industries better salaries, and the stockholders better dividends. Public service has been a long-time ally of the successful motion-picture exhibitor. The local theater and theaterman has been the focal point in the community for Red Cross, Community Chest, War Bond and other patriotic and civic drives. He is long experienced in the community effort and could add greatly to the public service opportunities of television broadcasting.

You will note that I have not tried to prophesy the future of either 3-D, periphery vision or drive-in theaters, nor even TV; but of several facts I am sure. The American public wants and will pay for better viewing techniques.

Our television and motion-picture industries await these new improvements in viewing, in color and in various dimensions.

We need you — the engineers — and look to you for these new and exciting opportunities. With the help of the various crafts and allied artists and their productions of good entertainment, I am sure that we businessmen can sell our combined efforts to the American public and the world with ever increasing benefits to all.

In business, just as in a locomotive, the engineer is the man up front. Guide us well, gentlemen.

Letters to the Editor

Re: "Basic Principles of the Three-Dimensional Film"

[from H. Dewhurst]

In this most interesting paper by Raymond Spottiswoode, N. L. Spottiswoode and Charles Smith in the October 1952 *Journal*, the Authors appear to have singled me out by name as the pioneer protagonist of the "Human Vision" system of 3-D projection, about which they make criticisms which should not, I think, pass without challenge and on which, therefore, I feel I must take it upon myself to comment.

Otherwise, to my mind, the Authors are to be congratulated upon marked and positive contributions to the art of 3-D projection. They have, as it were, made a virtue out of expediency insofar as variable camera-lens interaxial spacing practice is concerned, in utilizing to the full the space in front of the screen; a forbidden ground hitherto which has tended to be regarded as taboo for all but stunt shots. An adjunct to this end which they have used — and a novel one as far as I know — is the placing in space in front of the screen of an aerial window, effected by marginal printing in the optical printer, enabling these in-front-of-the-screen shots to be viewed without eye strain. Their mathematical methods of analysis, too, cannot help but clear the air still further of current misconceptions, although I am a little dubious as to whether the lay mind will take readily to thinking in terms of reciprocals. Their concept of a "nearness factor" does, however, provide a much needed reminder that an image placed, say, half-way in front of the screen for one viewer is half-way for all.

And now for my few complaints. In particular criticisms of fixed camera-lens interaxial "Natural Vision" systems, the validity of the arguments advanced by the Authors is to a large extent vitiated by the assumption, as in the introduction on page 276 to the "Part III" critique, that the lens-focusing mechanism is always coupled to the convergence control. As far as my own system is concerned, this is a misconception. I had thought to make it clear in my paper ("Auto-Precision Stereoscopy," *Phot. J., Sec. B. 92B:* 2–24, Jan.-Feb. 1952) that this coupling was normally in operation only when my attachment was used in conjunction with a stills miniature camera, and then only for instantaneous "candid" work — the coupling being subsidiary to an independent manual override.

Even with this restrictive complication of coupling left out, it is in any case a misconception for the Authors to say (p. 276): "It is therefore not to be expected that a mere reproduction at the camera of the human eye separation — in the absence of human viewing methods — will of itself produce strain-free viewing. This cannot

be so simply achieved until it becomes possible to create real or virtual 3-D images in space." No protagonist of an "interocular" camera-lens interaxial spacing, certainly not I anyway, would have said that a fixed interaxial had got anything whatever to do directly *per se* with strain-free viewing; it should be obvious from my own paper, which follows Prof. Rule's classic lead, that the conditions for strain-free viewing to which I adhere lie primarily and essentially in the avoidance of too marked a deviation from the normal convergence/accommodation ratio in viewing, and in the avoidance of divergence of infinity points in projection.

Elsewhere the Authors are very properly insistent upon the necessity of avoiding distortions. Throughout their argument it is not perhaps made obvious enough in their advocation of a technique based on a variable interaxial that the onus of providing, in major part, the illusion of three dimensions in the majority of shots, is placed by them mainly upon the minor factor of convergence; nor, correspondingly, that their adoption of an interaxial camera-lens spacing of other than interocular must lead to the irrevocable recording of such disparate images on the film in the camera which, being once shot, cannot by any convergence or other means subsequently in the transmission procedure be made to give to the viewer that natural disparity between images which is the major and essential factor in a complete and lastingly convincing illusion of natural depth. This, to my mind, constitutes a major distortion which the advocates of a "Human-" or "Natural-Vision" fixed camera-lens interaxial spacing technique would I am sure regard as one which viewing audiences would not tolerate indefinitely.

However, my comments in the last paragraph above could be regarded as only an expression of a personal opinion and I would be far from expecting the Authors necessarily to agree with me, merely on my say-so! Clearly what is at issue here is the whole matter involved in the relative merits and demerits of techniques based mainly upon either a fixed or on a variable camera-lens interaxial or, if it comes to that, upon the fixed convergence technique of Dr. Reijnders as well. Such an issue cannot be much furthered by a mere exchange of letters and I hope that I may find the opportunity to sustain at length in a considered paper the argument as it appears to one of the fixed-interaxial school of thought. In that event, nevertheless, I shall be hard put to it to equal the able manner in which the Authors have put forward their own.

H. Dewhurst
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December 12, 1952

[from the Authors]

We appreciate Mr. Dewhurst's kind words about our paper, "Basic Principles of the 3-Dimensional Film," and feel that there is no fundamental difference of opinion between us, but rather a difference of approach. We are in full agreement that the vital requirements of strain-free viewing are careful control of the convergence/-accommodation ratio presented to the spectator, and in particular the avoidance of divergence on background images. It is in order to meet these requirements under the conditions of studio shooting that we have developed our two-stage technique of careful measurement of the depth-range presented to the camera, and adjustment of the interaxial separation to keep the images within the strain-free range. The shot itself will on occasion need to be altered from that first proposed by the director, if the depth range it contains is too great to be compassed even at the minimum interaxial.

Mr. Dewhurst advocates that the retention of the images within the strain-free range be achieved without alteration of the lens separation from 2.5 in.; this it would be possible to achieve only at the cost of exercising far more drastic control of the permissible depth-content of the scene being filmed, and hence limitation of the freedom of expression available to the director. We feel that Mr. Dewhurst only regards this as the more desirable alternative because he is accustomed to working with very small magnifications where the depth-range limits during filming become proportionately less restrictive — the maximum screen size referred to in his paper is 21 *inches* only. If he were face to face with

the practical problems of producing studio films for exhibition on screens as many *feet* in width and more, we feel sure that he would rapidly recognize the advantages of using both the two possible means of controlling the parallax range on film which we have analyzed.

We are afraid we do not follow Mr. Dewhurst's reference to our reliance on "the minor factor of convergence." It is true that the convergence does not affect the reciprocal-unit depth-range embraced by the camera, which in our nomenclature is purely a function of the C factor ($Mf_e t_e$); but its action is no less than to govern the position in theater space at which the image as a whole is reproduced. We do not think that this can be described as "minor."

Perhaps we should make it clear that Mr. Dewhurst misrepresents us in referring to our insistence on the necessity of avoiding distortion. On the contrary, we point out that distortion will inevitably be present, as a perfectly orthostereoscopic image can at best be seen only by a single spectator. What is important is that the cameraman shall have means available for assessing the amount of distortion present so that it shall not be permitted to exceed acceptable limits; and for this purpose we develop formulae for arriving at the depth magnification and width magnification of the image, which immediately give the required information. We certainly agree that the distortion introduced should be as small as possible compatible with the provision of strain-free viewing. Our whole procedure — based on an accurately controlled relationship between a variable convergence and interocular separation — has been devised to achieve these ends.

(the Authors)
Messrs. R. Spottiswoode, N. L. Spottiswoode and Mr. C. Smith
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April 3, 1953

Current Literature

The Editors present for convenient reference a list of articles dealing with subjects cognate to motion picture engineering published in a number of selected journals. Photostatic or microfilm copies of articles in magazines that are available may be obtained from The Library of Congress, Washington, D.C., or from the New York Public Library, New York, N.Y., at prevailing rates.

American Cinematographer

vol. 34, Jan. 1953

Set Lighting Innovations Mark the Photography of "5000 Fingers of Dr. T" (p. 16) *A. Rowan*

Servo Mechanism for Remote Control of Mitchell BNC Lens and Finder (p. 18) *J. D. McCullough*

vol. 34, Feb. 1953

Stereo-cine Corporation is Newest 3-D Filming Organization (p. 60) *A. Rowan*

"Fluid" Camera Gives Dramatic Emphasis to Cinematography (p. 63) *H. A. Lightman*

A Built-in Exposure Calculator for Motion Picture Cameras (p. 68)

What the Cine Photographer Should Know About Hyperfocal Distance (p. 70) *J. Walker*

World's Largest 16mm Laboratory (p. 74)

vol. 34, Mar. 1953

Practical Filming Techniques for Three-Dimension and Wide-Screen Motion Pictures (p. 107) *C. G. Clarke*

All Hollywood Studios Shooting 3-D Films (p. 108) *A. Gavin*

CinemaScope—What it is; How it Works (p. 112)

Producers Service's 3-D Camera (p. 116)

Magnetic Sound for Victor S.O.F. Projectors (p. 118) *J. Forbes*

Audio Engineering

vol. 37, Jan. 1953

A Flexible Single Recording and Re-recording Channel (p. 28) *H. Magargle*

Handbook of Sound Reproduction (p. 30) *E. M Villchur*

vol. 37, Feb. 1953

Real Theater Sound in a Small Package (p. 19) *T. R. Hughes*

The Wide Range R-C Oscillator (p. 21) *L. S. Goodfriend*

Audio Transformer Design (p. 26) *N. H. Crowhurst*

Distortion in Voltage Amplifiers (p. 28) *W. B. Bernard*

Handbook of Sound Reproduction (p. 30) *E. M. Villchur*

vol. 37, Mar. 1953

Theater Sound in a Small Package (p. 30) *T. R. Hughes*