

Broadcasting quality



Broadcasting organizations exist basically to communicate to people. Whether radio or TV stations are Government, Commercial or Private, whether programmes are spoken word, music, commercials or community announcements, in all cases the message needs to get through. The emphasis in programmes must always be on quality, both content and sound. Staff engaged in program presentation need to be conscious of making the broadcasting system seem to be transparent to the audience. Listeners and viewers should only be aware of the actual program and not the 'nuts and bolts' of the radio and / or TV station.

In order to ensure High Quality Broadcasting, a Broadcaster or Broadcasting company should by all means be instrumental in enhancing our understanding of the world - To inform its audiences and arm them with a better understanding of the world through news, information and analysis of current events and ideas. It is a function which comes hand in hand with the Stimulation of knowledge and learning, since the content should be of capable of stimulating its viewer's interest in the knowledge of arts, sciences, history and other topics through content that is accessible to its projected recipients and can easily encourage informal learning.

Representing diversity and alternative viewpoints is by all means also a component of responsible quality broadcasting. It is one its main purpose to make people aware of different cultures and alternative viewpoints, by showing programmes that reflect the lives of other people and other communities. One of the major influences affecting broadcasting would be the existing Socio-Economic factors. Economic components have long played a key role in public policy toward broadcasting, not only where private

commercial systems dominate but also where there is a public funding mechanism.

Major national public service broadcasters are large programme production industries that collectively represent a substantial capital and operating investment. Many of them have had commercial support, and no matter how "non-commercial" the production distribution-reception process, it is usually closely associated with (and profits from) a substantial private, profit-oriented industry that manufactures receiving sets and electronic equipment.

But broadcasting's direct contribution to the gross national product has been modest, especially when compared to most societies" major sources of economic activity (Blumler, 2000; 26). In the field of digital television broadcasting, North America has been some years ahead of the rest of the world in its faith in what could be done with very powerful image compression systems. The open decision-making process which has taken place in the United States for advanced television (ATV) is a considerable achievement, and a great credit to the many individuals involved.

In Europe, considerable expertise has been accumulated in image compression and digital modulation, but a range of factors and circumstances have influenced the profile given, until recently, to studies of digital terrestrial television broadcasting. These have included pessimism that the planning environment in Europe would allow the development of digital high definition terrestrial television with reasonable coverage, and pessimism that sufficiently attractive picture quality could be achieved with the bit-rates that are possible in terrestrial networks.

Today there is clear recognition in Europe that we must pursue quality digital television broadcasting, that we should be undaunted with the problems, and that we should explore the potential solutions, this is because the prize for success will be considerable. An international committee, the European Launching Group (ELG), has been established to try to coordinate the various projects which are developing digital terrestrial television broadcasting, or indeed related systems, in Europe.

This committee has a technical subcommittee, the Working Group on Digital Television Broadcasting (WGDTB). The WGDTB has examined the aims of the current collaborative projects, and their timescales, and looked at the potential uses of digital television broadcasting. They arrived, at the end of 1992, at a work plan, intended to make it possible for Europe to achieve common standards for digital television broadcasting within the next few years (Altschull, 1984, p 112).

European centered on the development of modulation systems appropriate for digital terrestrial television centered on the development of modulation systems for 20 GHz digital satellite television centered on the development of digital HDTV satellite point-to-point systems developing all aspects of digital terrestrial television developing all aspects of digital terrestrial television developing base band coding systems continuing studies of terrestrial and satellite planning, requirements and testing present article will outline some features of this plan, and give the background to the conclusions reached (Anand, 1993, p 156-210).

What the WGDTB has done is to develop a first scenario which needs now to be taken up by experimental work. A fundamental limitation on the quality

and ruggedness of terrestrial television services will be the terrestrial channel capacity. In Europe, the VHF/UHF broadcast television bands use either 7 or 8 MHz channels. The working assumption has been that the system should have a bandwidth of about 7.5 MHz. The prospect of using more than one channel in a contiguous way for a single broadcast service seem remote, and the prospects of obtaining new frequency allocations with a wider channel spacing, even more so.

Given a 7.5 MHz channel, it seems that the upper bound on gross bit rate is likely to be about 30 M bit/s. The first task the WGDTB undertook was to evaluate the options which seemed most likely to be attractive and saleable to the European consumer in the next century, in the light of what could be seen, or predicted, as general trends in society (Anand, 1993, p 156). There is no doubt that the quality expectations of viewers are rising, and that the long-term future of television lies with HDTV. Nevertheless, the Group was also conscious that viewing habits are changing as society evolves.

Therefore, when setting system goals there are dimensions other than quality which need to be taken into account (Briggs, 1999, p 145). It is not sufficient to ask what the public may want, we also need to ask when and where they will want it. Furthermore, the practical large flat-screen HDTV display, for many years regarded as the key to HDTV acceptability in the domestic environment, seems nearly as far away as ever. One underlying trend in society is toward individual activity, rather than group activity. A second element to consider is mobility.

Essentially sound-radio has migrated from a group experience in the home, to a near-individual activity in the car. We could reasonably ask if some of

the same evolution will apply to television to any degree, or at least whether television will also have to cope with a mobile environment. There seemed to be four options, essentially linked to different viewing environments, which were worthy of most attention. The options are as follows:- HDTV (high definition television), which offers services to viewers with very large screen receivers, using fixed roof-top aerials.

- EDTV (extended definition television), which offers services to viewers with medium to large screen receivers using fixed roof-top aerials. - SDTV (standard definition television), which offers services to viewers with portable televisions using set-top aerials. and LDTV (limited definition television), which offers services to viewers with small screen receivers using whip/stub aerials in a mobile situation (e. g. in a car). In order to translate these concepts to practical systems, it is necessary to decide what is meant precisely by the quality in each case, and what is meant precisely by each of the receiving environments.

Picture quality is difficult to quantify in absolute terms, because it is the net effect of a series of factors such as resolution, sharpness, noise, artifacts, etc. It is by no means only related to the scanning standard. The picture quality that is achieved will also be related to the source quality, the sophistication of the compression algorithm, and the bit rate used. The receiving environment can be defined somewhat more easily. It is related to the bit-error distribution in which the system is required to work. In other words, it is associated with the ruggedness necessary to achieve impairment-free pictures of the intended quality.

As a first assumption in the WGDTB, the roof-top environment is considered to be associated with a spectral efficiency of 4 bits/s/Hz. The portable environment is considered to need 1-2 bits/s/Hz, and the mobile environment is considered to need 1 bit/s/Hz.

2. REVIEW OF RELATED LITERATURE

A. The Dimensions of Picture Quality

Color Television was initially conceptualized in the 1950's. Back then, a single color picture requires three images, specifically red, green, and blue (RGB) for light emitting devices such as cathode ray tubes (CRT).

This would require a 30 MHz bandwidth to provide the desired picture rate, starting from the full progressive scan picture. To reduce the bandwidth to 15 MHz for an analog RGB system, an interlace is used. Within a studio the signals are carried on three separate cables at 5 MHz or more bandwidth each, a fundamental compression scheme used in color television is to translate the three color signals into the color-difference domain where the picture is represented by a luminance (equivalent to the earlier monochrome) picture and two color difference pictures, R-Y and B-Y.

Another name for this system is YUV, Y for luminance and U, V for the two color difference signals. Again using the limitations of the human visual system, in this case less color than luminance visual acuity, the bandwidth of the color difference signals is reduced by 50% for a total YUV bandwidth requirement of 10 MHz. Today, YUV signals are used in both analog and digital forms and have very little visible degradation compared to interlaced RGB video. Both forms are known as component video with YUV being used for most applications.

Nowadays, there are two reasons to compress television video signals, practical limitations of processing speed (bandwidth) and cost of transmission or storage resulting from the required bandwidth. Today, the availability of high speed semiconductors and integrated circuits make the latter reason most important in nearly all applications. Virtually all video compression methods utilize the limitations of the human visual system to remove the less visible picture information that might otherwise be present.

As broadcast television was being developed, display rates of 50 or 60 pictures per second were considered necessary. Discussing Quality Broadcasting and its future would not be complete without discussing the past and present of Broadcasting. Cathode-ray tube, also known as CRT's is the technology used in most televisions and computer display screens. A CRT works by moving an electron beam back and forth across the back of the screen. Each time the beam makes a pass across the screen, it lights up phosphor dots on the inside of the glass tube, thereby illuminating the active portions of the screen.

By drawing many such lines from the top to the bottom of the screen, it creates an entire screenful of images. The technology used for the display is also a critical part of the quality equation, and all broadcasters currently suffer from a lack of flat panel monitors which can be used to check that picture quality is perfect before it leaves the studio. The reason is because display are no longer made using 'CRTs', which had many disadvantages, but could be made as very high precision instruments when needed.

This is not so easy with today's flat panel display. An analysis of the options available for a common multiplex is currently being made. There seem to be

a number of potential candidates for a common multiplex, and particular attention unfocussed on the MPEG proposals and the DAB system. A unique system for DAB and Devises particularly attractive. a.) HDTV Nowadays, we have different prototypes of devices which we use to enhance broadcast information quality with.

One of these numerous devices would be what we call HDTV which is also known as High-Definition Television. This is basically a new television prototype that provides much better resolution and resonance than current televisions based on the NTSC standard. HDTV is a type of Digital Television (DTV) broadcast, and is considered to be the best quality DTV format available. Types of HDTV displays include direct-view, plasma, rear screen, and front screen projection. HDTV requires an HDTV tuner to view and the most detailed HDTV format is 1080i.

HDTV is a digital TV broadcasting format where the broadcast transmits widescreen pictures with more detail and quality than found in a standard analog television, or other digital television formats. High definition television is defined rather loosely by the International Telecommunication Union (ITU) as a system which has about twice the horizontal and vertical definition of conventional television. This still leaves open the amount of noise or artifacts that are permitted, and which affect the picture quality just as much as definition.

In Europe, Asia, South America and across other parts of the world the PAL system is adopted by each state, and often with some unique characteristic, such as the location of the sound carrier. This means for protecting sovereign borders has made for complications in program exchange, though

presumably has not impacted the set sales in any of the regions. Furthermore, there is a relatively wide range of definitions available within the term “conventional television”. In addition, interlaced systems have a triangular vertical-temporal response, so it is difficult to know where the concept of “twice resolution” applies (Anand, 1993, p 210).

To pin down HDTV, we have to look at the combined effect of all the quality factors on the picture; and, to some extent, make up new rules. It is apparent that the NTSC standard sets the limits today in television quality. The NTSC system is a composite system, meaning the color or chrominance information is embedded in the luminance information. In over-the-air and cable transmission there are frequently micro reflections produced, which deliver somewhat delayed second or third harmonic images (which are commonly referred to as ghosting).

Only so many scanning lines, so much bandwidth is in the standard. There is also the inclusion of interlace scanning, producing aliasing artifacts, interline noise (often called “twitter”), and dot crawl which is undeniably the factor which makes perfected separation by way of comb filtering of color and luminance information very expensive, thus color smearing results in most modestly priced sets without this device included. The accumulation of artifacts from the traditional NTSC standard has placed a practical

size limit of the television image since most consumers perceive an increase in size as a “cause” of the artifacts, rather than merely the exposing of them. While filtering techniques have improved, the cross color and dot crawl artifacts, there remains the unalterable fact that the total amount of picture information in the broadcast standard has a specific limit. When

deciding on a required picture quality we have to bear in mind the target viewing distance, and the need to ask, responsibly, for no more than is necessary.

Digital compression systems all work in a similar way. The information content of the source picture varies from scene to scene. The system reproduces the content of the input picture essentially intact, until the point is reached where the transmission bit-rate will be exceeded if nothing is done. At this point, a series of approximations are made to parts of the scene. The output scene can thus have (apparently) added noise or loss of resolution, to an extent depending on the original scene content.

For any practical system there will always be scenes which are reproduced perfectly, and others which are impaired. The system designer's intention is to make the impairments occur as infrequently as possible, and be as unobtrusive as possible. The main approach examined by the WGDTB to specify the quality needed is termed the "scene-contentfailurecharacteristic". This is a logical and scientific method, but it is also relatively expensive to use.

The basic element to be specified is the proportion of total programmed time which should be free of artifacts. "Freedom from artifacts" is considered to be associated with a minimum mean score of 12% in a double-stimulus continuous-quality scale (DSCQS) subjective evaluation. This is somewhat arbitrary figure, but much experience shows it to be a good rule of thumb for virtual transparency. The challenges are then, first, to decide what constitutes a sensible proportion of time for which impairment free pictures should be demanded.

The second challenge is to assemble statistical evidence about the relative occurrence of different kinds of scene content, so that it can be verified that the requirements are met. In choosing the proportion of time for which impairment-free pictures could be expected, we can look to the other “statistical” domain of picture quality, which is the propagation failure characteristic, used as a planning criterion. For example, in broadcasting satellite systems (BSS), quality is required to be maintained for a defined percentage of the worst month of the year.

If this kind of guide-line is acceptable for satellite systems, would it also be acceptable for terrestrial television broad-casting? Unfortunately, the answer is “not quite”. In satellite broadcasting, the “outage time” is used up in rain-fades, which occur over a period of, say, half-an-hour. The quantization-noise artifacts that are introduced by digital coding will probably be more spaced out than this, and their effects will therefore be less severe on the viewers overall perception of quality (this is sometimes called the “forgiveness effect”).

However, it may be appropriate to adopt a value similar to that for the BSS as a starting point for fixing the scene content failure characteristic requirement (Anand, 1993, p 210). The WGDTB has tentatively begun by taking 99.7% transparency as the requirement for the digital terrestrial HDTV service. Coupled with this, it is assumed that the reference quality is a 1250/50/2:1 HDTV studio signal, with 1440 samples/line. We do not yet have a catalogue of HDTV picture sequences and their places on a code “criticality table”, but we do have some experience from former 4:2:2 code studies (Altschull, 1984, p 112).

These suggest that to achieve the target transparency, the code would need to pass, unimpaired, almost all the test pictures so far devised, including the second most-stringent CCIR sequence “ mobile and calendar”(critical, but even so only in the area of 80%-90%criticality). The quality target is very high, and may not be achievable at the available bit-rate. But it certainly is worth aiming high at the start. It is known from past experience that HDTV source and display equipment quality will improve, and a system which will last well into the next century would be valuable.

The next key question is “ what quality can be achieved with 20-30 M bit/s? ” Initial tests may be possible in autumn 1993 with the HD-DIVINE system, and these would probably provide first clues. b.) EDTV The second quality level to be discussed is termed EDTV. EDTV is a common name for a particular subset of the DTV (Digital Television) standards, but On a large display screen only. It is also known as Enhanced Definition Television or extended definition television. EDTV is considered to be specifically a part of the HDTV format but does not fall near the quality and performance of HDTV.

EDTV as a whole can only simulate HDTV viewing quality. However, The EDTV prototype offers more technological advancements over the SDTV unit. EDTV operates as 480p (where 480 represents the vertical resolution and p represents progressive scan). To take advantage of the said 480p standard, video source that outputs that signal (i. e. a DVD player) must be used and the display must be able to read the 480p input signal. As an additional feature an EDTV unit also offers the benefits of Dolby digital surround sound

This is not a particularly appropriate name, because the scanning standard for the system would be the normal 625-line system. The level is included

because large-screen HDTV receivers, which have an HDTV dot pitch, will be very unwieldy and very expensive for many years to come. An EDTV level would fulfill a need for a lower-cost and lighter receiver. Having probably a screen size less than about 30 inches, it would not be dramatically inferior to an HDTV display in perceived quality. There may also be living rooms which are not large enough to take a true HDTV receiver.

The source format for EDTV is assumed to be a signal conforming to CCIR Recommendation 601, with 720 samples per line and a 16: 9 aspect ratio (Starks, 1993, p 196). The codes transparency required, in terms of the percentage of program time unimpaired, would be roughly the same as for the HDTV level (although in this case with respect to the 4: 2: 2 source). The best information available at the present time is that in order to achieve this level of transparency, a bit-rate of about 9–11 M bit/s is probably needed for a motion-compensated hybrid DCT system.

c.) SDTV The third quality level considered is SDTV,. Short for Standard Definition Television it is a type of digital television operation method which is able to transmit and produce images which are of a higher quality than standard analog broadcast. While SDTV does not reach near the quality of HDTV, it is definitely superior over traditional analog television. SDTV is typically a 480i signal - where 480 represents the vertical resolution and i represents interlaced. Digital cable and digital satellite programming is widely available in SDTV format.

This is specifically intended to match the quality needs of portable receivers. On small-to-medium screen sizes, even today's PAL/SECAM quality is very good. Thus, for the SDTV level, a system which has a 625-line scanning

format is needed, but some artifacts can also be accepted, as is the case for both PAL and SECAM. The kinds of artifacts associated with PAL/SECAM and a digital motion-compensated hybrid DCT system will be different, but it is believed that in order to achieve, globally, about the same over-all quality, a data rate of about 5–6 M bit/s is needed. d.) LDTV

The fourth quality level is LDTV, limited definition television. This is intended to match the needs of very small screen receivers, which might be used in cars, and now being incorporated to mobile phones as well. The quality requirements of this level would be about the same as the MPEG 1 codes or about VHS level. Specifying the quality requirements, and evaluating the systems in terms of their scene-content failure characteristics will be a major technical challenge, principally because of the need to establish how often scenes of a particular type of content are likely to occur.

There may be alternative simpler approaches which will also help to understand and quantify the systems' behavior. Another potential quality evaluation criterion, which the WGDTB has been asked to consider, is associated with the concept of " quality space". Our perception of the picture quality of a given system is directly influenced by the viewing distance. The further from the screen, or the narrower the viewing angle, the less discriminating we are in terms of resolution or artifacts.

One way, therefore, to see the various quality levels, is by imagining that there is a " quality space", which is a graphical representation of picture quality-versus-viewing distance. For the picture quality axis, we use the same axis as for DSCQS evaluations (Andersen, 1990, 291). There are five contiguous and equal intervals characterized by the quality descriptors:

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excellent, good, fair, poor, and bad. Similarly, It was specified by the EDTV system as one for which the results of assessments must fall in the excellent band at 4H.

SDTV systems are those for which the results must fall in the excellent band at 6H, and an LDTV system as one for which the results must fall in the excellent band at 8H. This seems a relatively clear means of defining and distinguishing between the quality levels, but experimental work remains to be done to establish its viability in practice. DISCUSSION A. Impact of Source quality Another interesting dimension to this question of picture quality concerns the impact of source quality on final picture quality under high compression.

Compression systems may show a characteristic such that it could be considered (in a simplified way) that their characteristics of quality-versus-bit-rate have two regions. A Camcorder video compression device was recently developed to function effectively in a variety of applications and which could effectively address the need for high-resolution surveillance image recording. The said device is able to simultaneously encode two separate streaming images — full size and quarter size — with robust compression and high quality.

The creator of the device, Showlei Associates has announced that its CamCoder video compression device will dramatically lower the cost, power consumption and size for the compression of high-definition streaming images. The IC also contains internal logic for user-programmable motion detection and watermark insertion, as well as on-board memory. High definition compression systems, as available today, do not perform as well

as predictions made several years ago, with the exception of the newly created device - but the next years should bring maturity and allow more complexity in equipment.

E It is a common consensus that the full benefits for broadcasters of the new advanced compression systems would be achieved eventually. However as of the present time inventors are still finding a way to get pass one of the quality defects of digital broadcasting today, this problem is the lack of synchronization between vision and sound. Achieving this may even become more difficult with more advanced codes. This still needs to be carefully evaluated by all broadcasters to find any loopholes in the said device.

Conclusion

The Quality of Broadcasting is by all means generated by a combination of both responsible dissemination of information and state of the art broadcasting equipment. The way in which information is disseminated and retained by the audiences would first and foremost be the determining factor as to effectiveness of the broadcasting being done. The content plays a very important role in keeping the interest of the audience and it should be discerned that without a substantially good topic, even the most advanced equipment to disseminate information would not be a factor at all.

It is in this context that commitments must soon be made and it is to be of utmost importance that all administrations and organizations which will be affected by technological changes should be able to share in the accumulated understanding of the factors involved with a view to taking carefully considered decisions. To assist in this process, the ITU/BR has convened a Workshop Tomorrow's television - Thaw IDER picture, with the

support of the European Broadcasting Union and the Asia-Pacific Broadcasting Union.

It aims to bring together the expertise necessary for a common understanding of the issues and, to allow a balanced representation of all contending systems, the Workshop is being held away from the main centers of study, in New Zealand. BIBLIOGRAPHY Altschull, J. H. 1984. Agents of Power: The Role of News Media in Human Affairs. New York: Longman, p 112 Anand, A. 1993. " Introduction," 1-24 in Women's Feature Service (ed.), The Power to Change: Women in the Third World Redefine their Environment. New Jersey: Zed Books, p 156-210 Andersen, P. A. & M. W. Lustig & J. F. Andersen. 1990.

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