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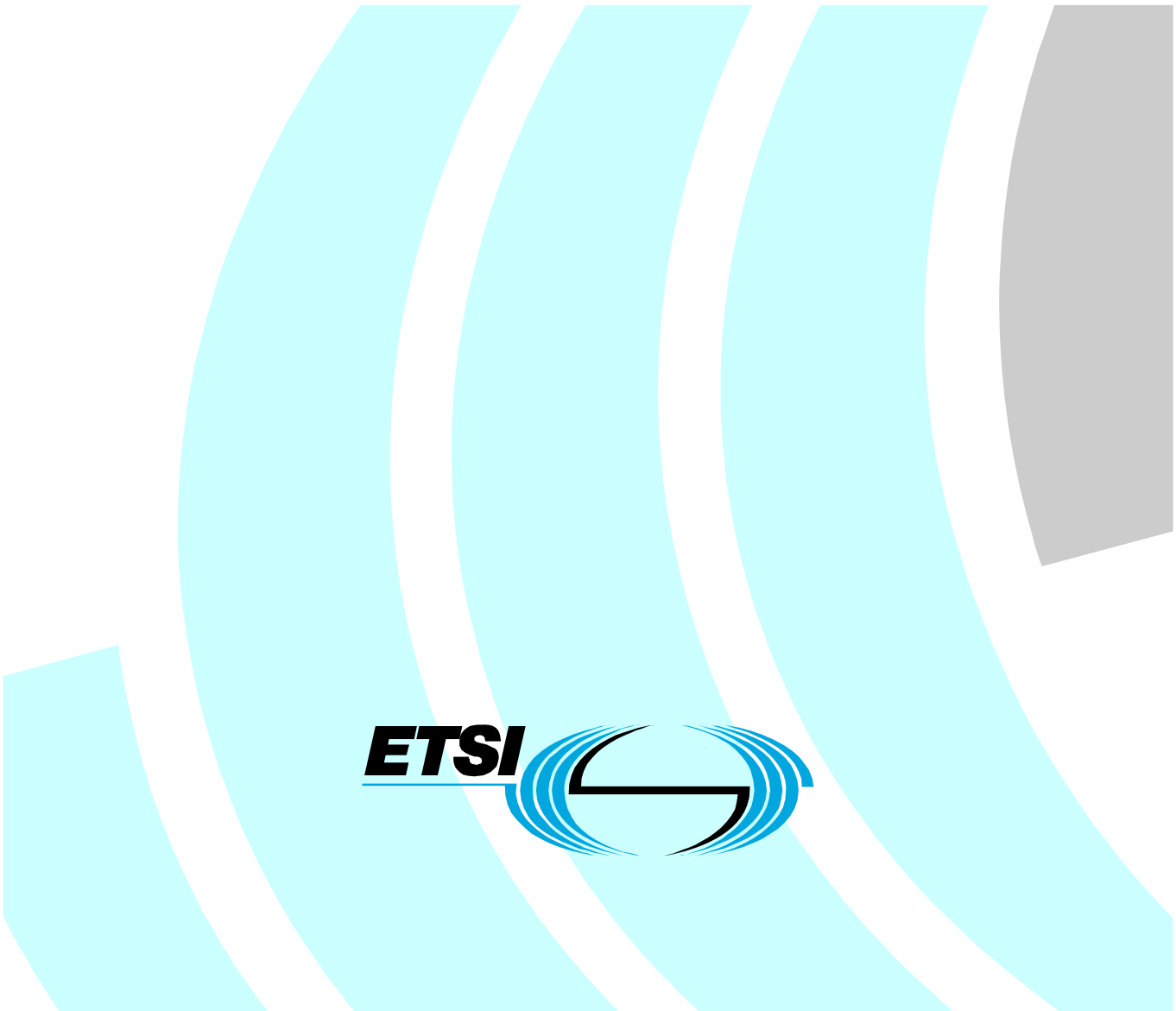
ETSI Guide

Human Factors (HF);
Guidelines for real-time person-to-person communication services



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Contents

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Foreword

This ETSI Guide (EG) has been produced by ETSI Technical Committee Human Factors (HF).

Intended users of the present document are:

- Network operators, especially persons responsible for:
  - strategic network planning;
  - system integration;
  - network testing;
  - marketing;
  - sales.
- Equipment manufacturers, especially persons responsible for:
  - development engineering;
  - marketing;
  - sales;
  - support.
- Service providers, especially persons responsible for:
  - system integration;
  - terminal testing;
  - sales.

Introduction

Real-time person-to-person communication services offer users the opportunity to interact using various communication media: text, audio, graphics, video and data. The communication services that use these media are real-time conversational text, audio-telephony, audio conferencing, avatar-telephony, data conferencing (e.g. a shared presentation or workspace), videotelephony, videoconferencing and multimedia conferencing. These services place different demands on the communication channel and terminal equipment (figure 1). In addition, these services continue to evolve for both mobile and static usage and provide complex choices regarding the most appropriate technologies, media and services that are suitable for different communication situations. TR 102 274 identified the need to develop guidelines for network operators, equipment manufacturers and service providers that address:

- the configuration and quality of different communication media;
- the selection between different communication media;
- acceptability of different communication media;
- future applications for real-time human communication services.

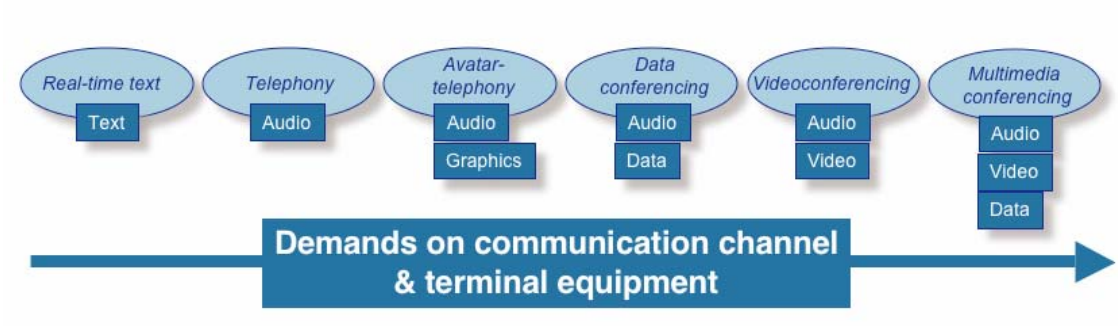

Figure 1: Main real-time person-to-person communication media and services

Distinction between Quality of Service and Quality of Experience

When implementing real-time person-to-person services there are many network, codec and environment characteristics that may interfere with human communication (Hestnes et al 2003). In a packet switched network the interfering characteristics are bandwidth, packet size, delay, delay jitter, packet loss, burst packet loss and sequencing. The codec characteristics are the media protocols (e.g. G.7xx, H.26x, MPEGx), video space resolution, video time resolution, delay, distortion and monitor size. The environmental characteristics are lighting conditions, background patterns, colour and reflex, acoustics, audio echo degradation, viewing distance, camera position and camera parameters. Description of these technical parameters is provided in Heim et al (2001).

These technical characteristics are typically a topic of Quality of Service (QoS), with measures of QoS being based on theoretical mathematical and engineering principles and removed from measures of quality as experienced by end-users. From a more user-centred perspective the concept of "Quality of Experience" (QoE) is attracting growing attention (Hestnes et al, 2003, Nokia, 2004). ITU-T SG 12 Q13/12 is addressing "Multimedia QoE/QoS performance requirements and assessment methods". By developing definitions proposed by Nortel (2003), Siller and Woods (2003) and TR 102 274 the current report suggests that QoE is:

- The performance of users when using what is presented by a communication service or application user interface. It takes into account the individual Quality of Services and measures the acceptability of a service or application by including factors such as usability, utility, fidelity and level of support from the application or service provider (e.g. sales, delivery, error corrections).

This is a general definition that should be able to encompass more specific concerns. What is important for current purposes is that although QoE embodies psychological measures of user behaviour it is also expressed in relation to technical QoS. Therefore, user-centred guidelines for real-time communication services should succeed where possible to combine both QoE and QoS measures to provide an expression of the user behaviour when performing a particular communication task with a particular communication service with known levels of QoS (TR 102 274).

Linking QoS and QoE in user-centred guidelines

TR 102 274 proposes an approach for deriving user-centred guidelines from user test results by extracting and combining QoE and QoS parameters where these data are known. The approach derives a database of detailed intermediate guidelines from which more concise guidelines can be abstracted. The intermediate guidelines are constructed based on the clause:

IF <communication situation>;

USING <service prescription>;

WITH <technical parameters>;

THEN <usage outcome>.

The attributes <communication situation>, <service prescription>, <technical parameters> and <usage outcome> have sub-attributes and sometimes sub-sub-attributes in order to cover the problem space and to correspond to existing knowledge of media effects on communication behaviour (TR 102 274). For example, the attribute "Communication Situation" has the sub-attributes "Task", "Setting" and "User"; and "Task" is defined by sub-sub-attributes including "Duration", "Situation formality" and "Urgency". The "Service prescription" contains the service used (e.g. telephony or video conferencing), the "technical parameters" concern QoS measures such as network delay and packet loss and "usage outcome" includes variables such as user communication efficiency and satisfaction.

With this essential information collected and structured, guidelines can be abstracted that aim to state the principal messages of relevance to the intended guideline users (Brooks et al., 2003). It is these abstracted guidelines (figure 2) that form the main content of the current report.

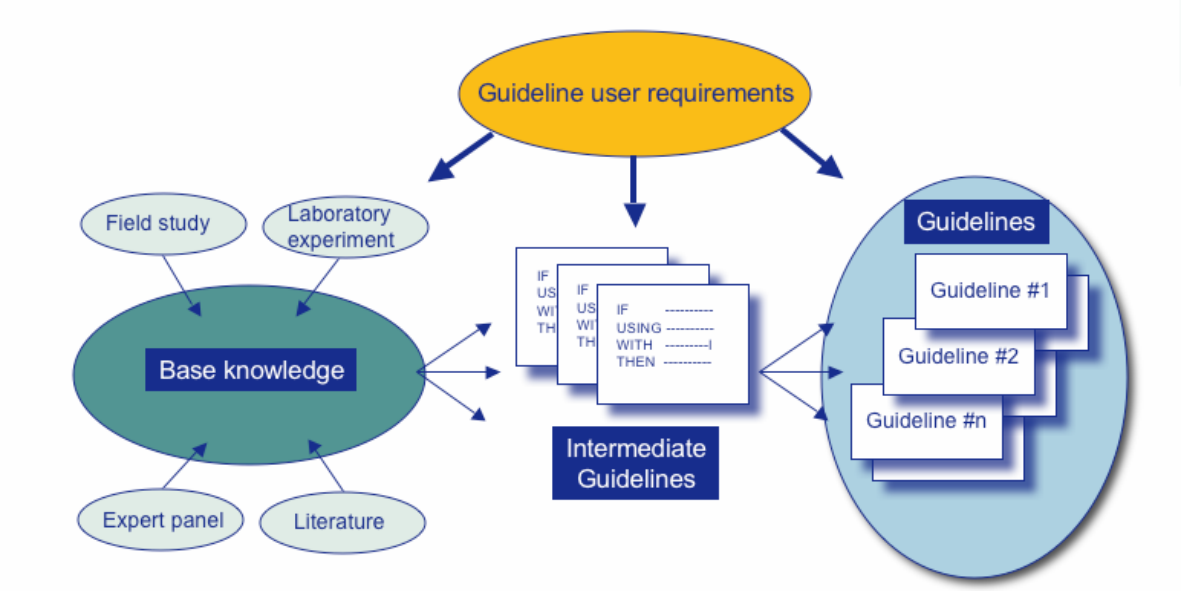

Figure 2: Guidelines are derived from base knowledge through a process of intermediate guideline development that map QoE and QoS variables

Maturity and restrictions of the guidelines

The guidelines are considered initial due to the relative novelty of this area of work. While based on scientifically derived empirical data or expert opinion, the validity of some guidelines remains open for further study. For example, some of the user tests on which the guidelines are based should be replicated and extended to different user groups and task types. Whereas there may be cross-cultural issues concerned with real-time communication services, the available user test data is mainly restricted to samples within particular countries (e.g. the UK and Norway). Most of the empirical tests involve condition comparisons that reveal where significant differences between independent variables exist and were not designed to identify precise thresholds. Also, most of the laboratory results that exist to date concern dyadic communication (i.e. between two people) that is point-to-point (i.e. between two locations). Some field data exists for group communication (i.e. between three or more people) that is point-to-point. There is currently little data available for multi-point communication (i.e. between three or more locations).

1 Scope

The present document provides guidelines for real-time person-to-person communication services. The guidelines are intended for persons working in network operator, equipment manufacturer, service provider and other organizations who may influence the development of services for end-users. This includes strategic planners, sales persons, customer support personnel and conference meeting facilitators.

The services examined concern text communication, audio communication, avatar communication, data communication, video communication and multimedia communication. Service aspects include audio-video synchrony, video resolution, video delay and packet loss for fixed and mobile networks.

Some of the guidelines are developed from initial guidelines contained in TR 102 274 whilst others were created for the present document. Guidelines are provided for topics that have been identified as important for intended guideline users and for which user-based data existed or could be collected. Therefore, the development of guidelines from published literature is not exhaustive.

2 References

No references are considered essential for the use of the present document.

Articles and reports on which the technical work was based and from which the guidelines were produced are listed in annex C "Bibliography".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the following terms and definitions apply:

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)

NOTE: It is calculated as audio delay subtracted from video delay (e.g. if audio delay is 50 ms and video delay is 200 ms, then asynchrony is 150 ms; if audio delay is 100 ms and video delay is 50 ms, then asynchrony is -50 ms).

audio communication: use of a service that transmits voice in real-time over a telecommunication network, such as ordinary telephony with a handset and loudspeaking audio conferencing

audio conferencing: telephone service that does not rely on amplification of the voice signal in very close proximity to the recipient's ear

EXAMPLE: Loudspeaking audio communication.

audio delay: time required for an audio signal generated at the talker's mouth to reach the listener's ear

audio protocol: set of rules defining the way audio information is represented in a network

audio telephony: "ordinary" telephone service using a handset as distinct from loudspeaking audio conferencing

avatar communication: use of a service that transmits voice signals in real-time over a telecommunication network in combination with a graphical (human) representation of the speaker

avatar telephony: service for transmitting voice signals in real-time over a telecommunication network in combination with a graphical (human) representation of the speaker

bandwidth: range of frequencies which can safely be conveyed in a communication channel

burst packet loss: loss of two or more packets in sequence

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

NOTE: 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 (ETR 160).

communication service: service that is provided via a telecommunication network

NOTE: Examples are audio-telephony, email, videoconferencing, avatar-telephony, audio conferencing.

communication situation: 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

conversational text: See real-time text.

data communication: use of a service that transmits personal computer-based information (e.g. presentation slides) in real-time over a telecommunication network in conjunction with the transmission of voice signals in real-time

data conferencing: See data communication.

duration: length of time of the communication task

dyadic communication: (distance) communication between two people

effectiveness: accuracy and completeness with which specified users can achieve specified goals in particular environments

NOTE: See ISO 9241 definition.

efficiency: resources expended in relation to the accuracy and completeness of goals achieved

NOTE: See ISO 9241 definition.

end-users: people who use a communication service for person-to-person communication

fitness-for-purpose: correct balance between technological performance and human performance, such that the interaction is both sufficient and beneficial for person-to-person communication and consistent with human expectations from face-to-face communication

frame-rate: 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

NOTE: Either in a point-to-point or a multi-point configuration.

interpersonal perception: extent to which the perception of the other person's attributes (how likeable, intelligent, friendly, etc.) is positive or negative

media effects: effect a particular communication medium has on an end-users task outcome, communicative behaviour, attitudes and beliefs

media/medium: See Communication Media/Medium.

monitor size: number in inches of the diagonal of the image screen on a screen

multimedia communication: use of a service that transmits voice, video and data signals in real-time over a telecommunication network

multimedia conferencing: service for transmitting voice, video and data signals in real-time over a telecommunication network

multi-point: distance communication between three or more locations

network quality of service: degree of conformance of the service delivered to a user by a provider with an agreement between them

NOTE: From ITU-T Recommendation E.860.

packet loss: loss of one packet that can be described using a certain statistical model

packet size: magnitude of a relatively small unit of data transmitted over a packet switching network as part of a message transferred from one user to another

personal involvement: extent to which the communication parties are committed to the outcome of the task or perform the task more on behalf of another party than themselves

point-to-point: distance communication between two locations

quality of experience: The performance of users when using what is presented by a communication service or application user interface.

NOTE: It takes into account the individual Quality of Services and measures the acceptability of a service or application by including factors such as usability, utility, fidelity and level of support from the application or service provider (e.g. sales, delivery, error corrections).

EXAMPLE: A service provider may conclude that a particular communication service with a certain level of Quality of Service used for a particular communication situation offers users good or very good Quality of Experience as measured by user satisfaction, task efficiency and task effectiveness.

Quality of Service: QoS offered by the service provider is a statement of the level of quality expected to be offered to the user/customer by the service provider

NOTE: The level of quality is expressed by values assigned to QoS parameters. These parameters are usually designed to be understandable to the user/customer. Each service would have its own set of QoS parameters.

EXAMPLE: A service provider may state that the availability of basic telephony service is 99,9 % in a year with not more than a 15 minute break on any one occasion.

real-time text: service for transmitting alpha-numeric characters in real-time over a telecommunication network

remote inspection: videoconferencing with video as data (e.g. for a remote person to see an object or environment rather than the person(s) with whom they are talking) (sometimes also called Tele-inspection and Tele-data)

resolution: term denoting the degree of detail which can be created by a particular visual display system

satisfaction: comfort and acceptability of the work system to its users and other people affected by its use

NOTE: ISO 9241 definition.

situation formality: relative amount of ceremonious or conventional communication versus casual or unconstrained communication

task outcome: extent to which task performance dependent on the medium

task: what users of *communicative technology* actually do in order to accomplish some *task goal*

NOTE: In experiments tasks may be described to the participants or they are embedded in scenarios as a part of a *situation*.

telephony: service for transmitting voice signals in real-time over a telecommunication network

text communication: use of a service that transmits alpha-numeric characters in real-time over a telecommunication network

NOTE: Also known as real-time text and conversational text.

urgency: extent to which a task is particularly urgent or under particular time pressure

usability: *effectiveness*, *efficiency*, and *satisfaction* with which specified users achieve specified goals in particular environments

NOTE: See ISO 9241 definition.

user satisfaction: comfort and acceptability of the task performance to the service user

NOTE: Operationalized as the extent to which the service is assessed to a pleasant communication medium for the task.

video communication: use of a service that transmits voice and video signals in real-time over a telecommunication network, i.e. use of videotelephony or videoconferencing

NOTE: For the current report the communication involves a loudspeaking audio system and not a handset.

videoconferencing: service for transmitting voice and video signals in real-time over a telecommunication network for group communication

NOTE: In the current report the audio system is considered loudspeaking and not with a handset or headset.

video delay: time between the input of the first pixel of a particular picture at the sending end encoder and the output of the pixel from the decoder at the receiving end

video protocol: set of rules defining the way video information is represented in a network

videotelephony: service for transmitting voice and video signals in real-time over a telecommunication network for dyadic communication

3.2 Abbreviations

For the purposes of the present document, the following abbreviations apply:

CIF Common Intermediate Format

NOTE: A video format defined by ITU-T.

GSM Global System for Mobile (telephony)
IPR Industrial Property Rights
IPR Intellectual Property Rights
IST Information Society Technologies
ITU International Telecommunication Union
MAUT Multi-Attribute Utility Technique
PLC Packet Loss Concealment
QCIF Quarter CIF
QoE Quality of Experience
QoS Quality of Service
SQCIF Sub Quarter CIF
STF Specialist Task Force
SVGA Super Video Graphics Adapter/Array
XVGA eXtended Video Graphics Array

4 Guidelines

The guidelines are grouped in the following clauses according to particular real-time person-to-person communication services:

- text;
- audio;
- data;
- avatar;
- video;
- multimedia.

There is also a separate clause containing guidelines for selecting between the communication services.

In addition, video communication is sub-divided into different types of service:

- "face-to-face" communication;
- remote inspection;
- multi-point and heterogeneous networks.

There are also clauses that address special user groups for real-time communication services. These are:

- blind and visually impaired people;
- deaf and hearing impaired people.

Within each group guidelines are clustered under topics, consisting of:

- a guideline number;
- main guideline statement;
- justification provided as an argument for the guideline.

Table 1 lists the main topics addressed and indicates which communication service has a guideline on that topic (marked "X").

Table 1: Main guideline topics addressed for different communication services

	SS	T	A	Av	D	V	F2F	RI	MPH	MM
Clause number	4.1	4.2	4.3	4.4	4.5	4.6	4.6.1	4.6.2	4.6.3	4.7
Reliability	x					x	x			
Cost-benefit						x	x	x		
Set-up time	x		x							
Duration	x	x								
Urgency			x			x	x			x
Asynchrony						x	x	x		x
Delay		x				x	x			
Packet loss						x	x	x		
Frame-rate						x		x		
Resolution					x	x	x	x		
Media quality			x							
Desktop, high quality						x	x			x
Screen size						x	x			
Appearance						x	x			x
Eye contact						x	x			x
Perception of other person(s)		x	x	x		x	x			x
Spatial speaker recognition		x								
Self view						x		x		
Window configuration						x			x	
Group conferencing						x	x			x
Human support						x	x			
Business communication	x		x	x						
Decision making										
Negotiation	x		x			x	x			
Joint problem solving	x		x			x	x	x		
Persuasion	x									
Object selection						x		x		
Showing surroundings						x		x		
Instruction			x			x	x			
Using a foreign language	x									
Elderly persons at home	x		x							
Blind persons						x		x		
Deaf persons	x	x	x			x	x			

NOTE: Abbreviations:

SS	Service Selection	V	Video
T	text	F2F	"Face-to-Face"
A	Audio	RI	Remote Inspection
Av	Avatar	MPH	Multi-Point and Heterogeneous
D	Data	MM	MultiMedia

4.1 Service selection guidelines

Topic	Guideline number	***Guideline*** • Guideline justification
Set-up time		
	4.1.1	***Audio communication with fast call set-up is preferred to video communication with a long set-up time*** • Audio communication with fast call set-up is preferred when used for managerial work tasks (compared with audio communication with high-quality and 7 second call set-up) • Audio communication with 3,1 kHz bandwidth and fast call set-up and call forwarding is chosen more when used for managerial communication (compared with audio communication with 7 kHz bandwidth and 7 second call set-up and no call forwarding)
Reliability		
	4.1.2	***Video communication set-up attempts that fail for 5 to 10 minutes usually result in users switching to audio communication*** • Video communication has a set-up time-slot of 5 to 10 minutes before people switch to audio communication, based mainly on service providers' experiences with booked meetings in videoconference rooms
Elderly persons at home		
	4.1.3	***Video communication when used for providing psycho-social and physical health care can be perceived to have higher utility than audio communication*** • Video communication when used for providing consultancy care services to elderly persons at home is perceived to have high utility (compared with audio communication) • Audio communication when used for providing consultancy care services to elderly persons at home is perceived to have lower utility (compared with home visits)
	4.1.4	***Video communication when used for providing psycho-social consultancy care can be perceived to have higher utility than home visits*** • Video communication when used for providing psychological and social consultancy care services to elderly persons at home is perceived to have higher utility (compared with home visits)
Negotiation		
	4.1.5	***Loudspeaking audio communication has a higher perceived utility than audio with a handset*** • Loudspeaking audio communication when used for negotiation has a higher perceived utility (compared with audio communication with a handset)
	4.1.6	***Audio communication has a higher perceived utility than video communication with 650 ms delay*** • Audio communication when used for negotiation has a lower perceived utility (compared with video communication with 650 ms delay)
	4.1.7	***Video communication has a higher perceived utility than audio communication with a handset*** • Video communication with no delay when used for negotiation has a higher perceived utility (compared with audio communication with a handset)

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Negotiation (continued)	4.1.8	***Video communication has a higher perceived utility than loudspeaking audio communication***
		• Video communication when used for negotiation has a higher perceived utility (compared with loudspeaking audio communication)
	4.1.9	***Video communication with 650 ms delay has a higher perceived utility than audio communication***
		• Video communication with 650 ms delay when used for negotiation has a higher perceived utility (compared with audio communication)
	4.1.10	***Video communication with 650 ms delay has a higher perceived utility than avatar communication***
		• Video communication with 650 ms delay when used for negotiation has a higher perceived utility (compared with avatar communication)
	4.1.11	***Mobile video communication has a higher perceived utility than audio communication***
		• Video communication with a small (3,5 inch) screen when used for negotiation has a high perceived utility (compared with audio communication)
	4.1.12	***Mobile video communication has a higher perceived utility than avatar communication***
		• Video communication with a small (3,5 inch) screen when used for negotiation has a high perceived utility (compared with avatar communication on a small (3,5 inch) screen)
	4.1.13	***Sellers may obtain a more-favourable outcome with video communication than with audio communication***
		• Video communication with high quality when used by people acting as sellers in a sales negotiation game can lead to obtaining a more-favourable outcome (compared with audio communication and people acting as buyers)
	4.1.14	***Sellers may obtain a more-favourable outcome with video communication than with Text communication***
		• Video communication with high quality when used by people acting as sellers in a sales negotiation game can lead to obtaining a more-favourable outcome (than with Text communication and people acting as buyers)
	4.1.15	***Agreement can be reached in similar times with audio communication, video communication and when face-to-face***
		• Audio communication with 7 kHz bandwidth when used for negotiation may not lead to a significant difference in time to reach consensus (with efficiency comparable with video communication and when actually face-to-face)
		• Video communication with high quality when used for negotiation may not lead to a significant difference in time to reach consensus (with efficiency comparable with audio communication and when actually face-to-face)
Joint problem solving		
	4.1.16	***Video communication with lip asynchrony of 200 ms has a higher perceived utility than audio communication***
		• Video communication with lip asynchrony of 200 ms when used for joint problem solving has a higher perceived utility (compared with audio communication with a handset)
		• Video communication with lip asynchrony of 200 ms when used for joint problem solving has a higher perceived utility (compared with loudspeaking audio communication)

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Joint problem solving (continued)	4.1.17	***Audio conferencing has a higher perceived utility than audio telephony***
		• Loudspeaking audio communication when used for joint problem solving has a higher perceived utility (compared with audio communication with a handset)
Persuasion		
	4.1.18	***Video communication when used for persuasion is considered suitable by potential users without direct experience***
		• Video communication with high quality when used for persuasion is considered suitable by potential users without direct experience (unlike Audio communication)
	4.1.19	***Audio communication is not considered suitable by potential users without direct experience when used for persuasion***
		• Loudspeaking audio communication with 7 kHz bandwidth is considered by people without direct experience as unsuitable for persuasion
	4.1.20	***Video communication may offer an advantage over audio communication if arguing a case with personal involvement***
		• Video communication with high quality when used for persuasion can have an advantage if arguing a case with personal involvement (compared with Audio communication)
	4.1.21	***Text communication may offer an advantage over audio communication if arguing a case with personal involvement***
		• Audio communication with 7 kHz bandwidth when used for persuasion can have a disadvantage if arguing a case with personal involvement (compared with Video communication)
		• Audio communication with 7 kHz bandwidth when used for persuasion can have a disadvantage if arguing a case with personal involvement (compared with Text communication)
		• Audio communication with 7 kHz bandwidth when used for persuasion when arguing when used for a third party can lead to users being perceived as more formal (compared with Video communication)
Managerial work		
	4.1.22	***If cost matters, video communication is chosen over actual face-to-face when used for straight-forward communication tasks***
		• Video communication with high quality is chosen more for group managerial work tasks that involve planning and task distribution when cost of meeting matters (compared with actual face-to-face communication)
	4.1.23	***Video communication is good when used for enabling group processes and active involvement from the participants***
		• Video communication with high quality is chosen more for group managerial work tasks that involve group processes and active involvement from the participants (compared with audio communication)
		• Video communication with high quality is chosen more for group managerial work tasks that involve planning and task distribution (compared with audio communication)

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Topic	Guideline number	***Guideline*** • Guideline justification
Using a foreign language		
	4.1.24	***Video communication may improve outcomes when used for people using a foreign language, compared with audio communication*** • Video communication when used for joint problem solving may improve task outcomes when the users' communication abilities are low (compared with audio only)
	4.1.25	***Audio communication may reduce outcomes when used for people using a foreign language, compared with video communication*** • Audio communication when used for joint problem solving may reduce task outcomes when the users' communication abilities are low (compared with video communication)

4.2 Text communication

Topic	Guideline number	***Guideline*** • Guideline justification
Delay		
	4.2.1	***1 to 2 second delay when used for Text communication is usable but not good*** • Text communication conversation with 1 to 2 second delay when used for conversation by general users is usable but not good
	4.2.2	***Less than 1 second delay when used for text communication offers good quality*** • Text communication conversation with less than 1 second delay when used for conversation by general users is considered good quality
Duration		
	4.2.3	***Text communication can take three-times longer than talking*** • Text communication with character-by-character transmission for negotiation can take three-times longer to reach consensus for no extra gain (compared with audio communication and when actually face-to-face) • Text communication with character-by-character transmission for negotiation can take three-times longer to reach consensus for no extra gain (compared with Video communication and when actually face-to-face)

4.3 Audio communication

Topic	Guideline number	***Guideline*** • Guideline justification
Media Quality		
	4.3.1	***Audio communication with each word understandable offers very good quality*** • Audio communication with every word spoken being understandable offers very good quality (compared with audio communication with quality that not every word is understandable)
	4.3.2	***Audio communication with ease of understanding who is talking offers very good quality*** • Audio communication that enables easily recognising the voice of the person who is talking offers very good quality (compared with audio communication when it is not possible to be certain who is talking)
Spatial speaker recognition		
	4.3.3	***Speaker identification between five or more people can be enhanced by a visual representation of speaker location that supplements spatial audio*** • Speaker identification during audio communication between five or more people is enhanced by a visual representation of speaker location in addition to spatial audio when some of the voices are unfamiliar (compared with mono audio and no spatial-visual representation) • Speaker identification during audio communication between five or more unfamiliar people is enhanced by a visual representation of speaker location in addition to spatial audio (compared with mono audio and no spatial-visual representation) • Speaker identification during audio communication between five or more slightly familiar people is enhanced by a visual representation of speaker location in addition to spatial audio (compared with mono audio and no spatial-visual representation)
Urgency		
	4.3.4	***Audio communication is preferred for urgent communication*** • Audio communication with a handset is regarded the best way to conduct urgent communication for managerial work tasks (compared with office-based loudspeaking audio communication, video communication, multimedia communication and avatar communication)

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Perception of other person(s)

4.3.5 ***Audio communication can lead to users being perceived as more formal***

- Audio communication with 7 kHz bandwidth when used for persuasion when arguing when used for a third party can lead to users being perceived as more formal (compared with Video communication)
- Audio communication with 7 kHz bandwidth when used for persuasion when arguing when used for a third party can lead to users being perceived as more formal (compared with Text communication)
- Audio communication with 7 kHz bandwidth when used for persuasion when arguing when used for a third party can lead to users being perceived as more formal (compared with actual face-to-face communication)

Business communication

4.3.6 ***Audio communication may lead to higher-status members dominating over low-status members, compared with face-to-face meetings***

- Loudspeaking audio communication when used for discussions can exaggerate the tendency when used for high-status members of a business organisation to dominate in meetings (compared to actual face to face communication)

Negotiation

4.3.7 ***Audio communication may allow less monitoring of the other person's concentration, compared with video communication***

- Audio communication when used for negotiation allows less monitoring of the other person's level of concentration (compared with video communication)
- Audio communication when used for information transfer allows less monitoring of the other person's level of concentration (compared with video communication)

Joint problem solving

4.3.8 ***Audio communication may reduce outcomes when used by people using a foreign language, compared with video communication***

- Audio communication when used for joint problem solving may reduce task outcomes when the users' communication abilities are low (compared with video communication)
- Audio communication when used for joint problem solving may not reduce task outcomes when the users' communication abilities are high (compared with video communication)

4.3.9 ***Dialogues may be shorter with audio communication than with video communication***

- Audio communication when used for joint problem solving produces shorter dialogues (compared with video communication)

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Joint problem solving (continued)	4.3.10	***Users may interrupt less with audio communication than with video communication***
		• Audio communication when used for joint problem solving produces less interrupted dialogues (compared with video communication)
Instruction		
	4.3.11	***Audio communication may allow less monitoring of the other person's concentration, compared with "face-to-face" video communication***
		• Audio communication when used for information transfer allows less monitoring of the other person's level of concentration (compared with video communication)
Elderly persons		
	4.3.12	***Background noise should be minimal***
		• Audio communication when used for general communication by elderly people should have background noise kept to a minimum
	4.3.13	***A receiving amplifier may improve communication***
		• Audio communication with receiving amplifiers when used for general communication by elderly hearing impaired persons can improve communication (compared with standard audio communication)

4.4 Avatar communication

Topic	Guideline number	***Guideline*** • Guideline justification
Business communication		
	4.4.1	***Avatar communication is perceived as unsuitable when used for business communication***
		• Avatar communication with poor audio and good graphics has no managerial communication activity for which it is regarded as suitable

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Business communication (continued)	4.4.2	***Communication outcomes with avatar telephony on a small screen may not differ either with video communication on small screens or audio communication*** • Avatar communication with poor audio and good graphics and 3,5 inch screen when used for negotiation can have no significant difference in task outcome (compared with video communication with 3,5 inch screen) • Avatar communication with poor audio and good graphics and 3,5 inch screen when used for negotiation can have no significant difference in task outcome (compared with audio communication) • Avatar communication with poor audio and good graphics and 3,5 inch screen when used for negotiation can have no significant difference in how users perceive their communication partner (compared with video communication with 3,5 inch screen)
Perception of other person(s)	4.4.3	***Perception of personality characteristics with mobile avatar communication may not differ with mobile video communication*** • Avatar communication with poor audio and good graphics and 3,5 inch screen when used for negotiation can have no significant difference in how users perceive their communication partner (compared with video communication with 3,5 inch screen)

4.5 Data communication

Topic	Guideline number	***Guideline*** • Guideline justification
Resolution	4.5.1	***Presentation materials in data communication should have at least SVGA resolution to offer good quality*** • Data communication with H.263 and CIF for presentation material is unusable • Data communication with H.263 and 4CIF for presentation material is usable • Data communication with H.263 and SVGA when used for presentation material offers good quality • Data communication with H.263 and XVGA when used for presentation material offers good quality

4.6 Video communication

Guidelines on videoconferencing are clustered within three different service areas:

- "face-to-face" communication;
- remote inspection of an object or environment (while also engaging in person-to-person communication using real-time audio);
- multi-point and heterogeneous networks.

4.6.1 Video communication: "Face-to-face"

Topic	Guideline number	***Guideline*** • Guideline justification
Reliability		
	4.6.1.1	***Video communication set-up is likely to be abandoned by people on reaching 3 to 10 failed attempts*** • An intended video communication session may be abandoned by people after 3 failed set-up attempts • An intended video communication session can be expected to be abandoned by people during up to 10 failed set-up attempts
	4.6.1.2	***Video communication with an up-time less than 90 % is perceived as unacceptable by users*** • Video communication between videoconferencing rooms with an up-time of less than 90 % is perceived by mainly business users as unacceptable
	4.6.1.3	***Video communication with more than 5 connection terminations per hour is perceived by users as unacceptable*** • Video communication between videoconferencing rooms with more then 5 connection terminations per hour is perceived by mainly business users as unacceptable
Human support		
	4.6.1.4	***Video communication rooms or equipment shared by occasional users is perceived as usable if human assistance arrives within 5 minutes when requested*** • Video communication for planned meetings using rooms or equipment shared by occasional users is perceived as usable if human assistance arrives within 5 minutes after being requested
Cost-benefit		
	4.6.1.5	"***Face-to-face" video communication can be expected to be used in business situations where the benefit is obviously high*** • "Face-to-face" video communication when travel is not an option can be expected to be used in business situations when the benefit is obviously high

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Delay

4.6.1.6 ***No delay may improve user performance***

- Video communication with no delay significantly improves joint problem solving performance (compared with video communication with 500 ms delay)

4.6.1.7 ***No delay may lead to less interruptions between users***

- Video communication with no delay when used for joint problem solving can lead to less interruptions (compared with video communication with 500 ms delay)

4.6.1.8 ***500 ms may reduce user performance when used for problem solving***

- Video communication with 500 ms delay when used for joint problem solving significantly reduces performance (compared with video communication with no delay)

4.6.1.9 ***500 ms may give more interruptions between users***

- Video communication with 500 ms delay when used for joint problem solving can lead to more interruptions (compared with video communication with no delay)

4.6.1.10 ***650 ms may give shorter communication than when there is no delay***

- Video communication with 650 ms delay when used for negotiation can lead to shorter communication (compared with video communication with no delay)

4.6.1.11 ***650 ms may not reduce user performance when used for negotiation, compared with a shorter delay***

- Video communication with 650 ms delay when used for negotiation can have no significant difference in negotiation outcomes (compared to video communication with a delay of 200 ms)

4.6.1.12 ***650 ms may not give more interruptions between users, compared with a shorter delay***

- Video communication with 650 ms delay when used for negotiation can have no significant difference in interruptions (compared to video communication with a delay of 200 ms)

4.6.1.13 ***650 ms may not effect turn taking, compared with shorter delay***

- Video communication with 650 ms delay when used for negotiation can have no significant difference in turn taking (compared to video communication with a delay of 200 ms)

4.6.1.14 ***650 ms may improve outcomes when used for a seller, compared to no delay***

- Video communication with 650 ms delay when used in a sales negotiation game can improve results for the seller (compared with video communication with no delay and those people acting as buyers)

4.6.1.15 ***650 ms may reduce outcomes when used for a buyer, compared with no delay***

- Video communication with 650 ms delay when used in a sales negotiation game can reduce results for the buyer (compared with video communication with no delay and those people acting as sellers)

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Packet loss

4.6.1.16 ***Video communication with audio protocol G.722 and video protocol H.263 should offer better than 1 % packet loss on a fixed line to be perceived as good quality***

- Video communication with audio protocol G.722 and video protocol H.263 and a random (not burst) packet loss of 1,5 % is usable
- Video communication with audio protocol G.722 and video protocol H.263 and a random (not burst) packet loss of 1% offers good quality
- Video communication with audio protocol G.722 and video protocol H.263 and a random (not burst) packet loss of 0,5 % offers very good quality

4.6.1.17 ***Video communication with 1 % packet loss on a fixed line offers good quality for the video channel***

- Video communication with 1 % random packet loss (not burst) offers good quality for the video channel

4.6.1.18 ***Video communication with 3 % packet loss on a fixed line offers good quality for the audio channel***

- Video communication with 3 % random (not burst) packet loss offers good quality for the audio channel

4.6.1.19 ***Video communication with 5 % packet loss on a fixed line with the PLC (Packet Loss Concealment) audio protocol offers good quality for the audio channel***

- Video communication with 5 % random (not burst) packet loss with G.729 with PLC (Packet Loss Concealment) offers good quality for the audio channel
- Video communication with 5 % random (not burst) packet loss with G.723.1 with PLC (Packet Loss Concealment) offers good quality for the audio channel

Resolution

4.6.1.20 ***Video communication with a 29 inch screen with CIF when used for general communication offers good quality***

- Video communication when used between videoconferencing rooms with 29 inch screens and CIF for mainly business communication offers good quality

4.6.1.21 ***Video communication with a 29 inch screen with QCIF when used for general communication is usable***

- Video communication when used between video conferencing rooms with a 29 inch screen and QCIF for mainly business communication is usable in some situations

4.6.1.22 ***Mobile video communication with SQCIF when used for general communication offers good quality***

- Video communication with a 2,5 inch screen with SQCIF when used for general communication offers good quality

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Screen size

4.6.1.23 ***Video communication with a 29 inch screen with CIF when used for general communication offers good quality***

- Video communication when used between videoconferencing rooms with 29 inch screens and CIF for mainly business communication offers good quality

4.6.1.24 ***Video communication with a 29 inch screen with QCIF when used for general communication is usable***

- Video communication when used between video conferencing rooms with a 29 inch screen and QCIF for mainly business communication is usable in some situations

4.6.1.25 ***Mobile video communication with SQCIF when used for general communication offers good quality***

- Video communication with a 2,5 inch screen with SQCIF when used for general communication offers good quality

4.6.1.26 ***A mobile screen can be used for negotiations (or in the same way as a large screen)***

- Video communication with 3,5 inch screen when used for negotiation may not have a significantly negative affect on task outcome (compared with a 29 inch screen)
- Video communication with 3,5 inch screen when used for negotiation may not have a significantly negative affect on communicative process (compared with a 29 inch screen)
- Video communication with 3,5 inch screen when used for negotiation may not lead to significantly different dialogue content (compared with a 29 inch screen)

4.6.1.27 ***QCIF works as well as CIF on a mobile screen***

- Video communication with 3,5 inch screen and QCIF resolution when used for negotiation can result in no significant difference in task outcome (compared with video communication with 3,5 inch screen and CIF resolution)
- Video communication with 3,5 inch screen and QCIF resolution when used for negotiation can result in no significant difference in communicative process (compared with video communication with 3,5 inch screen and CIF resolution)
- Videoconferencing with a mobile screen and QCIF resolution can result in no significant difference in usage outcome (compared with videoconferencing with a mobile screen and CIF resolution)

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Eye contact

4.6.1.28 ***Parallax differences of less than 8° are acceptable***

- Video communication with non-eye contact systems should provide a parallax differences of less than 8° to be within the acceptable range according to ETR 297
- Video communication in general conditions does not require the optical axes of camera and monitor coinciding
- The major video communication equipment manufacturers and service providers do not provide eye-contact systems on the market as users are not asking for them
- Video communication in a conference room with non-exact eye contact is reported as satisfactory for general use by users and service providers

4.6.1.29 ***Eye contact during negotiation may not lead to higher satisfaction***

- Video communication with direct eye-contact when used for negotiation does not lead to higher kevels of satisfaction or acceptance of the technology (compared to video communication without direct eye contact)

4.6.1.30 ***Eye contact during decision making may not lead to higher satisfaction***

- Video communication with direct eye-contact when used for decision making does not lead to higher kevels of satisfaction or acceptance of the technology (compared to video communication without direct eye contact)

Lip-synchrony

4.6.1.31 ***200 ms asynchrony offers good quality***

- Video communication with 200 ms asynchrony when used for joint problem solving may not significantly affect task outcome compared with video communication with synchrony)

4.6.1.32 ***200 ms asynchrony offers quality similar to audio communication***

- Video communication with 200 ms asynchrony when used for joint problem solving can lead to communications similar to audio communication

4.6.1.33 ***Video communication with lip asynchrony of 200 ms has a higher perceived utility than audio communication***

- Video communication with lip asynchrony of 200 ms when used for joint problem solving has a higher perceived utility (compared with audio communication with a handset)
- Video communication with lip asynchrony of 200 ms when used for joint problem solving has a higher perceived utility (compared with loudspeaking audio communication)

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Appearance

4.6.1.34 ***With a head-only view between strangers interaction may become less formal***

- Video communication with a head-only view between strangers can result in less formal interaction (compared to video communication with a head-and-torso view)

4.6.1.35 ***With a head-and-torso view between strangers interactions may be more formal***

- Video communication with a head-and-torso view between strangers can result in more formal interaction (compared to video communication with a head-only view)

4.6.1.36 ***With a head-only view between strangers, communication can become more like that between familiar people***

- Video communication with a head-only view when used for problem solving between strangers can result in behaviour that is more like interaction between familiar people (compared to video communication with a head-and-torso view)

High quality desktop

4.6.1.37 ***If people have video communication on their desktop, they are likely to use it***

- Video communication with high quality from a personal office can become integrated with daily work communications (compared with videoconference rooms)

4.6.1.38 ***High quality desktop video communication is preferred to a videoconference room***

- Video communication with high quality from one's own office when used for managerial work is judged to be an improvement relative to travelling to a dedicated videoconference room

4.6.1.39 ***Video communication is considered suitable if actual face-to-face communication is not possible***

- Video communication with high quality is perceived to be a good way to conduct a broad range of communication tasks when actual face-to-face communication is not an option

4.6.1.40 ***Video communication is suitable when used for the majority of managerial communication***

- Video communication with high quality when used for managerial work tasks between colleagues is perceived to be suitable when used for all communication tasks

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High quality desktop (continued)	4.6.1.41	***Video communication is preferred when used for process-oriented communications***
		• Video communication with high quality is preferred for managerial communications that involve a process (compared with loudspeaking audio communication, audio communication with a handset and avatar communication)
	4.6.1.42	***Video communication is preferred for non-urgent communication***
		• Video communication with high quality from a personal office for non-urgent communication is judged to be an improvement relative to using audio communication with a handset
	4.6.1.43	***Video communication is preferred for communication of long duration***
		• Video communication with high quality when used for managerial work tasks is selected more often if the duration of the call is long (compared with audio communication)
	4.6.1.44	***More is said with video communication for the same outcome, compared with audio communication***
		• Video communication with high quality when used for negotiation can increase the amount users say in order to agree a negotiated outcome (compared with audio communication and actual face-to-face communication)
	4.6.1.45	***Video communication can lead to more interruptions than with audio communication***
		• Video communication with high quality when used for negotiation can increase users' interruptions to agree a negotiated outcome (compared with audio communication and actual face-to-face communication)
	4.6.1.46	***An easy to set-up conference does not stop actual face-to-face meetings***
		• Video communication with high-quality and easy and low-cost access when used for managerial work tasks does not change the pattern of actual face-to-face meetings
Group video communication		
	4.6.1.47	***If cost matters, video communication is chosen over actual face-to-face when used for straight-forward managerial communication tasks***
		• Video communication with high quality is chosen more for group managerial work tasks that involve planning and task distribution when cost of meeting matters (compared with actual face-to-face communication)

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Group video communication (continued)	4.6.1.48	***Video communication is preferred for enabling group processes and active involvement from the participants***
		• Video communication with high quality is chosen more for group managerial work tasks that involve group processes and active involvement from the participants (compared with audio communication)
		• Video communication with high quality is chosen more for group managerial work tasks that involve planning and task distribution (compared with audio communication)
	4.6.1.49	***Video communication rooms or equipment shared by occasional users is perceived as usable if human assistance arrives within 5 minutes when requested***
		• Video communication for planned meetings using rooms or equipment shared by occasional users is perceived as usable if human assistance arrives within 5 minutes after being requested
Non-urgency		
	4.6.1.50	***Video communication is preferred for non-urgent communication***
		• Video communication with high quality from a personal office for non-urgent communication is judged to be an improvement relative to using audio communication with a handset
		• Video communication with high quality when used for managerial work tasks is selected more often if the duration of the call is long (compared with audio communication)
	4.6.1.51	***With video communication more is said for the same outcome, compared with audio communication***
		• Video communication with high quality when used for negotiation can increase the amount users say in order to agree a negotiated outcome (compared with audio communication and actual face-to-face communication)
	4.6.1.52	***Video communication can lead to more interruptions than with audio communication***
		• Video communication with high quality when used for negotiation can increase users' interruptions to agree a negotiated outcome (compared with audio communication and actual face-to-face communication)
Negotiation		
	4.6.1.53	***With video communication more is said for the same outcome, compared with audio communication***
		• Video communication with high quality when used for negotiation can increase the amount users say in order to agree a negotiated outcome (compared with audio communication and actual face-to-face communication)

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Negotiation (continued)	4.6.1.54	***With video communication users may interrupt more frequently***
		• Video communication with high quality when used for negotiation can increase users' interruptions to agree a negotiated outcome (compared with audio communication and actual face-to-face communication)
	4.6.1.55	***Video communication can allow greater monitoring of the other person's concentration***
		• Video communication when used for negotiation can allow greater monitoring of the other person's level of concentration (compared with audio communication)
Joint problem solving		
	4.6.1.56	***Video communication may improve outcomes when used for people using a foreign language, compared with audio communication***
		• Video communication when used for joint problem solving may improve task outcomes when the users' communication abilities are low (compared with audio only)
		• Video communication when used for joint problem solving may not improve task outcomes when the users' communication abilities are high (compared with audio only)
	4.6.1.57	***Dialogues may be longer with video communication than with audio communication***
		• Video- communication when used for joint problem solving produces longer dialogues (compared with audio communication)
	4.6.1.58	***Users may interrupt more with video communication than with audio communication***
		• Video- communication when used for joint problem solving produces more interrupted dialogues (compared with audio communication)
	4.6.1.59	***Users may interrupt less with audio communication than with video communication***
		• Audio communication when used for joint problem solving produces less interrupted dialogues (compared with video communication)
Instruction		
	4.6.1.60	***Video communication can allow greater monitoring of the other person's concentration when giving information***
		• Video communication when used for information transfer can allow greater monitoring of the other person's level of concentration (compared with audio communication)

4.6.2 Video communication: Remote inspection

Topic	Guideline number	***Guideline*** • Guideline justification
Cost-benefit		
	4.6.2.1	***Remote inspection video communication can be expected to be used for business applications in situations where the benefit is obviously high*** • Remote inspection video communication can be expected to be used for business applications in situations where the benefit is obviously high (such as in road construction, oil extraction or ship operations)
Audio-video asynchrony		
	4.6.2.2	***500 ms asynchrony offers good quality*** • Remote inspection with 500 ms asynchrony when used for giving advice on a procedure does not affect task performance (compared with remote inspection with no delay)
Packet loss		
	4.6.2.3	***Video communication with 1 % packet loss on a fixed line offers good quality for the video channel*** • Video communication with 1 % random packet loss (not burst) offers good quality for the video channel
Resolution		
	4.6.2.4	***Remote inspection with CIF and 15 fps when used for moving the camera to show the environment offers good quality*** • Remote inspection with asymmetric video (from a mobile device to a personal computer) with CIF and 15 fps when used for moving the camera to show the environment offers good quality
	4.6.2.5	***Remote inspection with CIF and 10 fps when used for moving the camera to show the environment offers acceptable quality*** • Remote inspection with asymmetric video (from a mobile device to personal computer) with CIF and 10 fps when used for moving the camera to show the environment offers acceptable quality
	4.6.2.6	***Remote inspection with CIF and 5 fps when used for moving the camera to show the environment is usable*** • Remote inspection with asymmetric video (from a mobile device to a personal computer) with CIF and 5 fps when used for moving the camera to show the environment is usable
	4.6.2.7	***Remote inspection with CIF and 15 fps when used for recognising objects offers good quality*** • Remote inspection with asymmetric video (from a mobile device to a personal computer) with CIF and 15 fps when used for recognising objects offers good quality

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Resolution (continued)	4.6.2.8	***Remote inspection with CIF and 5 fps when used for recognising objects is unusable***
		• Remote inspection with asymmetric video (from a mobile device to a personal computer) with CIF and 5 fps when used for recognising objects offers acceptable quality
	4.6.2.9	***Remote inspection with QCIF and 25 fps when used for recognising objects is usable***
		• Remote inspection with asymmetric video (from a mobile device to a personal computer) with QCIF and 25 fps when used for recognising objects is usable
	4.6.2.10	***Remote inspection with QCIF and 10 fps when used for reading 10-point text offers acceptable quality***
		• Remote inspection with asymmetric video (from a mobile device to a personal computer) with QCIF and 10 fps when used for reading 10-point text offers usable quality
	4.6.2.11	***Remote inspection with QCIF and 5 fps when used for reading 10-point text is unusable***
		• Remote inspection with asymmetric video (from a mobile device to a personal computer) with QCIF and 5 fps when used for reading 10-point text hinders good communication
	4.6.2.12	***Remote inspection with SQCIF and 10 fps when used for recognising an environment offers good quality***
		• Remote inspection with asymmetric video (from a mobile device to a personal computer) with SQCIF and 10 fps when used for showing an environment offers good quality
Frame-rate		
	4.6.2.13	***Remote inspection with CIF and 15 fps when used for moving the camera to show the environment offers good quality***
		• Remote inspection with asymmetric video (from a mobile device to a personal computer) with CIF and 15 fps when used for moving the camera to show the environment offers good quality
	4.6.2.14	***Remote inspection with CIF and 10 fps when used for moving the camera to show the environment offers acceptable quality***
		• Remote inspection with asymmetric video (from a mobile device to personal computer) with CIF and 10 fps when used for moving the camera to show the environment offers acceptable quality

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Frame-rate (continued)	4.6.2.15	***Remote inspection with CIF and 5 fps when used for moving the camera to show the environment is usable***
		• Remote inspection with asymmetric video (from a mobile device to a personal computer) with CIF and 5 fps when used for moving the camera to show the environment is usable
	4.6.2.16	***Remote inspection with CIF and 15 fps when used for recognising objects offers good quality***
		• Remote inspection with asymmetric video (from a mobile device to a personal computer) with CIF and 15 fps when used for recognising objects offers good quality
	4.6.2.17	***Remote inspection with CIF and 5 fps when used for recognising objects is unusable***
		• Remote inspection with asymmetric video (from a mobile device to a personal computer) with CIF and 5 fps when used for recognising objects offers acceptable quality
	4.6.2.18	***Remote inspection with QCIF and 25 fps when used for recognising objects is usable***
		• Remote inspection with asymmetric video (from a mobile device to a personal computer) with QCIF and 25 fps when used for recognising objects is usable
	4.6.2.19	***Remote inspection with QCIF and 10 fps when used for reading 10-point text offers usable quality***
		• Remote inspection with asymmetric video (from a mobile device to a personal computer) with QCIF and 10 fps when used for reading 10-point text offers usable quality
	4.6.2.20	***Remote inspection with QCIF and 5 fps when used for reading 10-point text is unusable***
		• Remote inspection with asymmetric video (from a mobile device to a personal computer) with QCIF and 5 fps when used for reading 10-point text hinders good communication
	4.6.2.21	***Remote inspection with SQCIF and 10 fps when used for recognising an environment offers good quality***
		• Remote inspection with asymmetric video (from a mobile device to a personal computer) with SQCIF and 10 fps when used for showing an environment offers good quality

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Self view

4.6.2.22 ***Remote inspection with self-view improves communication efficiency (compared with remote inspection without self-view)***

- Remote inspection with both sites seeing the same video images improves communication efficiency (compared with remote inspection without self-view)

- Remote inspection when the users at the site sending the video images do not see the images that are transmitted offers acceptable quality

Showing surroundings

4.6.2.23 ***Remote inspection with CIF and 15 fps when used for moving the camera to show the environment offers good quality***

- Remote inspection with asymmetric video (from a mobile device to a personal computer) with CIF and 15 fps when used for moving the camera to show the environment offers good quality

4.6.2.24 ***Remote inspection with CIF and 10 fps when used for moving the camera to show the environment offers acceptable quality***

- Remote inspection with asymmetric video (from a mobile device to personal computer) with CIF and 10 fps when used for moving the camera to show the environment offers acceptable quality

4.6.2.25 ***Remote inspection with CIF and 5 fps when used for moving the camera to show the environment is usable***

- Remote inspection with asymmetric video (from a mobile device to a personal computer) with CIF and 5 fps when used for moving the camera to show the environment is usable

Problem solving

4.6.2.26 ***Video communication used for remote inspection rather than when for "face-to-face" video communication may be preferred for problem solving***

- Remote inspection when used for problem solving may be preferred (compared to "face-to-face" video)

Instruction

4.6.2.27 ***Remote inspection may allow less monitoring of the other person's concentration, compared with "face-to-face" video communication***

- Audio communication when used for information transfer allows less monitoring of the other person's level of concentration (compared with video communication)

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Object recognition

4.6.2.28 ***Video communication used for remote inspection rather than for "face-to-face" video communication may be preferred for object selection***

- Remote inspection when used for object selection tasks may be valued more than "face-to-face" video communication

4.6.2.29 ***Remote inspection with CIF and 15 fps when used for recognising objects offers good quality***

- Remote inspection with asymmetric video (from a mobile device to a personal computer) with CIF and 15 fps when used for recognising objects offers good quality

4.6.2.30 ***Remote inspection with CIF and 5 fps when used for recognising objects is unusable***

- Remote inspection with asymmetric video (from a mobile device to a personal computer) with CIF and 5 fps when used for recognising objects offers acceptable quality

4.6.2.31 ***Remote inspection with QCIF and 25 fps when used for recognising objects is usable***

- Remote inspection with asymmetric video (from a mobile device to a personal computer) with QCIF and 25 fps when used for recognising objects is usable

4.6.2.32 ***Remote inspection with QCIF and 10 fps when used for reading 10-point text offers acceptable quality***

- Remote inspection with asymmetric video (from a mobile device to a personal computer) with QCIF and 10 fps when used for reading 10-point text offers usable quality

4.6.2.33 ***Remote inspection with QCIF and 5 fps when used for reading 10-point text is unusable***

- Remote inspection with asymmetric video (from a mobile device to a personal computer) with QCIF and 5 fps when used for reading 10-point text hinders good communication

4.6.2.34 ***Remote inspection with SQCIF and 10 fps when used for recognising an environment offers good quality***

- Remote inspection with asymmetric video (from a mobile device to a personal computer) with SQCIF and 10 fps when used for showing an environment offers good quality

4.6.3 Video communication: Multi-point and heterogeneous networks

Topic	Guideline number	***Guideline*** • Guideline justification
Window configuration		
	4.6.3.1	***Multipoint mobile video communication with continuous presence via a 4-spilt windows matrix when used for general meetings offers good quality*** • Multipoint mobile video communication with continuous presence with window(s) covering 1/4 of the screen when used for general meetings offers good quality
	4.6.3.2	***Multipoint mobile video communication with continuous presence via a 9-split windows matrix when used for general meetings offers good quality*** • Multipoint mobile video communication with continuous presence with window(s) covering 1/9 of the screen for general meetings is usable
	4.6.3.3	***If the users of multi-point videoconferencing can chose between audio-switching and continuous presence, they generally prefer continuous presence display of the other sites*** • If the users of multi-point videoconferencing can chose between audio-switching and continuous presence, they generally prefer continuous presence display of the other sites, even though continuous presence costs more

4.7 Multimedia communication

Topic	Guideline number	***Guideline*** • Guideline justification
Eye contact		
	4.7.1	***Parallax differences of less than 8° are acceptable*** • Video communication with non-eye contact systems should provide a parallax differences of less than 8° to be within the acceptable range according to ETR 297 • Video communication in general conditions does not require the optical axes of camera and monitor coinciding • The major video communication equipment manufacturers and service providers do not provide eye-contact systems on the market as users are not asking for them • Video communication in a conference room with non-exact eye contact is reported as satisfactory for general use by users and service providers

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Eye contact (continued)

4.7.2 ***Eye contact during negotiation may not lead to higher satisfaction***

- Video communication with direct eye-contact when used for negotiation does not lead to higher kevels of satisfaction or acceptance of the technology (compared to video communication without direct eye contact)

4.7.3 ***Eye contact during decision making may not lead to higher satisfaction***

- Video communication with direct eye-contact when used for decision making does not lead to higher kevels of satisfaction or acceptance of the technology (compared to video communication without direct eye contact)

Lip-synchrony

4.7.4 ***200 ms asynchrony offers good quality***

- Video communication with 200 ms asynchrony when used for joint problem solving may not significantly affect task outcome compared with video communication with synchrony)

4.7.5 ***200 ms asynchrony offers quality similar to audio communication***

- Video communication with 200 ms asynchrony when used for joint problem solving can lead to communications similar to audio communication

4.7.6 ***Video communication with lip asynchrony of 200 ms has a higher perceived utility than audio communication***

- Video communication with lip asynchrony of 200 ms when used for joint problem solving has a higher perceived utility (compared with audio communication with a handset)
- Video communication with lip asynchrony of 200 ms when used for joint problem solving has a higher perceived utility (compared with loudspeaking audio communication)

Appearance

4.7.7 ***With a head-only view between strangers interaction may become less formal***

- Video communication with a head-only view between strangers can result in less formal interaction (compared to video communication with a head-and-torso view)

4.7.8 ***With a head-and-torso view between strangers interactions may be more formal***

- Video communication with a head-and-torso view between strangers can result in more formal interaction (compared to video communication with a head-only view)

4.7.9 ***With a head-only view between strangers, communication can become more like that between familiar people***

- Video communication with a head-only view when used for problem solving between strangers can result in behaviour that is more like interaction between familiar people (compared to video communication with a head-and-torso view)

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High quality desktop

4.7.10 ***Multimedia communication is considered the most useful service when used for managerial communication***

- Multimedia communication with high quality when used for managerial work communication is considered the most useful new service (compared with video communication, audio communication and avatar communication)
- Multimedia communication with high quality when used for managerial work tasks supports a real need when used for this type of communication

4.7.11 ***Multimedia communication can become integrated into daily work communications if on the users' desktop***

- Multimedia communication with high quality from a personal office can become integrated into daily work communications (compared with a video communication room)

4.7.12 ***Multimedia communication is often preferred because of the ability to present information on the screen***

- Multimedia communication with high quality when used for managerial work is preferred because of the ability to present information on the screen (compared with video communication, loudspeaking audio communication, audio communication with a handset & avatar communication)

4.7.13 ***An easy to set-up conference does not stop actual face-to-face meetings***

- Multimedia communication with high-quality and easy and low-cost access when used for managerial work tasks does not change the pattern of actual face-to-face meetings

Non-urgency

4.7.14 ***Video communication is chosen for non-urgent communication***

- Video communication with high quality from a personal office for non-urgent communication is judged to be an improvement relative to using audio communication with a handset
- Audio communication with a handset is regarded the best way to conduct urgent communication for managerial work tasks (compared with office-based loudspeaking audio communication, video communication, multimedia communication and avatar communication)

4.7.15 ***With video communication more is said for the same outcome, compared with audio communication***

- Video communication with high quality when used for negotiation can increase the amount users say in order to agree a negotiated outcome (compared with audio communication and actual face-to-face communication)

4.7.16 ***Video communication can lead to more interruptions than with audio communication***

- Video communication with high quality when used for negotiation can increase users' interruptions to agree a negotiated outcome (compared with audio communication and actual face-to-face communication)

4.8 Special user groups

4.8.1 Blind and visually impaired people

Topic	Guideline number	***Guideline*** • Guideline justification
Mobile video communication		
	4.8.1.1	***Some blind persons may prefer to use mobile video communication rather than a guide dog or accompanying person*** • Mobile video communication with high quality on a 6 inch screen when used for a service provider to assist a blind user is preferable to a guide dog or an accompanying person when used for some blind people
	4.8.1.2	***Remote assistance is a service that blind users are likely to use*** • Mobile video communication with high quality on a 6 inch screen when used for a service provider to assist a blind user is likely to be used if offered as a real service • Mobile video communication with high quality on a 6 inch screen when used for a service provider to assist a blind user to observe someone or something can be very important when used for the blind user
	4.8.1.3	***At least CIF and 5 fps may be required when used for reading text*** • Mobile video communication with at least CIF resolution and 5 fps may be required for reading text with adequate effectiveness and efficiency • Mobile video communication with QCIF or SQCIF and 2 fps to 3 fps may not be adequate for reading text with effectiveness and efficiency (compared with mobile video communication with CIF resolution and 5 fps)
	4.8.1.4	***At least CIF and 10 fps may be required for identifying an object while moving*** • Mobile video communication with at least CIF resolution and 10 fps may be required for identifying an object while moving with adequate effectiveness and efficiency • Mobile video communication with QCIF or SQCIF and 5 fps to 6 fps may be inadequate for identifying an object while moving with effectiveness and efficiency (compared with mobile video communication with CIF resolution and 10 fps)
	4.8.1.5	***GSM audio offers good enough quality*** • Mobile video communication with GSM audio quality when used for assisting blind users is good enough quality

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Mobile video communication (continued)	4.8.1.6	***Assisting a blind user to verify an object or information can have high effectiveness***
		• Mobile video communication with high quality on a 6 inch screen when used for a service provider to assist a blind user to verify an object or information can be 100 % effective
	4.8.1.7	***Assisting a blind user to search for information or an object can have high effectiveness***
		• Mobile video communication with high quality on a 6 inch screen when used for a service provider to assist a blind user to search when used for an object or information can be 98 % to100 % effective

4.8.2 Deaf and hearing impaired people

Topic	Guideline number	***Guideline*** • Guideline justification
Service selection		
	4.8.2.1	***Mobile video communication with QCIF and 10 fps to 14 fps when used for sign-language may enable people with low written language competence to communicate more than with text communication***
		• Mobile video communication with QCIF and 10 fps to 14 fps when used for sign-language provides children who are deaf with more opportunities to communicate (compared with text communication and SMS)
		• Mobile video communication with QCIF and 10 fps to 14 fps when used for sign-language provides migrant people who are deaf with more opportunities to communicate (compared with text communication and SMS)
	4.8.2.2	***Mobile video communication with QCIF and 10 fps to 14 fps when used for sign-language can lead to a reduction in the use of text communication***
		• Mobile video communication with QCIF and 10 fps to 14 fps when used for sign-language by people who are deaf can lead to a reduction in the use of text communication
Text communication		
	4.8.2.3	***Text communication may not meet the need for spontaneous and flexible communication***
		• Text communication does meet the need for day-to-day spontaneous and flexible communication by people who are deaf (compared with mobile video communication for sign-language)

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Text communication (continued)	4.8.2.4	***Text communication may not provide sufficient opportunities for people with low written language competence to communicate, compared with mobile video communication***
		• Text communication may not provide sufficient opportunities for children who are deaf to communicate (compared with mobile video communication with QCIF and 10 fps to 14 fps for sign-language)
		• Text communication may not provide migrant people who are deaf with sufficient opportunities to communicate (compared with mobile video communication for sign-language)
Audio communication		
	4.8.2.5	***An induction loop may improve communication***
		• Audio communication with an induction loop when used for general communication by persons with hearing aids can improve communication (compared with standard audio communication)
Video communication - when used for sign language		
	4.8.2.6	***The hands and face should have the highest resolution***
		• Video communication with different resolutions for different parts of the picture when used for sign-language by deaf persons should give the hands and face the highest resolution
	4.8.2.7	***CIF resolution is good***
		• Video communication with at least CIF resolution when used for sign-language by deaf persons is good
	4.8.2.8	***QCIF resolution is usable***
		• Video communication with QCIF resolution when used for sign language by deaf persons is usable
	4.8.2.9	***QCIF and 10 fps to 14 fps video communication can increase spontaneity and flexibility in everyday life, compared with text communication***
		• Mobile video communication with QCIF and 10 fps to 14 fps when used for sign-language provides people who are deaf with more opportunities when used for increased spontaneity and flexibility in everyday life (compared with text communication)
	4.8.2.10	***QCIF and 10 fps to 14 fps enables users to benefit greatly from increased communication***
		• Mobile video communication with QCIF and 10 fps to 14 fps when used for sign-language enables people who are deaf to benefit greatly from increased communication
	4.8.2.11	***3G mobile video communication has reduced utility because calls fail***
		• Mobile video communication on a 3G network when used for sign-language by people who are deaf has reduced utility because 13 % to 17 % of calls either fail to connect or become disconnected

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Video communication - when used for sign language and lip-reading

4.8.2.12 ***20 fps offers good quality***

- Video communication with 20 fps when used for sign language and lip-reading by deaf persons offers good quality

4.8.2.13 ***12 fps to 15 fps is possible to use***

- Video communication with 12 fps to 15 fps when used for sign language and lip-reading by deaf persons is possible to use by experienced persons when used for short conversations

4.8.2.14 ***100 ms delay offers preferred quality***

- Video communication with maximum 0,1 second delay when used for sign language and lip-reading by deaf persons offers preferred quality

4.8.2.15 ***400 ms delay offers acceptable quality***

- Video communication with 0,4 second delay when used for sign language and lip-reading by deaf persons offers acceptable quality

4.8.2.16 ***800 ms delay hinders good conversation***

- Video communication with over 0,8 second delay when used for sign language and lip-reading by deaf persons hinders good conversation

Video communication - when used for voice-supported lip-reading

4.8.2.17 ***100 ms asynchrony is acceptable***

- Video communication with up to 100 ms asynchronisation between audio and video when used for voice-supported lip-reading by deaf persons is acceptable

4.8.2.18 ***QCIF resolution is adequate***

- Video communication with QCIF resolution when used for lip-reading by deaf persons is adequate

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Video communication - when used for sign-language interpretation and communication relay

4.8.2.19 ***QCIF and 10 fps to 14 fps offers acceptable quality***

- Mobile video communication with QCIF and 10 fps to 14 fps when used for sign-language interpretation and communication relay by deaf persons and interpreters can improve quality of life

- Mobile video communication with QCIF when used for sign-language interpretation and communication relay by deaf persons and interpreters functions beyond expectations

- Mobile video communication with 10 fps to 14 fps when used for sign-language interpretation and communication relay by deaf persons and interpreters functions beyond expectations

Annex A (informative): Overview of intended guideline users and their requirements

This annex provides a summary of intended guideline users and their requirements for guidelines and a web-based tutorial system. More detailed information is provided in TR 102 535.

A.1 Intended guideline users

It is possible to identify specific users of the current guidelines in network operator, equipment manufacturer and service provider organizations. These people have diverse roles as summarized in table A.1 and include persons from more technical to more financial work areas, and from more design-oriented to management functions. Persons from all of these categories have contributed to the requirements description summarized in this annex.

Table A.1: Main work functions for users of QoE data

Network operator	Equipment manufacturer	Service provider
Strategic network planning	Sales	Service creation
Sales	Marketing	Service host
Marketing	Development engineering	Service operator
System integration	Customer support	Service support
Network testing	Technical research	Sales
Development engineering	Human Factors research	System integration
Technical research		Terminal testing
Human Factors research		

A.2 Requirement derivation process

Identifying the requirements for guidelines in this area involved an iterative procedure. TR 102 274 (see bibliography) identified initial requirements based on scientific requirements for the manner in which data are collected and translated and also the requirements of the intended guideline users based on interviews in a small sample of network operator, equipment manufacturer and service provider organizations.

The resulting guidelines of TR 102 274 have subsequently been revised and extended based on further study with a larger sample of potential guideline users. Interviews, workshops and surveys have been performed with over 100 persons from network operator, equipment manufacturer and service provider organizations.

The precise procedure performed within a particular organization varied primarily due to the time available to the participants. However, the general approach was to:

- Present an overview of the:
  - issues concerning QoE of real-time person-to-person communication services;
  - approach being used for guideline development and example guidelines;
  - expected ways guidelines could be used;
  - web-based system.
- Obtain feedback from the participants concerning the:
  - draft guidelines;
  - web-based system;
  - topics for which guidelines should exist.

Results from this activity are summarized below.

A.3 Requirements for guidelines

TR 102 274 identified initial requirements for content and format of guidelines. Together with the subsequent interviews, workshops and questionnaire surveys with over 100 persons working in network operator, equipment manufacturer and service provider organizations the main requirements for information that could enhance their work. are described below, along with the main implications of each requirement.

A.3.1 Provide information on key topics of concern that will aid development choices

The issues that concern developers are primarily based on their knowledge of current and foreseeable future technology and market areas. These issues can therefore be considered as topics for which guidelines should be developed. An issue is usually related to a particular communication service with which an individual developer is most concerned. Current and foreseeable future real-time person-to-person communication services are text conversation, audio-telephony, avatar-telephony, data conferencing, videoconferencing and multimedia conferencing.

In addition to requiring QoE data concerning the optimum design of a particular communication service, data is also required to aid the selection between candidate communication services (e.g. reasons for choosing between audio conferencing and video conferencing). Guidelines that address some of these topics could be derived from existing empirical results available in the literature, or from dedicated user tests and expert panels (described further in clause B.1.4). Table 1 summarizes the main guideline topics identified to date and shows where user-based test results are currently available (using "X").

Some requested topics could not be addressed by the present document because user-based test data or expert opinion is currently too provisional or lacking. These topics and the need for further work in these areas are addressed in TR 102 535.

A.3.2 Provide information on related concepts

All system and service developers must deal with continually evolving technology and applications. This requires all persons to apply a certain amount of multidisciplinary knowledge, incorporating for example knowledge of technologies and knowledge of users, as can be seen in the range of topics in table 1. Therefore, information on related concepts should be available in order to help guideline users understand and apply the information on key topics.

This implies the development of tutorial information that explains the key concepts to which the guidelines refer (discussed further in clause A.4).

A.3.3 Provide QoE data that can be used from different perspectives

The application of QoE data will be different between different guideline users. For example, it will depend on their particular role in the development of a system or service. It is possible that particular QoE data can be useful for different developers dealing with apparently different, though related, issues. It is also possible that particular QoE data can be used by the same person differently at different times, depending on a particular project at hand.

The implication is that the development of guidelines from base knowledge of user behaviour should be topic related and allow for different abstractions to different guidelines. Base knowledge should be made accessible in a format that promotes abstraction to concise and applicable conclusions.

A.3.4 Link QoS and QoE variables

Although developers typically appreciate the need for user-based knowledge, their main reference points and decisions usually concern the technical QoS characteristics of a service. Therefore, whilst QoE embodies psychological measures of user behaviour it is should also be expressed in relation to technical QoS. Any guidelines should succeed where possible to combine both QoE and QoS measures to provide an expression of the usage outcome when performing a particular communication task with a particular communication service with known levels of QoS.

The approach used to develop the current report was to derive a database of detailed intermediate guidelines from which more concise guidelines could be abstracted. As summarized in the Introduction to the current report, the intermediate guidelines are constructed based on the clause:

- IF <communication situation>;
- USING <service prescription>;
- WITH <technical parameters>;
- THEN <usage outcome>.

The "technical parameters" concern QoS measures such as network delay and packet loss.

A.3.5 Provide information about user behaviour that is feasible to apply

The <usage outcome> attribute of an intermediate guideline could include many measures of user behaviour. For example, in the area of real-time person-to-person communication the traditional "usability" variables of (communication) effectiveness, efficiency and satisfaction can be supplemented with measures of interpersonal perception and social presence. Depending on the original user tests, all of these measures have the potential to consist of multiple variables.

However, most users of QoE data are not human factors practitioners and instead come from technical and business backgrounds. Therefore, meaningful summary statements of user behaviour are required that may differ from the original used in a user test. An example ordinal scale for Usage Outcome as a measure of QoE is shown in figure A.1.

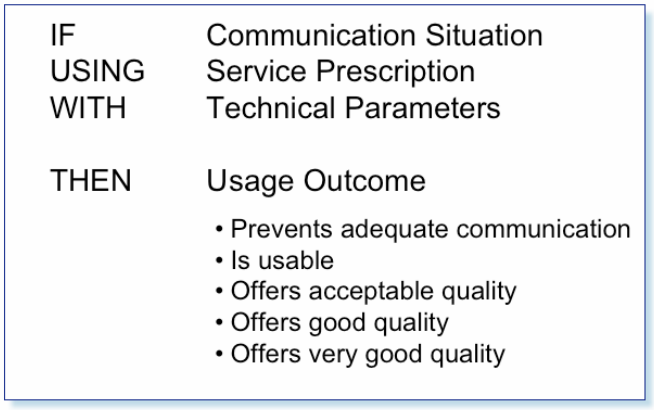

Figure A.1: Example of a Usage Outcome scale for concise expression of QoE

A.4 Requirements for a web-based system

In addition to providing guidelines in the present document, it has been found to be important to develop a web-based system in order to enhance three fundamental aspects:

- **Navigation:** To enhance traversing the information that is in the ETSI Guide (e.g. with hyperlink properties).
- **Education:** To tutor important aspects of the ETSI Guide; this is necessary because the Guidelines cover a complex and continually evolving area (e.g. guideline users must deal with an increasingly wide technological area) and because the guidelines deliberately combine multidisciplinary knowledge (e.g. from more technical QoS to more psychological QoE perspectives).
- **Dissemination:** To make the content available in an alternative way for a wider potential audience, thereby maximizing the spread of knowledge and good practice.

The main requirements for implementation have been identified as:

- Provide two main facilities:
  - "Find a guideline";
  - "Take a tutorial".
- Enable search for guidelines within:
  - Service areas;
  - Guideline topics.
- With each guideline, offer users the option to also receive:
  - Justification of the guideline;
  - More detail.
- Provide multi-media tutorials with default and user selection of media combinations (text, audio, graphics, video);
- Provide option to take a tutorial as:
  - Entire lesson;
  - Selected parts (e.g. overview, definition, frequently asked questions).

A web-based system is currently being developed by ETSI STF 284 to meet these requirements.

Annex B (informative): Background work providing user-based data for the guidelines

A number of methodologies which can be further developed were applied for specifically deriving base data from the guidelines:

- laboratory experiments;
- field studies;
- surveys;
- expert review and panels.

The expert reviews and expert panels were set-up in cases where there was previously no known empirical data existing for a topic area and it was not feasible to perform a user test.

Some base data were derived from existing literature. In order to be considered valid for the current guidelines it was necessary that published results were derived from user tests involving real-time communication between two or more persons. It was also necessary that the report provided sufficient information on the technical parameters of the equipment or service used.

B.1 Studies designed specifically to input to the current guidelines

B.1.1 Laboratory experiments

Comparison tests between text, audio, avatar and video communication have used a persuasion task (N = 100), a task involving negotiated outcome based on trust (N = 142) and a joint problem-solving task (N = 82).
(Schliemann et al., 2001)

Further laboratory experiments have tested audio, avatar and video communication (O'Malley et al., 2002). Seven main experiments were conducted to investigate effects of:

- changes in task type and its impact on performance and attitudes when communication services were varied between audio-telephony and video-telephony (N = 66);
- different tasks on opinion measures such as social presence and person perception (N = 44);
- manipulating discrepancies between audio and video delays (asynchrony) in a problem solving task (N = 48);
- different image sizes in a task involving negotiation to address questions about the use of small screens for mobile videotelephony (N = 48);
- variations in resolution for small screens and their impact on performance, communication and attitudes with a negotiation task (N = 86);
- delay and their impact on performance, communication and attitudes with a negotiation task (N = 42);
- variations in packet loss and delay in a remote inspection task aimed at simulating mobile communication (N = 48).

The laboratory experiments performed by Schliemann et al (2001) and O'Mally et al (2002) have been subject to a Multi-Attribute Utility Technique (MAUT) analysis to derive conclusions on the user-perceived utility of the communication services examined (Frowein et al, 2003).

B.1.2 Field studies

Several field studies provided test results for the guidelines:

- An investigation of communication service choice in an administrative work setting for five persons in a distributed organization. The participants were provided audio conferencing, avatar telephony, videoconferencing and multimedia conferencing for point-to-point communication. All communication services were equally accessible on the participants' desktop and the participants had an established pattern of communication before the field study (Folstad et al, 2002). In addition, The field study performed by Folstad et al (2002) has been subject to a Multi-attribute Utility Technique (MAUT) analysis to derive conclusions on the user-perceived utility of the communication services examined (Frowein et al, 2003).

- A study by the EC IST Eye-2-Eye project in collaboration with the EC IST project IST@Home that piloted how a service content provider could assess the utility of a service for elderly persons provided with videoconferencing in addition to audio telephony at home (Frowein et al, 2003).

- Two longitudinal studies of mobile videotelephony applied to the support of blind users from a service centre. The two blind participants undertook a trip for either leisure or business purposes specially developed test equipment with high quality video (Hestnes et al 2004).

- A study of five key usage situations for the application of mobile videotelephony to the support of blind users from a service centre. The study involved 10 blind or severely visually impaired persons in addition to the service operator (Hestnes et al 2004).

B.1.3 Survey

Participants (N = 53) from different demographic groups in Norway were asked to rate their preferences for different communication services and face-to-face communication for each of a set of communicative scenarios, after having acquired hands-on experience with the services (Schliemann et al, 2001). The communication services were implemented as optimal quality and involved text communication, audio communication with a handset, avatar communication and video communication. The demographic groups were:

- Youths: 6 males and 6 females, 14 years to 15 years of age.

- Young adults: 8 males and 9 females, aged 19 to 31 (mean 23).

- Senior citizens: 9 males and 3 females, aged 68 to 85 (mean 77).

- Business professionals: 9 males and 3 females, aged 27 to 55 (mean 39).

The different services were demonstrated by having the participants solve simple exercises through using video telephone, hands-free telephone, and text chat. The participants did not use the avatar telephone themselves. Instead they watched a demonstrational video of two persons interacting by the use of this technology.

B.1.4 Expert review and expert panels

Expert reviews involve a single expert making a judgement that could be used for a guideline. Expert panels involve two or more experts working interactively to derive a judgement.

Guidelines were derived from the following use of experts:

- An experienced service centre professional for the support of blind persons at distance by videotelephony was employed to assess the quality of mobile videotelephony for reading text and finding an object when moving. For these two situations video quality was reduced in terms of screen resolution (CIF, QCIF, SQCIF) and frame rate (2 fps to 3 fps, 5 fps to 6 fps, 10 fps to 15 fps, 20 fps to 25 fps) until the tasks could not be performed with the same speed and accuracy (Hestnes et al 2004).

- Members of the EC project IST-999-11577 Eye-2-Eye (Brooks 2003) formed a multidisciplinary expert panel to derive guidelines on the issue of eye-contact between videoconferencing participants. The panel applied knowledge from human factors research literature in addition to experience from equipment manufacturer and videoconferencing service provider perspectives.

- Expert panels of two or more members were specially convened by the ETSI STF and drew on the following specialities:
  - real-time services on current and future telecommunication networks;
  - telecommunication standardization and QoS;
  - development of fixed, mobile and multiparty conferencing;
  - hosting (service point-of-contact) point-to-point videoconferencing services;
  - principle operator of a videoconferencing service multi-party bridge;
  - psychology of real-time person-person communication.

B.2 Literature

Known published results are included only if they address a topic that was identified as important for the intended guideline users. Therefore, the development of guidelines from literature is not exhaustive.

In addition to the reports summarized in clause B.1, table B.1 lists literature from which guidelines were derived to address particular topics.

Table B.1: Use of published literature in addition to the specially designed studies

Guideline topic	Reference used
Elderly persons' use of audio communication	CEN/CENELEC Guide 6 (2002); ETR 334 (1996)
Business use of audio communication	France, Anderson and Gardner (2001)
Spatial voice identification with audio communication	Kilgore and Chignell (2005); Kilgore and Chignell (2006)
Delay in text communication	EG 202 320 (2005); ITU-T (2000)
Packet loss with video communication	TR 102 479 (2006); ITU-T Recommendation G.1010 (2001)
Eye contact with face-to-face video communication	Acker et al. (1987); Anderson et al. (1997); Anderson et al. (2000); Brooks et al. (1999); Bruce (1996); Doherty-Sneddon et al. (1997); ETSI ETR 297; Fussell and Benimoff (1995); Gemmell et al. (2000); Heath et al. (1997); Muhlbach et al. (1995); O'Malley et al. (1996); Rose and Clark (1995); Smith et al. (1989); Smith et al. (1991); Streeck (1993); Vertegaal (1998)
Negotiation with face-to-face video communication	Watts et al. (1996)
Joint problem solving with remote inspection video communication	Anderson et al (2000)
Joint Problem solving with face-to-face video communication	Doherty-Sneddon et al. (1997); O'Malley et al. (1996); Veinott et al. (1997)
Appearance (head-only vs. head-and-torso view) with face-to-face video communication	Grayson & Coventry (1998)
Perception of other person with face-to-face video communication	Grayson & Coventry (1998)
Deaf persons' use of face-to-face video communication	Frowein et al. (2001); ITU-T (1999); Post & Telestyrelsen (2005)

Annex C (informative): Bibliography

- Acker, S. & Levitt, S. (1987): "Designing videoconferencing facilities for improved eye contact". Journal of Broadcasting and Electronic Media, 31(2), 181-191.
- Anderson, A., Newland, A., Mullin, J., Fleming, A., Doherty-Sneddon, G. & Van der Velden, J. (1996): "Impact of video-mediated communication on simulated service encounters". Interacting with Computers, 8, 193-206.
- Anderson, A., Bard, E., Sotillo, G., Newlands, A., & Doherty-Sneddon, G. (1997): Limited visual control of the intelligibility of speech in face-to-face dialogue. Perception & Psychophysics, 59(4), 580-592.
- Anderson, A., Smallwood, L., MacDonald, R., Mullin, J., Fleming, A., & O'Malley, C. (2000): "Video data and video links in mediated communication: What do users value?". International Journal of Human-Computer Studies, 52(1), 165-187.
- Boyle E. A, Anderson A. H, and Newlands A. (1994): "The effects of visibility on dialogue performance in a cooperative problem solving task". Language and Speech, 37(1), pp. 1-20.
- Brooks P, Brundell P, Hamnes K, Heiestad S, Heim J, Hestnes B, Heydari B, O'Malley C, Schliemann T, Skjetne JH, Ulseth T (1999): "Final Report. ACTS Project AC314 Vis-à-Vis: Fitness-for-Purpose of Videotelephony in Face-to-Face Situations". CEC Deliverable A314/NSS/PB/DS/P/005/b1, June 1999.
- Brooks P, Schliemann T, Hestnes B, Frowein H, Aaby C, O'Malley C, (2003): "Final Report Project IST-1999-11577 Eye-2-Eye: Fitness-for-Purpose of Person-Person Communication Technologies". EC Deliverable IST11577/SEF/DIS/DS/Pub/008/b1, June 2003.
- Brooks, P. & Hestnes, B. (2003): "User-centred technical guidelines for real-time human communication services: Requirements and derivation". Proceedings of the 19th International Symposium on Human Factors in Telecommunication, Berlin, Germany, December 1-4 2003, pp. 11-18.
- Bruce, V. (1996): "The Role of the Face in Communication: Implications for Videophone Design". Interacting with Computers, 8(2), 166-176.
- CEN/CENELEC Guide 6 (2002): "Guidelines for standards developers to address the needs of older persons and persons with disabilities". Edition 1/January 2002.
- ETSI TR 102 274: "Human Factors (HF); Guidelines for real-time person-to-person communication services".
- ETSI EG 201 472: "Human Factors (HF); Usability evaluation for the design of telecommunication systems, services and terminals".
- ETSI EG 202 132: "Human Factors (HF); User Interfaces; Guidelines for generic user interface elements for mobile terminals and services".
- ETSI EG 202 320: "Human Factors (HF); Duplex Universal Speech and Text (DUST) communications".
- ETSI ES 201 275: "Human Factors (HF); User control procedures in basic call, point-to-point connections, for Integrated Services Digital Network (ISDN) videotelephony".
- ETSI TR 102 479: "Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); Review of available material on QoS requirements of Multimedia Services".
- ETSI ETR 160: "Human Factors (HF); Human Factors aspects of multimedia telecommunications".
- ETSI ETR 175: "Human Factors (HF); User procedures for multipoint videotelephony".
- ETSI ETR 297: "Human Factors (HF); Human Factors in Videotelephony".
- ETSI ETR 333: "Human Factors (HF); Text Telephony; Basic user requirements and recommendations".

- ETSI ETR 334: "Human Factors (HF); The implications of human ageing for the design of telephone terminals".
- ETSI TR 102 535: "Human Factors (HF); Guidelines for real-time person-to-person communication services - future requirements for real-time broadband services".
- ETSI TS 300 375: "Human Factors (HF); Pictograms for point-to-point videotelephony".
- Doherty-Sneddon, G., Anderson, A., O'Malley, C., Langton, S., Garrod, S., & Bruce, V. (1997): "Face-to-face and video mediated communication: A comparison of dialogue structure and task performance". Journal of Experimental Psychology: Applied, 3(2), 105-125.
- Følstad A, Brooks P, Heim J, Schliemann T, Wiig S, Hestnes B, Heiestad S, Ulseth T, Frowein H, Aaby C, O'Malley C, Brundell P, Lonsdale P (2002): "Results of Field Experiments of Communication Media. IST Project 1999-11577. Eye-2-Eye: Fitness-for-purpose of Person-Person Communication Technologies". CEC Deliverable IST11577/SEF/DIS/DS/Pub/004/b1, October 2002.
- France, E. F., Anderson, A. H. & Gardner, M. (2001): "The impact of status and audio conferencing technology on business meetings". International Journal of Human Computer Studies, 54: 857-876.
- Frowein, H., Kamphuis, H., Rikken, E. (2001): "Sign language interpretation via mobile videotelephony". Proceedings of the 18th International Symposium on Human Factors in Telecommunication, Bergen, Norway 5-7, 2001, pp. 191-196.
- Fussell, S.R. & Benimoff, I. (1995): "Social and cognitive processes in interpersonal communication: implications for advanced telecommunications technologies". Human Factors, 37(2), 228-250.
- Gemmell, J., Zitnick, C.L., Kang, T., Toyama, K. & Seitz, S. (2000): "Gaze-awareness for videoconferencing: A software approach". IEEE Multimedia, 7(4), 26-35.
- Grayson, D. & Coventry, L. (1998): "The Effects of Visual Proxemic Information in Video Mediated Communication". SIGCHI Bulletin Vol.30 No.3, July 1998.
- Hamnes K, Brooks P, Brundell P, Heiestad S, Heim J, Hestnes B, Heydari B, O'Malley C, Schliemann T, Skjetne JH, Ulseth T. (1999): "Specifications of Fitness-for-Purpose. ACTS Project AC314 Vis-à-Vis: Fitness-for-Purpose of Videotelephony in Face-to-Face Situations. CEC Deliverable A314/Tel/MuM/DS/P/004/b1, June 1999".
- Heath, C., Luff, P. & Sellen, A. (1997): "Reconfiguring media space: Supporting collaborative work". In K. Finn, A. Sellen & S. Wilbur (Eds.) Video-Mediated Communication (pp. 323-347). Mahwah, NJ: Lawrence Erlbaum Associates.
- Hestnes B, Heiestad S, Brooks P, Drageset L: "Real situations of wearable computers used for video conferencing - and implications for terminal and network design". Proceedings of the Fifth International Symposium on Wearable Computers (pp. 85-93), Zürich, 8-9 October 2001. IEEE Computer Society, USA.
- Hestnes B, Heiestad S, Ulseth T, Schliemann T, Brooks P, Følstad A, Frowein H, Aaby C, O'Malley C, Brundell P: "Fitness-for-Purpose Guidelines for Person-Person Communication. Project IST-1999-11577 Eye-2-Eye: Fitness-for-Purpose of Person-Person Communication Technologies". EC Deliverable IST11577/TEL/RAD/DS/Pub/065/b1, March 2003.
- Hestnes, B., Brooks, P., Heiestad, S., Ulseth, T., Aaby., C. (2003): "Quality of Experience in real-time person-person communication - User based QoS expressed in technical network QoS terms". Proceedings of the 19th International Symposium on Human Factors in Telecommunication, Berlin, Germany, December 1-4 2003, pp. 3-10.
- Hestnes, B., Brooks, P., Heiestad, S. (2004): "Mobile Eye-phone - a study of relevance, effectiveness and user-perceived suitability". Fornebu, Telenor R&D Report (Scientific Report R2/2004).
- ITU-T (1999) Application profile - Sign language and lip-reading real-time conversation using low bit-rate video communication. Series H: Audiovisual and multimedia systems, Supplement 1 (05/99).
- ITU-T Recommendation F.700: "Framework Recommendation for multimedia services".

- ITU-T Recommendation G.1010: "End-user multimedia QoS categories".
- Kilgore, R.M., and Chignell, M., (2005): "Simple Visualizations Enhance Speaker Identification when Listening to Spatialized Voices". Proceedings of the Human Factors and Ergonomics Society 49th Annual Meeting.
- Kilgore, R.M., and Chignell, M., (2006): Listening to unfamiliar voices in spatial audio: Does visualization of spatial position enhance voice identification?". Proceedings of the 20th International Symposium on Human Factors in Telecommunication, Sophia Antipolis, France, March 21-23 2006.
- Mulbach, L., Böcker, M. & Prussog, A. (1995): "Telepresence in Videocommunications: A Study on Stereoscopy and Individual Eye Contact". Human Factors, 37(2), 290-305.
- Nokia, 2004: "Quality of Experience (QoE) of mobile services: Can it be measured and improved?". Nokia Corporation, White Paper No. 11212-1004, Finland.
- Nortel Networks (Canada):"Quality of Experience. ITU-T Recommendation COM 12-D95, Geneva 27-31 January 2003".
- O' Malley, C., Langton, S., Anderson, A., Doherty-Sneddon, G & Bruce, V. (1996): "Comparison of Face-to-Face and Video-Mediated Interaction". Interacting with Computers, 8(2), 177-192.
- O'Malley C, Brundell P, McFadzean,J, Lonsdale P, Schliemann T, Brooks P, Følstad A, Heim J, Hestnes B, Heiestad S, Ulseth T, Frowein H, Devoldere P, Aaby C: "Results of Laboratory Experiments of Communication Media. IST Project 1999-11577. Eye-2-Eye: Fitness-for-purpose of Person-Person Communication Technologies". CEC Deliverable IST11577/UON/SOP/DS/Pub/003/b1, December 2002.
- Post & Telestyrelsen (2005): "Mobile video communications for people who are deaf: Report on trial operations with broadband for people with disability". Swedish National Post and Telecom Agency Report No. PTS-ER-2005:14.
- Rose, D. & Clarke, P. (1995): "A review of eye-to-eye videoconferencing techniques". BT Technology Journal, 13(4), 127-131.
- Schliemann T, Asting T, Brooks P, Følstad A, Heim J, Skjetne J.H, Hestnes B, Heiestad S, Ulseth T, Frowein H, Devoldere P, Aaby C, O'Malley C., Brundell, Lonsdale P: "Results of Baseline Communication Experiments. Project IST-1999-11577 Eye-2-Eye: Fitness-for-Purpose of Person-Person Communication Technologies". EC Deliverable IST11577/SEF/DIS/DS/5FP/002/b1, July 2001.
- Siller, M. and J. Woods (2003): "Improving Quality of Experience for MultiMedia Services by QoS arbitration on a QoE Framework". Packet Video 2003, Nantes, April 28-29.
- Smith, R., O'Shea, T., O'Malley, C., Scanlon, E., & Taylor, J. (1991): "Preliminary experiments with a distributed, multimedia, problem solving environment". In J. Bowers & S. Benford (Eds.), Studies in Computer-Supported Cooperative Work: Theory, Practice and Design (pp. 31-48). Amsterdam: Elsevier Science Publishers.
- Streeck, J. (1993): "Gesture as Communication. It's Coordination With Gaze and Speech". Communication Monographs. 60 (4), 275-299.
- Vertegaal, R. (1998). "*Look who's talking to whom: Mediating joint attention in multiparty communication & collaboration"*. PhD thesis, Cognitive Ergonomics department, University of Twente, Enschede.
- Vienott, E., Olson, J., Olson, G. & Fu, X. (1999): "Video helps remote work: Speakers who need to negotiate common ground benefit from seeing each other". Proceedings of CHI 1999, ACM.
- Watts, L., Monk, A. & Daly-Jones, O. (1996): "Inter-personal awareness and synchronization: Assessing the value of communication technologies". International Journal of Human-Computer Studies, 44, 849-873.

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