



Engaging adults in a 3D planetarium



Andrew Glester
University of the West of England, Bristol
Bristol, United Kingdom
andrewglester@gmail.com

Planetariums are evolving. In July 2015, the @Bristol Planetarium became the first 3D planetarium in the UK. Families frequent during the day, but little research exists considering the impact on adults in planetariums. This research sought to explore the role of the new 3D planetarium in communicating science with adults. Exclusively adult audiences attended three different shows and filled in self-completion questionnaires designed to test whether they were inspired and engaged and whether they learned anything. The literature review explored informal learning and existing efficacy research and tracked the evolution of planetarium research from 2D to full-dome, 3D.

3D or not 3D?

Previous research into the use of 3D in a planetarium is scarce due to the novelty of the technology in operation (Schnall, Hedge and Weaver, 2012).

The first 3D planetarium in France saw an increase of 44% of paying public visits to the planetarium, after it was upgraded to 3D, compared to the previous three years (Frappa, 2012), suggesting that the technology can attract new visitors. In terms of education, a study of 498 adults visiting another 3D planetarium in 2014 found that there was no difference in short term learning between 2D and 3D versions of the same film. From this study, 123 of the participants were also interviewed 6 months later and only those who had seen the 3D version of the film showed long term learning gains (Price, Lee, and Malatesta, 2014).

In 2010, Price and Lee found that, in a sample of 19 middle school students, there was no increase or decrease in accuracy for either 2D or 3D, but that those who had experienced the 3D aspects took significantly longer to complete the same tasks (Price and Lee, 2010).

Wyatt argued that the switch from 2D star mapping to full-dome video demanded a new

approach to the production of planetarium shows with a greater focus on the audience experience (Wyatt, 2005). Given the importance of the audience experience in the new 3D planetarium, the question of whether the audience feels that the 3D enhanced their experience comes into focus.

Methodology

The study was conducted at the planetarium at @Bristol Science Centre between June and October 2015. Three events were selected for the study: *Planetarium Nights*, *Aliens*, and *Blue Marvel*. The *Planetarium Nights* show covered stargazing, navigating the night sky, Greek myths of constellations, and the science of astronomy. Created by the team at @Bristol, it combined a live narrator with a mix of full-dome 3D and 2D films and demonstrations of the night sky. There were a total of 380 attendees.

Blue Marvel is a show about how space exploration has led to a deeper understanding of Earth ecology and the importance of looking after our planet. There were 4 programs with a total of 380 attendees.

The *Aliens* showings were a screening of the James Cameron 1986 film. The *Aliens* sample is the control group, consisting of a group of adults using the planetarium without any science communication taking place within the planetarium itself. There was no narrator. There were a total of 190 attendees.

For all three events, audience members were invited to explore the Space Gallery before

Why did you come to see the show in the @Bristol Planetarium?

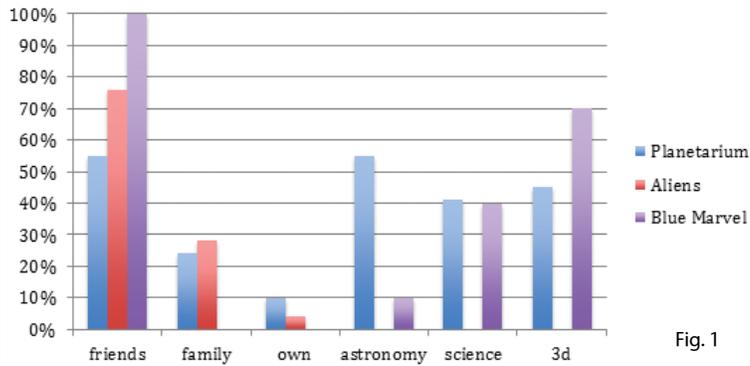


Fig. 1

Would you like more or less Myths, Stargazing, Science

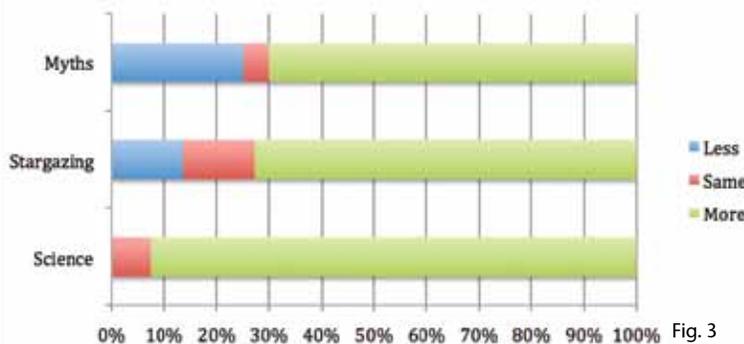


Fig. 3

How often do you look up at the stars/go stargazing?

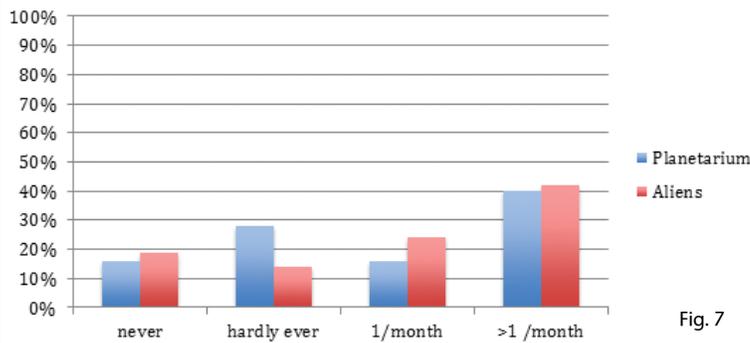


Fig. 7

Do you think that will increase as a result of seeing this show?

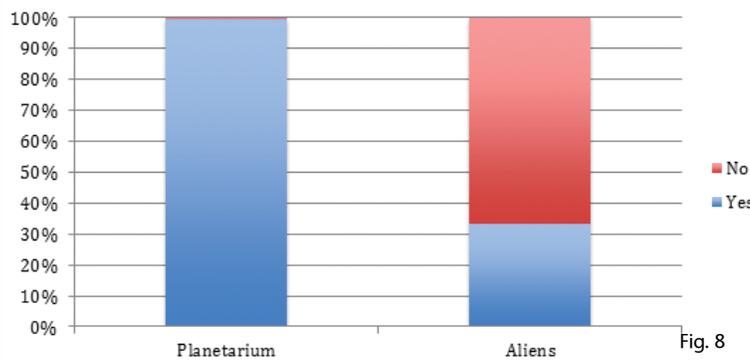


Fig. 8

Facing page: Adults in the @Bristol Planetarium. Photo by Lee Pullen. Glasses illustration from shutterstock.com. Remaining graphs and images from the author, except where noted. Note about identification: the figures retain their numbering from the author's master of science degree dissertation *Sitting outside the Milky Way: Communicating Science with Adults in a 3D Planetarium*.

Go to www.ips-planetarium.org/?page=EngagingAdults to read the entire paper.

and after their show. The Space Gallery was newly launched in June 2015 alongside the 3D planetarium upgrade and is made up of a combination of static and interactive exhibits which explore different aspects of space science. For the *Blue Marvel* event, the audience had access to the whole of the @Bristol Science Centre for an evening event exploring the theme "Earth."

Attendees self-completed questionnaires after the shows.

New and established audiences

Every show was sold out, suggesting a healthy adult audience for planetarium shows. Some 55% of the *Planetarium Nights* audience and only 10% of the *Blue Marvel* audience declared an interest in astronomy (Fig. 1) as a reason for them attending. With only 41% and 40%, respectively, citing an interest in science as a motivating factor, it seems that the 3D planetarium is an opportunity to reach adult audiences with varying degrees of interest in science and astronomy.

The audience for the *Blue Marvel* were at @Bristol for a special late night event, where the whole science centre was open exclusively to adults.

Some 45% of those who came to see the *Planetarium Nights* show did not cite an interest in astronomy and 60% did not declare an interest in science.

The new 3D upgrade of the planetarium was a motivating factor for 45% of the *Planetarium Nights* audience and 70% of the *Blue Marvel* audience. Another 19% came to experience the new 3D planetarium without declaring an interest in science or astronomy. A further 24% came with an interest in science but not astronomy; and 38% came because they were interested in astronomy but were not motivated by the new 3D planetarium or an interest in science.

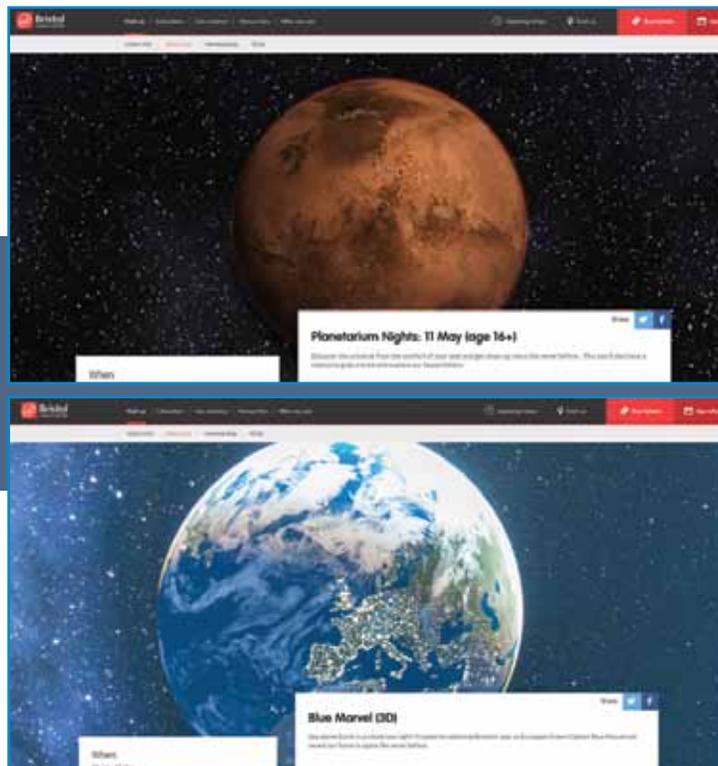
Inspiration

For *Planetarium Nights*, 96% of the audience thought that they would go stargazing/look up at the stars more often as a result of seeing the show (Fig. 8). The 4% who did not think it would increase said they were already doing it more than once a month (Fig. 7). That is compared to 33% of the *Aliens* screening.

The test of inspiration for the *Blue Marvel* audience was more complicated. The audience were asked whether they thought the show would elevate the importance of "potential environmental impact" in their minds when considering a range of activities.

The show featured 3D visualisations of the energy consumption of the UK in terms of renewable energies and the carbon and money saved by @Bristol by using renewable energies. This seems to have inspired the audience to act; after the show, 60% said they thought that potential environmental impact would be more important when

(Continues on next page)



Screenshots of @Bristol programs by editor



TM & © 1986 Twentieth Century Fox Film Corporation

they selected energy suppliers. Some 70% said it was already important to them, and 40% said it would be elevated in importance for each of home improvements, going on holiday, and shopping.

Engagement

Participants used the comment spaces on the questionnaire to express their delight, with words like “The WOW factor,” “Great. Keep it up,” “Breathtaking,” and “Great show-will come again” for *Planetarium Nights*. With 100% of the *Planetarium Nights* and 80% of the *Blue Marvel* audiences rating the shows as good or very good, it appears that they were engaged by the shows. It is interesting to note, by contrast, that 60% the audience for *Aliens*, seeing a film they presumably love to see again, rated it as very good, compared to 90% for *Planetarium Nights*.

What are they engaged with?

Some 93% of the *Planetarium Nights* audience, who saw a show which was 54% science, wanted more science. (Fig. 3). None of them wanted less science, but 24% wanted less about myths and 14% wanted less stargazing. (14% of the show was stargazing and 12% was about myths.) The audience were getting a lot of science and wanted more. The suggestion is that the science in the show was engaging them most of all.

The responses to the question “What was the most memorable/best part of the show?”

also provide insight into what engaged the audience most. With 33% of the *Planetarium Nights* audience referencing Saturn, 11% the Milky Way Galaxy, 15% Pluto, 4% black holes, and 11% the commentary, the science content was the most frequently recalled. The 3D aspects (11%), travelling through the universe (15%) and close ups (19%), combined with Saturn, Milky Way, Pluto and black holes, all suggest that the audience were engaged by the 3D nature of the show and 100% of the audience said that the 3D enhanced their experience.

Did they learn anything?

Further studies are needed to evaluate how much information is retained long term from a 3D planetarium show and this study can only consider whether the audience felt they had learned something.

Some 100% of the *Planetarium Nights* show said they learned something. While 100% is often a concerning statistic, the show does cover a wide range of topics, from classical myths to the latest science from the New Horizons mission. As such, it is likely that few people would already know everything they heard in the show.

For *Blue Marvel*, 90% of audience said they learned something new.

Fifteen people from the *Planetarium Nights* audience gave 26 responses to the question “What did you learn?” 62% of the responses referenced an aspect of the science in the show, 27% said they learned something about

stargazing, and 11% about myths. Again, this suggests that the audience was most engaged by the science, as it seems unlikely that 89% of the audience would know that in Greek mythology Lyra was the source of all music on Earth, for example.

The impact of the use of 3D

All audience members said that the 3D enhanced their experience and often cited a 3D aspect of the show as their most memorable/best part of the *Planetarium Nights* show. After the *Planetarium Nights* show, 70% of the people who answered the question chose something which was shown in 3D as the most memorable/best part of the show, with 11% specifically stating that the fact that it was in 3D was the most memorable/best part.

For *Blue Marvel*, which was entirely in 3D, 20% said that the fact that it was in 3D was the most memorable/best part, 20% said it was the perspective afforded to them by the stereoscopy, and 40% said it was seeing the planets, which were in 3D, like the rest of the show. The remaining 20% said that it was the information in the show which was the best/most memorable thing about it.

Planetarium Nights, which mixed 2D and 3D, was rated more highly than the *Blue Marvel*, which was entirely in 3D. There are some suggestions that shows which combine 2D and 3D do engage audiences more effectively than those which are entirely in 3D (Gandolfi et al. 2005; Plummer et al., 2013)

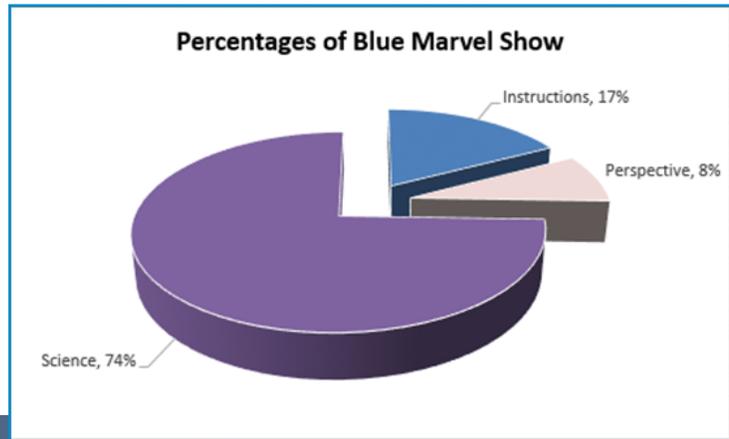
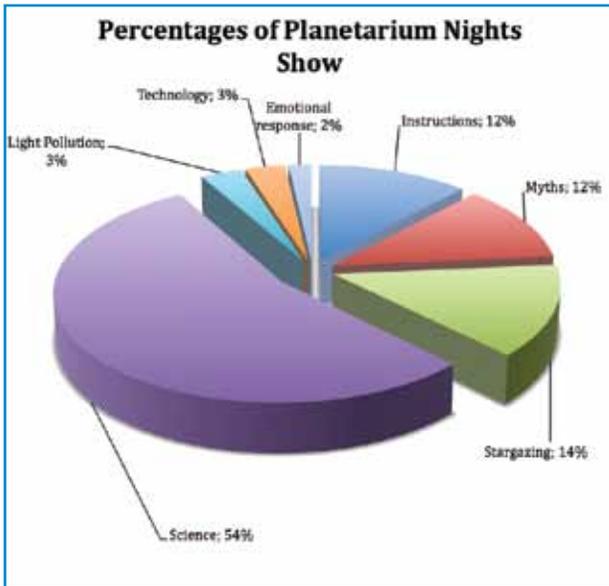


Fig. 15 (left): Content analysis: Percentages within *Planetarium Nights Show*;
Fig. 16 (above): Content analysis: Percentages within *Blue Marvel Show*

The impact of the 3D on learning and retention of information remains an intriguing area for further study. If audiences are more entertained, are they less (or indeed, more) educated, inspired or engaged by the science if the show is in 3D? Does seeing the show in 3D increase the retention of learned information as has been previously suggested (Price, Lee and Malatesta, 2014)



Attention to detail: The signage for the viewing of *Aliens*, especially for hard-core fans of the movie. LV-426 was the name of the moon (one of three known orbiting Calpamos in the Zeta2 Reticuli system, 39 light years away from Earth) that was the setting for the alien action.

Conclusions

There is a suggestion from the literature that a mix of 3D and 2D within a show leads to a more engaging and enjoyable experience for the audience (Gandolfi et al. 2005; Plummer et al., 2013). There seems to be some support for this suggested within the results of this research.

It will be interesting to see how audience reactions change as audiences get used to experiencing what the new 3D technology can offer in a planetarium setting. There is a strong suggestion from this and other research

(Frappa, 2012) that audiences are increased in volume and enjoy the show more when 3D is used as part of the show in the early months of operation.

The interest in 3D films appears to wax and wane, and it will also be interesting for further research to see if this is also true of the use of 3D within planetariums.

It would appear that the 3D planetarium of today remains a way to attract and engage new audiences with science. Astronomy and climate science were both well received by the audiences. In addition, the audiences were sufficiently inspired by the shows to wish to change their behaviours accordingly. It would be interesting for further research to design studies which follow up on this to see if those intentions are followed through.

Planetariums attract audiences around the world and the new 3D capabilities appear to be another opportunity to attract audiences who are not all already interested in science and astronomy as well as those seeking to indulge their interest in science and astronomy. Careful programming and the creation of engaging shows will be needed to maintain this high level of interest, but the opportunities are there as adult planetarium audiences are entertained, engaged, inspired and feel as though they have learned something.

References

Frappa, E. (2012) "Saint-Etienne, First 3D Plan-

etarium in France: Review after 6 Months of Operation." IPS conference, July 22-26, 2012, Baton Rouge, Louisiana.

Gandolfi, G., Catanzaro, G., Giovanardi, S., Masi, G. and Vomero, V. (2005) "New Perspectives in Planetarium Lectures." ESO/ESA/IAU Conference, Communicating Astronomy with the Public, 14-17 June 2005, ESO HQ, Garching, Munich, Germany.

Plummer, J. D., Kocareli, A. and Slagle, C. (2013) "Learning to Explain Astronomy Across Moving Frames of Reference: Exploring the role of classroom and planetarium-based instructional contexts," *International Journal of Science Education*, 36(7), pp. 1083-1106. doi: 10.1080/09500693.2013.843211.

Price, A. and Lee, H.-S. (2010) "The Effect of Two-dimensional and Stereoscopic Presentation on Middle School Students' Performance of Spatial Cognition Tasks," *Journal of Science Education and Technology*, 19(1), pp. 90-103. doi: 10.1007/s10956-009-9182-2.

Price, C. A., Lee, H.-S. and Malatesta, K. (2014) "Stereoscopy in Static Scientific Imagery in an Informal Education Setting: Does It Matter?" *Journal of Science Education and Technology*, 23(6), pp. 721-734. doi: 10.1007/s10956-014-9500-1.

Schnall, S., Hedge, C. and Weaver, R. (2012) "The Immersive Virtual Environment of the digital fulldome: Considerations of relevant psychological processes," *International Journal of Human-Computer Studies*, 70(8), pp. 561-575. doi: 10.1016/j.ijhcs.2012.04.001.

Wyatt, R. (2005) "Planetarium Paradigm Shift," *Planetarian*, 34, No.3. ☆

Andrew Glester recently completed his master's in science communication from the University of the West of England in Bristol and is now coordinator of the Space Universities Network and the host of The Cosmic Shed and Physics World podcasts. Check out his work at:
-www.youtube.com/channel/UC0jythXs3CuC-Ld2i-qVDpg
-thecosmicshed.com
-blog.physicsworld.com/2017/03/09/guest-presenter-shakes-up-the-physics-world-podcast