COMMITTEE T1 - PERFORMANCE
STANDARDS CONTRIBUTION

DOCUMENT NUMBER: T1A1.5/96-112
T1BBS FILE: 6A151120.DOC

DATE: May 31, 1996

STANDARDS PROJECT: Analog interface performance specifications for digital video teleconferencing/ video telephony service (T1Q1.12)

SUBJECT: Establishing an interactive, multimedia, subjective testing facility at ITS

SOURCE: NTIA/ITS

CONTACT: D.J. Atkinson
NTIA/ITS.N3
325 Broadway
Boulder, CO 80303
(303) 497-5281, fax (303) 497-5323
dj@its.bldrdoc.gov

KEY WORDS: Subjective testing, multimedia, performance

DISTRIBUTION: Working Group T1A1.5 (announced via T1A15@T1.ORG and T1A1@T1.ORG)

ABSTRACT

This contribution to the June 10-14, 1996 T1A1.5 meeting provides an overview of the multimedia interactive subjective testing facility being developed at the Institute for Telecommunication Sciences (ITS) and an overview of the three experiments being considered for the first application of the testing facility.

Introduction and Facility Description

Over the past several years ITS has been working on objective methods of measuring audio and video quality. Objective audio quality work has been conducted under Project T1Y1.20 and resulted in T1 Technical Report 20 [1], and an objective quality measure has been adopted by the ITU [2]. The objective video quality work has been conducted under Project T1Q1.12 and has contributed to three national standards [3-5].

Recently, the steady increase of computer processing, storage, and networking resources in conjunction with the development of ISDN and B-ISDNs has led to the proliferation of multimedia signals, services, and applications. As multimedia telecommunication becomes more prevalent, and more providers offer services, it will become necessary to provide consistent measures of multimedia quality. Part of providing this consistency is the development of standardized subjective testing measures, which ANSI started in [3-5] and the ITU has started in [6-8]. In addition to the subjective testing measures, the same arguments that led to the development of objective audio and video quality measures apply to the development of objective multimedia quality measures. Therefore, ITS has decided that integration of the relevant aspects of the objective audio and video quality measures, in conjunction with the development of new, multimedia-specific parameters, would be desirable.

In order to develop objective measures of multimedia quality that correlate well with users' perception of quality, it is necessary to have a substantial database of subjectively scored multimedia data. It is toward this end that ITS is creating an interactive, multimedia, subjective testing laboratory.

The ITS interactive, multimedia, subjective testing facility will consist of two sound attenuated chambers that approximates ITU-R Recommendation 500-6 [9] and meets Noise Criterion (NC) 30 [10] with internal dimensions of 106"(w) by 118" (l) by 84" (h). The rooms will be interconnected in a manner similar to that shown in Figure 1. Test subjects will be given a relevant task as described in [7] and then asked to score the communications quality. (The precise task and scoring system is currently under study.) The facility is expected to be completed by the end of September 1996.

Experiments Under Consideration

There are currently three experiments being considered for the first application of the testing facility. First is an extension of the lip-synchronization studies that have already been conducted. Second is mapping of tasks to audio/visual quality requirements. Third is a study of the ability of humans to compensate for poor audio or video quality by utilizing the other medium and the effectiveness of that compensation in completing the assigned task.

In the lip-synchronization experiment, the study presented in [11] would be expanded by studying the effects of differential audio/video (A/V) delay (e.g., lip-sync) on multimedia signals using video at lower resolution and frame rates (such as those experienced in H.261 systems). In addition to providing information about the subjective effects of A/V synchronization, the study would provide a subjectively score database for the development of an objective quality measure that predicts the subjective effects of A/V synchronization problems. Such a measure could be the first "integrated" performance metric mentioned above.

The task requirements mapping study would provide information regarding what represents sufficient audio and video quality to effectively accomplish certain tasks. For example, a surface representing the boundary between effective and ineffective performance of a task could be plotted against the overall quality of the audio and the spatial and temporal quality of the video. (Figure 2.) The subjectively scored database developed from this experiment would be very useful in combining the objective audio quality and objective video quality measures in an overall metric of multimedia quality.

The perceptual compensation experiment would be similar to the previous experiment, but would provide more fundamental information about humans' ability to compensate for the poor quality of one medium (i.e., video or audio) through extended use of the other medium (i.e., audio or video). (Figure 3.) The data produced in this experiment could be used to develop more advanced, perception based, mapping techniques from the separate objective audio and video quality metrics to an overall measure of multimedia quality.

Summary
This contribution has been provided to T1A1.5 to keep them informed of the new facilities being developed at ITS. A brief overview of the interactive, multimedia, subjective testing facility being developed was presented, along with three experiments that could potentially provide the first application for the new facility.

References

1 Committee T1 - Telecommunications, "A technical report on technology-independent, user-oriented, objective assessment of speech transmission quality," Report No. 20, Exchange Carriers Standards Association, Washington, DC, September 1993.

2 ITU-T Recommendation P.861, "Objective quality measurement of telephone-band (300 - 3400 Hz) speech codecs," Geneva, 1996.

3 ANSI, Inc., "American National Standard for Telecommunications - Digital Transport of Video Teleconferencing/Video Telephony Signals - Video Test Scenes for Subjective and Objective Performance Assessment," ANSI T1.801.01-1995, New York, 1995.

4 ANSI, Inc., "American National Standard for Telecommunications - Digital Transport of One-Way Video Signals - Performance Terms, Definitions, and Examples," ANSI T1.801.02-1996, New York, 1996.

5 ANSI, Inc., "American National Standard for Telecommunications - Digital Transport of One-Way Video Signals - Parameters for Objective Performance Assessment," ANSI T1.801.03-1996, New York, 1996.

6 ITU-T Recommendation P.910, "Subjective video quality assessment methods for multimedia applications," Geneva, 1996.

7 ITU-T Recommendation P.920, "Interactive test methods for audiovisual communications," Geneva, 1996.

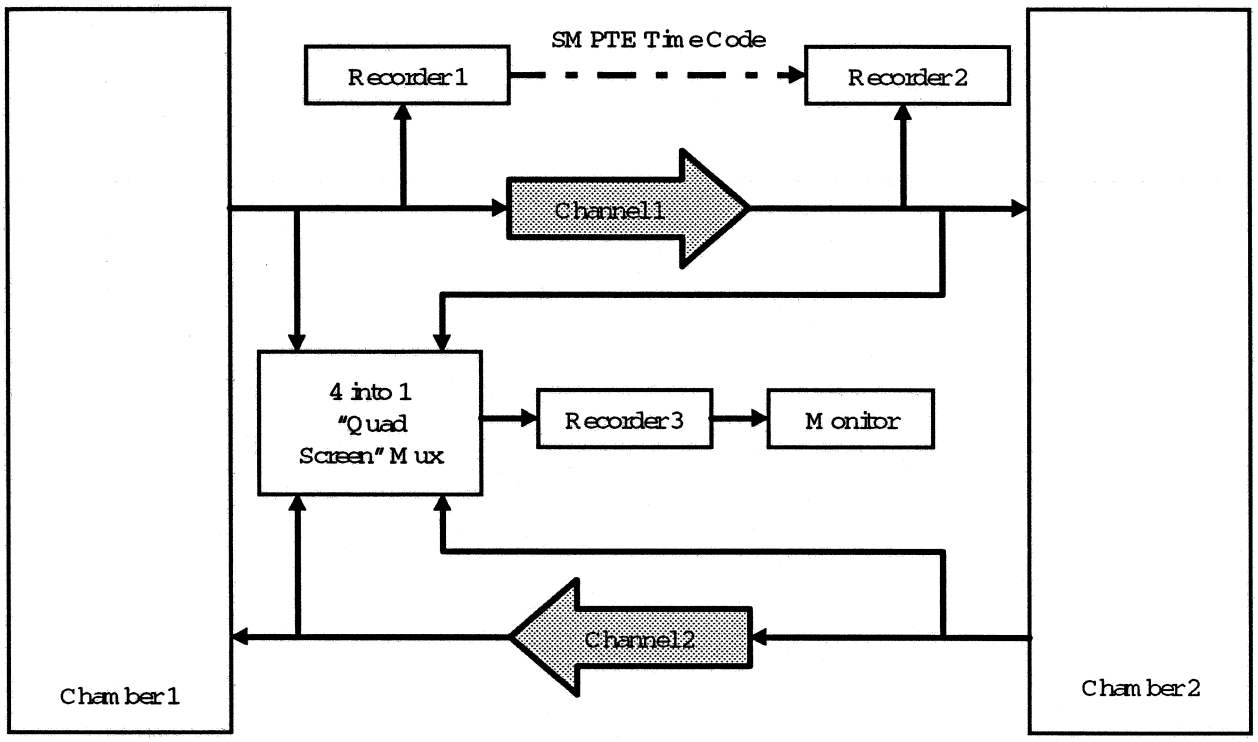
8 ITU-T Recommendation P.930, "Principles of a reference impairment system for video," Geneva, 1996.

9 ITU-R Recommendation 500-6, "Method for the subjective assessment of the quality of television pictures," Geneva, 1995.

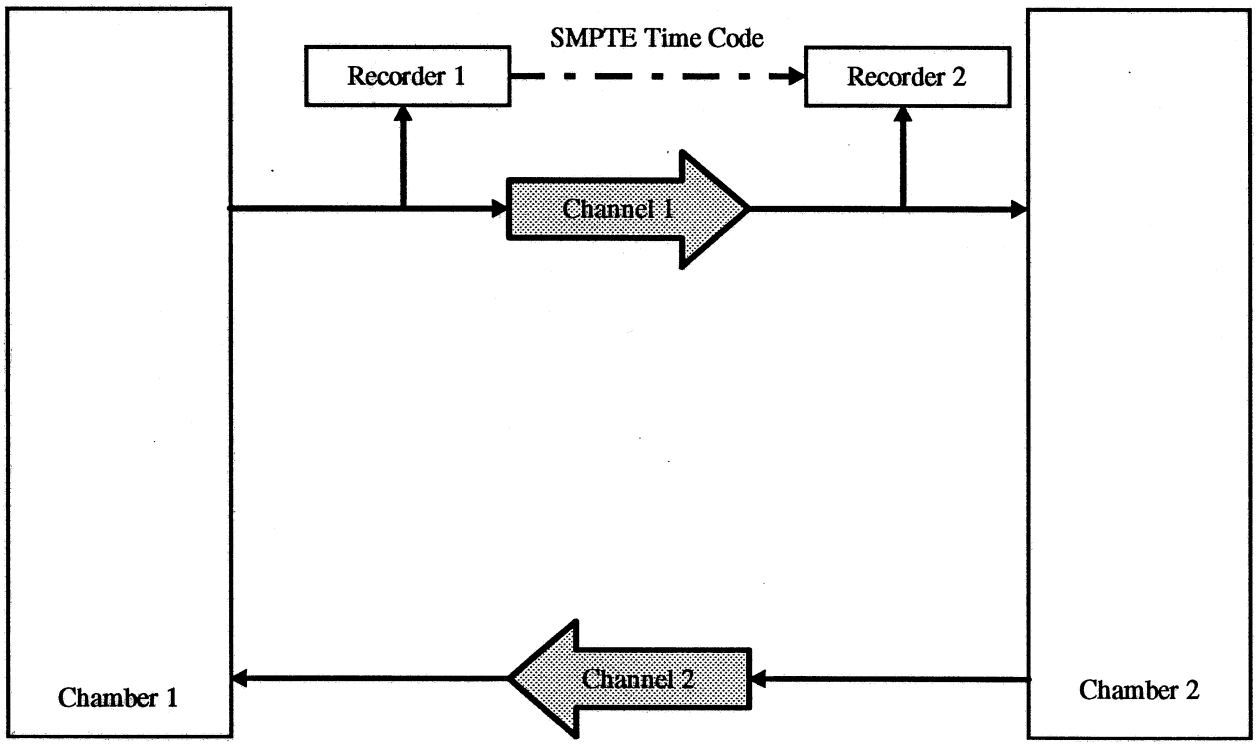
10 L. Beranek, *Noise and Vibration Control*, McGraw-Hill, New York, 1971.

11 S. Bersey and B. Cotton, "The impact of differential delay on video conferencing quality," ANSI T1A1 contribution T1A1.5/96-104R1, April 1996.

12 ITU-T Recommendation H.261, "Video codec for audiovisual services at p x 64 kbit/s," Geneva, 1993.



a. Video paths in multimedia subjective testing facility.



b. Audio paths in multimedia subjective testing facility

Figure 1. Potential configuration for ITS interactive multimedia subjective testing facility.

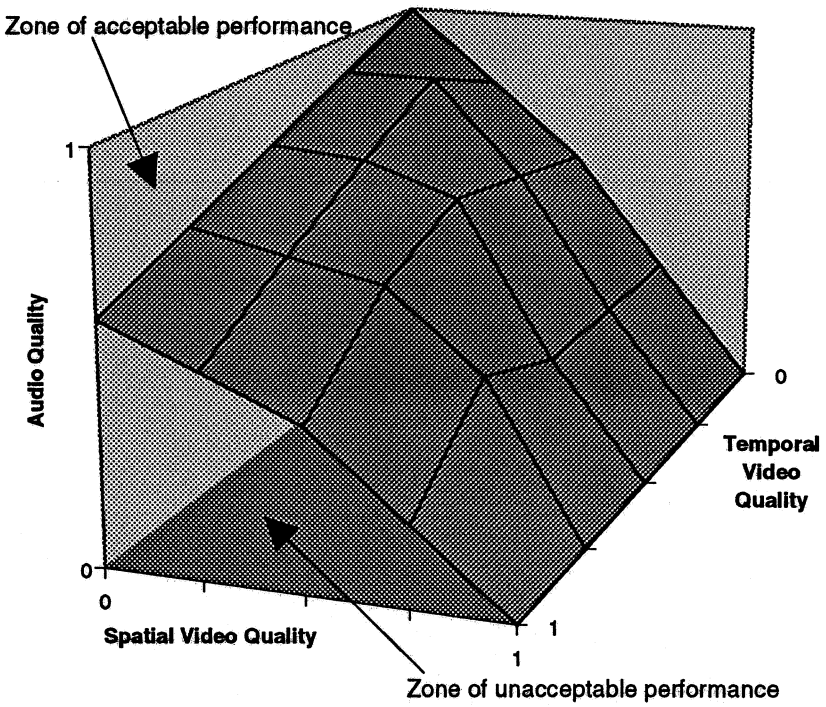


Figure 2. Example surface representing boundary between acceptable and unacceptable performance for a hypothetical task.

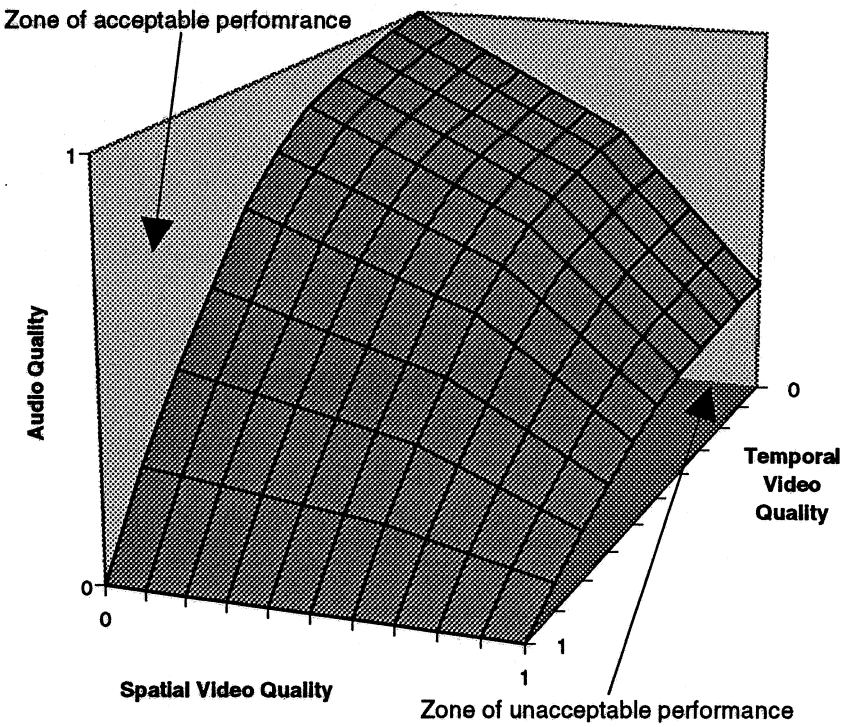


Figure 3. Example surface representing ability to trade some audio quality for some temporal video quality and still accomplish a hypothetical task efficiently.