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Source:	Nippon Telegraph and Telephone Corporation (NTT), Japan		
Title:	Proposal for subjective test plan of stereoscopic three-dimensional video		
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1. Introduction

Stereoscopic three-dimensional (3D) services are rapidly becoming widespread. To provide better 3D services, service providers need an accurate, dependable, and efficient assessment method to evaluate or optimize coding/transmission systems. We propose the necessary common or subset conditions to achieve the above-mentioned purpose in 3D subjective tests.

2. Proposal

We propose to consider the following three points in a 3D subjective test plan.

a) Clarify the appropriate assessment method for "video quality"

The Video Quality Experts Group (VQEG) is working to clarify 3D characteristics using the PC method. From a measurement viewpoint, this method is not appropriate for evaluating many conditions for optimizing an encoder/transmission system. To avoid the heavy burden of evaluating 3D video, we propose to clarify an appropriate method in terms of time and cost for determining "video quality" in the VQEG 3D subjective test. This clarification is worthwhile from the service provider's point of view.

b) Consider stereo acuity of observer

We conducted a screening test of observers with an ophthalmologist before carrying out a 3D subjective test for evaluating visual fatigue affected by 3D viewing. Initially, 35 observers took the screening test, and 13 passed. This was a very small ratio of people who had no problems viewing 3D video in terms of ophthalmology (Table 1). Therefore, in the VQEG 3D subjective test, the VQEG should check and report the observers' information (e.g. stereo acuity) in order to analyze its impact if necessary.

The conceivable parameters are as follows.

- Essential parameters
Stereoscopic visual acuity (fine stereopsis), binocular stereopsis (simultaneous perception, binocular fusion, coarse stereopsis), fusion area examination
- Optional parameters
Strabismus/amblyopia (self-enumeration or examination by an ophthalmologist), heterophoria (over 10 prism diopters), anisometropia (over 2 diopters)

c) Clarify the quality characteristics between professional monitors and consumer monitors.

3D video service operators do not use consumer monitors to perform a strict subjective test. However, VQEG is attempting to clarify 3D monitor conditions (e.g. cross talk, contrast) using consumer monitors. We propose that VQEG add the condition to use professional monitors as an examination object and to confirm that there is no difference in quality characteristics between professional and consumer monitors. NTT is capable of conducting the test for this clarification.

Table 1 Reasons for unsuitability for 3D test

Reason	Number of person (Out of 35)
Examined by ophthalmologist	3
Anisometropia (over 2 diopters)	1
Strabismus or amblyopia	3
Heterophoria (over 10 prism diopters)	4
No binocular vision	0
Abnormal accommodation range	1
Serious impairment in the adjustment function in both eyeballs	9

3. Information

URCF (Ultra-Realistic Communications Forum) to which NTT belongs have released some findings of fatigue caused by watching 3DTV based on an experiment using 500 adult participants. The main results are the followings.

- 1) The results of the objective indexes indicated that there was no difference between watching 3DTV and traditional TV (i.e., watching 2D contest without glasses) in degree of decline of visual and cognitive functions due to fatigue.
- 2) The results of subjective indexes indicated that there were some differences between watching 3DTV and traditional TV in the sensation of fatigue. However, these differences may not be attributed to watching 3D contest, but to wearing the 3D shutter glasses.
- 3) Although there was no difference in the sensation of fatigue between the different conditions when evaluated immediately after watching 3DTV, the results suggest that the sensation of fatigue may be persistent if 3DTV is watched at a distance closer than the standard viewing position (i.e., three times the screen's height)