In part two of Mark Trompeteler's interview with Douglas Trumbull, the pair continue discussion on the pursuit of the Holy Grail of cinema technology: cinematic virtual reality

BREAKING DOWN THE FOURTH WALL

MARK TROMPETELER (MT): So many people are obsessed with pixels and resolution, going for the maximum K, HDR and colour gamut — I am still wondering about all the parameters you are using to break down "the fourth wall" of the screen? You are placing an emphasis on the shutter and frame rate where others are not. When, as humans we look at the world, there is no shutter interruption or frame rate to our viewing of it is there? It is almost as if, philosophically and technically, you are reducing these things to the minimum to give us the most uninterrupted kind of image capture possible.

DOUGLAS TRUMBULL (DT): Shutter, and frame rate — you're right. People don't think about it. Before 3D and with my experimenting with a digital form of Showscan, it came to my attention that digital projectors can operate at almost any frame rate you want. Then I realised that with digital cameras and a 360-degree shutter, or should I say 359-degrees, there has to be a little bit of time to download the frame and then go into the next frame. I am trying to use that camera almost as if it was shutterless. That understanding gave me the idea that if you could shoot high frame rate contiguous shutterless photography, then you could take any two adjacent frames and merge them together and store the blur that needs to be bigger at a lower frame rate.

There is a direct proportion between the amount of blur and frame rate. If you were to lower the frame rate, the blur has to increase. That is an inverse proportion. By having a 360-degree shutter, you can blend any number of frames together, restoring the blur that is appropriate for the frame rate. →

Restoring the blur is a simple exercise — it does not require any computer processing or interpolation or anything. So that becomes elegantly simple.

When we were doing tests, we were shooting at 120fps and the performers were doing a dance. Since I was looking for motion and blur I had the guys dressed in outfits with focus charts on them — it gave us a way of analysing the motion and the blur. That's when I realised that you can change the frame rate on any pixel or any object dynamically through a scene. For example, if there turns out to be some scary things for audiences where you really might want to show it at 24fps (because that is the texture that they are used to) that is fine, but some part of the frame can be at a higher frame rate — the football, or the explosion, or the fist slamming into the face. If it needs to be faster so that you can see the action, you can dynamically change it.

MT: So, during the movie and within portions of a shot, you can change the frame rate?

DT: Yes you can. I applied for a patent and was granted it, so that is controllable territory now. When I tried the other experiment which was 3D, I recognised the way it was going to be projected 99% of the time was with a single projector. I know that there are two projector solutions out there, like IMAX theatres or where you have a big screen. However, the desirable way is with one projector — no-one wants to use two projectors when they can get by with one.

Let's say that most of the business is going to be single projector — alternatinge left eye, right eye, left eye, right eye — we said why don't we just shoot it that way so that we have what I call perfect temporal continuity. That is when I realised what actually had gone wrong with Peter Jackson's 48fps production — and what is wrong with 3D at 24fps. The frames are being multiple flashed. The motion is actually starting and stopping hundreds of times per second. It is not contiguous.

As soon as you make things smooth you get smooth motion. You can get 120 frames for the price of 60, or 144 frames for the price of 72, because the projector is actually doing 144. That is when I realised we can do high frame rate within the confines of a standard DCP spec. That is what I demonstrated last year in my film *UFOTOG* — a standard 2K 3D DCP running at 120 fps. It has perfect temporal continuity between switching the left eye and right eye. It is a little dark — but that is the name of the game right now — there are 20,000 or more theatres out there, that are a little dark and some are a lot dark.

We do everything at 14 or 15 fL because it is so easy to achieve with a standard projector and a torus screen off the shelf. All these things came to me as just ideas since I had been thinking about them for years. I did the Showscan thing — it was so simple and elegant because it was so easy to do.

▲ *Top and right*, the MAGI Pod provides for a highly immersive communal virtual reality experience; *above*, the highly reflective curved torus screen — a concept that envelopes the audience

THE MAGI PROCESS

MT: So the 3D 4K 120 fps process you have developed you call MAGI, pronounced MAG – eye.

DT: Yes - close to the pronunciation of the word eye. I am doing all this because I think I have, in a way, kind of discovered that "Holy Grail". We were fearful that it might look worse than 48 fps and look even more like television. This turned out not to be true. It was a revelation that by doing this 120fps alternating frame thing — giving 60 per eye — it did not look like television. It had no objectionable artefacts, it has no strobing, no judder, no blur and no flicker.

I thought this was really good — I applied for a patent and we recently were granted that patent, so now control this territory. I hope this will all come in handy, but my objective is no more than getting back to making movies.

I got this horrible reputation because I consciously chose to stop directing, it was my choice and I took full responsibility for it — but I do not have a reputation as a director anymore. People do not think of me, I am not on anybody's list.

I have been doing this investment of my time and effort to get the medium back on track. I want to direct in this medium. When you direct in this medium and you make a movie like this, you are creating a new form of entertainment. It is like virtual reality. It is not conventional story telling. It is not conventional cinematic language.

One of the components of the creative aspects — and the business aspects — of it is that if you take this big 3D 120fps 4K wide field of view thing and put it on a 3D TV or a laptop, it is not a good experience. Twelve inch high people do not look good — it is part of the equation of why 3D television has failed. It's a natural, obvious thing that anybody could have anticipated. When you miniaturise 3D, it doesn't look powerful.

With regard to the business side, if a studio invests in a movie using this process, the further away they go from conventional storytelling, the less useful it is going to be in the secondary market. That is a problem. It is so easy to change the primary market because there are tens of thousands of movie theatres that are already equipped with series two electronics that will go to 120fps. It is already there. There is not the problem of asking people to install new projectors. It is much easier now to get the entire movie industry to drag itself up by the boot straps and get it to adopt 120fps as the new standard.

A LIFE IN FILM

Douglas Trumbull worked on the classic 70mm film *2001: A Space Odyssey*. He contributed significantly in the area of visual effects and made a memorable contribution in development of the slit-scan photography process used in the "stargate" sequence. He went on to contribute effects to *The Andromeda Strain, Close Encounters of the Third Kind, Star Trek: The Motion Picture* and, in 1981, *Blade Runner*. Trumbull developed his patented Showscan process, a high-speed 70mm movie process, shooting and projecting at 60fps that provided an unprecedented visual clarity in movies. He directed the classic cult film *Silent Running* and the film *Brainstorm*. Redirecting his career away from Hollywood, he concentrated on developing technology for movie production and the exhibition industry on theme-park rides such as the "Back to the Future Ride" at Universal Studios. An Academy Award nominee on five occasions, he has received the American Society of Cinematographer's Lifetime Achievement Award.

MT: You make the point well. There would be a quick, significant increase in the differential between the stay-at-home viewing experience and this upgraded cinematic virtual reality experience.

DT: The beauty of it is that it is also downwards compatible. A 24fps version can easily be made for anyone who wants it on their smartphone, but you will not get the profound immersive experience unless you go to the cinema to see it.

CINEMA, MAGI & NOW

MT: Playing devil's advocate here, how do you prevent such a process becoming considered simply as a novelty or gaining the status of a fairground or theme park ride process by virtue of the possibility of it concentrating on visceral or experiential short subjects? One of the noticeable effects of the digitisation of cinema has been the ascendancy of fantasy, action and spectacle films at the box office where the vfx and action may be subjugating the expression of a theme and story. How do you encourage the creative and narrative development of such a process as MAGI into that new art form you are hoping for?

DT: There is some truth contained within your question, but remember that IMAX through its entire cinematic history, was such a powerful cinematic and immersive experience that no-one ever wanted more than 40 minutes of it. That became the standard of the IMAX world and it became an anomaly to take 35mm movies and print them up to IMAX, call that IMAX, and then ask the audience to watch for two hours. To some, it becomes a physiologically stressful experience. I do not like a 24fps movie enlarged that much. The juddering the blurring and the strobing are all objectionable — that is a problem.

On the content side it is interesting to note that the six or seven major studios are all making these big tentpole franchises, the Batman and Superman kind of thing, because they are all-action spectacles. Yes, they have changed the balance between story and special effects because that is what the audience wants. So I am not going to be derisive about it. I am derisive about the fact that it looks so terrible. The audience will vote with their pockets as to the kind of content they want.

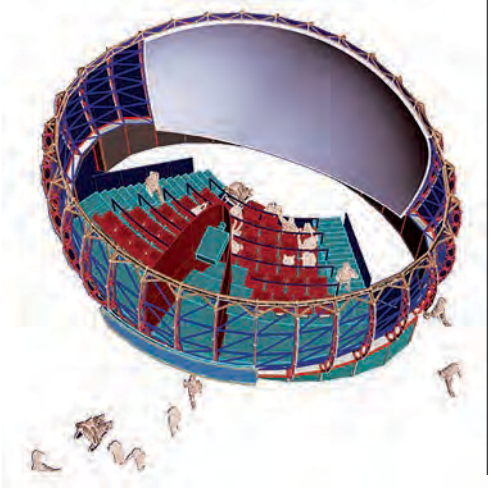
Once we have solved some of these problems, nature will take its course. Film-makers will do whatever they want and studios will do whatever they want. No-one can control that. Things will drift towards more shorter high-impact content and a more rapid turnover at the box office. Look at the audience and their demographic — their attention span is short.

MT: One of the original promises of IMAX was their saying that one day there would be feature films made in the IMAX process — but that never materialised. Do you forsee the production of feature films in the MAGI process or do you think it is initially all about short length content?

DT: Yes — IMAX tried to keep that promise going for as long as they could. As regards MAGI this is how we see it: the penetration of this process into the mainstream cinema business may take a significant amount of time because there is such lethargy about any future trajectories — it currently isn't going anywhere, doesn't seem to want to go anywhere. I put out as much press as I can about what we are doing. Nobody from the →

"IT IS EASIER NOW TO GET THE MOVIE INDUSTRY TO DRAG ITSELF UP BY THE BOOT STRAPS AND ADOPT 120FPS AS A NEW STANDARD"

▼ *MagiPod cinema: schematic*



▲ As the schematic, *left*, and the image, *above*, show, the MAGI pod deliberately steers away from the concept of big audience numbers, instead serving up a premium cinema experience with a small footprint

studios calls me up. But in what we call the location-based cinema business, we know it is commercially adapted to short form high impact entertainment. The interesting economic fact about it is that people will pay eight dollars for four minutes and 12 dollars for two hours. Profit-wise the potential is huge, it is spectacular if you can get sufficient theatres. I have no aversion to short form — I have done theme park rides.

The ideal length is this inverse proportion between intensity and time. That's why when I saw *Gravity*, for instance, I just thought it was great that movie was 90 minutes long. That is what made me feel uncomfortable when *Interstellar* was twice as long — I didn't need that length.

"WANT A STORY? WATCH TV. IF YOU WANT AN EXPERIENCE, THAT'S CINEMA. TV IS ON 24 HOURS A DAY — IT HAS ALL THE STORIES YOU WANT"

There is another component to entertainment. If you want a story, watch television. If you want an experience, that is cinema. TV is on 24 hours a day, it has 500 channels, it has all the stories you want about every conceivable subject matter, so there is no shortfall of stories. I am not against stories. If you want to tell a story, tell a story — romance, comedy, thriller, mystery. If you want spectacular immersiveness, this kind of virtual experiential thing — that is cinema.

There is a different balancing of story and visuals. You don't need to teach anyone how to do it, because it has already happened. These movies that Hollywood is now dragging out are basically storyless action pieces. People like it and that is what is supporting the industry to the tunes of billions and billions of dollars — so go with it. But if you can make that experience so profoundly improved, in terms of comfort, in terms of excitement, and physiological stimulation which is using high frame rates, audiences will be building in cinemas, rather than declining. You can't do anything about the third world and China — what is going to happen there is going to happen and you can't do anything about it.

LOOKING FORWARD

MT: Yes, there is so much evidence that television has now become the accepted medium for story-telling type content, films that where once the province of medium budget studio films.

DT: Major directors and actors are turning to television for storytelling because that is where that action is. That's fine and you can see some really interesting stuff in pay-for-view where it is not constrained by broadcasting restrictions on such issues as profanity and sex and so on. It has become a mature art form and I know people like George Lucas say that as a result of that they think cinema is in terminal decline.

One of the things my wife Julia and I decided about this MAGI concept is that we could talk about it for the next 20 years or we could actually do it. So we built a stage, we shot a test movie, and its not test shots of a pretty face and some flowers. It is a real dramatic story. So even though it is not big, it is an expression of a short test film, in the convention of the story-telling dramatic cinematic format. But it is more immersive and embraces the audience as a participant.

You can say we did it in our backyard and that it is a home movie taken to the extreme and we are very proud of it. But it was also the point that I knew I would never get back on the track of directing unless I directed something. So I wrote it, directed it and financed it myself and I hope it will be a stepping stone to be taken seriously again. Also to be taken seriously as one of the very few filmmakers who understands exactly where to go with this medium aesthetically, in that kind of *2001*-immersiveness way, which has not been replicated in 50 years — no one understands it. **CT**

CONCLUSION

At the end of the interview I realised how good it had been spending some time with Douglas and Julia Trumbull discussing views on cinema and the pursuit of cinematic virtual reality. They were generous with their time and the information they shared. Douglas did share the fact that Ang Lee had spent time at his studios looking at what he and his team had achieved.

Readers may recall that the June 2015 issue of *CT* featured a short report that Ang Lee's latest film *Billy Lynn's Long Halftime Walk* was to be shot in 3D, at 4K resolution and 120 fps. In the report, Julian Pinn confirmed that the film was to be shot at 120fps per eye, not the 60fps per eye that some had suggested. For release to many projectors, the 120fps per eye master would require downwards conversion. It is understood that Ang Lee was heavily influenced by Doug's work on MAGI. The day when both a short, and a feature, produced at 120fps, by two significant filmmakers striving for a better virtual experience, has arrived.

Learn more about the work of Trumbull Studios at www.douglastrumbull.com

With grateful thanks to Douglas and Julia Trumbull, and the National Media Museum Press Office.