

# 34th Annual Stereoscopic Displays and Applications Conference - Introduction

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## Abstract

*This manuscript serves as an introduction to the conference proceedings for the 34<sup>th</sup> annual Stereoscopic Displays and Applications conference and also provides an overview of the conference.*

## Introduction

The 34<sup>th</sup> annual Stereoscopic Displays and Applications (SD&A) conference was the first in-person SD&A conference since the last in-person conference was held in Burlingame in January 2020. Little did we know then that the next two conferences would be held online due to the COVID-19 pandemic. The 2023 SD&A conference was held at the Hilton Parc 55 Hotel in downtown San Francisco as part of the 35<sup>th</sup> annual Electronic Imaging Symposium.

The Electronic Imaging Symposium ran over the dates Sunday 15 to Thursday 19 January 2023 and the SD&A conference was active Monday through Thursday.

This year the conference had 13 oral presentations including two keynote presentations. Additionally, the SD&A conference held joint sessions with The Engineering Reality of Virtual Reality (ERVR) conference, The Human Vision and Electronic Imaging (HVEI) conference, and the Imaging for XR workshop which included another 22 oral presentations.

The final conference program is available on the SD&A conference website:

[www.stereoscopic.org/2023](http://www.stereoscopic.org/2023)

The program webpage also identifies which presentations have an accompanying manuscript and where to find it. Some of the papers are published in the Journal of Imaging Science and Technology (JIST) and are indicated with the designation "JIST first" since manuscripts submitted this way go through an accelerated full review process.

All of the published manuscripts from SD&A 2023 along with the other papers from the 2023 Electronic Imaging Symposium will be published open-access in the IS&T Digital Library at:

<https://library.imaging.org/ei>

Papers in the joint sessions can only appear in one proceedings volume so they may appear in the proceedings volume of one of the contributing conferences rather than the SD&A proceedings. The SD&A 2023 program page will provide a direct link to each of the manuscripts:

[www.stereoscopic.org/2023](http://www.stereoscopic.org/2023)

All manuscripts from the SD&A 2023 conference and the Electronic Imaging Symposium are published Open Access which significantly improves the visibility and accessibility of all work published through the Electronic Imaging Symposium.

## First Day

The first day of the SD&A conference had three technical sessions, plus the first EI Plenary and EI Highlights session.

The first keynote presentation of SD&A 2023 was presented by Shawn Frayne from Looking Glass Factory titled "The long-awaited arrival of holographic interfaces" – see Figure 1.



Figure 1. Shawn Frayne delivers his SD&A Invited presentation "The long-awaited arrival of holographic interfaces".

Shawn is a graduate of MIT (Massachusetts Institute of Technology) and got his start in 3D with a classic laser interference pattern holographic studio he built whilst in high school (Figure 2), followed by training in advanced holographic film techniques while at MIT. The presentation also charted the progression of autostereoscopic displays – holographic interfaces as he refers to them in this presentation – in terms of their volumes: 1→100, 100→100,000, 100,000→10,000,000, and 100,000,000→1,000,000,000 (Figure 3).

Shawn brought along the company's 32" Looking Glass Display to show at the conference, and also discussed their new 65" Looking Glass Display.

The two SD&A technical sessions this day were titled "Stereoscopic Displays" chaired by Bjorn Sommer and "Stereoscopic Simulation" chaired by Andrew Woods. In this last session Andrew Woods presented an in-memoriam slideshow acknowledging the recent passing of Lenny Lipton. The full listing of the individual presentations in these sessions are provided on the conference program web page:

[www.stereoscopic.org/2023](http://www.stereoscopic.org/2023)

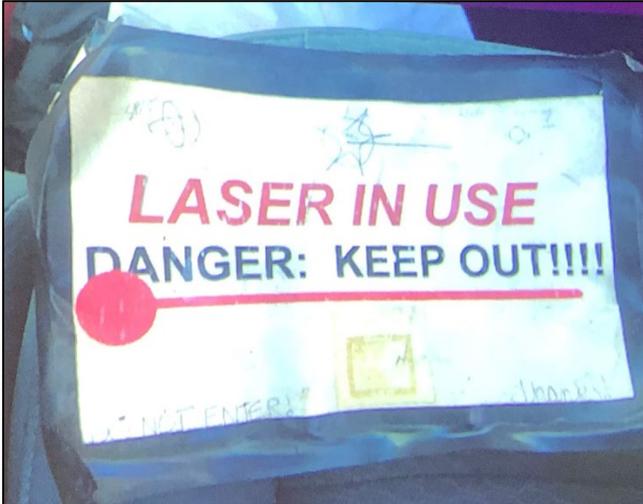


Figure 2. Sign on Shawn Frayne's bedroom door as a teenager in the 1990s to ensure his holographic exposures being taken with a very low-cost low-power HeNe laser were not disturbed.



Figure 3. A slide from Shawn Frayne's keynote presentation discussing the progression of autostereoscopic displays in terms of their volume – here the first 100 → 100,000.

One of the advantages of hosting an in-person SD&A conference was the opportunity to return to our regular Tim-Tam-Slam tradition in the coffee breaks (Figure 4) – thanks to a fresh supply provided by Andrew Woods and Eric Kurland. For those unfamiliar with a Tim-Tam-Slam we'll let you do a web search, or just join us at the next SD&A for a demonstration. This year there was also an English imposter, the Penguin – a chocolate biscuit with surprising similarity to the Tim Tam. The consensus amongst those that tried was that a Penguin-Slam was possible, but a lot harder to achieve. Also, a "Penguin-Slam" just doesn't sound right.

Later in the day was the first EI Plenary presentation titled "Neural Operators for Solving PDEs" by Professor Anima Anandkumar from California Institute of Technology and NVIDIA. This was followed by the newly introduced EI Highlights Session which included short preview presentations of one highly anticipated presentation from most of the EI Symposium conferences. The preview presentation for SD&A was from Bonnie Posselt who gave a teaser of her keynote presentation which would be delivered the following day.

In the evening was the EI Reception and the SD&A 3D Theater Session.



Figure 4. The return of the Tim-Tam-Slam at SD&A: (a) the selection of Tim Tams and the hot beverage of your choice, (b) Bjorn Sommer and (c) Dan Lawrence demonstrating their technique.

### SD&A 3D Theater Session

The 3D Theater session, held this year on the evening of Monday 16 January, is an opportunity to showcase a wide range of stereoscopic video content on the big screen that we have setup in the conference meeting room. The SD&A 3D Theater Session been a regular fixture of the SD&A conference for more than 20 years.

The 3D Theater session included a competition for best film in each of two categories, Animation and Live-Action. The event also featured a selection of Hollywood studio 3D films, and other special content, that was shown out-of-competition for demonstration only.

The 3D content that we screened at this year's session is as follows:

**Competition Category:**

1. "10 Years Old" from D. Carlton Bright (USA)
2. "3D Fractal" from Masuji Suto (Japan)
3. "3D PL(AI)ING" from Lluís Dubreuil (Spain)
4. "City of Dreams, City of Doom" from John Hart (USA) – winner in Animation category 🏆
5. "Coluna Vertebral Equina – Horse Bones" from Hélio de Souza (Brazil)
6. "Extrudía 3D" from José Eon (France)
7. "From The Air" from Maximus Clarke (USA)
8. "Hidden Pond Farm Equine Rescue" from Variety Films / Jonathan Sabin (USA)
9. "Ingrid Bennabbas, Chromadepth Artist" from Christian A. Zschammer (Germany)
10. "ISU World Congress 2023 in Tsukuba, Promotional Video" from Takashi Sekitani (Japan)
11. "Memories of Shared Air" from Peter Rose (USA)
12. "Misfit" from Steve Segal (USA)
13. "Philosophy no Dance – Don't Stop The Dance VR Music Movie – Heat and Passion ver." from Sony Music Entertainment (Japan) Inc. (Japan)
14. "Skateparks of Perth 3D" from Brendan Ameduri (Australia) – winner in Live-Action category 🏆
15. "Slo Mo Afterglow" from Mark Willke (USA)
16. "The Future of Houses: Designing for a Circular Economy" from Kath Dooley (director) (Australia)
17. "The Old, The New and The Other" from Sebastien Simon, Alaric Hamacher, and Minchol Cha (South Korea)
18. "The Search for Snow" from Jacqueline Farmer and Cyril Brabançon (France)
19. "Three Preludes" from Aleksey Osipenkov (Russia)
20. "Walking on the Ceiling 3D" from Andrey Anokhin (Russia)
21. "Wreckage from HSK Kormoran" from Andrew Woods, Curtin University (Australia)
22. "You Ought to be in Pictures" from Robert Bloomberg (USA)

**Demonstration only**

23. "Ant-Man and the Wasp: Quantumania" trailer from Marvel Studios (USA)
24. "Avatar: The Way of Water" trailer from Lightstorm Entertainment (USA)
25. "Elemental" teaser trailer from Pixar Animation Studios (USA)
26. "Guardians of the Galaxy Vol. 3" trailer from Marvel Studios (USA)
27. "I, the Jury (from 1953)" from ClassicFlix (USA)
28. "In Memoriam: Lenny Lipton, 1940-2022" from SD&A Committee (USA)
29. "Strange World" trailer from Walt Disney Pictures (USA)

We wish to thank all of the contributors who graciously allowed their 3D content to be screened at our event.

Our judges for the session selected the following winning films:

**Best of Show – Animation:**  
**"City of Dreams, City of Doom"**  
 from John Hart (USA) (see Figure 5)



Figure 5. A still frame from "City of Dreams, City of Doom" by John Hart.

**Best of Show – Live Action:**  
**"Skateparks of Perth 3D"**  
 from Brendan Ameduri (Australia) (see Figure 6)



Figure 6. A still frame from "Skateparks of Perth 3D" by Brendan Ameduri.

Brendan Ameduri received his prizes from Andrew Woods in Perth after the conference (Figure 7).



Figure 7. Brendan Ameduri (left) receiving his prizes from Andrew Woods.

The judges at this year's session were:

- Dr. Bonnie Posselt, Medical Officer, RAF Centre of Aviation Medicine
- Nicholas Routhier, President, Mindtrick Innovations
- Shawn Frayne, Founder and CEO, Looking Glass Factory

Our production team at this year's 3D Theater Session were John Stern, Eric Kurland, Dan Lawrence and Andrew Woods.

We are very grateful for the support of our SD&A 3D Theater Session sponsors: Christie Digital, DepthQ Stereoscopic, and 3-D SPACE.

## Second Day

On the second day, the SD&A conference had three technical sessions, plus the second EI plenary and the joint session with the Engineering Reality of Virtual Reality conference.

The second SD&A keynote presentation was titled "Human performance using stereo 3D in a helmet mounted display and association with individual stereo acuity" presented by Wing Commander (Dr) Bonnie Posselt from the Royal Air Force (UK). Bonnie Posselt is a medical officer and has been studying Helmet Mounted Displays and vision standards for her PhD. Her presentation discussed the effect of stereoscopic 3D on performance when used in a warning alert displayed in an HMD (see Figure 8).



Figure 8. Bonnie Posselt delivering her SD&A Keynote presentation.

The other two SD&A technical sessions were "Stereoscopy in Education and Vergence Accommodation" chaired by Takashi Kawai and "Stereoscopy in VR" chaired by Nick Holliman.

After lunch was the second EI Plenary titled "Embedded Gain Maps for Adaptive Display of High Dynamic Range Images" by Eric Chan from Adobe and Paul M. Hubel from Apple. The plenary presenters were particularly appreciative of the bright SD&A conference projector kindly provided by Christie Digital given the topic of High Dynamic Range.

The joint session with the Engineering Reality of Virtual Reality conference was titled "VR Systems and Immersion" and had six papers.

In the evening was the EI Symposium Demonstration Session chaired by Bjorn Sommer.

## Demonstration Session

The demonstration session was a lively event with symposium attendees visiting the booths from all the symposium conferences to see and discuss what was on show – as a follow-up to content presented in the technical sessions.

This year there were four demonstrations directly connected to the SD&A conference:

- Shawn Frayne and Alvin Lee from Looking Glass Factory (USA) demonstrated the 32" Looking Glass Display, a Looking Glass Portrait Display, and also a 3D capture solution. (see Figure 9 and 10)
- Bjorn Sommer from the Royal College of Art (UK) presented some VR content on a Meta Quest headset (see Figure 11)
- Eric Kurland demonstrated a range of 3D products from 3-D Space Museum (see Figure 12) and a head-mounted 3D projector which allowed him to show 3D movies on a blank wall using active 3D glasses (see Figure 13)
- Andrew Woods from Curtin University (Australia) demonstrated some shipwreck 3D reconstruction footage in anaglyph 3D and some 3D prints of shipwreck sites (sorry – no picture)



Figure 9. Looking Glass displays at the EI demonstration session.



Figure 10. Looking Glass Factory 3D capture solution at the EI demonstration session.



Figure 11. Bjorn Sommer (centre) getting ready to show some VR content to Sharad Sharma during the EI demonstration session.



Figure 12. Eric Kurland (rear) demonstrating a range of 3D products from 3-D Space Museum at the EI demonstration session.



Figure 13. Eric Kurland demonstrating a head-mounted portable 3D projector and (orange) 3D glasses at the EI demonstration session. Just find a blank wall and he can show a 3D movie.

### Third Day

On the third day there were three joint sessions held in cooperation with the Human Vision and Electronic Imaging (HVEI) conference.

The first joint session was a HVEI keynote titled "Display Consideration for AR/VR Systems" by Ajit Ninan, from Reality Labs at Meta.

The second joint session with the HVEI conference was titled "AR/VR" and comprised five technical presentations.

After lunch was the third EI Plenary titled "Bringing Vision Science to Electronic Imaging: The Pyramid of Visibility" by Andrew B. Watson from Apple.

In the late afternoon there was a panel discussion with Alexandre Chapiro, Ajit Ninan, Yuichiro Fujimoto, and Nick Holliman (see Figure 14).



Figure 14. (left to right) Alexandre Chapiro, Ajit Ninan, Yuichiro Fujimoto and Nick Holliman at the discussion forum.

### Fourth Day

On the fourth day of the symposium, the Imaging for XR workshop book-ended the symposium nicely with a set of XR related presentations. This was the second edition of the Imaging for XR workshop, the first one being held fully online in March 2022.

The abbreviation XR stands for Extended Reality and is an umbrella term for Virtual Reality and Augmented Reality topics. This edition of the Imaging for XR workshop

comprised nine technical presentations and also a discussion panel. All of the presentations related to XR/VR/AR technologies in one way or another.

The full program listing for the Imaging for XR workshop is available via the SD&A 2023 webpage: [www.stereoscopic.org/2023](http://www.stereoscopic.org/2023)

Technical presentations at the Imaging for XR workshop did not come with a matching manuscript – you needed to be there!



Figure 15. Gary Yost, holding a 360 camera, presenting at the Imaging for XR workshop.

## Discussion

A huge amount of effort goes into organising and running the SD&A conference and the Electronic Imaging symposium each year. We wish to extend a warm thank you to the many individuals, groups, companies and organizations for their support of this meeting and making it a successful event:

- conference authors and attendees,
- demonstration session presenters for bringing equipment to show,
- providers of 3D content for allowing their content to be shown at the 3D Theater Session,
- the SD&A conference committee: Neil Dodgson, Justus Ilgner, Eric Kurland, Bjorn Sommer, John Stern, Chris Ward and Laurie Wilcox,
- the staff at IS&T (Society for Imaging Science and Technology) - the organizing society instrumental in organizing all manner of aspects for the meeting – and in particular Suzanne Grinnan, Marion Zoretich, Ann McCarthy and Donna Smith,
- the AV staff at the venue managed by Adrian Romero from Spectrum AV.

The SD&A conference website, SD&A Twitter feed, and SD&A LinkedIn group provide a visible location for conference activities throughout the year.

The SD&A website has an extensive collection of content highlighting the activities of past conferences, including a full listing of all conference proceedings volumes, manuscripts and many presentation recordings. In addition, the website hosts the stereoscopic virtual library, which contains several

significant 3D books in PDF format for free download. The SD&A conference website is at:

[www.stereoscopic.org](http://www.stereoscopic.org)

The SD&A conference maintains a Twitter feed to keep everyone informed about SD&A events and activities:

<https://twitter.com/SDnAconf>

The SD&A LinkedIn group is available at:

[www.linkedin.com/groups?gid=1945944](http://www.linkedin.com/groups?gid=1945944)

The conference also has an announce-only mailing list. You can sign up here:

<https://lists.curtin.edu.au/mailman/listinfo/sdalist>

Most presentations at the SD&A conference, and also the joint sessions with the ERVR and HVEI conferences, were recorded and will be made available on the Electronic Imaging channel on YouTube:

<https://www.youtube.com/@ElectronicImaging>

Manuscripts presented at the conference will be indexed via the SD&A conference website:

<http://www.stereoscopic.org/2023>

## Conclusion

Next year's SD&A conference will be held in January 2024 as part of annual IS&T Electronic Imaging Symposium at the Hyatt Regency San Francisco Airport Hotel in Burlingame during the period 21-25 January. Past attendees of SD&A will be very familiar with this hotel and it's large enclosed auditorium. Please visit the conference website for up-to-date information.

Please consider attending, presenting, or demonstrating at the 2024 SD&A conference. Abstracts for the 2024 SD&A conference will be sought soon. Please see the Electronic Imaging website [www.ElectronicImaging.org](http://www.ElectronicImaging.org) and the SD&A website [www.stereoscopic.org](http://www.stereoscopic.org) for details and deadlines. We hope to see you there!

## Author Biographies

*Andrew Woods is an Associate Professor at Curtin University where he manages the HIVE visualisation facility and is a Research Engineer at the Centre for Marine Science & Technology. He specialises in visualisation, stereoscopic 3D imaging, 3D reconstruction, 3D cameras and displays, video electronics, underwater vehicles (ROVs), and engineering software development, with applications in offshore oil and gas, and maritime archaeology. He has BEng and MEng degrees in electronic engineering and his PhD was on the topic of crosstalk in stereoscopic displays. He is a senior member of IS&T. He was the technology lead on the Sydney-Kormoran Project which surveyed the wrecks of HMAS Sydney (II) and HSK Kormoran in 2015, and imaging lead for the survey of the wreck of HMAS AE1 in 2018. In 2017 he was recognised as one of Australia's Most Innovative Engineers by Engineers Australia. He has been co-chair of the Stereoscopic Displays and Applications conference since 2000.*

*Nick Holliman is Director of CUSP London (Centre for Urban Science and Progress) and Professor of Computer Science at King's College London researching the science and engineering of visualization and visual analytics including the fundamental challenges of visualizing big data. This includes working with psychologists to understand how the human visual system processes information, developing novel computational algorithms for the control of image content and demonstrating how these algorithms work in practice in cloud-based software tools and award winning stereoscopic 3D visualizations. He has worked in both industrial and academic environments and is experienced in delivering commercial impact from research outputs.*

*Takashi Kawai is a Professor in the Department of Intermedia Art and Science, Faculty of Science and Engineering, Waseda University, Japan. He received his Ph.D., M.A. and B.A. in Human Sciences from Waseda University in 1998, 1995 and 1993, respectively. His research interests include ergonomics and human factors in advanced imaging technologies such as stereoscopic imaging, virtual / augmented / mixed reality and cross-modal systems. He is a Certified Professional Ergonomist (CPE).*

*Bjorn Sommer is a Research Tutor at the Royal College of Art (London) where he is leading Year One of the Innovation Design Engineering program. He is working on the boundary of Visual/Immersive Analytics and design of ocean-related data, collective behaviour, as well as mesoscopic and molecular data modelling. He has experience since more than a decade in the development of 3D-stereoscopic applications. He holds a B. Sc. in Media Informatics, an M.A. in Interdisciplinary Media Sciences, and a PhD in Bioinformatics from Bielefeld University. From 2015-2016 he was working as a Research Fellow at Monash University (Melbourne), and from 2016-2019 at the University of Konstanz.*