DRAFT PROTOCOL 01:

TU DELFT LAB EXPERIMENT

VARIUM: Visual Artifacts Interference Understanding and Modeling

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August 25, 2013

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I. RESEARCH QUESTION

This study aims to understand the influence of a set of artifacts on the quality of video, their relationship with the content and to determine the impact of them on visual quality perception. The set of artifacts used in this study was chosen among those perceptually most relevant for digital video applications (e.g. blockiness, blurriness, packet-loss etc). Later, it is expected to design an objective metric for overall video quality considering visual attention and specific spatial and temporal artifacts, their reciprocal impact and their mutual importance for a wide range of video content.

II. EXPERIMENTAL SETUP

For the experimental session, subjects will be requested to score a set of test videos with different combinations of artifacts. The experiment will be in a room with constant illumination of approximately 70 lux, each subject will access the stimuli on a $23''$ LED monitor of resolution 1360×768. The distance between the subject's eyes and the video monitor will be 3 times the monitor screen's height.

Subjects are seated straight ahead of the monitor, centered at or slightly below the eye height for most subjects. A chinrest will be used to guarantee a constant distance between the subject's eyes and the monitor. The room has a table, 2 chairs, a chinrest, 2 CPUs, mouses, keyboards , 2 displays' and a *SensoMotoric Instruments* GmbH Eye Tracker.

All subjects will assess all experimental stimuli and, during quality scoring, the eye-movements of the subjects will be recorded (by Eye-Tracker). The user interface for the experiment was implemented using the *Neurobehavioral Systems* software Presentation. It is expected a total of 20 observers from the Delft University of Technology.

A. Video Database

The video database used in this experiment was generated from seven high-definition videos (original videos) with 1280×720, 50 fps and 10 seconds duration and that correspond to a diverse content (Basketball, Romeo and Juliet, Park Run, Cactus, Park Joy, Barbecue and Into Trees), as depicted in Figure 1. From the original videos were generated several different degraded versions (more details can be seen in the Subsection II B and in Tables I and II).

FIG. 1: Screenshots of the first frame of the sequences included in Experiment.

B. Artifacts

New versions of each original video were generated by different combinations of artifacts. To generate test sequences have been used blockiness, blurriness and packet loss artifacts [1].

- 7 original videos have been distorted with different combination packet-loss, blurriness and blockiness at different strengths;
- 4 different strengths of blockiness and blurriness were used: 0.2, 0.4, 0.6 and 0.8 [2];
- 3 different packet loss ratios were used, PckErr_1 $= 0.7\%$, PckErr_2 $= 2.6\%$ and PckErr_3 $= 8.1\%$ [3].

Thus, the 41 combinations (blockiness, blurriness and packet loss) $\times 7$ (original videos) $+7$ original videos will generate a total of 294 videos. So, some choices must be made on which videos to select since this is a such database of videos large amount to be judged in a single experiment. These choices can be based on the results of the previous experiments, as following:

1. Total time necessary to execute the overall experiment;
2. Mean Annoyance and Strength scores are not significantly different among packet loss ratios 0.7 and 2.6 and among packet loss ratios 2.6 and 8.1. Thus, this experiment will use the most significant scores, i.e., 0.7% and 8.1% packet loss ratios. Table II shows the combinations generated (p.e, $PckErr\_1 + 2$ is the combination between packet loss ratio 0.2% and degraded video version 2, and so on);
3. 2 different strengths of blockiness and blurriness were used 0.4 and 0.6 in order to avoid combinations where, the impairment is weak (original dominates the combination) and the impairment is exaggerated (boost the difference between video with defects and original). Table I shows all the combinations of different blockiness and blurriness strengths. The combinations were applied to each original video, resulting in new degraded videos.

Combination	Blocky	Blurry
2	0.0	0.4
3	0.0	0.6
8	0.4	0.0
10	0.4	0.4
11	0.4	0.6
12	0.6	0.0
14	0.6	0.4
15	0.6	0.6

TABLE I: Strength of artifacts (blockiness and blurriness) and combinations used to generate degraded videos.

Thus, taking these choices, it results into 24 combinations $\times 7$ (video versions) $+7$ original videos $= 175$ videos.

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[1] These artifacts have been used in the previous experiments of this project.
[2] These blockiness and blurriness strengths have been used in the previous experiments of this project. In the previous Experiment's documentation the algorithms for generating both the artifacts are described.
[3] These packet loss ratio have been used in the previous experiments of this project.

Combination	Packet-Loss	Blocky	Blurry
$PckErr\_1 + 2$	0.7	0.0	0.4
$PckErr\_3 + 2$	8.1	0.0	0.4
$PckErr\_1 + 3$	0.7	0.0	0.6
$PckErr\_3 + 3$	8.1	0.0	0.6
$PckErr\_1 + 8$	0.7	0.4	0.0
$PckErr\_3 + 8$	8.1	0.4	0.0
$PckErr\_1 + 10$	0.7	0.4	0.4
$PckErr\_3 + 10$	8.1	0.4	0.4
$PckErr\_1 + 11$	0.7	0.4	0.6
$PckErr\_3 + 11$	8.1	0.4	0.6
$PckErr\_1 + 12$	0.7	0.6	0.0
$PckErr\_3 + 12$	8.1	0.6	0.0
$PckErr\_1 + 14$	0.7	0.6	0.4
$PckErr\_3 + 14$	8.1	0.6	0.4
$PckErr\_1 + 15$	0.7	0.6	0.6
$PckErr\_3 + 15$	8.1	0.6	0.6

TABLE II: Combinations of the packet loss ratio (PckErr 1 and 3) with blockiness and blurriness artifacts.

III. EXPERIMENTAL METHODOLOGY

During the experiment, the experimenter will be guiding the subject through all sessions. The experiment is divided into calibration, free viewing, training (split in two parts), practice and a main experiment (split in two parts with a break and other equipment calibration in between):

- In the calibration, participants will be requested to focus on different points spread over the monitor screen, and their eye fixations will be recorded to calibrate the eye-tracking data.
- In free viewing session, participant will be asked to freely look at seven high quality videos, as if they are watching TV at home.
- In the training, participants will be shown all four high quality videos. Then the user will be shown the videos with the strongest defect derived from each of the four high quality videos. The intent of this stage is to familiarize the test subjects with the endpoints of the defect range and to define the task that they will perform.
- In the practice stage, participants will run through a limited number of practice trials of the experiment. The practice trials give the subject a chance to work through the data entry procedure and shake out last minute questions or concerns. The initial responses may also be somewhat erratic. The practice stage will allow the test subject responses to stabilize. No data will be collected during this task.
- The main experiment is split into 2 sessions. As in Practice Trials, they will be asked to estimate the annoyance of defects or impairments of each degraded video. After each sequence, the subject will be asked "Did you perceive any impairments or defects in the video?", prompting for a "yes" or "no" answer. Then participants will be asked to perform the annoyance task consisting of giving a numerical judgment of how annoying the detected impairment is. Once the participant has scored all videos of the first session, a break will be given. The break will not have a time limit, but it is expected that the participant takes a break of around $5 - 10$ minutes. Once the participant is ready

to continue, he/she will be instructed to begin the next session. Before the beginning of this session the calibration task will be repeated. When the system is ready, the experimenter will ask to the participant to proceed to the calibration task. Once the calibration task is finished, the participant will rate the remaining videos. When is finished, he/she may leave the room. A more detailed explanation about the experiment itself can be given to the participant, if asked.