

# Open Profiling of Quality as a mixed method approach to study multimodal experienced quality

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## ABSTRACT

To reach users' overall quality acceptance is a very important aspect for the success of new technologies. Therefore, user studies following a psychoperceptual evaluation approach have been used for a long time. However, these studies neglect the dualistic nature of quality. While they are able to capture quality in its holistic excellence, methods to understand underlying quality factors are still missing. Open Profiling of Quality (OPQ) is a mixed method approach that combines quantitative and descriptive quality analysis with naïve participants. OPQ is meant as a tool to create deeper understanding of perceived multimodal quality.

## Categories and Subject Descriptors

H.1.2 [User/Machine Systems]: *Human information processing*

## General Terms

Measurement, Human Factors, Experimentation

## Keywords

Open Profiling of Quality, subjective quality, quality evaluation, Quality of Experience, mixed method

## 1. INTRODUCTION

The optimization of quality according to users' perception has become a very important part in the development of new multimedia technologies. To provide better experience and higher quality than existing systems is a crucial point for the success of new technologies. Modern quality research needs to take into account the different aspects of quality. Beside the evaluation of quality in the actual context of use, understanding of underlying quality factors is a main goal of user-centered Quality of Experience research [1]. Recommendations on quality evaluation methods have targeted a quantitative evaluation of critical components to measure their quality excellence [8]. But quality in terms of its dualistic nature is not only related to the degree of excellence of a product. Quality is also characterized by distinctive attributes or characteristics that are possessed by products. Only few research approaches exist that try to capture the dualistic nature in subjective quality evaluation. In this paper, we present Open Profiling of Quality (OPQ) as a mixed method research approach to study perceived multimodal quality.

## 2. RELATED WORK

While the produced quality of multimedia application relates to the quality provided by the system under its constraints related to technical factors, perceived quality describes the users' perception of quality. Perceived quality is characterized by an impact of all

levels of human perception processes [3]. Multimodal quality assessment has tried to measure the perceived quality on a quantitative basis [1]. Results of these methods present quality in terms of its hedonistic excellence. However, quality is a "multidimensional construct of user perceptions and behaviors" [15] and only few methods exist that offer possibilities to study and understand this construct. Bech et al.'s RaPID method [1] was a first profiling approach, but it is limited through extensive training with test participants. Focusing on naïve assessors, Jumisko-Pyykkö et al. [4] and Radun et al. [7] use interview-based methodologies to combine quantitative evaluation with an elicitation of experienced quality factors. In contrast to interviews, Lorho uses methods of sensory profiling in his Individual Vocabulary Profiling [5] approach. It allows assessors to develop and to apply their own quality attributes in the evaluation task. However, this approach has not been applied in mixed method research.

## 3. OPEN PROFILING OF QUALITY

OPQ [12] is a mixed method that combines evaluation of quality preferences and the elicitation of idiosyncratic experienced quality factors. It therefore uses quantitative psychoperceptual evaluation and, subsequently, an adaption of Free Choice Profiling. The goals of the method are a) to define the excellence of overall quality, b) to understand the characteristics of quality perception, c) to construct a link between preferences and quality attributes, and d) to provide a test methodology that is applicable to use with naïve assessors. OPQ does not limit assessors in the development of quality attributes to certain predefined parameters. It is *open* for assessors to elicit whatever they perceive as quality factors.

### 3.1 Procedure

The procedure of OPQ is described in detail in [10] and [12]. First, a psychoperceptual evaluation is conducted which follows the recommendations of the ITU [8]. Test participants rate the acceptance of overall quality and the satisfaction with overall quality. Then, a sensory profiling evaluation follows in a second task. In our research approach, we adapt the method of Free-Choice Profiling [14] which allows users to evaluate overall quality using their own vocabulary. After an introduction, test participants develop their own quality attributes, preferably adjectives, in the attribute elicitation task. In the following attribute refinement task test participants select their final vocabulary by identifying those attributes that a) are unique and b) can be described precisely by the users. At the end of the attribute refinement task, each attribute is attached to a 10cm long line labeled with 'min' and 'max' in its extremes. It results in an

individual score card which the test participants will use for stimuli evaluation. In the sensory evaluation task, test stimuli are presented one after another. The test participants mark the sensation of the attributes on their score card for each test item. 'Min' means that the attribute is not perceived at all while 'max' refers to its maximum sensation. Stimuli can be repeated several times during the evaluation.

### 3.2 Analysis

The application of Open Profiling of Quality results in two independent data sets. The quantitative data set can be analyzed using Analysis of Variance to get a preference ranking of the items under assessment. The sensory data can be analyzed using Generalized Procrustes Analysis (GPA). The result of GPA is a low-dimensional model of the users' perception. This model shows the separation of the test items along its principle components as well as the correlation of principle components and idiosyncratic attributes. By identifying their meaning the researcher gets deeper insight into underlying quality rationale to explain possible quality preferences in the quantitative data. The final step of OPQ is the combination of quantitative and sensory data. Using External Preference Mapping [6] allows the researcher to map preference data into the perceptual model. This finally connects the users' preferences to their quality attributes.

## 4. APPLICATION OF OPQ IN 3DTV RESEARCH

Open Profiling of Quality has been developed in constructive research in three studies related to 3DTV research. For detailed results of each study I refer to the respective full papers [10][11][12][13]. The first study targeted the evaluation of different audiovisual 3D presentation setups [13]. The application of OPQ has helped to see that participants were qualitatively able to differentiate variables, although no quantitative excellence of stimuli was identified. Further, different sensorial preferences as a part of any multimodal quality evaluation were identified. The second and third studies were both conducted in the context of mobile 3DTV research. The second study [11] examined influences of mono and stereo audio and visual presentation format on perceived overall quality and perceived depth. The third study finally targeted the selection of an optimum coding method for mobile 3D television and video [10]. The application of Open Profiling of Quality has helped to understand the quality rationale of autostereoscopic perception. The perceptual models of the second and third study both show that video quality is the determining component in 3D quality perception. The expected added value of depth perception only was visible when the perception of artifacts was low. These results confirm Seuntiens' 3D Quality of Experience model [9] and extend it to a hierarchical interaction of video quality and depth perception.

## 5. CONCLUSION

In this paper, I present Open Profiling of Quality as a mixed method approach in multimodal quality assessment. OPQ closes the shortcomings of commonly applied quantitative research methods. It combines the evaluation of the quality excellence as well as the characteristics of quality for the items under assessment and so allows capturing quality in terms of its dualistic nature. Although further work needs to study the application of OPQ in audiovisual quality research, OPQ is a valuable tool in the context of multimodal quality evaluation.

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