The Cinematographer and the Lens for Film and Television. An Inquiry.

September 2014

Center of Advanced Studies of Film and Television
Technology of the HFF Munich

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Point of Departure

Lenses are one of the most important tools to create a "Look" in films. Understandably, object lens manufacturers are working to perfect lenses by eliminating optical artefacts and maximising sharpness etc.

But which lenses would the USERS, the camera people, really want to work with? What are their priorities and needs?

In times of digital cameras, the choice of film stock or photochemical processes to influence the look of a picture while recording has vanished. On the other hand, digital colour grading has become more and more important – a part of the production chain that can often not or not completely be influenced by the DoP.

Has the lens therefore become one of the last possibilities to create a photographic look?

The next big changes in film technology are unstoppable on their way – the development to even more picture quality with 4K/8K or UHD.

What are the consequences for the development of new lenses?

Target

In May 2014, the Center of Advanced Studies of Film and Television Technology – a scientific institute of the HFF Munich – wanted to answer this question together with the community of lens-users in order to start a communication in between picture designers and lens developers.

Method

Prof. Dr.-Ing. Peter C. Slansky, managing Professor of the technology department of University of Television and Film Munich and director of the Center of Advanced Studies of Film and Television Technology developed a questionnaire. Katrin Richthofer, manager of the Center of Advanced Studies of Film and Television Technology realized a survey in German and English and the statistic evaluation, assisted by Claudia Stoll. They used the Software Umfrageonline by enuvo, Zürich.

The survey addressed all camera people who were responsible for the camerawork in Cinema or TV-productions in the years 2012/2013/2014 as their main profession. The German version of the survey was online from June 26th to August 29th, the English version from July 7th to August 29th 2014.

The 34 questions differentiate in between the specific usage of lenses for TV or Cinema productions as well as different ways to create pictures. It also contained a glossary with optical technical terms. It also took into account, that different projects have different optical requirements. The survey concept tried to balance between the two diverging positions: "We need to construct the perfectly optimized lens with no artefacts" versus „In artistic creation, you can't generalize the characteristics of a lens, because each oeuvre is unique and the aim of art has to be aberration from the norm."

Analysis

In the evaluation, all participants answering the obligatory questions were rated. Therefore, the actual number of answers for each question was statistically evaluated separately.

Even though the survey had two different language versions, there's an overall evaluation. Interesting diversities in between the two language versions are explained in the text.

The survey was anonymous, with identical statistical value for each answer. As for the free text questions, some especially significant answers are quoted and general opinion trends or significant individual opinions are explained in the text. The answers were chosen according to their significance for an individual opinion or representative for opinion trends. We quote literally, and if necessary, correct the spelling. In this English version, the quoted German-language free text answers have been translated and marked with a G.

If you are interested in all the answers to the individual questions, please contact The Center of Studies of film Technology (HFF) – sft@hff-muc.de.

Acknowledgments

Results

Participation

Worldwide, a total of 442 camera people took valid part in the survey, 171 (39 %) in the German and 271 (61 %) in the English version. As mentioned above, not every participant answered all the questions, resulting in a varying number of answers for the individual questions. Only valid answers were counted.

1: Are you a member of one of the following camera associations?

52 % of all participants were members of a camera association, 48 % were not.

BVK: 9,4 %
BVFK: 7,4 %
SCS: 2,0 %
AAC: 0,2 %
ACO: 2,0 %
ASC: 1,1 %
BSC: 3,1 %
GBCT: 4,4 %
IMAGO: 8,1 %
AMC: 0,2 %
Others: 14,2 %
No membership: 48,0 %
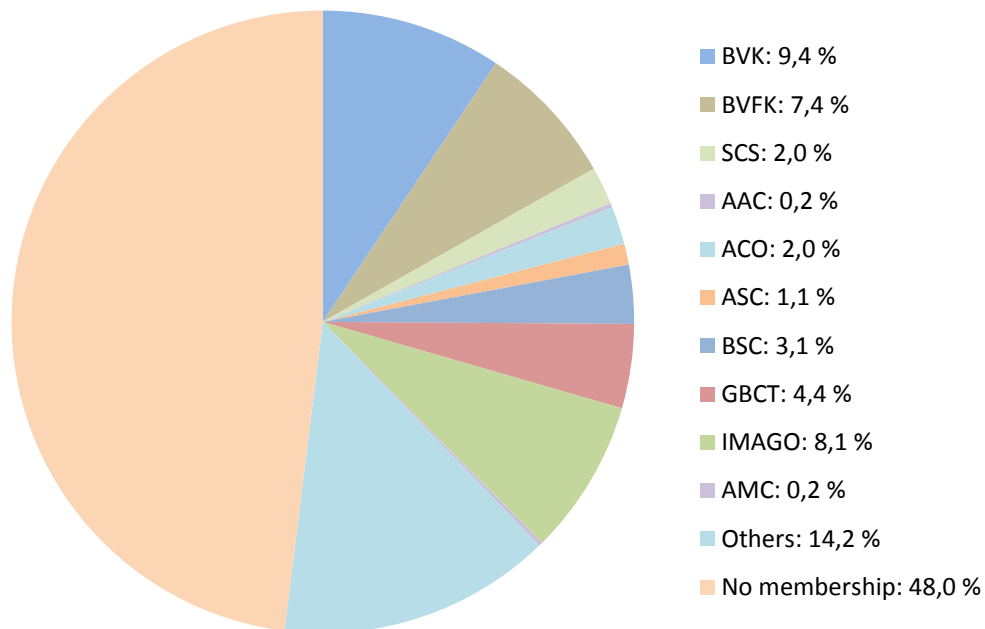
BVK	German Cinematographers Association
BVFK	German Television Cinematographers Association
SCS	Swiss Cinematographers Society
AAC	Austrian Association of Cinematographers
ACO	Association of Camera Operators
ASC	American Society of Cinematographers
BSC	British Society of Cinematographers
GBCT	Guild of British Camera Technicians
IMAGO	European Society of Cinematographers
AMC	Mexican Society of Cinematographers

2: What was your chief employment in the production years 2012/ 2013/2014?
Here the participants were asked to evaluate the work time they spent for 6 different fields of activity. The answers were accumulated.

- Fictional cine film including TV coproduction: 26,2 %
- Documentary cine film including TV coproduction: 11,4 %
- Cine or TV commercial: 21,3 %
- Fictional TV film/ TV series: 16,1 %
- Documentary TV formats (feature, documentary, report): 20,4 %
- TV studio productions and outside broadcast (E-camera-production via control desk): 4,6 %
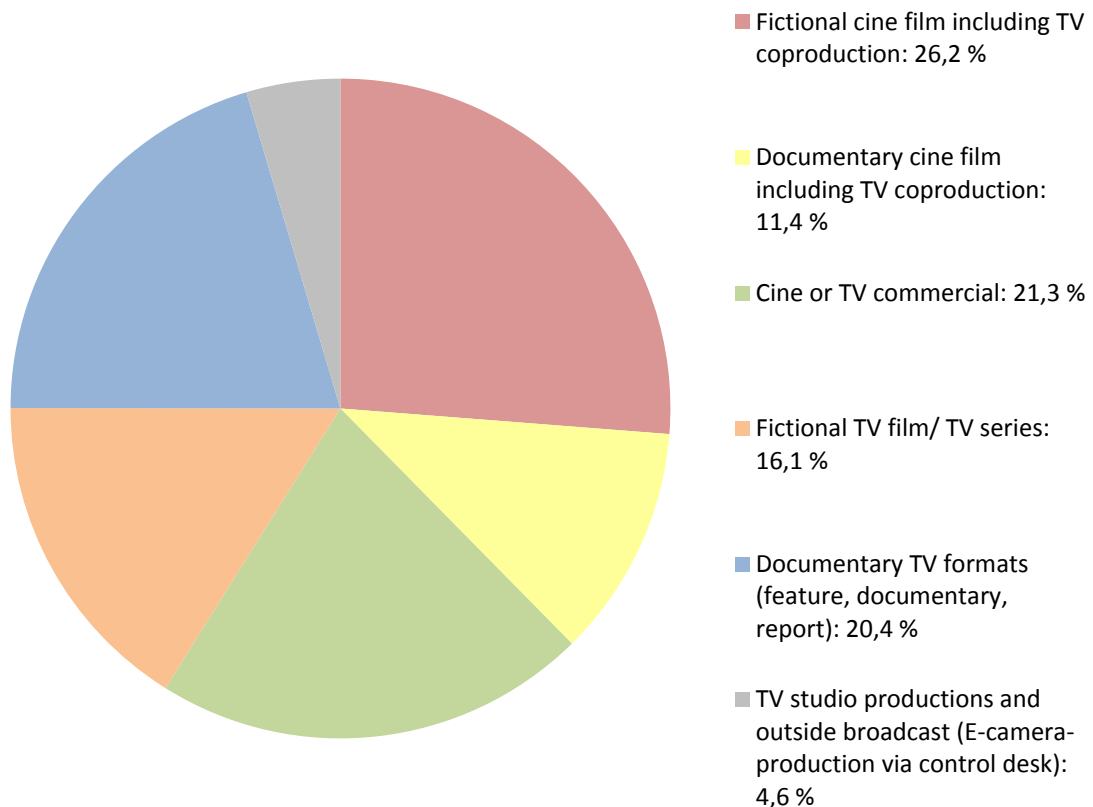
In comparison, significantly more English- speaking camera people working in the area of cinema production and cinema advertising answered the survey. With the German-language version, we reached more camera people working in the field of documentary TV formats and TV studio productions and external mobile recording ("outside broadcasting").

The significantly higher number of camera people with a focus on the first four categories is easily understandable due to the topic of the survey.

3: Which camera type did you use, and how often, in the last 3 years?
Here the camera people were asked to evaluate the percentage of usage of four different categories of cameras over the last three years; the results were accumulated.

35mm film: 7,3 %

16mm film: 4,6 %

Digital one-sensor-camera; S 35 size or similar: 68,4 %

Three-CCD-videocamera; 2/3" size or smaller: 19,7 %
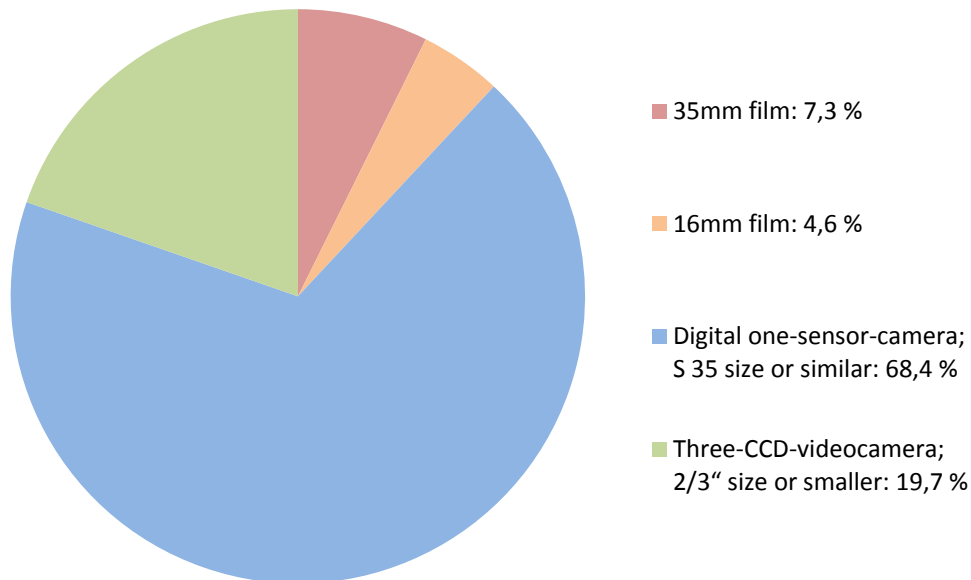
Interestingly, approximately 12 % of the productions were still shot on film. Of course this doesn't reflect the worldwide volume of this means of production. This is also reflected by the fact that in the German-language version, the number of productions shot on 3-CCD-Videocameras was significantly higher. This correlates with the higher number of TV productions in question 2. The free text answers quoted stated that the typical TV formats that used to be shot on 3-CCD-videocameras are now increasingly shot on digital one-sensor-cameras. This is leading to different requirements for lenses.

The fact that almost 70 % of the productions were shot on Digital one sensor cameras underlines the central importance of the results of this survey: It significantly answers the question of which lenses are desired for Digital One sensor cameras. In the future, it is in this area in which the greatest changes in lenses are to be expected.

4: Who decides which camera you use in your main field of activity?

This and the following question are related to the chain of added value of the production practice.

- Yourself: 56,9 %
- The producer or the broadcast station: 28,4 %
- Other answer: 14,7 %
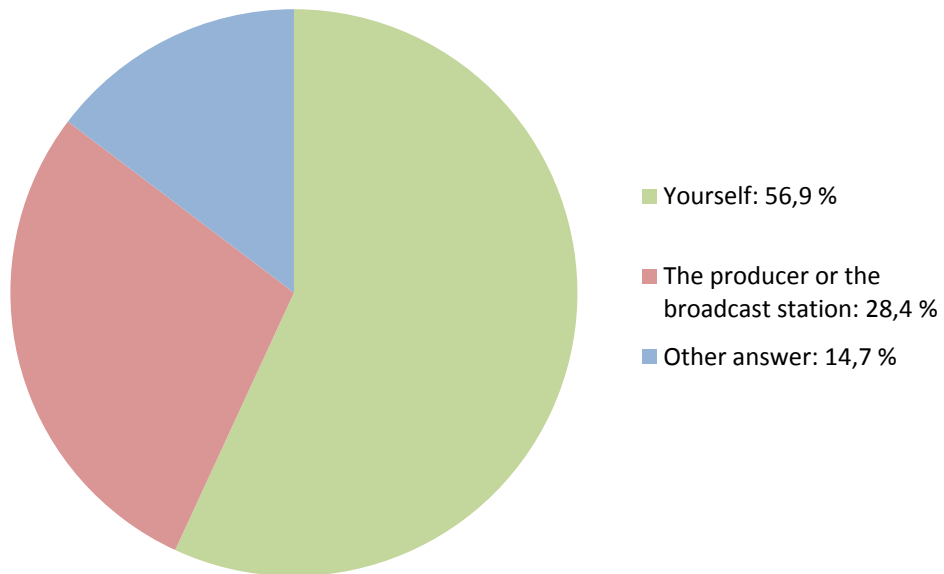
Here the answers diverged a lot between the participants working mainly for cinema or TV. At least half of the participants answered that they can choose the camera themselves. In the free text field a typical answer was a combination of camera, production, direction or an agreement among those functions.

5: Who decides which lens you use in your main field of activity?

■ Yourself: 79,9 %

■ The producer or the broadcast station: 11,5 %

■ Other answer: 8,6 %
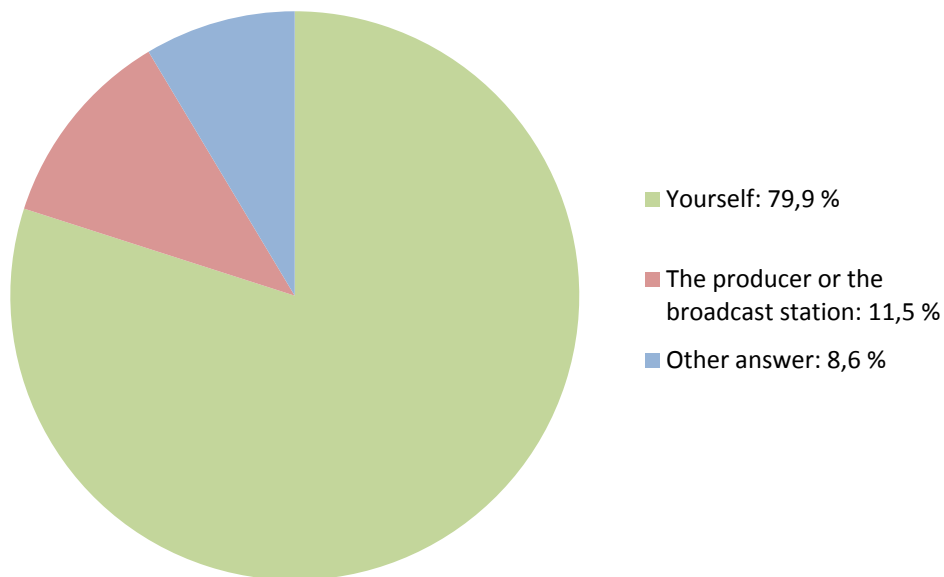
Here the answers were pretty uniform: the majority of camera people can decide which lenses they want to use. Limitations by producers or broadcast stations mainly existed in the area of TV productions.

This underlines the importance of communication between lens manufacturers and camera people, since the chain of added value comprises the lens manufacturer, the lens buyer (mostly film equipment rental agencies) and the user who asks for a certain lens: The camerawoman or cameraman.

These general questions about production circumstances in the production years 2012-2014 are followed by questions judging the general technical improvements in Cinema and TV.

6: How do you judge the technical improvements of cinema and TV over the last ten years with respect to your creative work?

The improvement of picture quality in TV from Standard Definition to High Definition or in Cinema to Digital projection in 2K/4K ...

- ...is great for my camera work: 47,2 %
- ...was alright, but now we've reached a limit – I look critically at further improvements: 26,3 %
- ... hasn't brought a lot of changes for my camera work: 12,4 %
- ...was negative for my camera work: 6,3 %
- Other answer: 7,8 %
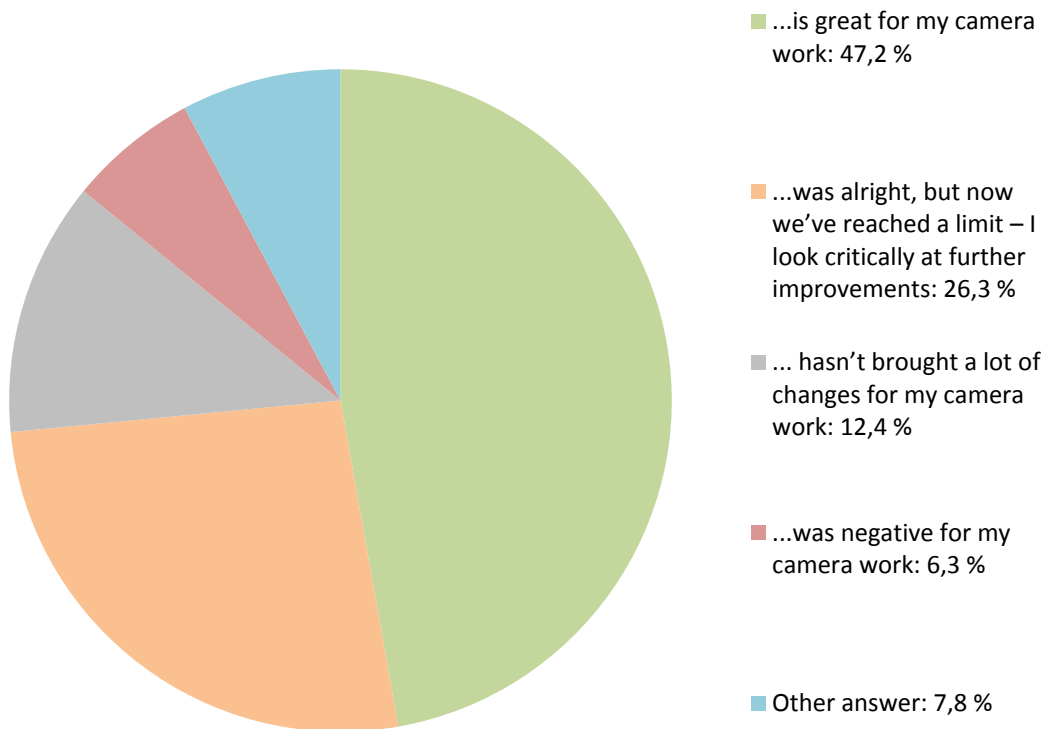
Interestingly enough, almost half of the participants welcomed the improvements of quality whole-heartedly. More than a quarter, however, stated they felt that a limit has been reached. It's interesting that the English answers were significantly more positive than the German answers. Citations from the free text fields:

[Translated from German:] "I welcome the possibilities, but on the other hand, I constantly work against them because they overwhelm conventions of viewing and draw attention from the essentials."

"It is great since it opens up more possibilities and tools, however we have to stay critical and alert and keep the focus on creativity, vision and intuition and not on technology. Nonetheless, technology will inevitably progress."

"It has brought benefits in terms of latitude and immediacy of grading, but has also brought a uniformity to the images and laziness to lighting."

7: How do you judge further improvements like the introduction of UHD and 4K/8K with respect to your artistic work?

The introduction of Ultra High Definition and 4K/8K ...

- ...is absolutely positive for my camera work: 14,6 %
- ... has positive and negative aspects for my camera work: 54,0 %
- ... is irrelevant for my camera work: 22,8 %
- ...was negative for my camera work: 4,4 %
- Other answer: 4,2 %
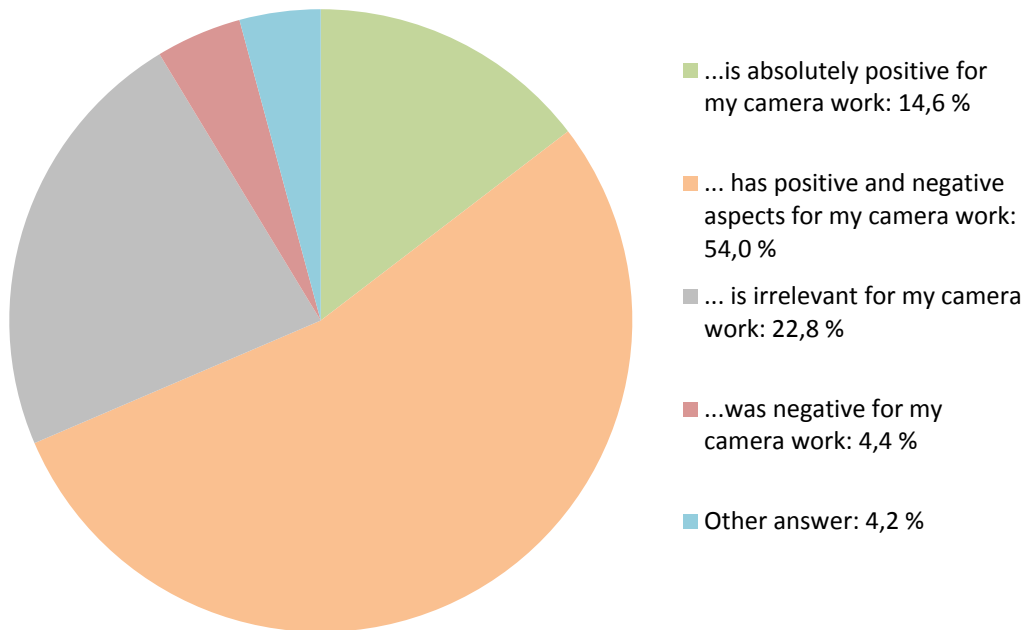
It is truly remarkable that further improvements of quality in TV and cinema are judged very critically by camera people: Just a seventh of them judged them absolutely positively. Here the two groups (German-speaking and English-speaking) do not differ a lot.

Excerpts from the free text answers:

[G.:] "I think that the focus on yet more sharpness is a development in a completely wrong direction – it won't improve the pictures!"

[G.:] "…imposes difficult tasks for scenography and decor. I welcome selective sharpness, whereas too much detail takes the focus off the essential picture content."

"Good for tech. Pain for DIT and data wrangling."

"8K tv? Are you serious?"

8: Has the significance of the choice of a certain model of lens changed with the technological improvements of the last years?

With the technological improvements of the last ten years – digital cameras, postproduction, colour grading, cinema projection and High Definition flat screens - the importance of the camera lens for the look design has...

- ...increased: 70,9 %
- ...not changed: 22,6 %
- ...decreased: 6,5 %
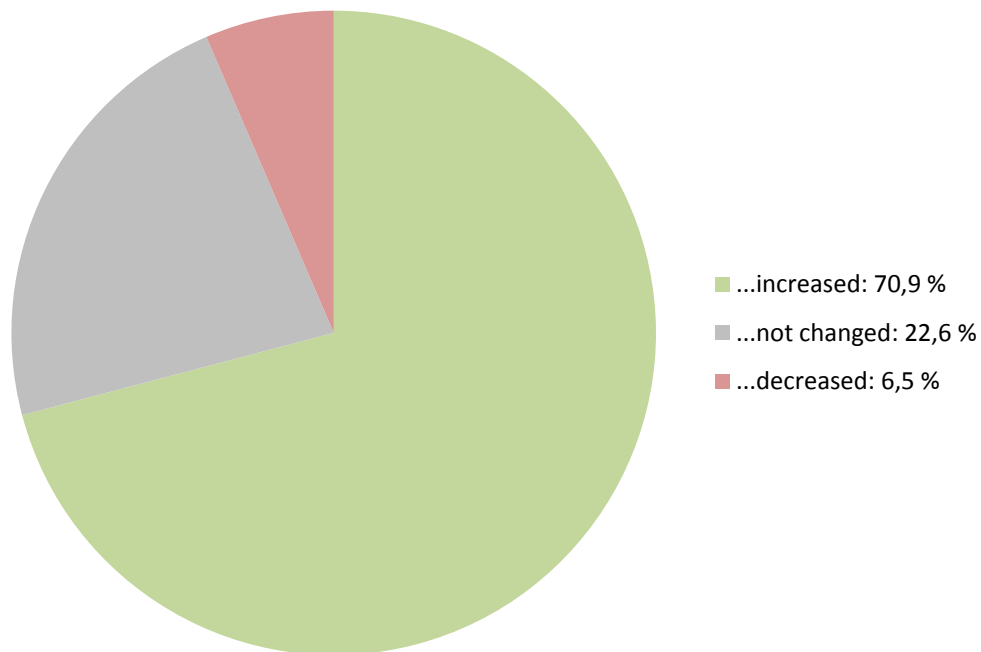
The overall agreement is even greater in the German-language survey.

The answer to this question confirms the central thesis on which the survey is based. Contrary to the skeptical answers to Question 7, it is an encouraging sign to lens manufacturers to enhance further technical developments. In a constant dialogue between the partners, this could lead to the rediscovery of the original photographic values and to an enhancement of the importance of lenses. As the next question illustrates, camera people are generally open to technical improvements of lenses – whatever that means in terms of specific parameters.

9: How do you judge the technical improvements of lenses over the last ten years in respect to your creative work?

The improvement of the reproduction quality of camera lenses, especially of their focusing abilities...

■ ...is great for my camera work. I welcome all further improvements: 53,4 %

■ ... was positive. But now we've reached a limit – further improvements will be rather counterproductive for my camera work: 9,4 %

■ ...has brought advantages and disadvantages for my camera work. I look very critically at further improvements: 28,4 %

■ ...was negative for my camera work: 1,3 %

■ Other answer: 7,5 %
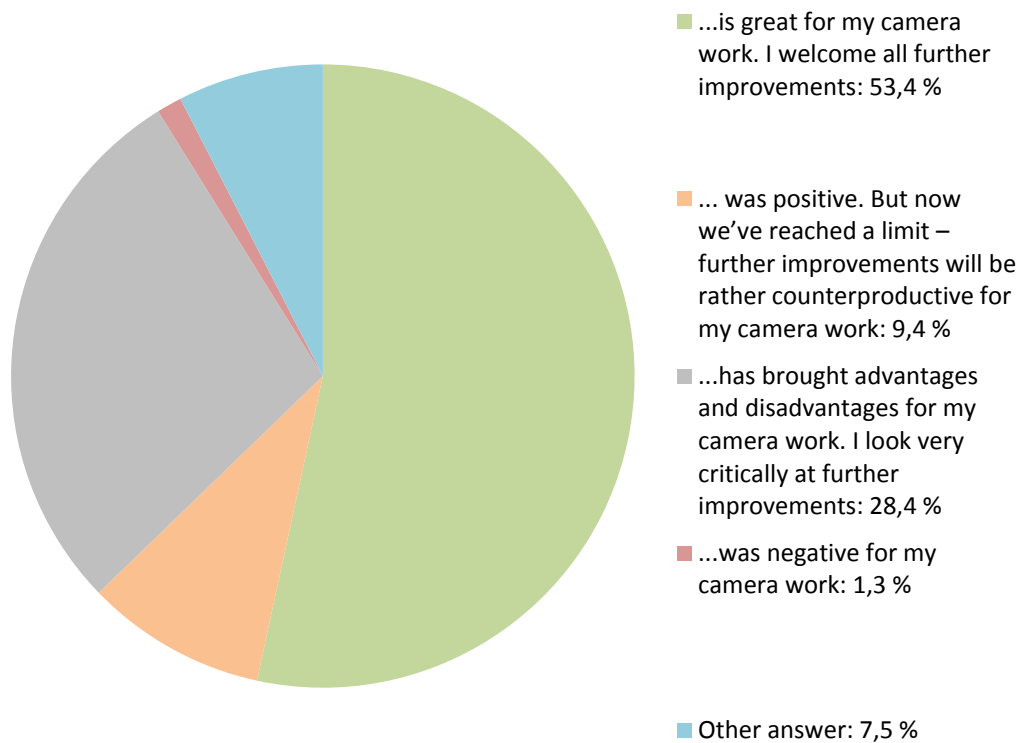
This very interesting result signifies that a majority of the interviewees welcomes technical improvements of lenses far more than in other links in the production chain (see proceeding questions). Nevertheless here as well almost a third judges further improvements as critical.

Here the English speaking group was even remarkably more positive than the German: 59,4 % as opposed to 44,8 % welcome all further improvements.

Excerpt from the free text answers:

[G.:] "That needs to be differentiated between different ways of propagation and genres. For me, working in TV, the "perfect" lenses are rather negative."

[G.:] "I welcome the improvements, but I don't have a choice anyway. The technical improvements continue, we need to produce what the station wants."

[G.:] "It's great to have more sharpness in total views of landscapes. In close ups though I don't need to see the pores!"

[G.:] "Any improvement widens the range of possibilities. Therefore old lenses are just as well one tool in the toolbox of image creation. The choice of lenses replaces the choice of film material and lab-negative-process."

[G.:] "I chose my lenses according to creative needs. For some projects I'd wish for even more sharpness, for others I'd rather chose soft lenses, technically inferior to the sharpness of the cameras but thus creating a look. Therefore I welcome the better sharpness of cameras, since they can optimally transport the reproductive quality of lenses."

"I think it is important to keep looking at how lenses react to digital cinema and the look of vintage glass for a particular look is as important as a highly sharp and distortion free lens."

"The focusing ability has reduced for digital sensor because the sensor has not the depth of field as the negative has, so improving lenses especially for digital sensor would be advisable."

"More and more cinematographers are seeking for old vintage lenses to counter the increasing clinical look the higher the resolution of the sensors get."

In the following part we asked about the importance of different optical quality parameters for the personal creative work. As we expected there were high overall ratings, therefore the differences were sometimes rather minute. A lot of the interviewees point out that the importance of lots of the criteria differ according to the individual projects and the intended look.

10: How do you create pictures?

This question should differentiate between two groups of picture creators: We asked the interviewees to group themselves in one of two differing categories, since the way of creating pictures differs a lot, especially in between fictional and documentary projects.

- I rarely have a chance to create a look by choosing different camera lenses: 25,8 %

- Creating one or several special looks for a certain project – for example by choosing special lenses – is a vital part of my camera work: 74,2 %
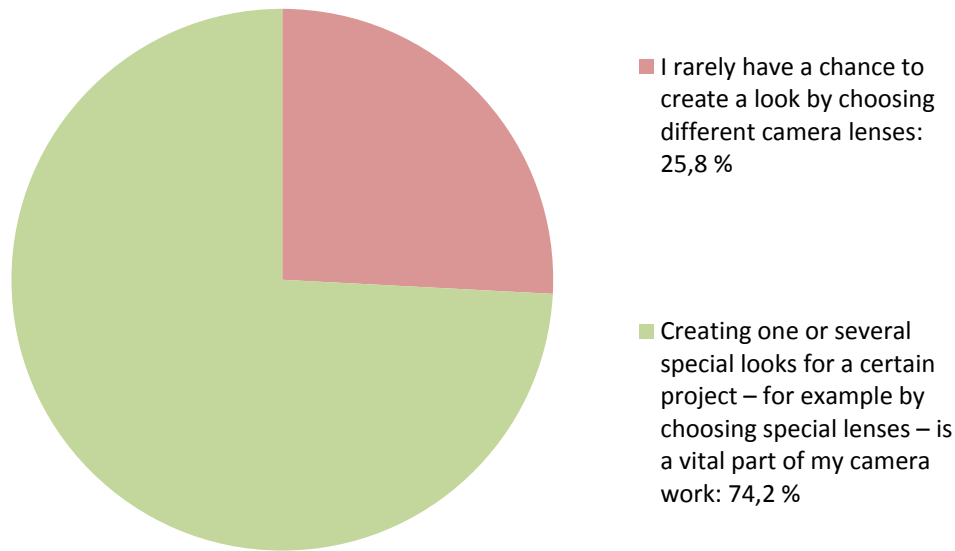
The result of this question correlates generally – but not in every detail – with question 2 about productions. The first four categories – fictional and documentary cine film, commercials and fictional TV film – represent those productions in which the individual look of an oeuvre is generally judged as very important. These productions also sum up to approximately 75 %. On the other hand, documentary TV formats (feature, documentary, report) and TV studio productions and outside broadcast represent the rather depictive productions, also summing up to appr. 25 %.

For the following questions the survey was split according to the answer to this question: "Look" or "No Look" the last group we also refer to as "Technicians". The questions concerned the same parameters but were sometimes worded slightly differently. For the evaluation all the answers were merged. A differentiating evaluation for "Look" and "No Look" would have been possible but proved to be unnecessary due to pretty similar overall results. Where there were interesting differences we point them out. For the evaluation it's only a fact that three quarters of the interviewees judged the parameters as "more or less important" whereas a quarter of them judged the same question as "better" or "worse".

Therefore there will be pairs of questions, until with question 32 both lines will meet up again.

11/12: Besides pictorial design, camera movement and lighting I use the following technical tools to create a special look:
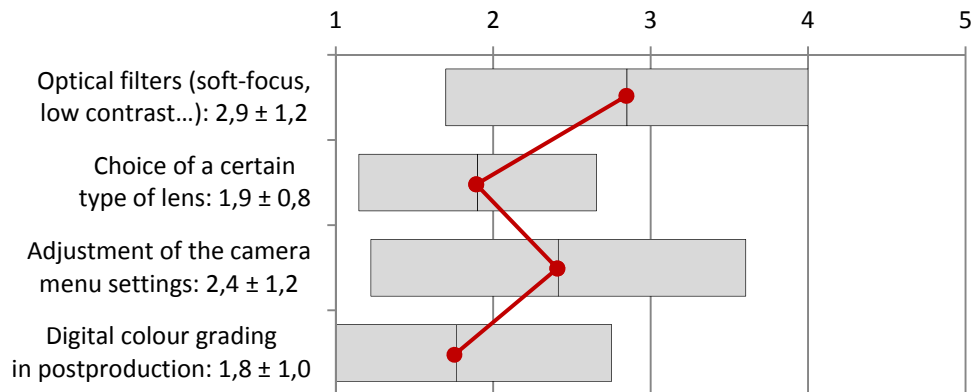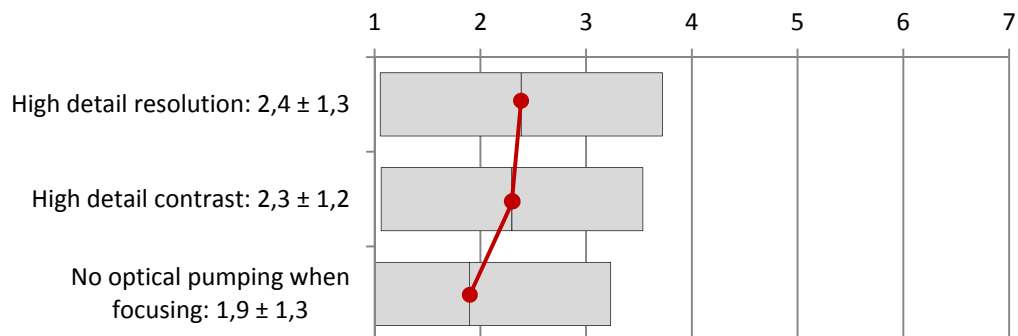

The evaluation used a scale of five "Grades": 1 (very often), 2 (often), 3 (occasionally), 4 (seldom), 5 (never). The average of all grades is shown by a red dot. The dots are linked by a red line, the grey bars show the standard deviation. The wider the grey bar, the more variated, the smaller, the more consistent the answers.

These results are quite stunning since the colour grading is made in Post Production whereas the other three design media are part of the filming itself. Thus with the digitalisation for a majority of filmmakers a number one design media has shifted from their first field of activity to a second – to which they often don't even have access any more. Here and for the choice of a certain model of lenses the different groups differ remarkably – ratings around 1,5 from the "Look creators" worldwide are counteracted by a 2,66 (average importance of digital colour grading) or even 2,96 (choice of lens) of the German "Technicians".

In the optional free text answer a variety of other design media were listed. A few camera people answered that optical filters are nowadays are more or less replaced by digitally emulated filters in Colour Grading.

Hereafter the ratings of the individual quality parameters are listed in tabular form. Three quarters of the interviewees ("Look") rated them as "more or less important" whereas a quarter of them ("No Look") judged the same parameters as "better" or "worse". The evaluation scale was widened to seven steps: 1 (very important) to 7 (unimportant).

13/14: In regard to the acuity of the lens, the following features are important to create a look:

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

High detail resolution: 2,4 ± 1,3

High detail contrast: 2,3 ± 1,2

No optical pumping when focusing: 1,9 ± 1,3

15/16: Contrast graduation of the lens

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

Low sensitivity against flare: 2,8 ± 1,7

Low blooming of highlights: 2,6 ± 1,5

Low tendency to lens flares: 3,0 ± 1,7
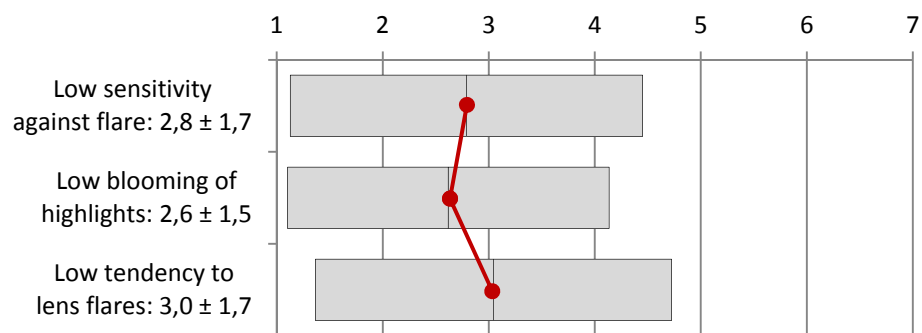
Concerning acuity of lenses, as to be expected the criteria „detail resolution" and „detail contrast" were generally rated as very important. Even more important – and here interestingly everybody agrees – is a consistency of the framing when pulling focus. This is a demand typical to film as opposed to still Photography. Therefore still photography lenses can't be used unproblematically. In the optional free text fields lots of comments state that from a certain point too much detail resolution decreases the possibilities of image composition and the viewing experience, since fine details draw attention from the central issue – the story.

Remarkably enough a low sensitivity against flare and blooming are rated far less important than sharpness.

17/18/19/20: False colours/Colour reproduction by the lens

Low optical aberrations: 1,8 ± 1,2

Overall neutral colour reproduction: 2,0 ± 1,2

Visually pleasing rendition of skin tones: 1,6 ± 1,0
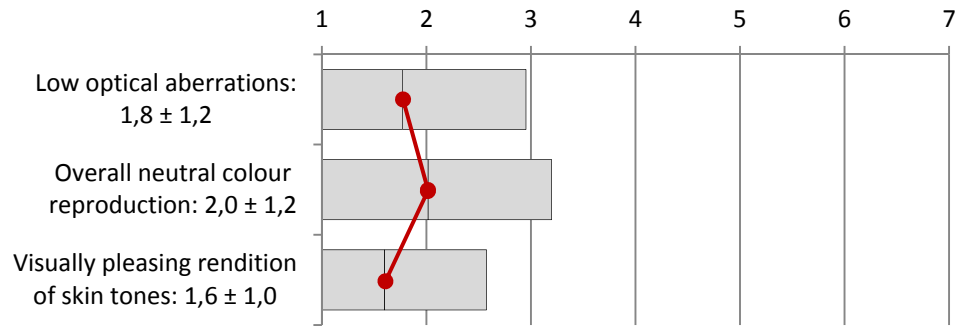
21/22: Other photo-optical characteristics

High speed: 1,9 ± 1,0

Short closest focusing distance: 2,1 ± 1,2

Pleasing bokeh: 2,0 ± 1,1

23/24: Balance behaviour

Balanced sharpness from center to the corners: 2,1 ± 1,1

Balanced brightness from center to the corners: 2,1 ± 1,2

Low pincushion or barrel distortion: 2,2 ± 1,3

Low curvature of image field: 2,1 ± 1,1

Balanced optical characteristics for all focal lengths of a set of lenses: 1,7 ± 1,0

Balanced optical characteristics for the whole zoom range: 1,5 ± 0,8

In these three genuine photographic questions the demands are generally very high. An important result is, that a visually pleasing rendition of skin tones is rated as the most important parameter at all, more important than an overall neutral colour reproduction. In contrary the second result – a clear "yes" to low chromatic aberrations – isn't surprising, since this is an anorganic artefact.

It's as well little surprising that the demands to high speed and a harmonic bokeh were rated as very important.

Strikingly for the parameter „Balance behaviour" the optical distortion and the curvature of field were rated as least important. We had a lot of free text responses, stating that thos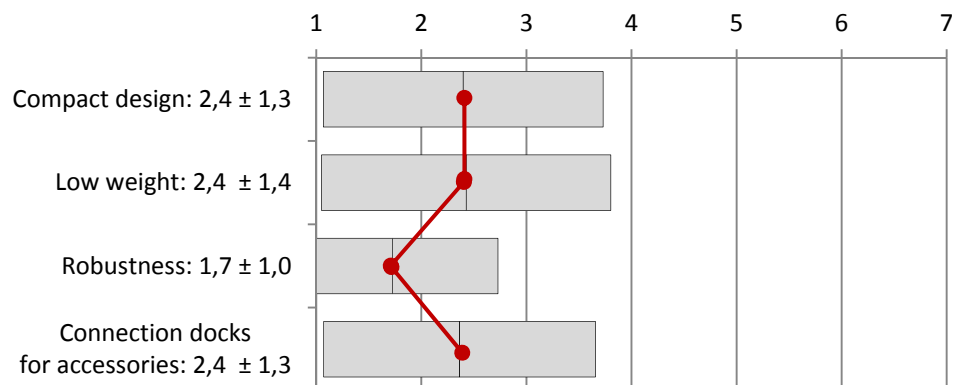e distortions can be part of an intended look, as to distortions only the barrel distortion though. There is a contradiction, especially for wide angle lenses: If the lens is optimized for exact planarity, a two dimensional test chart will be rectangular and parallel, whereas in a scene, a round object at the edges of the frame – a head for example – will be distorted. Therefore, for scenic use, wide angle lenses with a "mild", "harmonic" barrel distortion are preferred. A perfectly plane lens is only preferred for shots with f.e. architecture as a main image content. This similarly applies for the curvature of image field.

Constant optical parameters for all lenses of a set of fixed focal length lenses and – even more important – within the focal lengths of a zoom are rated as very important.

25/26: Handling

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

Compact design: 2,4 ± 1,3

Low weight: 2,4 ± 1,4

Robustness: 1,7 ± 1,0

Connection docks
for accessories: 2,4 ± 1,3

Noticeable are the medium marks in the field of „Handling" – except for robustness. The high standard deviation shows the very different needs and judgements.
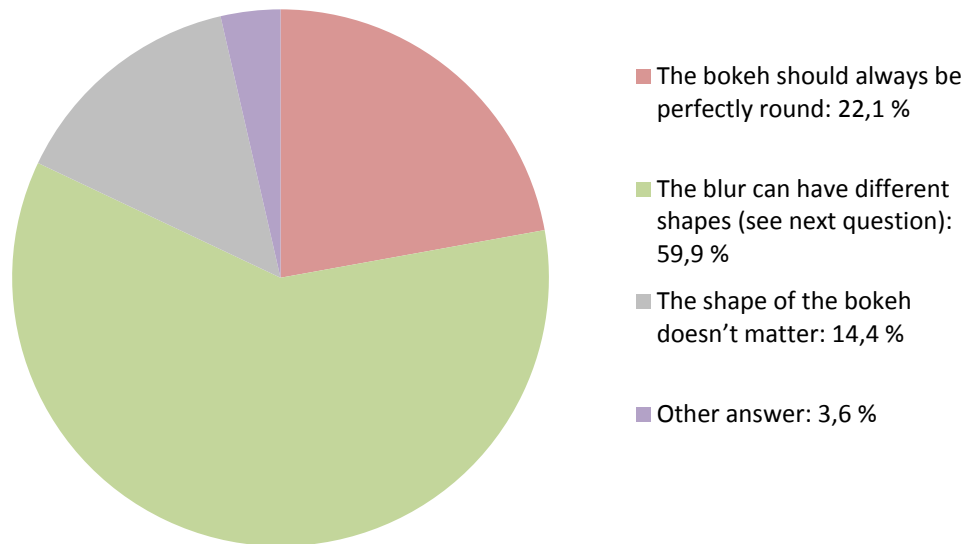
Within the free text answers lots of different singular aspects were stated according to the distinct use and production- especially differentiating between film and TV.

Besides that, the importance of a possibly similar handling within lenses of one produc-tion series was emphasised: Camerapeople wished for a preferably identical diameter and position of sprockets for aperture and distance, an identical diameter of the moun-ting of the front lens and a similar centre of gravity to ensure a fast changing of lenses and connection to follow focus and compendium.

Zoom objectives from the still fotography that changed their length and centre of gravity when zooming were rated critically.

Whereas normally English speaking "Look creators" were usually the most positiv, fol-lowed by German "Look creators", English speaking "Technicians" and German speaking "Technicians", here the picture for once changed: Interestingly the German "Look creators" most fervently asked for connection docks for accessories, rating this answer with an average 1,95 – as opposed to an average 2,23 of the German "Technicians" and a 2,66 of the English speakking "Look creators".

27/28: Bokeh: Which shapes of blur do you prefer or do you decline?

- The bokeh should always be perfectly round: 22,1 %
- The blur can have different shapes (see next question): 59,9 %
- The shape of the bokeh doesn't matter: 14,4 %
- Other answer: 3,6 %

29. Shape of blur (bokeh)

**Only if question 27/28 was answered "The blur can have different shapes":
Which shapes of blur do you prefer?**

round: 1,6 ± 0,8
nonagonal or polygonal: 2,8 ± 1,2
octagonal: 3,1 ± 1,3
heptagonal: 3,7 ± 1,4
hexagonal: 3,7 ± 1,6
pentagonal: 4,2 ± 1,6
square: 5,7 ± 1,6
triangular: 5,2 ± 1,8
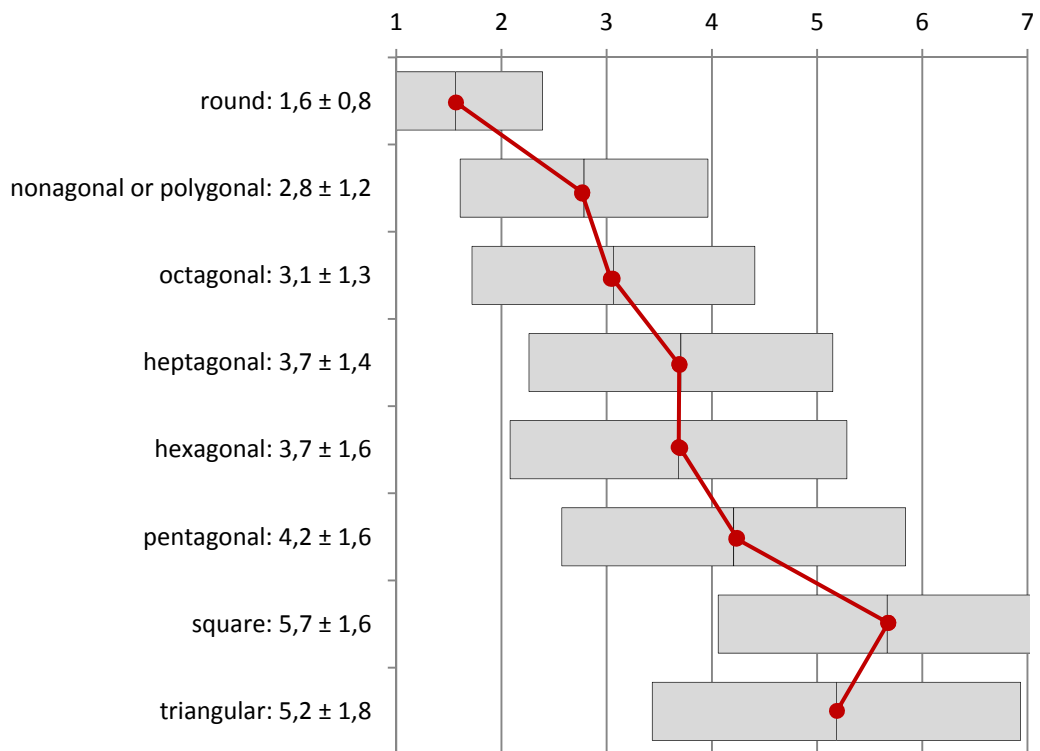
The bokeh is very important for the look as a phenomenon, thus it wasn't surprising to see a very differentiated answer. Still it's remarkable that around a fifth prefers the harmonic bokeh of a perfectly round iris aperture. In contrast two third of the participants votes for different shapes of the defocus transition to create different looks. A nonagonal bokeh is rated as second best, lesser numbers of focus blades reproducing a defocus figure of this shape are rated successively worse, a pentagonal or even triangular shape is dismissed.
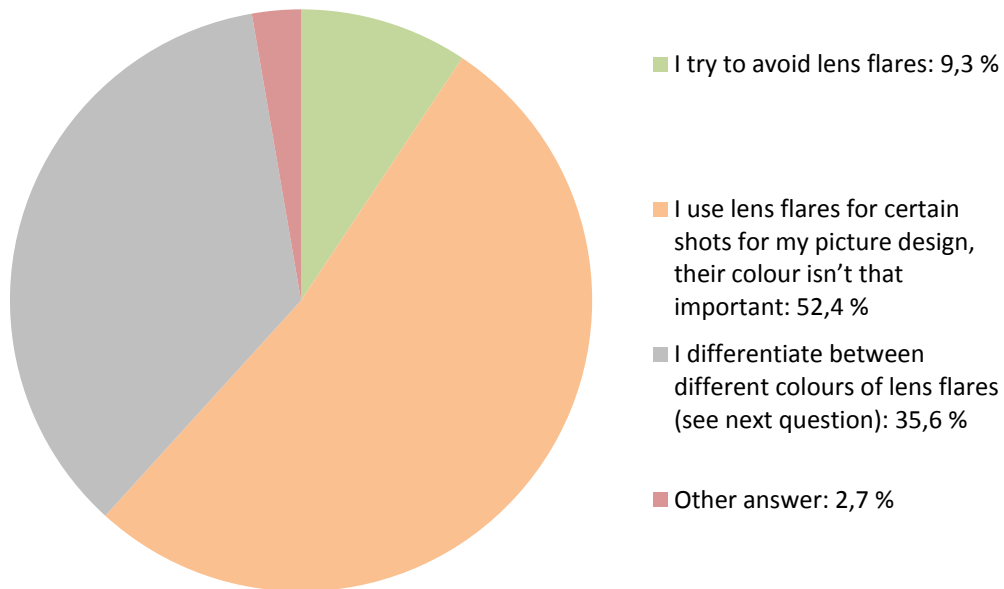
Here you have to keep in mind that an uneven number of focus blades evokes a different reaction to bright highlights than an even number: The deflection on every edge between two focus blades causes star shaped aureolas around the highlight. An uneven number of iris focus blades creates a star with double as much rays, whereas for an even number of blades the star will have the same number of rays as iris blades since here two rays mask one another. Therefore an iris focus with three and six blades will both produce a six-ray-star, only with a differing distribution of brightness and shape of the rays.

The bokeh is a very complex phenomenon altogether, with considerable influence on the look in certain recording situations.

Take into account that the dynamic of a lens – f.e. when pulling focus – greatly influences the recording. Here – depending on the motif of course – different shapes of defocus figures can lead to very different visual impressions of the focusing process.

30: Which colours should/ shouldn't lens flares have?

If a light source shines directly into the lens (e.g. the sun) there are light spots along the optical axis due to internal reflections on the surface of the lenses, so-called lens flares. Due to different coatings on the lenses, those lens flares can have different colours.

- I try to avoid lens flares: 9,3 %
- I use lens flares for certain shots for my picture design, their colour isn't that important: 52,4 %
- I differentiate between different colours of lens flares (see next question): 35,6 %
- Other answer: 2,7 %

31: Lens Flares: Colours

Only if question 30 was answered „I differentiate between different colours": Which colour(s) should/shouldn't lens flares have?
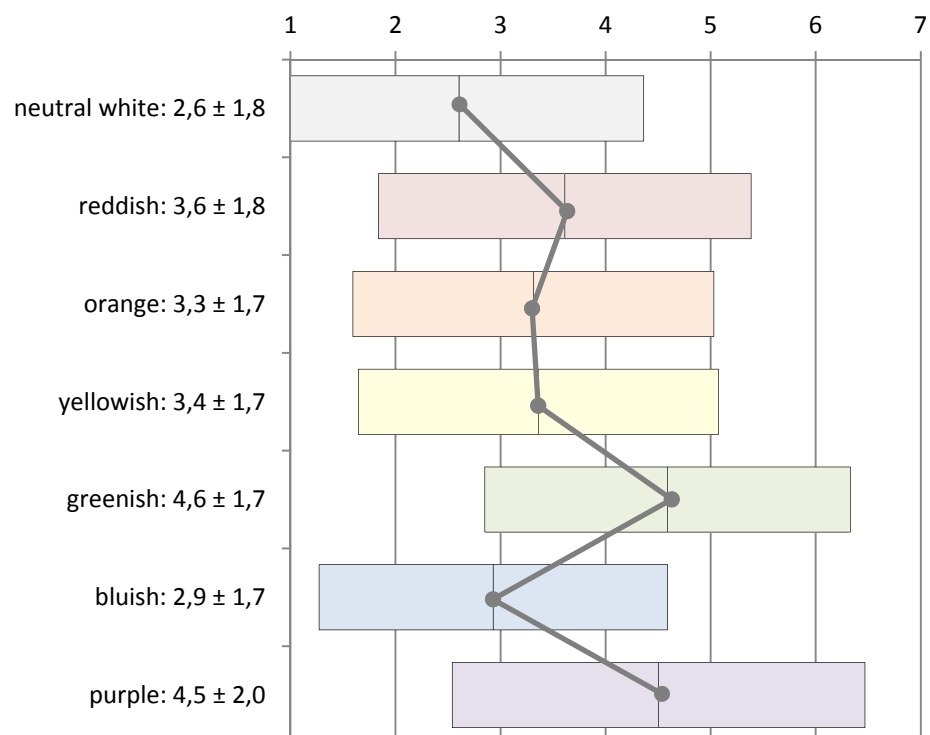
When this survey was realized, there was a strong tendency to use lens flares as a means of look creation in commercials. There's rarely a car commercial without backlit shots with lens flares in all different colours.

The results of question 30 show, that a majority of the participants judges lens flares as a possible design medium. Only a good third of them has concrete ideas about which colours of lens flares they prefer or avoid. Amongst this group, neutral white lens flares are generally preferred. Lens flare colours on the scale red-orange-yellow to bluish are also acceptable, whereas lens flares on the colour scale green to purple are mostly rated negatively.

This must be seen in relation to the colour-rendition questions 19/20: If in a backlit situation the lens flare is on a person, the colour of the skin is superimposed by the lens flare. The scale red-orange to bluish (including reddish and yellowish) is part of the colour temperature scale and therefore a variation of natural light sources. Whereas orange or bluish lens flares mostly desaturate or saturate the skin tone, Lens flares on the colour scale green to purple interfere unharmoniously.

Especially in the look of their lens flares, old lenses differ from modern ones.

32: Currently, a lot of camera people often use old lenses on modern digital cameras. What's your position on this?
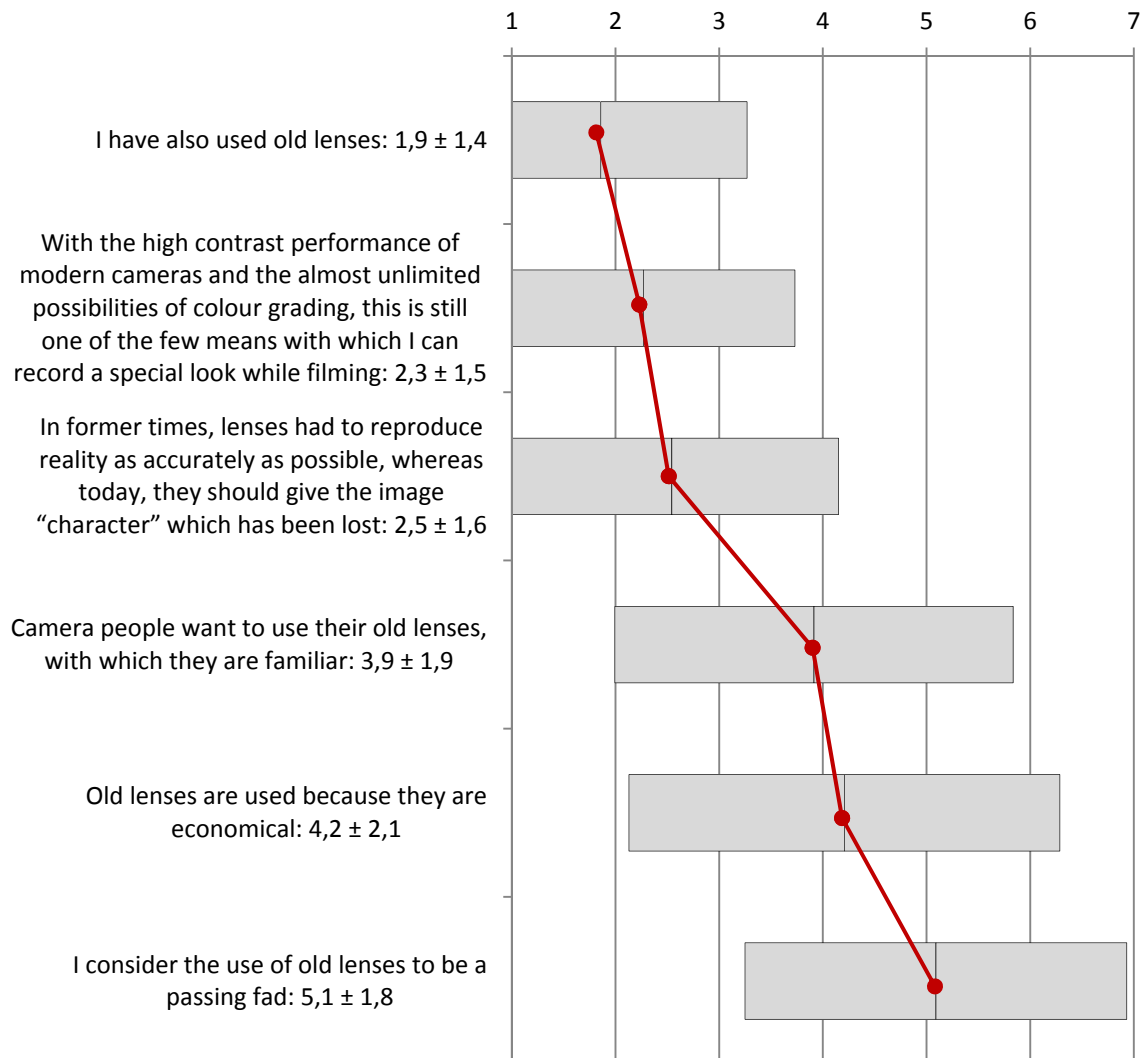
In this question there's a remarkable consensus: A majority of the participants states to have used old lenses and will go on doing so. Old lenses are not used because they are economical, but to record a special look while filming. A lot of the participants agree that in former times, lenses had to reproduce reality as accurately as possible, whereas today, they should give the image "character" which has been lost. Excerpt from the free text answers:

"Lenses are chosen for a project. Some for their accuracy, some for the beauty of their aberrations and flares."

They also point out problems in handling old lenses though.

33: Have you shot in 2,37:1 in 2012/2013/2014?

■ Yes: 55 %
■ No: 45 %
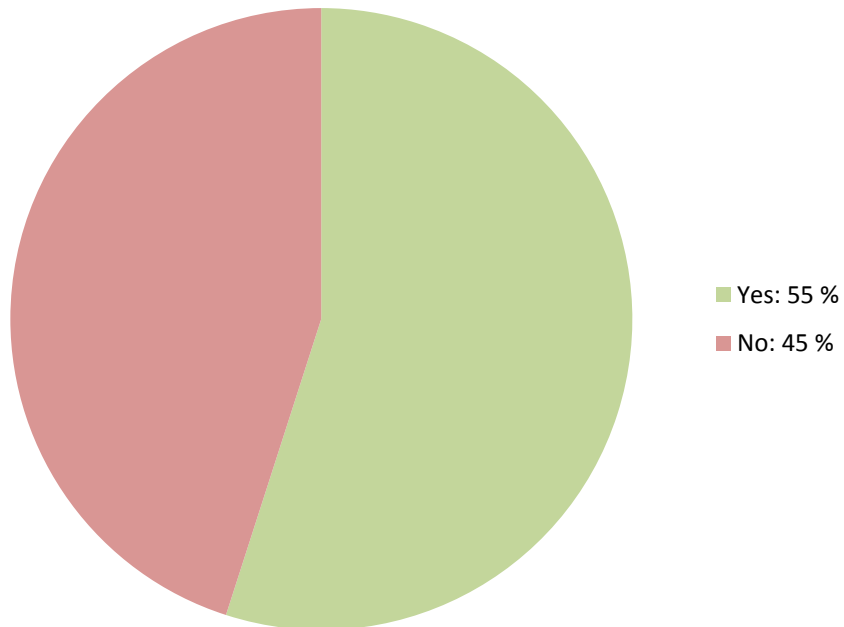
34: If "Yes": With what kind of lenses?

■ 78,8 % with spherical lenses

■ 21,2 % with anamorphotic lenses

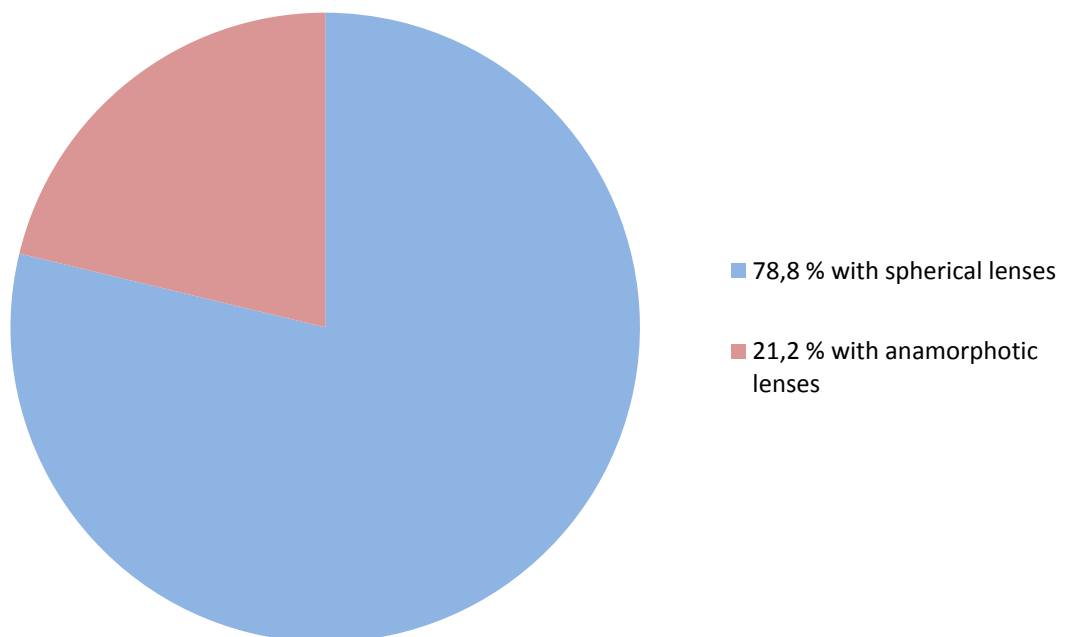The question about the format 2,37:1 evokes an interesting divergence between the German- and the English-speaking participants: Whereas only 40 % of the German-speaking group used this format, 55 % of the English-speaking participants did. This can be partially explained by the higher rate of cinematic and commercial productions in the English-language survey.

Overall, 79 % of the 2,37:1 productions were shot with spherical lenses and 21 % with anamorphic lenses. Many participants blame this distribution as being necessary due to budget or workflow reasons, however lots of them wish to shoot with anamorphic lenses more often due to creative reasons. Nevertheless, for a number of projects the use of spherical lenses was also substantiated with creative reasons.

35 Please explain your decision!
Excerpt from the free text answers pro-anamorphic:

[G.:] *"Anamorphics have their own look, especially when pulling focus (asymmetrical bokeh)"*

[G.:] *"I often shoot cars, there they like anamorphic lenses. The typical lens flares are part of the look. Especially if the camera shows the cars headlights at night."*

[G.:] *"With anamorphic lenses, I use the whole sensor/ the whole negative. I am fasci-nated by the optical, cinematic character of anamorphic lenses. They produce a stronger feeling of depth and their character creates some kind of 'non-naturalistic alienation effect' that opens up a space for interpretation. "*

"Whenever widescreen (2.35/2.40) is desired, I always prefer to shoot with anamorphic lenses but sometimes it's not possible and we shoot spherical and crop in post."

Pro-spherical:

[G.:] *"The main reason for choosing spherical lenses was due to wanting an artistic look, plus lower costs due to less light and faster handling due to their smaller size."*

"Flexibility of post production and costs. Also I don´t think the anamorphic is needed nowadays. We had resolution and next step is the sensor size, so: anamorphic for what?"

"Anamorphic lenses are too expensive, I try to emulate anamorphic lenses look in post."

"I prefer wide screen format from a spherical lens. Less aberrations and clear focus are the reasons. Weight, cost, and lightness are the secondary reasons."

Summary

In the optical part, questions 11-35, we asked about the importance of different optical quality parameters for personal creative work. As was expected, there were high overall ratings, therefore the differences were sometimes rather minute. A lot of the inter-viewees pointed out that the importance of lots of the criteria depended on the individual projects and intended look.

Acuity

A lot of the free text answers pointed out that from a certain point, too much detail resolution decreased the possibilities of image composition and the viewing experience, since fine details drew attention from the central issue – the story.

Optical pumping when focusing

Concerning acuity of lenses, as could be expected, the criteria "detail resolution" and "detail contrast" were generally rated as very important. Even more important – and here, interestingly, everybody agrees – is a consistency of the framing when pulling focus. This is a demand particular to film as opposed to still photography. Therefore, still photography lenses can't be used indiscriminently.

Shape of the defocus figure

As to the bokeh of lenses, two thirds of all participants voted for different shapes of the defocus transition to create different looks.

Still, around a fifth preferred the harmonious bokeh of a perfectly round iris aperture. A nonagonal bokeh was rated as second best; lesser numbers of focus blades reproducing a defocus figure of this shape were rated successively worse - a pentagonal or even triangular shape were rejected.

Lens Flares

If a light source shines directly into the lens (e.g. the sun) there are light spots along the optical axis due to internal reflections on the surface of the lenses, so-called lens flares. Due to different coatings on the lenses, those lens flares can have different colours. Leaving aside the question of look and whether lens flares should be avoided at all, neutral white lens flares were generally preferred. Lens flare colours on the scale re-orange-yellow to bluish were also acceptable, whereas lens flares on the colour scale green to purple were mostly rated negatively.

Distortion

For the parameter "optical distortions" a lot of free text responses pointed out that there is a contradiction, especially for wide angle lenses: If the lens is optimized for exact planarity, a two dimensional test chart will apear rectangular and parallel, whereas

in a scene, a round object at the edges of the frame – a head for example – will be distorted. Therefore, for scenic use, wide-angle lenses with a "mild", "harmonic" barrel distortion were preferred. A perfectly plane lens was mostly preferred for shots with architecture, e.g., as a main image content.

Colour reproduction

An important result is that a visually-pleasing rendition of skin tones was rated as the most important parameter at all, more important than an overall neutral colour reproduction.

Balance behavior

Constant optical parameters for all lenses of a set of fixed focal length were rated as very important. This refers to their optical reproduction characteristics as well as to measurements, weight and handling.

The same applies – even more importantly – to constant optical parameters within the focal lengths of a zoom. Zoom objectives from still photography that changed their length and centre of gravity while zooming were rated critically.

Use of old lenses

A majority of the participants confirmed they had used old lenses. Old lenses were not used because they were economical but to record a special look while filming. A lot of the participants agreed that earlier, lenses had to reproduce reality as accurately as possible, whereas today, they should give the image "character" which has been lost.

Anamorphic lenses for the format 2,37 : 1

The question about the format 2,37:1 evoked an interesting divergence between the German- and English-speaking participants: Whereas only 45 % of the German-speaking group used this format, 55 % of the English-speaking participants did. This can be partial-ly explained by the higher rate of cinematic- and commercial productions. Overall 79 % of the 2,37 : 1 productions were shot with spherical lenses and 21 % with anamorphic lenses. Most participants blamed this distribution as necessary due to budget or work-flow reasons, however lots of them wished to shoot with anamorphic lenses more often due to creative reasons.

> In the closing questions 36 to 38 the participants could express their expectations, wishes and comments in several free text fields.

36: Which other characteristics of lenses are especially important for you?
Excerpts from the free text answers:

[G.:] *"Less F-Drop when using extended focal length, lighter construction (HD lenses, ENG)"*

[G.:] *"Interesting bokeh, soft decline of acuity."*

[G.:] *"Exterior construction: Compact, good handling, robustness. Optical performance: high luminosity, good sharpness, realistic colour rendition, but a unique 'character' constant through the whole set of lenses. To me that is more important than maximal sharpness and illumination in the edge areas. Pumping when pulling focus is inacceptable to me. Zooms have to keep their focus when zooming!"*

[G.:] *"Individuality!!! A wider range of real differences in the optical reproduction!!!"*

[G.:] *"The optical reproduction should be as good as possible in all disciplines. If I am looking for specific effects (special bokeh, soft focused edges) I can use old lenses or ask post production to produce these effects."*

[G.:] *"Like most of this survey, this question aims at choosing general characteristics for all lenses one works with. It's very important though that the look of different cameras is getting more and more similar. Aside from grading, the choice of a certain model of lens is the only possibility to crucially influence the look of a film. An emotional chamber play, living completely from its characters, has completely different needs for the pictorial design than a science fiction film with lots of special effects. Therefore, for one project it can be important to use vignetting lenses with low contrast and focus but a warm, cinematic rendering of skin tones. For a different project, 8K and a technically extremely precise lens can be exactly the right choice. What was done earlier by the choice of film stock and lenses, is done today a lot more by the choice of a certain lens."*

"To have good rendering of the skin tones. Some are too sharp and so I love to use filters."

"Real stop marks in focus ring."

"No breathing while focusing, being able to select which lenses I want to use for flares, having zooms that match primes (in look), being able to have lower resolution lenses for creative decision-taking, having the ability to use any lens on any mount via adapters."

"The lens is my first tool for creating moods and I take the decision on creative needs. In commercials, I often offer the sharpest image I can achieve. On every project, I try to ask for different lens series."

"Interchangeable lens mounts for different cameras. Constant aperture zoom lenses."

"Organic look - naturalism (as opposed to clinical)."

"I think for me, the bokeh is important as I tend to shoot wide open, or close to it. Also the speed of the lenses, I quite like T 1.3 lenses as they give you nice out of focus elements in the image. Another item that is important for me is the T-stop, the more open/ faster the lens, the more desirable it is for me. I quite often light to T 2 – T 2.8 but it's always good to have one or two stops in the reserves, when something comes up and one needs to act fast for changing environment or when the director asks to shoot at 50 fps. Then there is the obvious thing of prolonging the day by having the extra stop. Those are the practical reasons. But then it is the aesthetic side of T 1.3 (or theoretically 0.7 or 1.0) that is quite beautiful in close-up work and shooting with wide angle lenses and still gets a separation between foreground and background with out of focus elements."

37: What do you wish from lens manufacturers?

Besides the obvious but trivial wish for "good budget lenses" there were a lot of good ideas:

Variety of lenses

There was a strong wish among the creative pictorial designers for a variety of lenses with differing imaging properties to create different looks. This included new constructions as well as old lenses. Only a minority wished for the "perfect lens"; a majority emphasized that for them the choice of a certain model of lens is an important design element.

Compact ENG-type zooms

Many of the participants wished for a compact, light zoom lens for S-35 in the medium zoom range. The existing range is seen as too limited. Frequently they wished for an ENG-typical design with integrated handgrip for documentary work with one sensor cameras.

Integrated Gray Filters

Many of the participants stressed the fact that - with the higher sensitivity of cameras of usually more than 800 ISO- a lot of recording situations required the use of ND-Filters. This should be taken into account by the lens and/or camera manufacturers (here the wishes were divergent) and be integrated in the construction design, instead of frequently having to use big front lens filters. The latter was regarded as critical for the colour reproduction as well as the handling of the camera.

Budget anamorphic lenses

As mentioned above, a lot of camera people wish to use anamorphic lenses more often for wide screen formats. In the past this often failed due to budget reasons.

Acknowledgment of quality

The interviewees acknowledged and praised the high quality of certain lenses in particular and all the modern lenses in general.

Better communication

A lot of the participants found the survey to be an important step towards better communication between pictorial designers and lens manufacturers. Many of the free text answers lamented the fact that there was a big barrier between the two worlds which had to be broken down in order to get the really desired lens products.

Citations:

[G.:] *"The development of two categories of lenses. Besides the existing, perfected, high resolution, hyper-luminosity lenses, a second set that takes focus and harshness from the picture. It's no coincidence that it's almost impossible to find […] old sets of lenses worldwide any more, and that more and more of those old lenses are adjusted to modern standards with motorized focus pulling. No optical filter in front of the lens can simulate the silken soft focus, the focus decrease towards the edges of the picture and the soft vignetting that those old lenses produce. These technical "inadequacies" don't just reproduce technically correctly but give back a "soul" to the objects on film. Apps like Hipstamatic and Instagramm simulate exactly this demand of technical imperfection in photography, in order to generate a mood in an otherwise lifeless digital photo. "*

[G.:] *"I wish for a bigger range of zoom lenses for digital cinematography and the "big sensor" cameras. It's very hard at the moment to find compact zooms with a range wider than 3,5x for hand- or shoulder cameras. Zooms that aren't too heavy, weighing multiples of the camera itself, so the whole set won't become too heavy in the front, since the cameras themselves are becoming smaller and lighter.*

[G.:] *"Studio lenses: precise focus readout in the viewfinder (number); bigger, manually tactile marks for the focus at the focusing adjustable range on the focusing wheel (for long focal lengths (you have to work in the range of millimeters), heatable control elements, a general manual adjustability of the drag of the focusing wheel, continuous electronic adjustability of the curve of zoom and focus on the operating devices, bracket for camera light on box lenses, automatic adjustment of the register of flange-to-film-distance, bubble level in the area of the lens hood of ENG lenses to estimate the horizon, focus wheels without backlash, extractable lens hoods on box lenses, other long focal ranges for studio zooms: as small a lowest focus length as possible (8 mm, 2/3 inches)*

and as big an ending focal length as possible (500 mm, 2/3 inches) with closest focusing distance max. 1 m."

[G.:] "More orientation towards the needs of cinematography (the moving picture). Straight lines, e.g., are less important than undistorted faces near the edges of the frame."

[G.:] "Budget anamorphic lenses… with nice lens flares…"

[G.:] "Adjustable shape of the bokeh."

[G.:] "Better, more detailed scales for focus at zoom lenses"

[G.:] "Blending of big sensor lenses and EB lenses, e.g. a zoom lens with equal luminosity throughout its range like on EB cameras with a servo zoom, macro ring and register of flange-to-film-distance for big sensor cameras.

[G.:] "High definition, compact, light and luminous zoom lenses! Simple construction! For me, consistency of the framing when pulling focus, decrease of luminosity or sharpness towards the edges of the frame aren't problematic. I'm very much interested in new mounts with a smaller register. Future cameras won't have an optical viewfinder. A smaller register enables smaller and lighter lenses. This development happened for digital photo cameras (Micro four Thirds, Fuji x-mount, etc.), like that you can adapt all the other lenses with a bigger register."

[G.:] "Bigger focal range for zoom lenses for TV documentations, with compact and light construction for Super-35. Budget lenses for Super-35. More compactly built Super-35 lenses with long focal distances "

[G.:] "Budget mid-range-zoom, approx. 22-160 mm, constant aperture less than F 4.0, ENG-like zoom handle, no pumping when pulling focus, for Super-35 Sensors."

[G.:] "Compact ENG- lenses."

[G.:] "Zoom handles as ergonomically- negative imprint of the hand, CNC-milled out of 7000-Alu with wooden applications, brazen zoom teeterboard, a focus scale that you can see from the viewfinder (maybe second scale towards the viewfinder), no exotic filter threads."

[G.:] "Since I'm working a lot in native 3D productions, I'd wish for well-matched and fitting pairs of lenses, fixed focal lengths and zooms!... Keep working on the reduction of the weight of lenses."

"They are doing a pretty good job."

"Understanding that cinema production is an art form, and lenses should have personality and idiosyncrasies which can be used to help tell the story."

"Unlock anamorphic and keep optical viewfinders alive."

"Be more reactive in production: lenses are announced, people are investing and then manufacturing delays are so long, delivery is always delayed…"

"Try to make lenses with a character. There are 'perfect' lenses already, we need personality."

"To stop focusing on the resolution of a lens and more on the color rendition, bokeh and mechanical handling. The constant aim to go along with the increasing resolution of the sensors will always be counteracted by cinematographers through the use of optical filters."

"To make more affordable anamorphics. Both 2x and 1.3x. I think the anamorphic look has gotten a huge boom lately and I would love to see more of those lenses."

"I would ask for a good long focal length like a 20 - 135mm on a super 35mm sensor and a constant f stop."

"More PL zooms with handgrip, servos and cheaper."

"Hermetic seals to prevent the ingress of moisture therefore mitigating internal misting when going from cold to warm would be a god send."

" [What] I really need to see in the lenses is a back filter option, a hole where we can add a smaller filter, (some have, but I am asking at least for the big lenses or the very wide ones, where you can't even put a filter, like the underwater ones)."

"Interchangeable rear mounts."

"A new, luminous and sharp borescope!"

"Detailed and honest information about their lenses with different tests available."

"To continue the excellent work in lens design for modern 4K/8K cameras and beyond."

Closing remarks

The full evaluation of the survey was presented at the annual meeting of the European Optical Society in Berlin on September 19th 2014 and at the Cinec in Munich, September 20th 2014. The report can be downloaded from the website of

The Center of Advanced Studies of Film and Television Technology (SFT)
www.filmtechnologie.de.

Detailed questions can be answered by Katrin Richthofer, sft@hff-muc.de. Comments, and suggestions are also welcome!

In March 2015, the SFT will organize a Lens Workshop at the Munich Film School (HFF). Please contact: www.filmtechnologie.de / sft@hff-muc.de.

Peter C. Slansky/Katrin Richthofer, 19.9.2014

The Cinematographer and the Lens for Film
and Television. An Inquiry.

Munich, September 2014

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