



Everything Everywhere All at Once: AI and the Movies

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Chair, ISO/TC 36 Cinematography



Agenda for the next 10 minutes

- About ISO/TC 36 Cinematography
- The Ever-evolving Technology of the Movies
- Artificial Intelligence in the Movies Today
- Directions, Challenges, Collaboration



Disclaimer and Acknowledgements

The views expressed today are my own and do not necessarily represent those of ISO/TC 36

Furthermore: these views are a compendium of my own, of many colleagues and TC36 members that I spoke with, and from great reports by the Entertainment Technology Center @USC/SMPTE, Variety, The Interwebs, and A24

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ISO/TC 36 Cinematography

- Among the first ISO Technical Committees - c.1952
- Before that: Society of Motion Picture Engineers (SMPE, now SMPTE) - standardized 35mm film and more in 1917
- The Movies (a.k.a. Motion Pictures) is the *only* art form built on technology. And its technology *always* evolves.

MOTION PICTURE STANDARDS

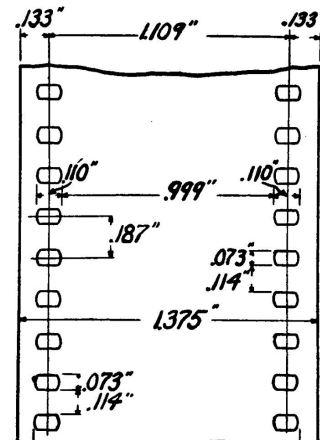
ADOPTED IN COMMITTEE OF
THE WHOLE SOCIETY

The following have been adopted as standards by the Society of Motion Picture Engineers, and are promulgated to encourage uniformity and standard practice throughout the Industry as a whole. Their early universal adoption will save the industry a great deal of present annoyance and monetary loss.

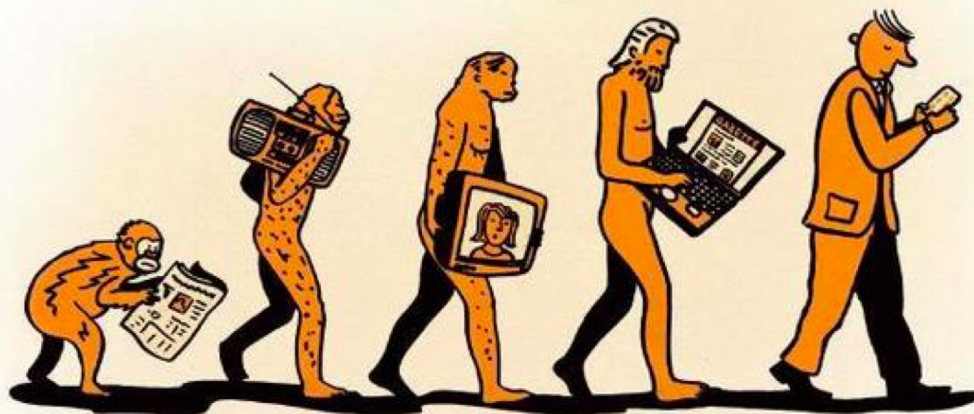
Film speed—A film movement of sixty feet per minute through motion picture mechanisms shall be considered as standard speed.

Frame line—The dividing line between pictures on motion picture film, shall lie exactly midway between the marginal perforations.

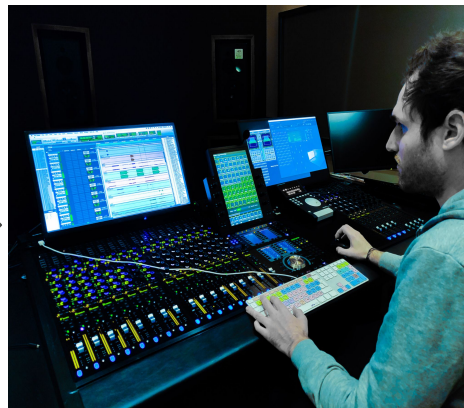
Projection angle—The maximum permissible angle in picture projection shall not exceed twelve degrees (12°) from a per-



Media and Entertainment - ever evolving tech: Human-Machine Teaming from the Get-go

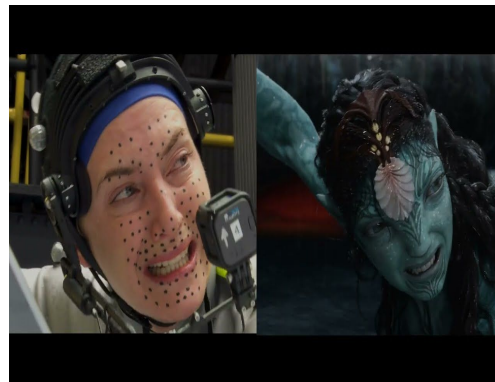


In Production...



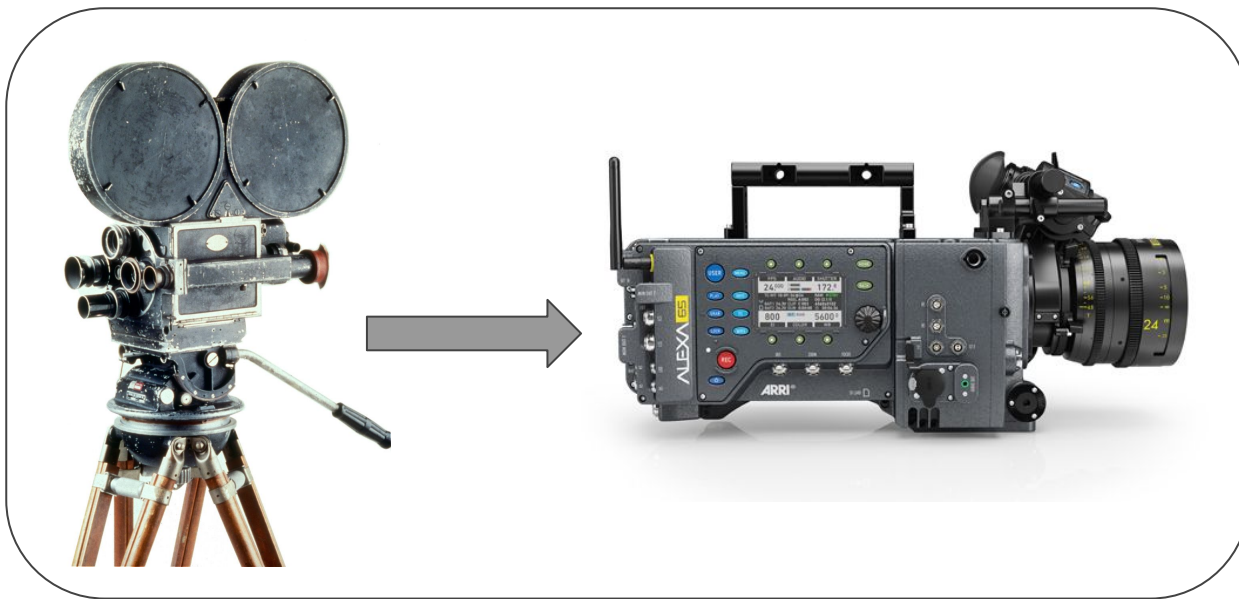
Analog soundtracks (1926) to digital sound (1990s)

In Production...



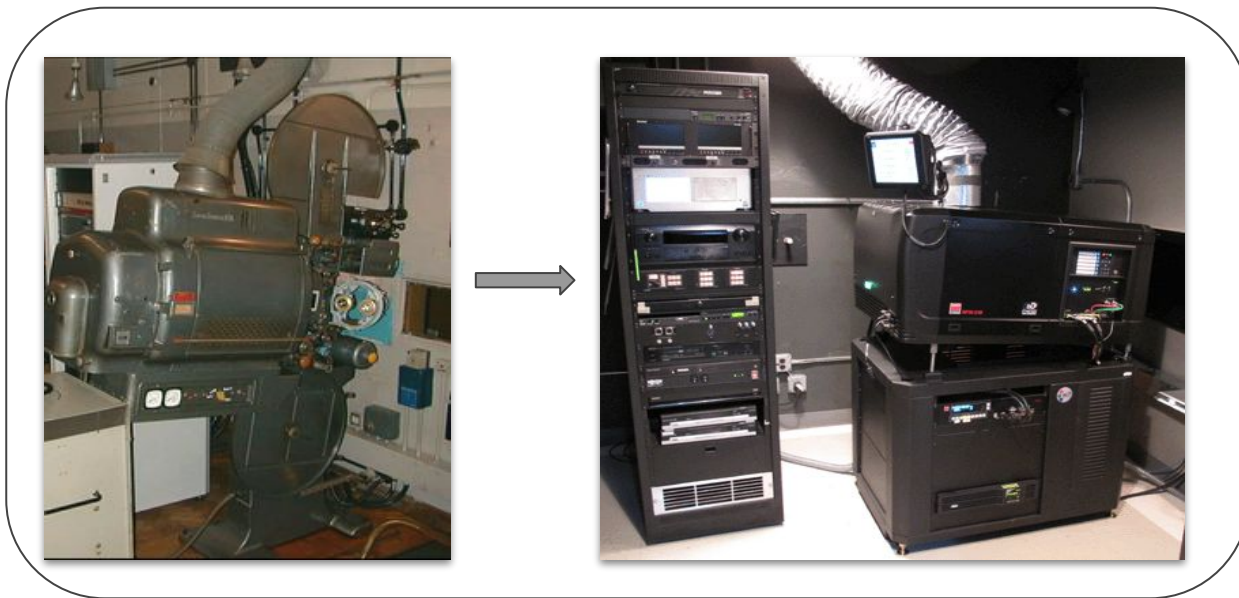
Photochemical visual effects (1930s) to
digital visual effects (1990s -> today)

In Production...



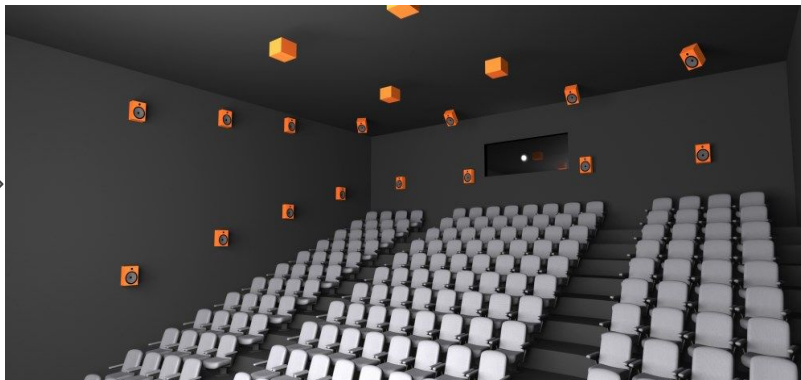
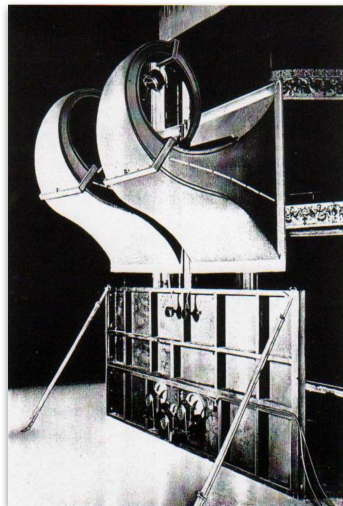
Photochemical film capture (1890s) to
digital cinema cameras (2010s -> today)

And In Theatrical Exhibition



Film projection (1890s) to
Digital Projection (2000s -> today)

And In Theatrical Exhibition



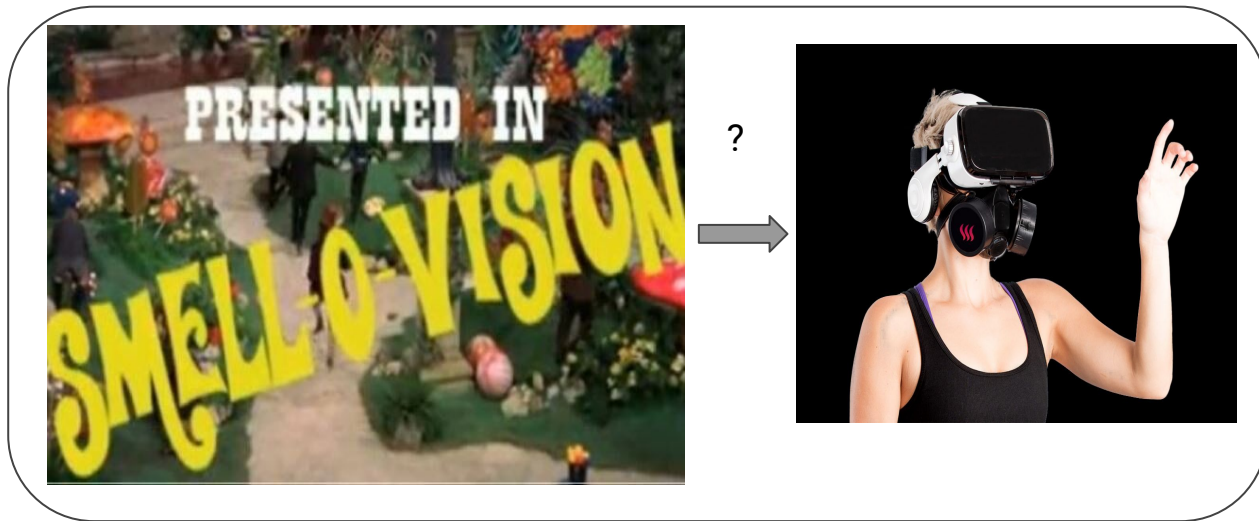
Monaural analog sound (1926) to multichannel
immersive digital sound (1990s->2010s)

And In Theatrical Exhibition



Photochemical film stereoscopic 3D (1950s) to
digital 3D (2000s)

And In Theatrical Exhibition



AI has been *in* the movies a lot and for a long time

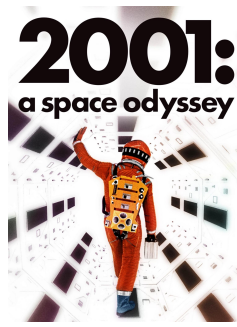
1927



1934



1968



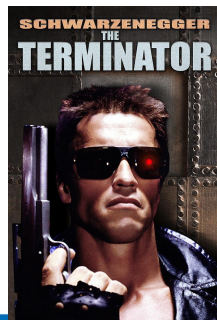
1970



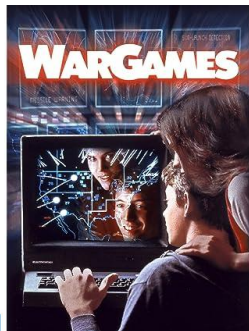
1973



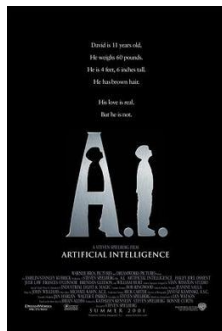
1973



1983



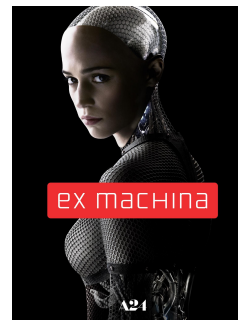
2001



2013



2015



2023



Will (Generative) AI *make* The Movies?



Will (Generative) AI *make* The Movies?



Source: John Minchillo/AP



Source: Chris Pizzello/AP

Probably not by itself for some time (if ever)

➤ AI/ML has been working its way into the movie-making process

bit-by-bit

- Feature extraction, cataloging: improved finding aids for specific characters, locations, props, etc.
- Face and voice replacement (a.k.a. Deep Fakes) - picture and sound
 - e.g., Grand Moff Tarkin (Rogue One), localization
- Image processing:
 - Resolution enhancement
 - Rotoscoping (removing unwanted image elements)
 - Set extensions
 - Color correction
- Sound processing:
 - noise reduction
 - sound effects
 - dubbing

A couple of examples



Spatial resolution upscaling

From The Verge: *[Image: The Red House (1947) / United Artists / Adobe]*

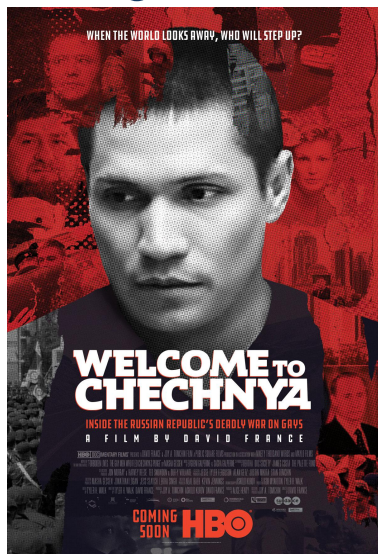
A couple of examples



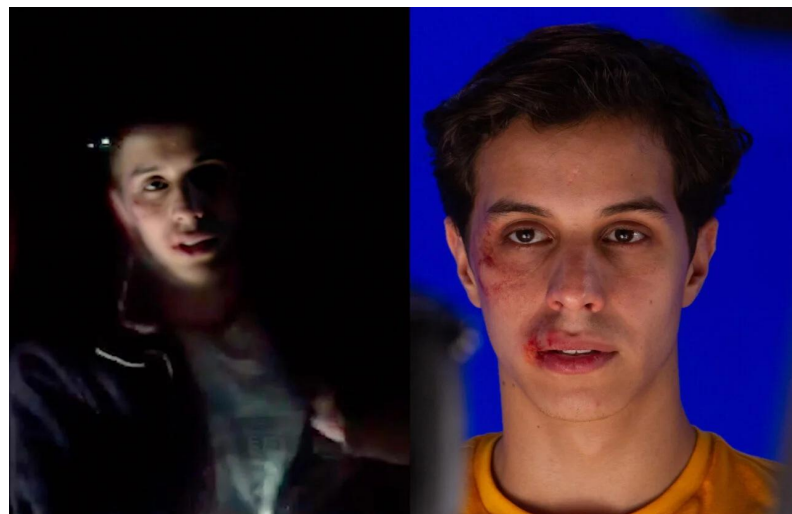
Set extensions

A Notable Success for Gen AI in the Movies

- 2022: First Academy of Motion Picture Arts and Sciences recognition for AI use (Ryan Laney)



Source: Circuit Breaker



Source: The Wrap

Everything Everywhere All At Once

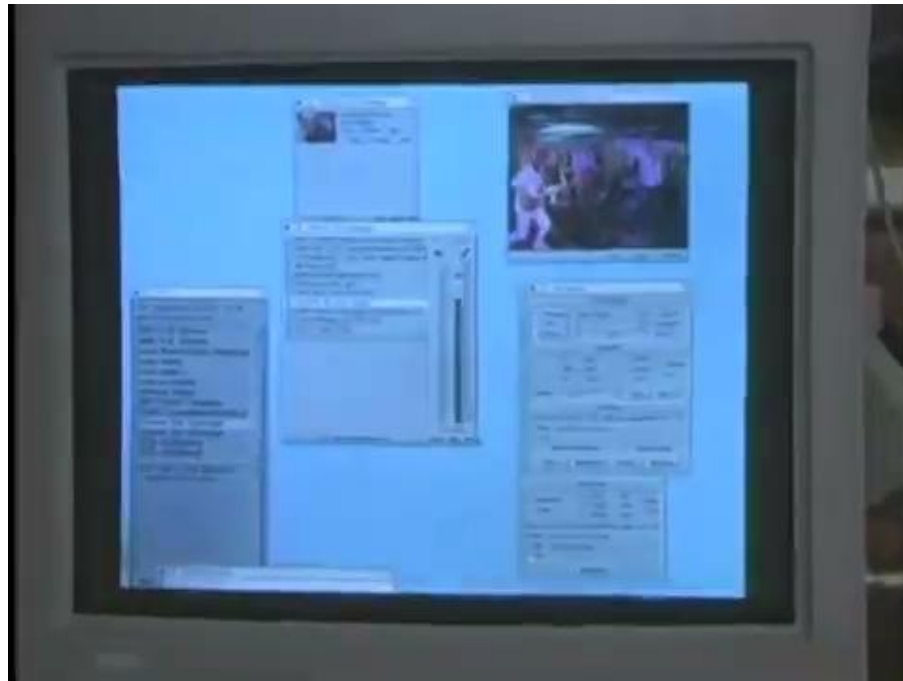
Available AI media tools as of 12/4/23

NOTE: Analytics not included due to their competitive nature

<u>Writing/Composition</u>	<u>Production</u>	Deepomatic	Get3D	Runway	Ziva Dynamics	Digital DNA Studio	Resemble AI	Tabbing
AI Tools	ArtBreeder	Descript	Imagen Video	Sensei	<u>Audio/ Music</u>	Eleven Labs	Respeecher	Analytics
Bard	Axibo	Dream Fusion	Imagend	Shotbox	AI Foundation	Endel	Synthesis	Cinelinx
ChatGPT	BigSleep	Dreamix	Largo.ai	SmartROTO	Amadeus Code	Jukebox	VALL-E	Cinelytic
Claude	Colourlab.ai	EBsynth	Make-A-Scene	Stable Diffusion	Polly	Love	Veritone Voice	MANTIS
CopyAI	ControlNet	eDiff-I	Metaphysic	Starry AI	Amper	Moises	VoiceMod	Merlin
Dramatron	CopyCat	ElectricSheep	MidJourney	Strada	Boomy	Mubert	WaveAI	ScriptBook
Koala.ai	Craiyon	Firefly	NightCafe	Strada AI	Character.ai	Musenet	<u>Coding</u>	Zephyr
NovelAI	Cuebric	Flawless	Phenaki	Vanity AI	Dance Diffusion	Neutron	Code Whisperer	AND
Sudowrite	DALL-E 2	Fotor	PhotoSonic	Veritone	Deep Composer	Papercup	Copilot	MORE
A bunch of tools Bard made up	Deep Dream	GauGAN2	Pika	Voodoo	Deepdub.ai	Replica Studios	Replit	COMING

Never say never?

- A few decades make a difference
 - 1993 - first live stream on the internet
 - 2005 - Youtube
 - 2007 - Netflix
 - 2020s: vA whole bunch of HD/4K/HDR/Immersive Audio/Live streaming services
 - Many standards along the way
 - The production tools and storytelling evolved along the way



Severe Tire Damage - 1993 on the Mbone

Source: https://archive.org/details/CC1232_internet

Where AI is (likely) headed for Movie Production

- Better image and sound quality: a high bar for Professional Use
- More expansive sequences (currently a limited number of frames)
- More automation of mundane/repetitive tasks
- Digital Assistants to improve productivity and reduce costs
- More “Good Enough”
- Improve computing efficiency

What about Standards?

- They are important for the global movie industry
 - US\$40B+ annual box office revenues (COVID notwithstanding)
 - Any “print” can play in any theater around the world
 - First ISO standards for digital presentation published in 2008:
 - Picture and sound data formats
 - Packaging
 - Content Security
 - Presentation quality metrics

What about Standards?

- Historically, production standards come later in the game:
 - Innovation and Creativity require a big, unconstrained sandbox in which to flourish
 - The movie industry is highly distributed; innovation happens organically all over the world
 - Modern example: transition from photochemical film production technology to digital began in the early 1990s, accelerating in the mid-2000s
 - First standard: SMPTE 268M:1994 - Digital Picture Exchange (DPX)
 - Digital Image Structure for Motion Pictures (“24P”): SMPTE 274M:1999
 - Digital Production Standards, SMPTE 2065 suite (“ACES”) and related - 7 standards covering image encodings and file formats (2011)
- We do reference other standards:
 - e.g., ISO/IEC 22028, 11664 (Color); ISO 16363 (Trusted Digital Repositories)
- AI is a new era of The Wild West: it’s in the hands of the Creatives

Possibilities for Collaboration and Standardization

- Leverage work that's already started
- Consider the motion picture industry's requirements because we usually have to adapt (or ignore) existing standards
- Some specifics:
 - Vocabularies, Taxonomies, and Ontologies
 - Training set data formats, interoperability, licensing
 - Ethics - very broad topic, here are a few that matter to us:
 - Safety - e.g., autonomous drones
 - Validation/transparency/repeatability - important for documentary filmmaking, restoring older movies
 - Bias
 - Copyright
 - Workforce considerations: unintended consequences of broad adoption of AI tools
 - Use Cases: Human Machine Teaming

Looking forward to a great conversation

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<https://www.iso.org/committee/48090.html>

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