, was long in duration or when it could be possible to talk in parallel with another activity.

User Group	Communication task
Mature, Business	Messages
	Yes/no questions
General adult	Formal situations that require reference to notes/papers

Youth, Student	Work situations
	Simple help
	Group participation
	Informal/Family situations: chat and do other task
	Long conversations

8.4 Possible limitations of the results

One obvious limitation of the focus group results presented in this report is the fact that they are based on information from only three small groups of people - a total of 19 persons. Also, the baseline and laboratory results have been obtained with a limited set of tasks. What the field study gained as an in-depth longitudinal study of all relevant work-related tasks was at a cost of including only 5 participants in the group receiving the new communication services. More detailed discussion of possible limitations of the baseline tests, laboratory experiments and field study are contained in their individual reports. The remaining discussion concentrates on the current focus group studies.

Even if steps were taken to ensure that focus group participants were informed about the nature and approach of previous Eye-to-Eye studies, we can never be sure that their responses were based on a complete understanding of the project issues discussed. However, participants were carefully chosen for their relevance as informant groups (experienced communication technology users, media class students, and former laboratory test participants), and the general impression was a high level of understanding of the focus issues.

Participants of focus groups 1 and 2 had no prior experience with the actual Eye-to-Eye technology used. They were given a brief hands-on demonstration of the different services, and again, the impression was that the participants had a very realistic understanding of the technology involved.

The fact that both user groups 1 and 2 expressed a similar - and quite correct - anticipation of project results, indicates that their understanding of both the task issues discussed and the technology used were high.

Regarding new application areas, the discussions were not exhaustive. Unfortunately, time ran out, and discussions were quite brief. Future research would benefit from more extensive surveys on people's attitudes and expectations for future use of new communication services.

9 Next steps in the project

This report is intended as a stand-alone resource that integrates the findings from the three separate phases of the project's user tests (baseline, laboratory, field) and reports conclusions on new application areas and contexts for real-time person-person communication services. In addition, however, findings from the focus group studies shall be incorporated into the project's guidelines and experience of running the focus group methodology shall feed into the evaluation toolkit in the remaining stages of the Eye-2-Eye project.

The timing of completion of relevant future deliverables is summarised in Table 4.

Table 4. Timing of the project's main future deliverables

no.	Title	Nature	Date
D6.5	Fitness-for-Purpose Guidelines	Public Report & Tool	January 2003
D1.3	Fitness-for-Purpose Evaluation Methodology	Public Report & Tool	February 2003
D5.3	Cost-Benefit Analysis Tool	Public Tool	March 2003

All project deliverables are available via the project website at www.Eye-to-Eye.org.

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Glossary of main Eye-2-Eye terminology and concepts [5]

Acceptable price: The price that end-users are willing to pay for a particular communication service or for improved quality of service. The price of telephony (equipment as well as service) should be used as a benchmark when asking (potential) end-users about acceptable price; and the latter should be expressed as a percentage of the price of telephony, e.g. 50% (half the price of telephony), 300% (three times the price of telephony), etc.
Asynchrony: When audio and video information that leaves one communicating party at the same time is received by the other communicating party at different times (e.g., typically the audio information arrives before the video information in an asynchronous situation)
Audio telephony: An 'ordinary' telephone service as distinct from Audio conferencing
Audio conferencing: A telephone service that does not rely on amplification of the voice signal in very close proximity to the recipient's ear
Avatar telephony: A service for transmitting voice signals in real-time over a telecommunication network in combination with a graphical (human) representation of the speaker
Benefits: Benefits to the end-users from using a particular communication service (e.g. savings of travel time and costs, achievement of task goals, ease of use, easy accessibility to the called party, increased communication quality and effectiveness, etc.).
Communication activity: What the end-users (want to) do with a communication service (e.g. social chatting, buying or selling shares, conducting a job interview, etc.).
Communication media: Types of information with which humans communicate. Examples are text, audio, moving image (video, moving graphics) and still image.
Communication service: A service that is provided via a telecommunication network. Examples are ordinary telephony, email, videoconferencing, avatar telephony, audio conferencing.
Communication situation: The combination of task, motive, content and user (group) characteristics.
Communicative behaviour: End-user behaviour while using a communication service, including turn taking, interruptions, verbal and non-verbal back-channels and gaze.
Conference: used as follows within the scope of Eye-2-Eye: (a) From a technical orientation a point-to-point connection (i.e., there were no studies of multi-point connection); From a service orientation it is always person (or group)-to-person (or group) communication.
Costs: Costs that the end-user has to pay for using a particular communication service. These include not only financial costs but also subjective costs; e.g. the user may see loss of privacy as one of the costs to pay for having a videophone.
Duplex: A mode of operation by which information can be transmitted in both directions simultaneously between two points.
Dyadic: (Distance) communication between two people

[5] This is a general list for the Eye-2-Eye project as a whole and is not restricted specifically to this document.

Effectiveness (ISO 9241 definition): The accuracy and completeness with which specified users can achieve specified goals in particular environments.
Efficiency (ISO 9241 definition): The resources expended in relation to the accuracy and completeness of goals achieved.
End-users: The people who use a communication service for person-to-person communication.
End-users: The people who use the communication service*(s)*.
Fitness-for-Purpose: The correct balance between technological performance and human performance, such that the interaction is both sufficient and beneficial for person-person communication and consistent with human expectations from face-to-face communication.
Frame rate: The frequency by which a full video frame is updated, sometimes called video temporal resolution or image frequency.
Group: (Distance) communication between three or more people.
Half-duplex: A mode of operation where, at a given instance, only one of the two correspondent information streams is transmitted.
Interpersonal perception. The extent to which the perception of the other person's attributes (how likeable, intelligent, friendly etc.) is positive or negative.
Media effects: The effect a particular communication medium has on an end-users task outcome, communicative behaviour, attitudes and beliefs.
Media preferences: The subjective assessment by users or user groups of when a given communication medium is preferred over another.
Multimedia conferencing: A service for transmitting voice, video and data signals in real-time over a telecommunication network
Multi-point: Distance communication between three or more locations
Packet loss: A loss of one packet that can be described using a certain statistical model
Point-to-Point: Distance communication between two locations
Quality of service: Those aspects of the service which are assumed to affect the degree of satisfaction of the user of the service (e.g. the number of frames per second in videoconferencing, the auditory bandwidth in audio conferencing).
Resolution: A term denoting the degree of detail which can be created by a particular visual display system
Satisfaction (ISO 9241 definition): The comfort and acceptability of the work system to its users and other people affected by its use.
Target audience: The people or organisations who are going to use the fitness-for-purpose guidelines, the cost-benefit analysis tool and/or the fitness-for-purpose evaluation toolkit.
Task elements: Features of *tasks* that can be expected to vary (e.g., extrinsic-intrinsic origin, symmetrical-asymmetrical balance, originator-recipient role, ego involvement level, information dependency, sociability level)
Task goal: The aim or object towards which the communication is directed. It is what end-users want to do with the *communication technology* (e.g. social chatting, buying or selling shares, conducting a job interview, etc.).
Task outcome: The extent to which task performance dependent on the medium

Task: What users of *communicative technology* actually do in order to accomplish some *task goal*. In experiments tasks may be described to the participants or they are embedded in scenarios as a part of a *situation*.
Usability (ISO 9241 definition): The *effectiveness*, *efficiency*, and *satisfaction* with which specified users achieve specified goals in particular environments.
User groups: End-users who with respect to their usage of communication service may be grouped together (e.g. business executives, university students, grandparents, deaf people, etc.).
Videoconferencing: A service for transmitting voice and video signals in real-time over a telecommunication network
Videotelephony: See Videoconferencing.
Willingness to pay: An end-users willingness to pay in financial terms for a given communication service in a given situation.

List of Main Project Abbreviations

ACTS	Advanced Communications Technologies & Services
AI	Artificial Intelligence
AMR	Adaptive Multi-Rate
ANOVA	Analysis of Variance
AO	Audio only
API	Application Programming Interface
BER	Bit Error Rate
CIF	Common Intermediate Format – a video format defined by ITU-T
CBA	Cost-Benefit Analysis
CBAT	Cost-Benefit Analysis Tool
CODEC	Coder/Decoder
COST	Co-operation for R&D in Science and Technology
CSCW	Computer supported collaborative work(ing)
CVE	Collaborative Virtual Environment
EC	European Commission
EDF	European Disability Forum
ERCIM	European Research Consortium for Informatics and Mathematics
ETSI ETR	ETSI Technical Report
ETSI	European Telecommunications Standards Institute
EUD	European Union of the Deaf
FtF	Face-to-Face (real-time human communication in the physical rather than digital world)
fps	(video)frames per second
FfP	Fitness-for-Purpose
GSS	Group Support System
GUI	Graphical User Interface
H261	Standard for audio-visual coding
HDTV	High definition television
HCI	Human Computer Interaction
I2I	Eye-2-Eye (abbreviation)
ICIF	Interlaced CIF (having the same number of pixels per line as CIF but twice the number of lines (i.e., 352 pixels per line and 576 lines)
ICT	Information (and) Communication Technology
IETF	Internet Engineering Task Force
IMPP	Instant Messaging/Presence Protocol
IMTC	International Multimedia Telecommunication Consortium
IP	Internet Protocol
IPR	Industrial Property Rights, Intellectual Property Rights
IRC	Internet Relay Chat
ISDN	Integrated Services Digital Network
ISO	International Standards Organisation
IST	Information Society Technologies
ITU	International Telecommunication Union

I2i	an abbreviation of the project's short name.
Kbps	Kilo Bits per Second
kHz	Kilo Hertz
LAN	Local Area Network
LEO	Low Earth Orbite – a new generation of satellite systems for mobile communication (both low and high bandwidth)
LSD	Least Significant Difference
MAN	Metropalitan Area Network
MAUT	Multi-Attribute Analysis Technique
Mbps	Mega Bits per Second
MCP	Medium Choice Pattern
MOS	Mean Opinion Score
MPEG	Motion Picture Experts Group
MPLS	MultiProtocol Label Switching
MRT	Media Richness Theory
ms	Milli-seconds
MSN	MicroSoft Network
MSP	Media Selection Panel
MUD	Multi-User Dungeon
NTSC	National Television Standard Committee
PAL	Phase Alternating Line – a TV standard used in most European countries (except France)
PC	Personal computer
PDA	Personal Digital Assistant
PSTN	Public Switched Telephone Network
QCIF	Quarter CIF
QoS	Quality of Service
R&D	Research and Development
RACE	R & D in Advanced Communications in Europe (R&D Programme, 1985-1995)
RLR	Receive Loudness Rating
RSVP	Resource ReSerVation Protocol
RTD	Research, Technological Development and Demonstration
RTP	Real-time Protocol
SDL	Specifation and Description Language
SIF	Source Input Format – a video format defined for MPEG 1
SLR	Send Loudness Rating
SMS	Short Message Service
SVHS	Super VHS – improved performance compared with VHS
SQL	Structural Query Language
TAP	Telematics Applications Programme
TCP	Transmission Control Protocol
TELR	Talker Echo Loudness Rating
TH	Talking Head

TIPHON	Telecommunications and Internet Protocol Harmonisation Over Networks. An ETSI project which started in Spring 1997 with members from Europe (including Israel), North America and Australia and co-operating with a Japanese regional standardisation organisation.
UDP	User Datagram Protocol
VHS	Video Homes System – a format for Home Video Cassette Recorders
VMC	Video mediated communication
VoIP	Voice over IP
VPN	Virtual Private Network
WAN	Wide Area Network
WAP	Wireless Application Protocol
WtP	Willingness to Pay

Appendix 1: Project time schedule and deliverables

In the following chart, deliverables emphasised are associated with the project's empirical phases of baseline, field and laboratory tests that provided input to the current report.