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The preservation of colour films

A simple examination of the problem and the solutions currently available.

THE PRESERVATION OF COLOUR FILMS

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and
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FIAF Symposium held at Rapallo/Italy - 6 May 1981

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Annexes:

1. THE AIMS OF THE SYMPOSIUM

a few introductory remarks by the Chairman, David Francis:

Although members of FIAF have been aware of the problem of colour film fading for more than twenty years and the Preservation Commission published a comprehensive manual on the "Preservation and Restoration of colour and sound in films" in 1977, it was the American film director Martin Scorsese who first aroused public interest in this matter.

His campaign aimed at ensuring that prints of colour films produced in future would not be subject to fading, has resulted in considerable comment from one of the major manufacturers of raw colour film stock, the Eastman Kodak Co. and from many sections of the film industry.

The Executive Committee felt that FIAF must take full advantage of the interest in the problem of colour film fading generated by the Scorsese campaing. Today's symposium is the first move in this direction and is an attempt to explain it in simple terms to those who are not familiar with it; to assess its scale from an archival point of view; to show what archives are currently doing to try and solve it and to suggest what can be done immediately even by archives with limited resources. Wherever possible the costs involved will be specified.

On this occasion we are not concerned with the preservation possibilities offered by the video disc or digital technology. Developments in these fields are being carefully monitored by the Preservation Commission and its findings will appear in a new preservation manual devoted to magnetic records which hopefully will be published later this year. The President of the Commission will present a brief summary of the new technical developments at the end of the day's session.

As little was known about archives' holdings of colour films a questionnaire was sent to all FIAF members and observers (Annex 1). Harold Brown, the Chief Preservation Officer of the National Film Archive in London, will analyse the responses later in the day.

First we will try and illustrate with film extracts the nature of the problem and some solutions already tried. As time is short, I suggest that other interventions, questions and discussion only take place at the points indicated in the programme.

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I've prepared a brief paper on the aims of the symposium and also our programme for the day which we shall follow roughly; but if a particular discussion develops I don't think we will need to follow it absolutely precisely. I think it's more important to take the flow of conversation and so we may deviate from this paper, which is just a guide. Because of the difficulties of having a discussion in this theatre, I've tried to centralize the discussion at two points. If things work out the way planned, one of those points will be in the morning and one will be in the afternoon; it's easier to centralize the two points, I think, rather than to have comments all the time.

As far as the film Programme is concerned, there is also a sheet headed "Programme of Film Extracts" which follows below:

1) KISMET -

To show the effect of gross fading of Cyan and Yellow dyes.

2) AN AMERICAN IN PARIS -

To show that dye-transfer prints like Technicolor which are 30 years old have not faded significantly.

3) MUNCHHAUSEN (an original print) -

To show faded Agfacolor more than 30 years old.

4) MUNCHHAUSEN (duplicated from the copy above via a set of 3 separation negatives which received different degrees of development, and were printed directly onto Eastman print film 5283) -

To show that some improvement may be obtained by this means of copying.

5) SIXTY GLORIOUS YEARS -

This copy was made from a nitrate Technicolor print via separation negatives, - colour reversal intermediate negative and colour print.
Separations were used in order to obtain a dye-free record on safety film for permanent preservation.

6) THE LIFE AND DEATH OF COLONEL BLIMP -

This copy was made from shrunk nitrate separation positives. (The only fully complete form in which the film survived). From these were made safety separation negatives and then this print directly from those. The colour balance is known to be poor. The point of this sample is solely to show that registration of the 3 separations can be obtained even from shrunk originals.

7) THE GARDEN OF ALLAH -

This example also started from separation positives which were copied onto colour negative and then this print made from the negative. In this case, confident grading (timing) was possible with the familiar colour materials.

8) TEMPLE OF SHADOWS -

These are some odd scenes in the familiar Pathe Stencil colour process which was used from 1905 to about 1930. We are able to show these because they are on safety film.

9) TEMPLE OF SHADOWS -

This is a copy from the previous one, which is to show that a copy can be made from stencil colour which is a fairly good match to the original. This was made via camera negative stock.

10) CHINESE SCENES -

This print derives from Technicolor matrices. Although it is not necessary for their function in making dye-transfer copies there is a visible image on these matrices. We were able to copy from them onto colour negative and this is a print from the negative. This particular procedure is unlikely to be of any value to most archives, but hopefully will remind us to look into the possible value of unconventional methods.

11) AGFA COLOR DEMONSTRATION FILM

We haven't got unfortunately, items 1, 2, 5 and 6 - alas these are still in Genoa airport, but we are hoping to cope with the situation by using the epidiascope to show a certain number of still frames which Mr.Henning Schou happened to have with him, which we are extremely grateful for.

We've got one or two extra bits of film - instead of the Kismet sequence n° 1; we have a piece of Gevaert colour film (I believe it's an advertisement) called "On Winning Races" and that comes first. We've got, between 3 and 4, an extra piece of Münchhausen which is a print made via a colour dupe negative with compensating filters; then the rest of the programme is as planned.

I won't repeat everything that I said in the "Aims of the symposium" but I think it's worth underlining one or two of the things said there. I don't know how many Congresses we now have been having with a technical symposium but we wanted to keep the idea going. Of course it is a little more difficult to have a symposium like this if you are not in the premises of an archive, because you can't do side by side demonstrations, and you cannot show nitrate film.

There are all sorts of things you would like to do in a technical symposium which you cannot do when you are away from the premises of an archive. On the other hand there are some things you can do very well and I think one of those is simply to try and talk about our problems, what people are doing, what they'we tried to do and failed to do, what they would like to do, information that they would like about a particular problem. In this case we are talking about the preservation of colour films, although there are obviously things that overlap colour and black and white and therefore are equally interesting to both. I wouldn't want to eliminate those, I wouldn't even want to prevent the conversation drifting a little away from colour if that is valuable.

It seems to me that the work of the FIAF Commissions is rather difficult in many ways because they often do not know exactly what sort of information the people want. What I'm hoping is that by analysing just the points that are made today - the bits and pieces of conversation, the comments - we may help the Commissions to understand the direction in which they should be moving. Particularly, in this case, the Preservation Commission. I think the Commission needs a response from members and often the actual Assembly room - the actual meeting place - is not the easiest place to make such a contribution. Therefore I'm hoping here that, just in the conversation, points will come up which will lead to future investigations by the Preservation Commission.

Another reason of course for taking a particular interest in colour at this time is because of the world-wide interest generated by Martin Scorsese. Although of course we must recongnize that his aim is rather different from our aim, in the sense that he is basically trying to insure that films made today - the colour on films made today - will remain such that people who see these films will see them as the director intended. I think we have a slightly different angle on that, because if we can satisfactorily preserve the original material - the negatives, etc. we are able then to produce copies which are satisfactory; so we have a slightly different angle than Scorsese.

On the other hand, as I said in the introduction, we've known of the problem of colour fading for 20 or more years. We have the manual prepared by the Preservation Commission: "The Preservation and Restoration of Colour and Sound in Films". I think perhaps I should just take this moment to mention that the Ist edition is sold out and the new edition now comes with a grey cover (it had a blue cover before). Now it's available again and if you haven't a copy of it I think it's vital that every archive have at least one if not 3 or 4 copies of this manual.

So as I said FIAF has already studied the whole problem of colour film fading in detail but we have never been able to get people interested in the problem beyond the confines of the archive movement. We must take the opportunity of this campaign so that we can possibly involve other people who can help us in the solution, and the other people consist not only of the stock manufacturers but also of the producers and others.

Later in the day, I hope we can have a general discussion about how we can progress our study of this problem. Should it be an international conference? How is it organized? What items should be discussed at that conference? etc. I think that is a very important discussion and whatever

happens, we will need a certain amount of time to consider that. Well, I don't want to say much more because we have got a relatively short day.

But first perhaps I should introduce my 2 colleagues in the front row:

- Harold Brown who is the Chief Preservation Officer of the National Film Archive in U.K. I think a lot of people know Harold.
- Paul de Burgh, who is our Laboratory Supervisor; I think I should explain we have a commercial laboratory and we also have an experimental laboratory where we handle all the things that are too difficult to put through a commercial laboratory, where we examine new techniques etc... and Paul de Burgh is in charge of this operation. He came to us with a lot of experience in the commercial film industry so I'm hoping he will be able to talk particularly about the things that one could do or might do to further our experience.

Now, what we are going to start doing is using the epidiascope just to show a few slides - because we don't have the film extracts that we wanted - just to make a few points, then we are going on to the film program. Thank you.

2. FILM EXTRACTS

with comments by Harold Brown:

It happens that Henning Schou had with him three little pieces of film which we can use to illustrate the fact of the complete colour film being composed of 3 separate colour records, as he has placed the 3 separate pieces of film into the epidiascope to show the effect - when the 3 separate records are successively removed; this is a demonstration which we do not have in motion picture form.

David Francis:

I would like to refer to how much knowledge of the structure of colour film to assume. Here let me make a statement: I don't think one should assume knowledge, because I believe that there are some people here who don't know much, who are not technical, and some others who know an awful lot; but it won't hurt the people who know an awful lot to hear it again; so my suggestion to you would be to assume relatively little knowledge.

Harold Brown:

Well then, shall I go on to say that the normal colour films which we are accustomed to see have 3 separate images laid one on top of each other with a different colour recorded in each layer. The colour picture as we see it is composed of 3 separate colour layers, each recording one of the primary colour sensations, and since this problem is concerned with the different behaviour of the different layers we're asking Mr.Schou to take these layers away successively. That which was removed is known as the Cyan layer.

If you look at the six squares in the lower part of the frame, the bottom left hand one, which formerly had colour there, is now removed completely and you see the effect of that upon the picture above it. We now remove the yellow and we have only the one colour record, the Magenta, and certainly to most of us that appearance of picture is all too unfortunately familiar. Can we show the yellow record alone? I think perhaps we should complete the cycle by putting up the cyan layer. This is the one which normally fades first and leaves the result which we saw when only the other two were left in the slide.

It's quite amazing to see that when you add all three strips - the magenta, the yellow and the cyan you create all the colours in the spectrum - also black, grey, and white. Many people think that when you watch a colour picture and you see black areas in it - there's silver in the film, that's not the case. It's just three dyes absorbing all the light in the visual spectrum.

As David Francis has said already, it was, in a way, the activity of Martin Scorsese which prompted this occasion. He has been going around complaining of what he has called "awful pink prints". We will start with a print which exhibits exactly what he has been saying and which many of us have been aware of for a good many years. The subject matter of this specimen is of no particular significance. One of the things Martin Scorsese has been doing is saying that all this trouble is the fault of the Eastman Kodak Co. Now, this print which we are seeing is on Gevaert film. That fact illustrates that this is not a matter solely of any particular manufacturer's film, it is the nature of the dye materials which have to be used. That film was made in about 1950.

The next film which we were going to show you (Kismet), was made in 1956. This suffers from some fading of the cyan and yellow dyes. It has not gone anything like as far as the piece we have just seen. This was meant to be illustrative of the fact that not all the prints - even of the time of about 1956 - necessarily fade to the quite useless irrecoverable degree which that first one has.

The next piece was to have been just an example of the Technicolor print which, although to many of us is very familiar (and we are aware that, because of its quite different means of manufacture, does not fade like the Eastman colour type material), we thought it would have been desirable to show a piece that not necessarily everyone is completely familiar with.

The next piece which we do have is a reel of Munchhausen which was made in Agfacolor (the first of the negative-positive integral tri-packs) in 1947. We will show that reel next. In that although, clearly it has gone very magentary, there is clearly a remnant of the yellow and cyan dyes and we wanted to see what might be possible to restore. In a first experiment we duped onto colour negative, inserting colour filters designed to restore the balance to what was perhaps more nearly as it was intended in the first place. The result is really just not effective.

Paul de Burgh:

As you can see, it didn't do a lot for it, it just more or less put some over-all cast on the subject. We have got a film of the test now which was made from 3 black and white separations, these were made onto normal B+W duping stock (Kodak panchromate duplicating negative type 5234), and then printed back through the 3 primary colour filters, Red, Green and Blue onto Eastman colour print film, type 5383.

We used Kodak Wratten filters: n° 29 for Red
n° 16+61 for Green
and n° 47 for Blue

We also used a 2B filter to remove any ultra-violet and also a piece of clear Eastman Colour negative in order that the Pan dupe stock should look as nearly as possible like the colour negative that one normally prints from.

Harold Brown:

No one is suggesting that this demonstrates a total recovery of the original. I do feel that it does offer the indication that some improvement is possible, and that more improvement is possible by using separations, than is possible just by filtering and copying onto colour negative.

Paul de Burgh:

There is one other thing I would like to say on that, which is that the 3 negatives were all processed for the same time - whereas had we developed the red record to a higher contrast, we could have achieved more improvement. This, of course, is something we are going to try when we go back home.

I have heard from the Rank laboratories that they develop separations in a black and white positive type developer, which of course is a contrasty developer. The point to emphasise here is that one doesn't necessarily use only the classical methods - that one tries everything to see what comes out best.

At this point was shown a demonstration reel from "Garden of Allah".

David Francis:

I didn't ask Mr. Jon Gartenberg from the Museum of Modern Art to introduce that extract, but I'd like to have him come up and say a few words about it now.

Jon Gartenberg:

There are just a few points I wanted to mention about this film to give you some background. It would be, I think, in the best interest of the symposium to really talk about some of the difficulties we still have in getting the results - financially and technically. I'll give you a little background about this material. In our collecting - we've been collecting films since 1935 and we have great problems with colour because we have Techni-

color in its two-colour and three-colour forms, nitrate tinted films, Prizmacolor, Eastman colour and so forth and so on. So what we're confronted with in each case is trying to find the appropriate method to preserve these films - each one being in a different colour process.

The other thing that you should keep in mind is that we do not have our own laboratory - so we rely entirely on the use of commercial laboratories - which of course presents many problems. One is the great cost that we incur using commercial laboratories to do our preservation work - and the other one is finding good personnel, who know the material and who will work with us, and will be interested in getting the quality that we want.

Over the past 4 or 5 years we have had many large problems in terms of this. Now the Garden of Allah is the Museum of Modern Art's first Technicolor preservation work in a group of Selznik Studio films. We obtained the original nitrate 3 strip camera negatives as well as nitrate master separation positives, out-takes, trailers, and screen test material from the masters which were in slightly better condition than the negative material. We made 35 mm acetate separation negatives at a laboratory in California called "Film Technology". We then made a colour duplicate negative and the Eastman colour print that you've seen here. As you can see it is of excellent overall quality - although there were certain colour timing problems which we feel we can easily correct in subsequent printings. However, I would like to point out that there were several problems in other reels. There were intermittent registration problems in other reels. First there were some cinch marks and scratches in some of the reels. We decided that given the great expense already incurred in the preservation, which is now more than about $ 30 - 35,000 (about 25% of the preservation budget we have for the entire year) - that we needed a practical compromise, that we could ideally try to correct all these problems, but it would be an enormous expense and we had to balance that against the registration problem caused by the differential shrinkage of the nitrate masters and that was less serious than correcting scratches (which you do not see in this reel), but which were much more noticeable. So this means that we will have to go back to the protective masters and see if the scratching can be eliminated through the liquid-gate printing process.

Harold Brown:

The problem on which we mainly have our minds at present is the fading of the current type of colour materials, but I wish to refer now to the preservation of colour films which are on nitrate based materials. The need there is to get copies onto another medium like safety film, because of the decomposition of the nitrate base rather than because of any particular problem with the deterioration of the colour image itself. The archive in London has copied a number of nitrate films onto new safety film via a set of separation negative, and then copied that onto C.R.I. (colour reversal intermediate negative) and onto colour print. We had hoped that we would be able to show successively, the original films in some of those cases, and the results we obtained in the copies, for a direct comparison to see how nearly one could get to the colour rendering of the originals. Unfortunately since we weren't able to show nitrate films in this theatre - that demonstration was impracticable. However, there is one kind of colour film that is not natural colour, but the Pathé stencil colour film, of which we had a safety copy.

Most of these stencil coloured films (of which quite a number of archives have examples) are almost all nitrate films. We happened to have one which had some scenes on safety film; so we are able to show, in this case, the original film and the copy which we have produced. In this case the copying was not done via separations, but was made directly onto colour negative and then onto a colour positive. The scenes themselves are not of any particular interest. The point is to compare the colour character of the original with how nearly accurate a representation we have so far succeeded in obtaining with the copy.

At this point was shown the original and copy of scenes from "Temple of Shadows".

There is now another demonstration piece which we propose to run. This we have derived from Technicolor "matrices". I will assume that there are people who do not know what is meant by "matrices". In the Technicolor means of making the final prints for projection, the means of putting the colours onto the film is entirely different from the normal other one. In the Technicolor process, a set of 3 positive films is made, one for each of the colour records. These "matrices", as they are called, in themselves have no need of any visible image. The colour record is contained by them according to the degree to which the various parts of each picture are able to absorb dye. Each "matrix" is passed through a bath of dye, it absorbs the dye in the places where it is required and then that "matrix" is brought into contact with virtually blank film which (apart from the sound track) consists of base and clear gelatine and which will become the final positive copy. The dye then moves out of the "matrix" and into the blank film. This is done successively with the yellow, the cyan and then the magenta - to build up the complete colour picture. I emphasize the fact that the "matrix" itself does not need any visible image. It happens however, at least in the more recent "matrices", that there is a visible image because there is some carbon incorporated into these. It happened that, a while ago, we had the opportunity to acquire quite a number of film subjects in the form of these "matrices" (films which we didn't have or were not able to get in any other form); we were therefore interested in the practicability of making copies by photography, not by the means for which the "matrices" were intended and which is not longer available.

We made from the "matrices", by triple printing through Red, Green and Blue filters, a colour negative and from that a colour print. We realise that this, in itself is of little interest, because it is very unlikely that archives will have access to "matrices", but I want to illustrate a point which is of value; and that is that, in our thinking about problems of colour preservation or anything else, we should not limit ourselves to thinking in terms of the normal, average, regular procedures. We should always also look outside those for the solutions to our problems.

Now I would ask Paul to give us a bit more detail about the procedure by which that was made.

The demonstration film "Chinese Scenes" was then shown.

Paul de Burgh:

This test was made from the 3 separations supplied by Technicolor. There are one or two places where the grading could be improved, but that of course is up to the laboratory that turned out the colour print. Procedure here was very much as with Münchhausen, except that we had to get some kind of line-up for colour balance between the 3 matrices as we didn't know to what contrast they'd been developed in the first place. One starts by reading the separate red, blue and green response of the matrix to the colour filter. In other words the yellow, magenta and cyan matrices were then printed back on a printer that we possess, through the primary filters - the blue, the green and the red. It's interesting, once again, that the Technicolor matrix has a positive perforation, and our printer has negative register pins, and therefore we should not have been able to get as good a registration as we have done. I'm quite surprised myself because again as I say - each perforation has a difference in height from the negative perforation of 5/1000 of an inch. So it proved that one can, in fact, get something out of things that normal laboratories would probably throw their hands up in horror over! When we look the tests to Technicolor, they were quite surprised at the results - and they thought it was something they should have tried themselves at some time. We printed this onto 5247 original negative films because, as I pointed out, the other films in fact are very very slow and our lens is quite a slow F9 lens, so that the technical requirements we have at the moment, are not as good as we should like them to be. We probably will be able to do a bit better in the future and then we would in fact try to use the normal duping stocks.

I think that we might be able to improve the contrast in the future by actually flashing the stock to a neutral grey before we actually expose it. In other words, we put about .30 neutral density onto the stock, and then we re-expose it to the film that is to be copied, thus reducing the excessive contrast. Thank you.

David Francis:

I would now like to ask our president - Wolfgang Klaue to introduce the next item which he kindly brought with him. Thank you.

Wolfgang Klaue:

Well, it's not an example of preservation but nevertheless it's a unique reel you will see. It's a world première, maybe it's the first and last public showing. We got one reel a few years ago from the former AGFA company, nowadays ORWO in GDR. It's a film without credits, with no other information on it, but it is a compilation of 9 different colour systems (Pathé-Color, Kornraster, Multicolor, Ufa-Color, Technicolor, Agfa-Reversal, Gaspar-Color, Pantachrome and the Agfacolor negative-positive process) - which existed during the 1930's, and the company put them together - 9 different colour systems and at the end it's all Agfacolor system which was developed during the second part of the 1930's and the beginning of the 1940's. So the reel was certainly not stored under optimum conditions for colour material. We don't know how the film was kept in the company over 30-35 years - let's say they kept it under quite normal room conditions - maybe not even air-conditioned. After we got it, we stored this reel in our nitrate vault which has temperature +6°C to +8°C and humidity of 60%.

So you can all see how colour faded differently in these different 8 or 9 colour systems which were put together in the compilation, and probably it was intended to demonstrate, when the film was done, the quality and the effect of the Agfacolor system. You will see how it looks now. This was in the experimental stage in the AGFA company. Only a few films were made for internal purposes.

The demonstration film was then shown.

David Francis:

Thanks again indeed Wolfgang for that marvellous film. I don't think that would have survived in that company archive somehow - so I'm very pleased that it is in an official archive. Just one other point of interest - we have a feature film of UFA colour - "Pagliacci" directed by Carl Bloom and in Britain it's called British Chemicolour - so we have a feature film in the same process. We've tried to restore it, and in fact I showed it in Venice - the original nitrate and the copy we made from it.

I was going to suggest that we didn't have any discussion until we've had an analysis of the responses to the questionnaire. May I ask Harold Brown if he would make a brief analysis of the responses he received from the members. I would also like to take this opportunity of asking the people whether they would object to us reprinting the questionnaires as they are for internal use only. So that we could actually make a more detailed analysis of the responses, because obviously the sort of analysis one could do on this occasion is very brief. And if we could reprint those and prepare a more detailed analysis I think it would be very interesting. Obviously a questionnaire like that doesn't contain too much detailed information but I do think we could analyse it further than how Harold is about to do now. I'll give you a chance to think about it and ask you again at the end of the day whether you would agree. Thank you.

Harold Brown:

I think the first thing to say is a great big thank you to the 30 archives who went to the trouble of providing the information which is asked for - which we hope will prove of use. I'd prefer to go through the questions in the questionnaire in the order in which they were put. I don't like this word "analysis" - it implies something very mathematical and, of course, the questions invited the archives to make some reply - whether they could be in detail or very vaguely. By the very nature of that fact, the responses are in many different forms which make them difficult for a direct comparison. I will try to bring out some of the things which the replies indicate rather than a formal analysis.

The first question asked about "total quantity". Some archives were able to say precisely "so many metres", other archives were only able to say "Well, we've got about so many titles"; and from that we only have a very approximate idea. But it seems that knowing the scale of how much colour film there is in archives is good. And the figures as nearly as I can work them out very approximately, just to indicate the sort of scale, come out to 300 million metres. The next part of the question asks for an indication of the proportion of 35 mm, 16 mm and 70 mm film. It seems that half of the archives have a significant proportion of 16 mm. But the range of the proportion runs from about 10% of the collection to 100% of the collection.

I think it's interesting to note that to some archives 16 mm is the significant factor. Some other archives, whose interest is in the feature film sphere, may tend to forget 16 mm. For instance we have had no 16 mm film in any of the presentations we have had here this morning. There seems to be a very small proportion of 70 mm films. Only 10 archives admit having any 70 mm films at all; and in every case the proportion of 70 mm is almost insignificant. Perhaps that word "insignificant" is open to challenge.

The next part of the questions enquired about the amount of nitrate film, as compared to safety film, which archives have. And it's clear that the amount of nitrate colour film is a comparatively small quantity. Typically, about 5% of the archive's total holdings of colour films seem to be in nitrate films. There were 2 archives - which stood out from the typical 5%. One was the University of California - UCLA. It seems that 75% of their colour film collection is nitrate. And the Imperial War Museum in Britain seems to have 25% of their colour film on nitrate.

The next part of the questionnaire asked about the kind of colour film which people had - whether it was negative, intermediates or projection positives. And this is perhaps the most significant point in the whole of the problem. The average figures which the archives had in the form of positive prints is about 83% ! It is the positives which suffer from fading rather more than other materials. So the fact that we have this great preponderance of that sort of material in archives is the most significant factor to be shown by this enquiry. As to the amount of the other kinds of material; it was very unclear and I find it impossible to sort out and indicate proportions of the various kinds of intermediate materials, colour intermediates and so on. One figure I was able to extract from that was that 11 archives do have some films in the form of separations. I'll jump a moment to the proportion of release projection prints. Two of the archives have their whole collection in that form. And only one archive has less than 50% of it's collection in the form of positive copies.

Question 2 a) about tinted and toned films, in a sense, is not really connected with the main colour fading problem and there is no indication in most of the answers as to the quantity held. The question didn't really ask that, but 21 of the archives say that they have got some tinted and toned films.

The next question was asking if the archives had hand or stencil-coloured films. I'd like to rest a moment there and ask if, in the course of any discussion, the archives who said that they have got hand-coloured films, can tell us how they distinguish between hand-coloured films and stencil-coloured films. This is a problem which I've encountered - that one looks at some of these artificially coloured films from the early years of the cinema and, with some of them, one is very uncertain about whether these have been done free-hand or by stencils. So, any information about clues would be interesting. Now I think 17 of the archives have got some hand or stencil-coloured films.

The next question, I feel, was not clear. Here I'm critisising my own questionnaire and the wording of it. Quite a number of people marked "Technicolor" in that place - but I feel that there was so little 2-colour Technicolor prints made before they introduced the dye-transfer process, that I suspect a confusion there with that word "Technicolor", as between the more familiar dye-transfer Technicolor prints and the earlier processes practiced by Technicolor, like the cemented - pairs system. So I feel a doubt about the answers. It may be that the archives concerned can confirm subsequently for us one way or the other. There were 8 archives who said they had got some example of one or more of the 2-colour processes. Everyone has got some integral tri-pack. Those are the things that are the processes in current use. These are the materials which present us with our real major problem. We asked the archives to name other colour processes of any kind which were not mentioned otherwise and which they held and a few archives did. I'd particularly like to mention that 6 of the archives mentioned Gasparcolor. I think Gasparcolor is a process which offers possibilities, not the Gasparcolor process itself but by reason of being a dye-destruction process, and the fact that they have survived very well; and that there is a comparable dye-destruction process in commercial use today in still photography - mainly Cibachrome. I felt it was a possible valuable line which we'd like to pursue.

The following question related to dye-transfer prints such as Technicolor, and there were 6 archives which did not have any of those.

Question 3 related to storage conditions. A number of archives do have controlled conditions of storage. The question asked here was rather vague - and the answers were expressed in many various terms. What I tried to do was to categorise the responses in relation to the archives which have controlled conditions for their safety colour films.

Safety colour film is the central problem, and I divided the kind of conditions which were mentioned in question three:

1) "Deep freeze" - which is the condition in which the target temperature is something less than freezing point, 0°C.
2) "Cold" - there are a number of archives which have controlled conditions of cooling which is between freezing and +8°C, and
3) there are some other archives which have controlled conditions, where their temperature was 10°C or something more.

They were divided thus; 10 archives reported keeping their safety colour film in controlled conditions of 10°C or more; 4 archives have controlled conditions of between 0°C and +8°C (the cold but not freezing conditions); 2 other archives expressed their intention to store in that condition in the future; 4 archives said that they had some degree of freezing - below 0°C temperatures at present, and 4 more either, are making, or intending to make, stores at below 0°C temperatures.

The thing perhaps to which we should all direct some attention at some time (perhaps in connection to the proposed 1982 conference), is the relative humidity. Some of the replies did draw attention to the problem of humidity and they even described their conditions as very aggravating. And the people who quoted figures revealed a wide range of variations of humidity. I use the expression "wide range" both to indicate that some archives had one range and some archives had another range, and that, in some archives, conditions varied within uncomfortably wide limits. I'd like to draw your attention to a matter which is significant and wants some more attention from the Federation. We asked about sealing of the films; and only 3 people referred to using any form of sealing. Some referred to wrapping in plastic bags; and I am not clear whether that means that they are loosely wrapped; or whether that means that they achieve a hermetic seal within some plastic bag. This seems to be in doubt. It is clear that the merits or the objections to sealing (or this form of sealing) is a subject calling for further attention. Anna-Lena Wibom from Stockholm has some form of demonstration in relation to such sealing procedure.

David Francis:

She is actually going to talk about the humidity problem as well. I think possibly in view of you drawing attention to both of these problems, we might start the afternoon session with hearing from her.

Harold Brown:

Question 4 - relates to measurements and observations. Although some archives refer to making measurements no one actually submitted any measurement. It seems that there isn't much in the way of actual measurements being done, although a lot of people are perhaps contemplating doing some. Going to the subjective observations, which is the second part of question 4, 14 of the replies specifically made mention of observing fading in positive copies; 4 archives referred to negatives having faded; 4 archives specifically drew attention to the different rate of fading between the projection positives, and intermediate and negative materials. 3 archives specifically mentioned that Technicolor prints retained their colour better than the other processes; and 2 archives said the Gevaert colour was particularly bad and 1 said the Kodachrome was good.

Other little separate observations which were made refer to the need to adjust the colour balance in printing from old colour negatives. And there was also mentioned a fact, which I think is perhaps quite natural, that it was prints from the 1950's which were worse than prints from the 1960's and 1970's. Whether that is purely a matter of their relative age or whether there has been any change in the keeping qualities of the different kinds of colour positive stocks as they have been introduced with the passing of time is a question that perhaps we should do some work to find out. I think that is perhaps significant; whether there is a difference in the keeping qualities of the different print stocks, whether they have been improved as the different ones have been introduced, or whether this difference, that the older ones are the worst, is just a matter of the greater age.

Question 5 asked about the experiments which archives had carried out; and several archives referred to some experiments, so I'll mention what those were. Netherlands referred to the experiment which is being done on transferring from film to video disc in comparison with the copying of film by photographic means. The University of California - Los Angeles / Film Archive are now making their prints onto the Eastman LF film - LF for low fade. That is new and there can be no judgement of the effect of this for quite a long time. Finland referred to making some experiments "via video" - they just used those two words. Perhaps they will be able to throw more light on that in the course of the discussion. Ottawa reported that the National Film Board of Canada had done some work on restoring Kodachrome and Ektachrome films. These must be 16 mm which reflects the very serious interest of some archives in 16 mm. The Filmoteka Polska reported some work by the Polish Film Research Centre into 9 types of film which they found to be of value for archive work. Sweden reported printing from a camera negative by conventional means and via video tape onto 16 mm. The Library of Congress, in association with some other people, have been concerned with experiments of keeping colour film records on laser generated holograms. That brings us perhaps somewhat into the sphere of future high technology. The archive of Bois d'Arcy in France have made a great many experiments in printing by a variety of methods using both colour film materials and separations; and trials of low temperature storage. Gosfilmofond reports on the experiments carried out by NIKFI (the Russian Central Experimental Organization) - whereby they recommend conditions of colour film storage of -5°C; it was this work which was the basis of the recommendation in the Preservation Commission's book to advise that temperature as the most advantageous for cold storage of colour films. The archive of the DDR has made experiments with elevated temperatures to show that the decline of the colour densities begins very quickly after the film is manufactured. The Rumanian archive has carried out some experiments on the effect of protective lacquers on the stability of colours.

We next come to Question 6, which asked what copying of colour films had been done. No archive gave precise technical details of the methods they had used; so perhaps the representatives of those archives may be able to add to the information or answer queries. I will do the same with this question I did with the responses to the questions on experiments. UCLA Film Archive have made colour inter-negatives and separations in the course of copying. They report good results of copying nitrate colour films onto Eastman colour intermediate film. They don't have a date on that, so which of the Eastman intermediate films they used, whether it's 5253 or 5243 is not indicated. Finland has done some copying onto 16 mm Eastman colour reversals. There are various Eastman colour reversal materials - and it is not stated which were used. They have also transferred to video tape the results of both of these they described as "not satisfactory", partly because they regard these materials as not sufficiently colour-stable rather than necessarily the achieved colour rendering. The National Film Archive of Australia have been copying fading colour films onto Eastman colour with "boosting" of colour saturation. It was not clear to me if that "boosting" was an undesired effect which happened or whether they were seeking to enhance the colour saturation. They observed that copying from Tech-

nicolor prints onto Eastman colour materials failed to achieve the typical saturation of Technicolor prints. Cinémathèque Quebecoise reports copying of old colour films onto Eastman 5272 - that is the current Eastman inter-negative which as I understand is designed to be specifically used in connection with Eastman Ektachrome reversal materials. Ottawa reports satisfactorily copying onto Eastman intermediate stock and also successful transfers onto video-tape. Whether video-tape, in that sense, was the ultimate material or whether this was a step on the way to going back onto colour film - I don't know. Filmoteka Polska state that they have tried duping from colour prints using intermediate materials for projection print purposes as I understand it. This is an unusual procedure but maybe they were taking the advice I offered this morning before I had expressed it, of using a non-normal procedure for some deliberate purpose. If there's anyone here who is in a position to say more about that, I think it would be revealing. Yugoslovenska Kinoteka said that they had made some duplicates and some examples are satisfactory but there was no information about the particular materials which they used. The Imperial War Museum of London have said that they copied from 3-strip separations onto 3-strip separations with results they described as excellent. They say the same for having copied from 3 strip materials onto Eastman inter-negative but they say it's terribly expensive. They copied from Kodachrome originals onto Eastman inter-negative materials and observed that there was some loss. They also refer to "Dufacolor" which is a process which we have not seen here today. I did have some thoughts of bringing some Dufacolor (it would have been convenient because it's all on safety film), but I felt that is was a process which is not of practical future value and probably there wasn't very much of it that other people would be interested in copying from.

The Imperial War Museum copied some Dufacolor onto Eastman colour materials and observed the problem arising from the non-match of the transmissions of the dyes in the Dufacolof to the sensitivities of the emulsions of the Eastman materials onto which they were printed. The Library of Congress say they have made a few inter-positive and have reached no firm conclusion about their being satisfactory. They also referred to trying to evaluate colour information via a video record. The American Film Institute in Washington also reports having made colour inter-negatives and having made separations; printing them directly back onto colour positive final print film. They referred (and I think this is a significant point) to the need for trial and error to get the correct colour rendering. The Museum of Modern Art also said that they have had to make 3 prints before arriving at a satisfactory one. Cinemateca Uruguaya have used Agfa-Gevaert reversal materials for copying from Eastman colour films. They state emphatically that this was not satisfactory. The Archive at Bois d'Arcy, France, have used a material which I've not heard of being used anywhere else - the Agfa-Gevaert 35 mm colour reversal type 902 and 780 which is reversal positive (not the same function as the Eastman C.R.I. negative with which many of us are familiar). They regard it as an economical procedure, and we all know very well that economy is of vital importance - money being our greatest worry. This is a one-step procedure. I've seen some of them and they are very reasonable representations of the originals. They have also used Eastman colour negative (that is the normal camera negative type 5247) for copying stencil coloured films.

That is the same material as we used for the copies of stencil colour which we showed here this morning. Bois d'Arcy regard it as good for stencil colour. They have also made separations on the Eastman separation films type 5296 & 5235, but I don't know about the nature of the results.

The Library Board of Western Australia say they have taken Eastman colour prints and copied them onto Ektachrome. Again this is a one step reversal process which is attractive, particularly if you work with 16 mm anyway, (it's the money question again). They have described the results as "reasonably satisfactory".

Gosfilmofond of Moscow say that they, for either immediate use or for preservation purposes, make copies by normal procedures. They specifically say that they have not made transfers to other media.

The Staatliches Filmarchiv of East Germany have printed from a number of the oldest of the AGFA colour negatives. They have found that these negatives have not deteriorated beyond the point where it is possible, by the amount of adjustmend and correction which is available in normal printing, to come back to a satisfactory colour rendering in the print. They finished up their report by saying that these negatives were very near to the limit. They say it's a case of do it now - and they are doing it now, or it will be too late. They have also copied tinted films via a black and white negative; and then copied that onto colour positive, presumably through selective filters, in order to keep a record of the original tints.

Arhiva Nationala de Filme in Bucarest has reported that they copied practically all their nitrate colour negatives onto acetate reversal films. They have experimented with tranfers via separations in order to restore colour balance.

We in the U.K. have also done some copying both via separations and by colour negative; you have seen some of those this morning - so I won't say any more about that.

Question 7 - Colour film printing laboratory facilities in your country : I summed up in 3 words - "everything to nothing". In some countries they can do anything for which there is the means, while other countries say that they have no printing facilities at all; and there is every combination you can dream of in between.

Question 8 was another one of these insufficiently clear questions. It asked what information you recorded about colour films. It seems that almost no one records any really detailed information. Usually the name of the colour process and the type of colour material.

Cinémathèque Québecoise reported that they record the pH measure of acidity. They make a densitometric statement and a measure of the Residual Hypo.

Several archives say that they record some statement about the state of the colour fading. Others referred to making records of the tints on tinted films. A couple of archives say that they record the printing light values that they have used in printing (which, if the archive is doing that kind of work itself, I would have thought it was rather vital), but there are only 2 archives which reported that they are actually doing that.

The Turkish archive records the contrast and density values which they read from the films.

Question 9 invited the expression of other ideas: it was intended as an open question to say "let's not leave anything out if you can think of it". Lots of things were mentioned in that area. There was one plea for the introduction of polyester base, which would be valuable in connection with the possible differential shrinkage of separations. Another feeling was that experiments should be made with the KODAK low fade stocks. The next matter which was raised is something which I think is rather serious and which I think the Federation should give some help with, and that was a request for guidance in the siting and building of storage vaults in tropical countries. We are here living in temperate zones and can sometimes find easier solutions to getting the sort of conditions of storage which we would like. It must be a very difficult task for the people in the tropics. I think we should take note of that plea from the heart.

Another thing that was mentioned was chemical restoration. Most of the attention which has been given to colour has been with conditions of storage and copying. The Preservation Commission booklet does have a section on chemical treatment, and although it can be a dangerous thing to do, I don't think we ought to turn our backs on chemical restoration completely.

Another was the advocacy of the use of "grey scales" attached to every reel of colour material to be used for sensitometric correction when making copies.

David Francis:

Well, thank you very much indeed Harold. I think that should give us a lot of food for thought. The next step really comes to whether people would be prepared for us to ask a few further questions. Because, as Harold says, the first time you prepare a questionnaire you don't always manage to put the question in the way which obtains the information you want, and I think there are some supplementary questions one would like before one goes into some form of written analysis. They would not be, hopefully, too many questions, because obviously if you analysed in more depth you could involve an archive in a considerable amount of research work. I think they're mostly clarifications of answers given, more than anything else. Wouldn't you think that was the case ?

Harold Brown:

Yes. In many cases archives have said "We've made copies via separations", but how did they process the separations? All to the same contrast? or to different contrast? What material did they make them on? And if it's pos-

sible to state precisely which film stocks were used, and more precisely - how they were used. The printing light - what colour filters were used? It would be more helpful to the people who are trying to achieve the same object.

David Francis:

Also another thing that comes out is that one is not sure of the scale of some of these activities at all. Are they simply experiments? Are some of those things done for a fair amount of the material in the collection? I think some indication of scale would be very interesting as well.

Harold Brown:

Now I think, in justice, I must say that there were some indications of scale which I haven't mentioned. Some archives have stated the amount of films which they have copied. Yugoslavia has said "We've copied virtually all our nitrate". So there are some indications of scale, but I think it's still important to collect more information on scale from other archives.

David Francis:

I think perhaps the written results would make a very good basis for a programme to be held in a well-equipped archive, hopefully in connection with a future congress where one perhaps could see examples of material which has been actually copied by the various means listed in here. I think the stage to move on from here would be somehow to look at examples of all these different experiments that have taken place, but I think you can only do that in an exceptionally well-equipped archive. And hopefully, one of the archives which will be hosting a congress in future might like to consider this as a possible subject for a symposium. Maybe we can do it as a separate thing altogether.

Well, I think those are all the comments I would like to make, I'd rather like to hear comments from the floor. First of all, I think I should say that there were certain points where Harold felt he would like to have some elaboration. I wonder whether any of the representatives of archives referred to in this report, might feel that they'd like to add something about any of the points made?

Question (not recorded) about cold storage temperatures.

Harold Brown:

Yes, I didn't say anything about that here, but we were due to be speaking about cold storage in another part of the day's proceedings. There does arise, from some responses to the questionnaire, a point of serious importance about cold storage conditions.

Of the archives who report using temperature below 0°C there are 2 archives who state that their target temperature is -2°C and one says -3°C. I think this is a very important point - and since the question has been made we'll say it now. The Preservation Commission's recommendation was -5°C, and that was for very good and serious reasons. The basic point being that it is very bad for a film to be frequently frozen and thawed, frozen and thawed,

frozen and thawed, passing backwards and forwards across that threshold of 0°C. That can be damaging to the structure of the film. Therefore it is important if one is using below zero temperatures to stay below zero and not go above it in storage. It's a different matter when you withdraw a film from store occasionally. If it's going backwards and forwards in store, it can happen - who knows how many millions of times - and no apparatus is absolutely on it's target all the time; in fact with most of these apparatus, the correcting mechanisms are very inaccurate. And the feeling was that being 2°C away from danger was too close. So the recommendation was very valid - don't aim at anything nearer to zero that -5°C.

Herbert Volkmann:

(Inaudible) ..... minus eighteen ?

Harold Brown:

Minus 18°C is the equivalent of 0°F - which is very much below the freezing point. No, no one is saying that they are aiming at as low a temperature as that - the lowest temperature mentioned is -7°C.

Henning Schou:

When questions are asked from behind, could you please give a short summary of the content. It is very difficult to hear the questions from the floor.

Harold Brown:

Mr Volkmann was asking how much below 0°C were the temperatures of the archives which reported having their stores at below 0°C.

Henning Schou:

I think that film archivists are mainly worried about crossing 0° Celsius because this, as we all know, is the freezing point of pure water. But as soon as it is absorbed in gelatine it does not have the chemical physical properties of pure water - it cannot form what we call interhydrogen bonding with other water molecules - so we might well find that we can go far below zero before any crystals are formed in the emulsion of the film. It is also possible that water is arranged in some kind of a lattice in the gelatine both above and below zero - and it therefore doesn't matter at what temperature we store the film. - And you have evidence of that from Kodak, Larry?

Larry Karr:

I've been assured three times, verbally, by Eastman Kodak, that there is no problem and that they have done studies which we have not yet gotten in writing, where they have tested and found no damage whatsoever after passing rapidly through the freezing point. They're merely saying over and over that there's no problem: "Don't worry, throw the film into the freezer and everything will be all right!".

Henning Schou:

I wouldn't use the word "easy" - but it should be possible to check this by a method called Differential thermal analysis or perhaps by X-ray crystallography which ought to show changes taking place in the emulsion as the film is cooled down. Differential thermal analysis is a rather simple method - it's just a matter of finding the time for these kinds of experiments. They've probably already been carried out by Eastman Kodak.

Harold Brown:

Can I come back with a question to Henning Schou. He has just said that in the case of water in association with gelatine in the emulsion - that ice crystals are not formed at zero (degrees) Celsius as they would be with pure water. Now, are they formed at some other temperature, either higher or lower? If it's very much lower, it may not matter, because I don't think anyone is going to take films down to very much lower temperatures - but if it occurs, say for instance, at plus 5 degrees Celsius or a higher temperature, then you might be getting the same trouble but at a different temperature.

Henning Schou:

No - formation of ice crystals as such - definitely not at temperatures above zero degrees Celsius.

Harold Brown:

So if it happens at all, it would be at lower temperatures - and we would not be reaching those.

Henning Schou:

At this stage I don't know the critical temperature; there probably isn't any as Kodak claims. It would depend on the amount of water in the gelatine. x)

This, by the way, is another important point: Archivists are often concerned about the relative humidity in the film vault, and rightly so. More specifically it is the absolute amount of moisture on the surface of the film that is important. The problem is that the distribution of water between the emulsion and the surrounding air could vary with the temperature. At minus 5 degrees Celsius, for instance, water might bind more tightly to the gelatine than at zero degrees which means that the relative

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x) Gelatine is able to absorb approximately 20 times it's own weight of water. Any excess of water in the emulsion (i.e. "free" water which isn't bound to water-saturated gelatine) will turn into ice crystals when frozen. However, if the film has been in equilibrium with air of 50% relative humidity and 20 degrees Celsius prior to freezing, nothing will happen - according to Eastman Kodak's research scientists.

humidity of the air should be adjusted accordingly. We don't know much about that either, as far as I'm informed, so we'll have to do what is called a Van't Hoff plot.

That's another possible research project.

Larry's report on the Cold Storage Conference raised many questions. What I've just mentioned is some of the research we could do trying to find some of the answers.

Larry Karr:

It should only take one archive with the right amount of staff and facilities to do it.

Henning Schou:

A third point I would like to make is this: there could be some danger of ruining the film, if you keep it at minus 18 degrees Celsius without close monitoring of the humidity. This isn't connected with the possible formation of ice crystals - on the contrary. In order to get a vault temperature of minus 18 degrees Celsius, you'll need a cooling coil that is even colder, say minus 25 degrees Celsius, and this coil might act like a freeze trap: the water will evaporate from the film emulsion and condense on the coil. In other words, you might run the risk of actually freeze-drying the emulsion which will then become very brittle. This we ought to look into as well - so there are a lot of questions to be answered.

Paul Spehr:

This is a personal observation about some additional information to the survey, that I think will be very useful for our own laboratory people. We, at the Library of Congress, are not copying very much colour film, but we will be going into it. I'd be interested in knowing how many archives are actually operating their own laboratories to duplicate colour film and in addition to that I could very much use information about what specific cleaning machines they are using for colour duplication, what filtering systems they're using, and the film stocks they are using. - Incidentally, Kodak is making some very specific recommendations about film stocks that archives should be using now. I didn't bring along my copies of that. Do you have them? (David Francis: Yes). Because it is something that most Members should have.

David Francis:

Was it in one of the two hand-outs?

Paul Spehr:

Yes - we have a new chart that lists the film emulsions of the recommended (stocks for archival use) - but it would be interesting to know what film stocks have been used and some qualitative evaluation of the results from these.

David Francis:

Calls on Jon Gartenberg (Museum of Modern Art).

Jon Gartenberg:

Concerning copying in archives where there are so many different kinds of material: Eastman Color, Technicolor, and so forth - a long list, which Mr Brown referred to in his survey. I think it would be very helpful - for us at least, an maybe for others - to actually get, not only to be able to look at practical examples, but to have people share their experiences. Perhaps that could be done in a written form, so that we could learn about the practical efforts people have made in terms of trying a particular system. For example: we see starting with Technicolor - there are several ways to go, several advantages and disadvantages, and certain trade offs - and we would like to know what they are. Another example: we had some Kodachrome material which we copied on Eastman Color stock. Now, some people might think that's not the way to go - there's another way, but to know what the advantages and disadvantages are, I think would be useful, so that people would write up: we did this, but we couldn't get the red saturations, or we took another process, but there was too much grain. Maybe actually that might help in making valued decisions about what the trade offs or advantages and disadvantages might be. I can seen, in a written form this might be useful: getting information from people writing up after practical experiences in the archive.

David Francis:

If there are no other comments at the moment I'd like to call on Anna-Lena Wibom to talk about her "conditioning box" because I don't want the day to go pass without her talking about it. It seems fascinating.

Anna-Lena Wibom:

I'm embarrassed to open my mouth in front of people like Mr Brown and Mr Volkmann who have an overwhelming and deep knowledge of these problems. However, every time I come to a FIAF meeting I get somehow depressed because all the problems related to FIAF discussions and symposiums are problems related to the past which we have been talking about since our ancestors - or things we should have looked after 10 years ago. I have a feeling that many, many archives are continuing this policy. Sometimes I feel very guilty for not looking after the future. We can relive that very often and say why didn't people look after their films any better than they did - and that's why we are today faced with all these problems.

I've always been very much concerned about what's happening with the production that's taking place today. How did we look after it? What do we do? Do we know what to do about it? How should we protect it? And I think one of the duties of a film archive is to develop methods for that and educate producers and filmmakers to look after their negatives and their intermediate materials in a way so that it will be in shape for future printing. And things vary from different country to country but

that's one thing that every archive could do - sort of tell the producers, tell the filmmakers how to keep their materials so that they could remain stable.

As soon as the Swedish Film Institute was also working as a producer, we have spent many years and arguments that they should turn over negative material to the archive. We have been keeping it at minus 5 or minus 6 or minus 7 degrees Celsius for many years. However, we were not very sure that this was the right way to handle the case and one of the heads of the laboratories that works for us went to see Kodak and asked them: how should we ideally keep our negatives, our intermediate material. He has put out a recommendation which I presume is well known, at least to the American Archives. They sort of have designed certain measurements under which material should be kept.

The "conditioning box" that I am talking about is particularly aimed at the 5243 stock which is the low fade interpositive material. x) In relation to separation positives, it is the second best carrier for colours according to Kodak - if the separation positives are made with this lay-in stability. And Kodak - well, that's what they say. I'm just repeating what they are saying. Mr Karr is sitting there shaking his head. They say that if this 5243 stock is conditioned to a relative humidity of 25-30% and sealed into a bag - an airtight bag - which is kept at minus 5 degrees Celsius, they guarantee the life of the colours for something like 70 or 80 years. Kodak is not yet prepared to publish these results because I understand that if they are not sort of proven to be correct, you get fined or electrocuted or something. I don't know what happens to them, but I understand that they are testing these results.

At the Film Institute, however, we have constructed such a box. I have photographs and a cross-section drawing of it here which you could pass around so that you could look at the machinery - if you are interested. The idea is that you put the bag into this machine which doesn't take up any more space than two refrigerators, one beside the other. You make sure that it gets down to 25-30% humidity, not more, not less, and then seal it in an airtight bag which I also pass around. It's an aluminium plastic bag that you seal with a heater. Then you put it in a box and put it at whatever temperature you can afford.

Henning Schou:

The most important thing in this context is to make sure that you reduce the relative humidity before you cool the film down. Don't forget that if you cool air of, say, 20 degrees Celsius and 50% RH down just 10 degrees, the relative humidity increases to above 90% - so it's rather easy to pass the dew point.

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x) Eastman Color Intermediate Film (for both internegatives and interpositives).

Anna-Lena Wibom:

Yes, you have to test that before putting it into the bag. That is the crucial point. You are touching it and we know that it will take a different amount of time to get it to the right relative humidity. We know it will vary in time according to the local conditions. If you are in Havana, for example, where I realize there is a higher degree of relative humidity than here or in Stockholm, I'd think the time you have to put in the box will vary.

Henning Schou:

So you actually adjust the relative humidity as you cool the film down?

Anna-Lena Wibom:

It takes place at the same time, I think. Then you seal it. These are the facts which I also pass around so you can look at it. If you keep it at that relative humidity and at minus 5 degrees Celsius, they guarantee less than 10% fading for 70 years, and that's plenty for me. This is something, that we, for the time being, are testing out on our national production because if we don't look after our national production, nobody else will, that's for sure. I think it is a thing that is suitable for any country, that has not a tremendous production, at least at the testing stages. The advantage of this method is, of course, that the initial costs are very low.

We have made a prototype of this machine and that costs something like $ 30,000, but the guys who made it, who are the heads of our laboratories, they say that if they get an order for ten of them, they could deliver it for 1/3 of that price or even less. They don't know, but they just worked this prototype out.

You buy those bags and then you put in the films, seal them and put them in a box. What is more important is that when you take them out of the freezer, if you want to print from them, you keep them in the bag until they have reached the temperature that you want and then you are rid of the condensation problem. You don't have any water on the prints when you take them out. One, even more important thing is that all you have to do once the bag is sealed, is that you don't have to worry about the humidity in your cold vaults because the humidity within the bag remains stable because it's sealed. And for us, they say, it is going to save more than 50% of the construction costs for new vaults, and it's going to save 80% of the electricity costs, because what is really expensive in a cold vault is constructing it for humid air and for cold air at the same time. That seems to be a special problem and then it takes an awful amount of electricity to keep cold and humidity at the same level. In fact, if this is true, what they are saying, that you can seal the footage in a box you could actually rent the space in a deep freezer for meat or whatever. You could store that almost anywhere and that might be important for the national production of a developing country, because I'm sure that even if there's not enough money to construct cold vaults for film, there are deep freezers for food or other more important objects. As long as you could rent a corner and put it in there.

Peter Kubelka:

What kind of material are they made from and how are they sealed ?

Anna-Lena Wibom:

This bag has been tested. Kubelka just asked about the chemical construction of the bag and it's aluminium and plastic. It is non-soft plastic x) which is not supposed to produce any chemical vapours; it has been used by Kodak for more than 25 years and they have no problems with it. They are very happy with it.

Larry Karr:

What is the conditioning time to put a whole reel of film through your machine ?

Anna-Lena Wibom:

That depends on the condition of the film when it comes in and the temperature outside and inside.

Larry Karr:

At typical room temperature.

Anna-Lena Wibom:

20 degrees Celsius. We think about 24 hours.

Larry Karr:

And how many reels of films does it hold ?

Anna-Lena Wibom:

In this prototype that we have made, it holds 20 reels, but the capacity - the machinery or the capacity of the machine could hold something like 100 reels. It could easily be put up, but we are just testing this machine and of course we will have a better report on this, printed in the Bulletin as soon as we have some test results. But I thought it was so interesting - these results - particularly for beginning archives who have lots of problems in establishing their status and who feel worried about the state of present day production.

Audrey Kupferberg:

Does Kodak suggest you change the bags every few years ?

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x) "Non-soft plastic" means plastic without plasticizer, like polyethylene plastics.

Anna-Lena Wibom:

I haven't heard them say so, no. There is actually a lecture on this particular topic that was given at the SMPTE Conference held in New-York in November 1980 that is available. They can't print it, but they can distribute a tape on it, so, anyone who is interested could write to the SMPTE and ask for a cassette. It's number 24 (Bard and Kurtz), if you're interested. The Bard and Kurtz' lecture from November 1980 and the cost is $ 6,00. So, I think I should mention this even if we have not tested it, even if Kodak doesn't dare to publish the results because, at least for us, it has changed our views of the future construction of the vaults. I mean it's fine if they could last from 70 to 80 years with 10% loss. Then, I'm more than satisfied.

They even say that if you freeze it down to minus 25 degrees Celsius, it will last you for more than 300 years but by that time I'm sure there are other techniques available. But they obviously believe very firmly in this idea. And I must say that they have been extremely helpful, giving out information and checking out everything. We are very grateful for this and we also have had a great interest from the industry - because also they have been reading about fading prints of today and how they should be preserved etc. Any more questions?

Paul Spehr: (Inaudible)

Anna-Lena Wibom:

Paul asked how long we have been testing this and whether we have taken it in and out several times. This prototype was finished less than a week ago. We have no test results at all. What we like about it is that it is inexpensive and it saves space in storage and whatever, so we are just hoping that it will work. But it's constructed on the recommendations of Kodak, by our technicians. I have no vested interest in Kodak. I don't sell their stock, I don't sell their machines, but if it works out, we will certainly investigate the possibilities of making it available to other interested FIAF members. I think it may be particularly interesting for medium sized productions and will be great if we could find out what it could do to prolong the life of colour positives. We don't know that, because that is what we have, most of us. But at least it is a fairly cheap way of preserving today's productions. At least it is far cheaper that anything I have heard of. I don't know if it's as good, but let's hope so.

Henning Schou:

During the Cold Storage Conference, Larry asked what happens both to the dyes and to the physical conditions of the film when it's cycled between two temperatures and two humidity levels. At which end of such a cycle is the most damage done? I just want to point out that probably the most risky part of the cycling operation is when you allow the film to thaw because it's when the temperature is slowly raised that crystals - if there are any - will grow.

David Francis:

Thank you very much indeed. I'm afraid... time is running out, unfortunately, and we have Mr Finestauri, the Technical Director of Technospecs with us here, and I don't want any more time to go past before I give him a chance to speak. So what I'm going to do is, I'm afraid, cut items 5 and 6 (see Annex 2) because to a certain extent a lot of the points that were going to be covered in those, have come in the course of conversation, in the course of description of extracts etc. and I think I'm going to go straight on and invite Mr Finestauri to come here and talk to us for a moment.

It gives me great pleasure to welcome you here Mr Finestauri and simply, may I hand the floor to you?

Don Elio Finestauri:

Ho chiesto al Dottor Cincotti, che è il Direttore della Cineteca Nazionale Italiana di seguire i lavori della FIAF più che altro per imparare, per ascoltare, non per prendere la parola, perchè per me tutto quello che è stato detteo oggi è molto interessante e volevo appunto ascoltare questi argomenti.

Mi sono poi invece trovato nella lista dei conferenzieri e allora prendo la parola appunto per dare le mie impressioni. Io provengo da uno stabilimento di sviluppo stampa, quindi il nostro lavoro è molto simile al vostro, in quanto anche noi trattiamo nella vostra maniera, come salvataggio di materiali passati, ma li trattiamo nella vostra routine commerciale, industriale, per cui il nostro maggior impegno, la nostra maggiore attenzione non è tanto nel conservare le pellicole positive, quanto nel conservare i documenti negativi, intermedi ed internegativi, quindi abbiamo una attività affine ma non uguale.

Io avevo prospettato questo, e oggi ho avuto qui, seguendo soprattutto quanto detto questa mattina, la conferma che il vostro lavoro di conservatori delle pellicole, degli archivi, è un lavoro che si basa soprattutto su documenti positivi, in quanto spesso si tratta di lavori di 30, 40, 50 anni fa, diciamo pure 60, 70 anni fa, e quindi il negativo non esiste più, magari c'è qualche rara copia positiva da una parte o dall'altra del mondo ed è quella che bisogna salvare, ed è su quella che bisogna lavorare, quindi dagli appunti che ho preso, ed anche dai film che sono stati proiettati questa mattina, ho visto che il lavoro principale è quello che si basa sulla rigenerazione di un positivo che è in quel momento, in quella determinata cineteca, mentre invece il lavoro dello stabilimento di sviluppo stampa e il lavoro di conservazione, che appartiene allo stabilimento di sviluppo stampa è un lavoro che riguarda soprattutto i negativi e sono quelli che a noi ci danno da lavorare, ed è quello il documento che noi dobbiamo conservare al massimo perchè dai negativi e dagli internegativi possimao ristampare le altre copie.

Ora da questa distinzione secondo me discende anche un problema che ha sollevato Martin Scorzese e gli altri esponenti della cinematografia americana l'anno scorso, e i grandi direttori della fotografia, tipo,

adesso cito gli italiani: Mediglio, Storaro, ecc., essi cioè si preoccupano, e con questo mi riallaccio al discorso che faceva la signorina che presentava la cineteca svedesa, le preoccupazioni di questi signori, dicevo, si riallacciano al materiale negativo che dovrà essere conservato in futuro, non diciamo per 70 anni, ma addirittura per centinaia, forse per migliaia, perció sono due discorsi separati, ed io per quanto mi riguarda, mi riferisco soprattutto al secondo discorso cioè a quello che riguarda la conservazione dei negativi e dei materiali negativi nel proseguo degli anni e dei secoli.

Ora a quale punto siamo arrivati con la tecnologia per la conservazione del materiale filmico a colori nel proseguimento degli anni?

Praticamente come tecnologia siamo a cuello che già si conosceva da una decina di anni, forse anche da una ventina, cioè la transformazione dell' immagine a colori in immagine argentica, in bianco e nero, e la conservazione di questa immagine, perchè mentre l'immagine a colore, l'immagine cromatica è deperibile nel tempo, sia essa negativa o positiva, molto di più il positivo un po' meno il negativo, mentre questa è deperibile, il materiale in bianco e nero invece non lo è.

Se la cinematografia a colori fosse nata con questo sistema, con il sistema molopac, 90 anni fa all'epoca dei fratelli Lumiere, probabilmente adesso quei documenti non li avremmo più, e se non si fosse ricorso subito a delle operazioni di riparazione, non li avremmo più, non li potremmo più vedere, mentre invece ancora li vediamo, ancora li gustiamo, perchè erano una immagine argentina, cioè una immagine in bianco e nero; ora come ora penso che il nostro problema sia quello di conservare il documento cromatico, sia esso negativo, sia esso internegativo, di conservarlo transferendolo in bianco e nero come la separazione neo prodotta.

Ci dovranno essere anche delle altre tecniche nel prossimo futuro, si parla di quella termoplastica su video dischi, anzi ci siamo già quasi arrivati, mi sembra che in una di quelle risposte che sono state date al questionario, mi sembra che la cineteca olandese, di cui mi sono preso nota, abbia già fatto degli esperimenti in questo senso.

Forse quella sarà la strada giusta nel prosieguo degli anni per arrivare ad una conservazione dell'immagine negativa a colori in maniera molto meno costosa di quello che non sia l'attuale sistema delle separazioni monocromatiche in bianco e nero, però certo per arrivare a quella tecnica penso che si dovrà migliorare enormemente la risoluzione delle linee del sistema elettronico delle macchine e portarlo dalle 625 lineee attuali per lo meno a 5-6-10 mila linee, quindi se ne parlerà chissà ancora tra quanti anni.

Un video disco di tipo commerciale già è uscito, già esiste, anche se in Europa circola poco, ma il video disco di tipo professionale, quello che dovrebbe essere adatto per la conservazione dei documenti di archivio non esiste e non si sa ancora quando sarà fatto.

Per cui ritornando al discorso di Scorzese e alla preoccupazione mondiale per la conservazione di questo materiale molopac, dissimile da quello precedente che era già bianco e nero, il vecchio sistema tecnicolor era un sistema in bianco e nero, quindi non corre questo pericolo, ed anche i sistemi precedenti di colore additivo, qualcuno lo abbiamo visto questa mattina, erano sistemi in bianco e nero e non corrono pericolo.

Il pericolo lo corrono i sistemi che vanno dalla creazione del molopac ad oggi, di cui il primo fu appunto il Barone.... e poi prese un grosso slancio dagli anni 50' in poi.

Sono quindi materiali che bisogna preoccuparsi di proteggere e allora che cosa si deve fare?

Questa transformazione, dicevo, in immagine in bianco e nero e poi affidare questo nostro prodotto, per lo meno quelli che vale la pena di salvare, e ci potrebbero essere delle commissioni che li esaminano, affidare questi nostri prodotti mogliori della nostra civiltà dell'immagine alla seconda generazione che ci seguirà, e poi loro con le tecnologie che avranno studiato e che saranno state messe a punto tra 25-30 anni, trasferirle in sistemi che si mantengano per l'eternità, come si sono mantenuti per l'eternità i geroglifici degli egiziani.

Quindi nostro compito fin d'ora, e mi riferisco sempre al lavoro dei negativi e alle preoccupazioni che abbiamo adesso di quello che sarà il futuro di questi nostri negativi, il nostro compito è un compito di transizione.

Siamo un po' come un anello della catena e forse l'anello più fragile che dovrà essere messo in atto per poter assicurare al futuro quello che è stato fatto nel passato fino ad oggi.

Quindi secondo me le disposizioni dei negativi, le leggi che dovranno essere emesse in questo periodo devono appunto rivolgersi a questo fine, perchè non è ne' poco costoso, ne' si sa da chi deve essere fatta questa opera di salvataggio.

Quindi secondo me l'autorità delegative, non solo italiane ma parliamo dell'Europa, del mondo, dovranno preoccuparsi di fare quello che fanno ad esempio per le pitture, per gli affreschi, con i quadri, si preoccupano di conservarli per il futuro, anche se un affresco magari è in una Chiesa che non ha un soldo per poterla mettere a posto, ci pensa lo Stato a sistemarla.

Io penso di aver espresso il mio parere su questo argomento prima separando quali sono i problemi intrinseci nostri delle diapositive da quelli che sono i negativi e poi mettendo a fuoco quella che è l'intenzione e l'aspirazione di tutti coloro che assieme a Martin Scorzese si sono messi in questo campo.

Grazie dell'Attenzione.

David Francis:

Thank you very much for that. I sincerely hope that we will be able to convince the governments to provide us with this support before it's too late. I think many of us have been trying to do this for some time and I think that is our biggest worry. I think that we also have a slight worry whether we will adequately be able to get back from those separations when we discover the new technology. Will we still be able to print them back into registration - I don't know. Unfortunately, as I said earlier, time is creeping on so I think we can't really engage in a discussion on these points.

And I promised the president of our Preservation Commission, Mr Volkmann, that he would be able to have a few words before the end of the afternoon. So what I would hope is that we will have a little time for the discussion of point 9 "Proposal for a special conference on colour film preservation" before we finish. - Mr Volkmann, do you mind coming up here?

Herbert Volkmann:

I believe most of you have heard Mr Kubelka, yesterday during the General Meeting. I regret very much that he had not yet seen the examples shown this morning. When you have seen these examples and seen how much energy was used to make these prints, better prints than the originals, and how poor are the effects, you realize it is nearly impossible to restore a colour if it is already faded.

We have spoken here only about one problem, and this problem is the colour in the film, not the colour film. There are, of course, other problems linked with it. The problems are not only the colours, it is also the different layers of the film, that is the base of the film, that is the adhesive layer. There are a lot of problems that have nothing to do with colour. But we are restricted to colour in the moment. And you saw which have been shown here, the first examples were films which have been developed in chromogenic development. The cyan has faded away and we have only a pink colour, through the whole film. We have seen also that there are better preservation methods: the Aida technologies, that is printing and bleaching, have much better colours, but that is a thing of chemistry, because they use other colours, for instance, azomethines and indoanilines.

The only means by which the archives can fight against time - is to make separations and cold storage. Separations, even on one film, costs a lot of money. It's impossible for the archives to store a lot of films in this way. Cold Storage is better and is simpler - you go down to a certain temperature (and there ideas differ but that's not so important whether you take -7°C or -10°C or -20°C) - the important thing is that you can stop the fading for 40 or 50 years or even for 100 years - I believe it's possible.

A big archive as our archive in Berlin DDR, needs half a century to transfer the stocks to the other medium. By building our new cold storage vaults, we gave science 50 years to find a new medium. But I believe science will

not need these 50 years because we are now at a point where it is already possible to transfer the film - in principle and in practice - to other media. There are only 2 pre-conditions. The one pre-condition is that the electronic image has better quality than it has now. I'm convinced science will do this and we will have an image which maybe has not 1500 lines but only 625 lines, but looks like it has 1000 lines. Maybe conditions will be bettered and we shall have television sets with more than a thousand lines - but I doubt it.

It will of course be possible in a few years to see big projections with electronic pictures. That means if we keep our holdings for many years - for hundreds of years, maybe thousands of years, we must transfer it in a certain time - not now - to other media. I believe this may be principally electronic medium. And there are 3 possibilities - there are tapes, there are holograms and there are discs.

Tapes - we have some archives (3 or 4) which have already transferred their colour films to tapes because they have more problems with the dyes. But the tape cannot be conserved forever.

Holograms - as a rule they are of very bad quality, but that does not mean that in future times it will have the bad qualities it has now. It's necessary to wait for any development in this case.

Then we have the disc. The disc is already in commercial use. Philips sells it in the United States and is ready to sell it in Europe; it is made from metal, from inorganic material which will not be destroyed in such a short time as 500 years or so.

But there are two problems with the discs; one is the core of the matrix, it is iron, and the engravings, the records, are on nickel and this proximity to chrome, from iron and nickel may cause some difficulties. On the discs, the engravings are only 1/1000 of a mm deep in the middle.

We don't know how it will be possible to preserve this for thousands of years. It is possible to store metal and minerals for thousands of years, but we know they are not as they were thousands of years ago.

Those are the problems we have for the future.

We in Berlin have now concluded the work on a big colour vault for 320.000 reels. We are convinced we need this vault because we haven't much time; maybe 10% will survive the time until we can transfer it to a safer system.

Thank you.

David Francis:

Thank you very much. I don't know if there are any quick comments or questions.

I think probably it's fair under the circumstances that Peter Kubelka, can have a word.

Peter Kubelka:

I'm not an expert in preservation, as everybody knows. I just want to make some very short comments on the results that, let's say, I would like to see.

Seeing today's programme, of course Mr Volkmann is right: the results are not satisfactory. We cannot consider as saved films which have been, say, difficult. So the consequence is: do not throw away, do not consider as safe films which have been duplicated in this way.

Let's take as example: the Pathé stencil film. The original is a black and white film, which has more black and more white and the colours sort of swim on the surface. And this gives a certain atmosphere which can only be rendered when it is restored as was the original. When we put it on colour stock we get all colours with a background which is not black and white anymore - the background becomes blue or beige or whatever.

So now, what does this mean? Is this so important or not?

I'll give you 3 examples: Technicolor, Agfacolor has been made, let's say from modern Eastmancolor printing stock. Colour is not colour, everybody who knows and works with the material - I have done it as a film maker - knows.

For example I wanted to achieve a special colour in my African film - I shot on Gevaert colour and I printed on Eastman stock and I got something which was remarkable - I could get some effects which I really wanted.

Now also every colour system is very pure: when you have Agfacolor you have the German subtlety. The real Agfacolor is pastel like.

And I remember still my relatives after the war. Those who weren't sympathising with the Nazi times said "Kodak is so great, it is so strong!". And it was, you know: Kodak is glorious positivism, it is optimistic, you see. So as the special climate of Technicolor, which covers a period of about fifty years, is essential to the American colour film, Münchausen is a fantastic example of the German subtlety.

Now the new Eastman stock reflects the new American pessimism: you see, it's good for dirty films, criminal films; it reflects also their views, it's not just technique. So what follows?

Of course I am not speaking of cost, I am not speaking of possibility, of feasibility; I am speaking of the ideal which we have to aim for: to try not to save a Kodak film through Agfa stock, and try not to safe an Agfa film through Kodak stock, if there is Agfa available. Which means that if you print a film of the past, as Münchausen, through a Kodak printing stock, you will give it an injection of American feeling and you will de-Germanize it.

Now the second point refers to the 35.000 dollars for the salvation of that film: this is the sum, 35.000 dollars, which brings up something else. How much would it cost to rebuild a Lumière projector and make it workable, and remake the printing stock Lumière had, with the same core and, without describing it here now, it has different holes, it has a different size, it is "different".

Anyway, with 35.000 dollars we could recreate, I'm sure, a whole viewing situation which will provide a climate of great approximation to the situation in this coffee house in 1895. And this is a very important point: why don't we do this thing?! Why do we want to look at something of the past? Because we really want to get the feeling of what it was, we do not want to modernize it and to better it, because if we make it less flickering, if we make it more slow, it will not be better: it has to have this heavy clumsiness.

All this could be done for that amount of money. So the idea, for me, for future preservation would be to specialize more in recreating certain halls with the complete technical apparatus that was there.

We are now in an early stage of preservation: we have these 300 million meters; and here comes in my apology to Mr Volkmann: I am not completely against what he says, because in order to get a 60% or 40% salvation of big amounts of film a large amount of money is required; and such an effort, also if it becomes cheaper one day, may be interesting to preserve a part of it, but only in connection with the other extreme: to recreate, maybe for very few films, very typical films, to completely recreate them historically as they were, and show them in the conditions as they were at the time.

To be able to do this one day, this is my main idea: not to consider films safe when they are duplicated on another medium, just consider the duplication as a measure of security, not to lose everything, but keep every machinery, keep the stencils, keep everything, and I am quite sure it will be used again.

We have this process in other historic media, like music: the whole Baroque period has been wiped out by the Classic period. Bach has written very difficult pieces for flute, then came the more modern instruments with which you can easily play the difficult Bach pieces.

Then the instruments became louder and now the whole field transformed, so that today, if you ask a musician "Who is the best Bach pianist in the world?" the answer is "A good Bach interpreter doesn't play the piano any more: he is an harpsichordist. You have to look among the harpsichordists".

So I mentioned the Baroque music just to cite an example: the whole instrumentarium has been rebuilt. For the flauto dolce only two examples had survived to give the tone as it was, and from them the whole reconstruction movement departed.

This is why it is so important to keep the old films as long as possible and not to consider them safe if they have been transferred.

Thank you.

David Francis:

Thank you very much Peter. I'm afraid we'll have to come to the end of the session. We haven't even had time to talk about the future proposals - of how we carry on considering this problem. I fear that's going to have to be for the future executive committee of FIAF to suggest.

In fact, we really, and I think it's perfectly justified what Peter said, we've almost gained a problem today because we not only have to preserve the material, we have to preserve the production and audience experience at the same time.

I think that's a whole new area of preservation which we need to consider. I'm very glad that he raised it. I also think it's a very good way to finish.

Thank you very much.

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Annex 1

A copy from the archives' answers to this questionnaire can be obtained from the FIAF Secretariat.

QUESTIONNAIRE ON COLOUR FILMS HELD IN ARCHIVE

Please answer questions in very general terms if you cannot give much or any detail. Whatever information you can give, including dates of manufacture of the film copies will be helpful.

1. Total Quantity

   (a) Express in numbers of metres or feet; reels; or titles in that order of preference.

   (b) 35 - 16 - 70mm. separately if possible.

   (c) Divide into nitrate and safety base if possible.

   (d) Camera original; Neg.; Reversal; Intermediate Pos.;Inter.Neg.; B.W.silver separation; Projection print.

2. Colour Systems or Processes

   (a) What proprietary, named, colour processes or systems are represented in your collection. Examples are:

   (i) Tinted and toned films.

   (ii) Hand or stencil coloured films (e.g.Pathe colour of silent era).

   (iii) Two-colour systems with emulsion on both sides of the base (e.g. early Technicolor; Prizmacolor; Cinecolor; Magnacolor, etc. etc.).

   (iv) Integral Tri-pack films of the kind most generally in use at present (i.e. dye- development processes).
   (e.g. Agfacolor; Fastman Colour; Orwo color; Warnercolor; de Luxe; Sovcolor; Gevacolor; Ferrani -color etc.etc.).

   (v) Other proprietary types which were formerly in use (e.g. Dufaycolor; Gasparcolor).

   (vi) Dye transfer or imbibition prints (e.g.Technicolor).

3. Storage Conditions

In what conditions of temperature and humidity have you stored, or do you store now?

If you have no controlled conditions of storage, can you give any indication of the range of temperature and degree of humidity which exists in the area of your store.

Are the films sealed in any way in their containers to prevent entry of moist air?

4. Measurements and Observations

Have you made any measurements of the dye densities of any films, or any measurements to show the rate of fading or change of dyes in any of your films?

Apart from actual measurements, have you made any observations about the fading of colour? (e.g. Has it been necessary to change any printing exposures (grading - timing) after a period of time - either for density or colour-balance? Has anyone noticed that a film copy which once had good colour, now looks thoroughly wrong?)

Give dates, precise or approximate, of the measurements or observations if possible.

5. Experiments

Have you carried out any experiments, (or do you know of any experiments being made in your country) into any aspect of the behaviour of any colour films?

6. Copying

Have you copied any colour films (apart from any current normal procedure) either in order to obtain copies for use; or as means of preservation of the colour record?

A statement of what has been done would be helpful. (e.g. was a copy made onto film of the same kind or another kind; was the film transferred to another medium such as videotape?)

Can you state your view of how satisfactory these procedures are?

7. Colour Film Printing Laboratory Facilities in Your Country

Are there many, or any, laboratories printing and processing colour films? If so, what kinds and brands of film are used?(e.g. neg.; pos.; reversal; colour intermediates; B.W. separations; 35 - 16 - 70mm.)

8. Can you list what information you normally keep on your records of colour film?

9. Any other information, or ideas not covered in these questions.

10. If you have colour films of any kind or in any form not mentioned in the questionnaire, it would help if you could name or describe them.

FEDERATION INTERNATIONALE DES ARCHIVES DU FILM

Secrétariat
Coudenberg 70
1000 Bruxelles Belgique
Adresse télégraphique FIAFILM
Téléphone 511 13 90

QUESTIONNAIRE SUR LES FILMS EN COULEURS DETENUS EN ARCHIVE

Nom de l'archive :

Nous vous prions de ne pas hésiter à répondre aux questions en termes très généraux si vous ne pouvez fournir que peu ou pas du tout de détails. Toute information que vous pourrez fournir, y compris les dates de fabrication des copies des films, sera utile.

I. Quantité totale des films en couleurs détenus par l'archive :

a) Indiquer, dans cet ordre de préférence, le nombre de mètres (ou de pieds), le nombre de bobines, ou le nombre de titres.

b) Si possible, exprimer les quantités respectives en formats 35mm, 16mm, 70mm.

c) Si possible, exprimer les quantités respectives de films sur pellicule nitrate et de films sur pellicule safety.

d) Quantités respectives :
- originaux de prise de vues
- négatifs
- inversibles
- positifs intermédiaires
- internégatifs
- sélections noir et blanc
- copies d'exploitation

2. Systèmes ou procédés de couleur

a) Quels sont les systèmes ou procédés de couleur brevetés ou dénommés qui se trouvent dans votre collection? (Soulignez ou ajoutez les systèmes non cités) Par exemple:

- Films teintés ou virés
- films coloriés à la main ou au pochoir (par ex. le Pathécolor à l'époque du muet)
- systèmes bichromes avec émulsion sur les deux côtés du support (par ex. l'ancien Technicolor, le Prizmacolor, le Cinécolor, le Magnacolor, etc...)
- Pellicules à 3 couches superposées, du genre de celles qui sont utilisées aujourd'hui (C.à.d. à traitement par développement du colorant). Par ex. Agfacolor, Eastmancolor, Orwocolor, Warnercolor, Deluxe, Sovcolor, Gevacolor, Ferraniacolor, etc....

./.

- Autres types brevetés qui ont été en usage jadis (par ex. Dufaycolor, Gaspacolor).

- tirages par transfert de colorants ou imbibition (par ex. Technicolor).

3. Conditions de stockage

Dans quelles conditions de température et d'humidité avez-vous stocké ou stockez-vous maintenant?

Si vous n'avez pas de conditions de stockage contrôlées, pouvez vous donner quelques indications sur la fourchette des températures et des degrés d'humidité qui existent dans l'aire de stockage?

Est-ce que les films sont scellés de quelque manière que ce soit pour empêcher l'entrée d'air humide?

4. Mesures et observations

Avez-vous fait des mesures quelconques des densités des colorants de certains films ou une mesure quelconque qui montre le niveau de décoloration ou de changement des colorants dans certains de vos films ?

A l'exception des mesures réelles, avez-vous fait des observations quelconques sur la décoloration des films en couleur? (Par ex. A-t-il été nécessaire de changer certaines données d'expositions lors du tirage (lumières de tirage - temps de pose) après un certain temps, soit pour la densité, soit pour la balance des couleurs? Quelqu'un a-t-il remarqué qu'une copie de film, qui avait à un moment donné une couleur satisfaisante, paraissait maintenant complètement erronée ?)

Si possible, donner les dates, même approximatives, des mesures ou des observations.

5. Expérimentations

Avez-vous réalisé des expérimentations (ou avez-vous connaissance de certaines expérimentations qui auraient été faites dans votre pays) de quelque nature que ce soit, sur le comportement des films en couleur, quels qu'ils soient ?

6. Duplication

Avez-vous duplicaté certains films couleur (à l'exception des travaux entrant dans le cadre habituel de vos activités), soit pour obtenir des copies de projection, soit afin d'assurer la conservation de l'information colorée?

Un état de ce qui a été fait serait utile. (par ex.: est-ce que la copie a été faite sur le même type de pellicule que la copie originale ou sur un autre type? Est-ce que le film a été transféré sur un autre support tel que bande magnétique vidéo?)

Pouvez-vous donner votre opinion sur le caractère satisfaisant ou non de telles procédures?

7. Installations d'équipements de tirage de films en couleur dans votre pays

Existe-t-il un ou de nombreux laboratoires assurant le tirage et le développement des films en couleur?

Dans l'affirmative, quels genres et quels types de pellicule sont utilisés? (par ex.: négatif, positif, inversibles, interpositifs et internégatifs, sélection noir et blanc; 35mm, 16mm, 70mm).

8. Pouvez-vous faire la liste des informations que vous indiquez habituellement sur les fiches relatives à vos films en couleur ?

9. Indiquez ici toute autre information ou point de vue qui ne serait pas inclus dans les questions précédentes.

10. Si vous avez des films en couleur de tout autre type ou sous toute autre forme non mentionnés dans le questionnaire ci-dessus, il serait utile que vous puissiez les nommer ou les décrire.

Fragebogen über die in Ihrem Archiv

lagernden Farbfilme

Bitte beantworten Sie die Fragen in allgemeinen Begriffen falls Sie nicht mehr oder weniger Details angeben können. Alle Angaben, die Sie machen können, einschließlich der Daten der Herstellung der Filmkopien, können nützlich sein.

1. Gesamtkapazität
   a.) Nennen Sie die Anzahl der Farbfilme in Meter oder Fuß, Rollen oder Titel. (in welcher Angabe Sie es bevorzugen)
   b.) 16-35-70 mm, wenn möglich getrennt nach Formaten.
   c.) Unterscheiden Sie nach Nitrat- und Azetat- Unterlage.
   d.) Original- Aufnahmematerial, Negativ, Umkehr- Material, Duplikat- Pos., Duplikat- Neg., Schwarz- Weiß- Auszüge, Vorführkopien.
2. Farbverfahren
   a.) Welche Materialien nach den verschiedenen Farbverfahren oder Farbsystemen sind in Ihrer Sammlung vorhanden.
   Beispiele sind :
   (i) Eingefärbtes oder getöntes Material
   (ii) Hand- oder matritzencolorierte Filme (z.B. Pathe- Filme der Stummfilmzeit)
   (iii) Zwei- Farbensysteme mit Emulsionen auf beiden Seiten des Schichtträgers (z.B. frühere Technicolorverfahren, Prizmacolor, Cinecolor, Magnacolor usw.)
   (iv) 3- Schichten Farbverfahren (Farbentwicklungsprozeß) wie es zur Zeit am meisten verwendet wird.
   (z.B. Agfacolor, Eastman- Color, Orwocolor, Warnercolor, de Luxe, Sovcolor, Gevacolor, Ferraniacolor usw.)

(v) Andere Verfahren, die früher benutzt wurden (z.B. Dufaycolor, Gasparcolor)

(vi) Farbübertragung oder Druckverfahren (z.B. Technicolor)

3. Lagerungsbedingungen

Unter welcher Temperatur bzw. Luftfeuchtigkeit lagerten bzw. lagern Ihre Filme?
Falls Sie keine kontrollierten Lagerungsbedingungen haben, können Sie Hinweise über den Grenzbereich Temperatur und Luftfeuchtigkeit in Ihren Lagerräumen geben?
Sind die Filme in ihren Behältern in irgendeiner Weise abgeschlossen, um den Eintritt von feuchter Luft zu verhindern?

4. Messungen und Beobachtungen

Haben Sie Messungen über die Farbdichte in Filmen vorgenommen oder Messungen an Ihren Filmen durchgeführt, um den Anteil des Farbrückganges oder der Veränderung der Farben nachzuweisen?
Haben Sie neben den laufenden Messungen irgendwelche Beobachtungen über das Verblassen von Farben gemacht? z.B. War es notwendig, die Belichtungszeit (für den Kopierprozeß) nach einer bestimmten Dauer entweder für die Dichte oder die Farbbalance zu verändern? Liegen Angaben vor, ob eine Filmkopie, die einmal gute Farben hatte, jetzt durchweg schlecht aussieht?
Machen Sie nach Möglichkeit genaue oder annähernde Angaben über die Messungen und Beobachtungen.

5. Versuche

Haben Sie irgendwelche Versuche durchgeführt (oder kennen Sie Versuche, die in Ihrem Land gemacht wurden) über irgendwelche Aspekte des Verhaltens von verschiedenen Farbfilmen?

6. Kopierung

Haben Sie Farbfilme kopiert (neben normal laufenden Verfahren) um Kopien für die Benutzung zu erhalten oder als Mittel für die Erhaltung der Farbaufzeichnung? Jede Angabe über das Erfolgte könnte helfen.
(z.b. Wurde eine Kopie auf Film der gleichen Sorte oder einer anderen hergestellt; wurde der Film auf einem anderen Medium z.B. Videoband überspielt?
Können Sie Ihren Standpunkt darlegen, wie erfolgreich diese Prozesse sind?

7. Farbfilmkopiermöglichkeiten in Ihrem Lande

Gibt es einige oder mehrere Werke, die Farbfilm kopieren und verarbeiten können?
Wenn ja- welche Sorten und Formate werden benutzt?
(z.B. Negativ, Positiv, Umkehr, Farb- Intermediate, Schwarz- Weiß- Auszüge, 16-35-70 mm Film)

8. Können Sie Daten angeben, welche die Protokolle für Farbfilme enthalten?

9. Weitere Informationen oder Ideen, die nicht in den Fragen enthalten sind.

10. Falls Sie Farbfilme in irgendeiner Form haben, die nicht auf dem Fragespiegel erwähnt sind, würde es helfen, wenn Sie sie nennen und beschreiben würden.

Annex 2

THE PROBLEM OF COLOUR FADING

A Statement of the problem and of the nature of some approaches to solutions

(by Harold Brown)

The very basic problem is that dyes fade. More particularly, the general class of dyes which has to be used in the processes of colour photography, which have been in common use during approximately the last 30 years, is one which is particularly prone to fading. We refer to fading in darkness; not to fading as a result of exposure to light. Motion picture film is normally only exposed to light briefly during inspection, printing or projection. The amount of exposure during these uses is very slight and quite negligible as far as our problem is concerned. The problem is with the fading which takes place during dark storage.

In these processes, known as "dye-development" or "chromo-genic" processes, substances incorporated into the emulsion layers during manufacture of the sensitive film, re-act with the developer solution to produce dyes in the film where exposure to light has occurred during photography. The class of dyes which are capable of being created in this way is one which has poorer dark-keeping stability than certain other classes of dyes.

It is important to realise that the problem is not just the fact of fading; the dyes in the film fade at different rates thus causing a distortion of the colour. Not commonly, the cyan dye fades first, then yellow. The magenta dye is normally the most durable and so it is common to find film prints which are described as being "pinky".

It has been observed that there are some colour films which have been in existence for nearly 50 years and the colours show little or no apparent sign of having faded. These films have been produced by processes fundamentally different from the ones in current use as referred to above.

I will mention some of the process names associated with these. They all use dyes of different kinds from the current dye-development processes:

1. TECHNICOLOR

   The universally known "Technicolor", in which dye is first absorbed by a "matrix" from a bath of dye, and then transferred to the final print film. In this manner of making prints, there is no photochemistry in the print process itself. It is mechanical and physical. The dyes which have been employed by Technicolor, for this purpose, have always been ones which fade very little during the four decades or so during which the process was in use.

   For this process Technicolor have been able to select dyes which are good in respect of their dark-fading properties.

2. GASPARCOLOR

This process was worked intermittently between 1934 and about 1948. In this process, dyes are incorporated uniformly into each of the three emulsion layers in the manufacture of the films. After photographic exposure, the developing solution, selectively destroyed the dyes in proportion to the exposure. Gasparcolor films exhibited good colour saturation, good sharpness of image and even early examples have clearly suffered no observable fading.

3. KODACHROME

This very familiar process was introduced in 16 mm form for amateur use in 1935. Early examples have faded as severely as any other colour films. From about 1940 the development process was changed and from that time, Kodachromes have kept their colour reasonably well. The process differs from the usual dye development processes, in that the dye-forming substances are in the developer, not in the emulsion layers. The process has the disadvantage that the processing is reported to need very precise control; and in practice, only Kodak processes it.

4. DUFAYCOLOR

In this process, the colours are placed on the base of the film in the form of a regular pattern of lines and rectangles by a mechanical printing process. There is no photo-chemical process in producing these colours. The colours of Dufaycolor have survived with no noticeable fading for over 45 years. The process suffers from other severe disadvantages; particularly because it is an additive process, so that about two-thirds of the projecting light are absorbed by the primary colours of the dyes. Further, the resolving power of the system is limited by the size of the elements of the pattern of coloured patches. It has not been worked for nearly 35 years and could not compete in quality with other 3-colour processes.

5. 2-COLOUR PROCESSES

There were many of these in use prior to the coming of colour negative. They vary in their chemistry and colour rendering which (as 2-colour processes) could give no close approach to a true colour rendering.

It is thus difficult to know whether they have changed until any such change is quite great. However, on the whole they do not appear to be anything like as bad as current prints in respect of fading.

In practice archives are obliged to accept films in the form and process in which they exist. Probably most of us are often obliged to accept what we can get. That is most usually a positive print intended for projection. The collections of most of us contain, at least, a majority of projection prints. If the subject matter of these is to survive, it is these that we have to start with.

It seems that there are two basic ways to preserve them:

I. Cold Storage

The lower the temperature of storage the slower is the rate of fading. The FIAF Preservation Commission has advocated -5°C (Minus 5 degrees) as the most satisfactory temperature. Storing at even lower temperatures will slow the fading even more, but not in proportion to the reduction of temperature; and not in proportion to the greater cost of maintaining the lower temperature. Cold storage is expensive and needs continuing consumption of energy and can break down, but when applied to current types of negative and intermediate films can provide a length of life which may permit the record to survive until a medium of high quality and great durability comes into existence.

II. Transfer to a more durable medium

This could be to any of a number of alternatives:

A. A set of 3 silver-image (black and white) separations which would be as long-lasting as any other black and white safety-base films. Subsequently, for purposes of use, a normal colour copy can be made from the separations, re-combining the three images onto a single colour film.

B. To one of the more durable dye-image films, such as a duplicate negative or intermediate positive. These still need cold storage for a really useful length of life.

It would be better to transfer to a "dye-destruction" material of the same basic kind as Gasparcolor. Such a material which is in present use has demonstrated its durability in the "still" picture field, but is not, at present, manufactured in motion-picture form.

C. To one of the new media which are in course of creation; such as a video disc. This is not a present practicality for 3 reasons:

1) It is not yet known which of the several video disc systems will eventually become established. It would be rash for archives to commit their holdings to a system which no-one else was using.

2) All the disc systems now with us use one of the television standards of 525 or 625 lines, which is a standard of resolution which cannot compare with that normally achieved on 35 mm photographic film.

3) The cost of transfer from film to Master disc is prohibitive in terms of the finances usually available to archives. In a mass market, where that initial cost is shared among a huge number of copies, its cost is comparatively small; but archives are not working in a mass consumer market.

To summarise the virtues and disadvantages of A, B and C:

A. Virtues:

Has no dye and is as durable as other black and white safety film. Preserves the high definition of 35 mm film. Some correction is possible for fading which has already taken place in the original.

Disadvantages:

Is expensive to make and due to increased bulk is expensive to store. Engineering precision at least as great as that of a fine camera is needed to make and re-combine the three images. This may be made more difficult if the three records shrink with time by different amounts. This problem would not arise in the case of three separations, made on one strand of film; and would be substantially avoided by the use of polyester base. At present, suitable films are not manufactured on polyester base.

B. Among the "dye-development" materials it is the release print stocks which are worst for dye-fading. The camera negative and intermediate duplicating materials are better in this respect, although far from satisfactory.

Virtues:

The record is in its original form on a single film.
There is no problem of re-combining.
There is no problem of changing format as with transfer to video disc.
There is no loss of resolving power as with the 525 or 625 lines standard of video-disc.

Disadvantages:

Is still a dye-development image and will eventually fade and still really needs cold storage.

C. Virtues:

The electronic stage of transfer offers considerable possibilities of correction of fading which has already taken place in the original.
The "master" disc is expected to be of a very durable form.

Disadvantages:

The limit, at present, of 625 line resolution. - Cost.

PS: The above was written for the Congress at Rapallo in May 1981.
In April 1982, Ciba-Geigy provided the N.F.A. in Britain with a small supply of Cibachrome coated onto 35 mm motion picture film on polyester base. As at mid-April the Archive has made a first series of test exposures which are now with the manufacturers for processing.

FURTHER OBSERVATIONS ON COLD STORAGE

1. The Preservation Commission book on colour preservation makes a firm recommendation that the most satisfactory storage condition which archives should aim for is -5°C. Relative Humidity 15% - 30%.

2. Fundamentally the colder the film is kept, the slower will be the dye change. It has been calculated that a decrease of temperature of 17°C will multiply the life of the dyes by 10 times, but the experiments which led to the -5°C recommendation concluded that the difference achieved by going below -5°C was small, particularly when related to the increase in cost.

3. I would here refer to the fact that in reply to the questionnaire, certain archives referred to an intention to adopt a temperature of minus 2°C or "near zero". In this connection a warning would seem to be in order. The -5°C recommendation was chosen because if the film is to be frozen, it is vital that it remains frozen in store. What is damaging to the substratum of the film is an often repeated freezing and thawing. Now if the temperature aim is near zero (freezing point) or very near to it; then any variation in the temperature is liable to result in alternately going above and below that temperature. No equipment is absolutely precise. Any cold store will have a cycling of the temperature. Therefore it is necessary to aim well below zero, so that the upper part of the cycle remains securely below zero. Moreover, in the event of breakdown, there is more time for repair before the temperature reaches above zero, if the aim temperature is lower.

4. The other precaution which is vital in these conditions when the film is brought out for use, is to prevent access of warmer moist air to the film itself before the temperature of the whole of the film has been brought near to that of the surroundings. This does mean the whole of each reel. It is possible that the outside of the reel has come into equilibrium, but not the inner part. Then upon re-winding, there could be condensation of atmospheric moisture onto the film. It has been indicated that it needs at least 24 hours for the necessary adjustment to be made. The time will vary with the size of film, and how reels are packed together.

5. These dangers and necessary precautions may be some of the cause why some archives have opted for a temperature just a little above freezing. This avoids the problem of crossing the freezing threshold while getting some benefit from a temperature lower than the natural surroundings.

6. There seems to be some question about the amount of air which is permitted in contact with the film in the can. It is suggested that each can should be as nearly full of film as possible in order to have the minimum of moisture-bearing air. This seems to be offerred as preferable to closely wrapping or sealing the film in a polythene bag within the can. This may well be one of the matters to be explored at the proposed 1982 conference.

7. Another such matter may be that of the concept of Relative Humidity at sub-zero temperatures. Some authorities refer to per cent relative humidity figures at those temperatures. Others have been heard to state that at such low temperatures the whole idea of R.H. is irrelevant, because at these temperatures there is no water vapour.

8. A further matter which will probably repay some study is the effect of a deep-freeze store on its surroundings. The Preservation Commission report refers to the risk of damage to the store itself. There can also be an adverse effect on adjacent storage rooms.

9. There has also been a suggestion of using a multiplicity of comparatively small freezer cabinets instead of a large freeze room. Yet another aspect which might be explored under the 1982 conference, is the relative costs of these two solutions. Usually, "larger" is relatively cheaper; but it may be that in some circumstances, "larger" means specially built. "Smaller" may mean the use of mass produced cheap units. Small units could offer the possibility that if a small unit breaks down, it is practicable to quickly move its contents to a spare unit.

ADDITIONAL NOTES ON COPYING

1. Copying colour film only helps if one can copy onto a material which will last longer than the one which is fading away. One such material is black and white film and an effective means of preserving, if we could meet the cost, is to make a set of 3 black and white separations. Unfortunately the cost is high. A set of separations costs about 50% more than a colour intermediate negative or positive. Printing back from separations onto colour film also costs about 50% more than printing from a colour film so that overall it costs 2 1/4 times the cost of copying right thro. by dye-image material.

2. If the existing film has faded, it is also necessary to adjust the colour balance in order to restore a more nearly natural appearance to the colour rendering. Some adjustment can be made when printing onto other colour film, by adjustment of the colour of the printing light. There is a limit to the amount of fading which can be compensated when copying onto another colour film. There is very little modification possible in the processing of multi-layer colour films. When copying onto separations it is possible to develop the three records differently, increasing development of one or more and perhaps giving less than normal development to others, in order to bring the three records nearer to their original contrast.

3. When copying onto colour films, it is necessary to choose suitable films. The colour sensitivities of the three emulsion layers of the copy film need to embrace the colour transmissions of the film being copied. With comparatively recent original films it is possible to obtain this information from the literature of the film stock manufacturers. For older and long-obsolete types of colour films, such information is not available. In these cases it is usually found better to use a camera negative film. The specifically duplicating films have narrower bands of sensitivity designed to match the dyes in current colour materials.
