

the Henry Ford

MAGAZINE
JANUARY-MAY 2018

Gain perspective.
Get inspired.
Make history.



PAGE 28

What happens when a professor of physics starts playing around in a world of make-believe?

MOVIE SCREENS &
CHANGING SOCIAL SCENES
ANIMATION INDUSTRY
IN RETROSPECT
CARS AS FILM STARS

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OUR MISSION.

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KEEP CLIMBING



DELTA



There's a difference between being in a community and being part of it.

Citizens Bank is pleased to present Holiday Nights at Greenfield Village. We love supporting the Henry Ford Museum of American Innovation and its mission to inspire people to learn from America's traditions of ingenuity, resourcefulness and innovation to help shape a better future.

 **Citizens Bank**[®]



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ANIMATION IN MOTION

From ancient cave drawings to Saturday morning cartoons and films like *Frozen*, many steps have been taken to master the illusion of movement

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IS THIS THE REAL LIFE? IS THIS JUST FANTASY?

In today's animation nation, the laws of physics that rule the world we live in are what make the pretend so perfect

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SCREEN TIME PARADIGM

Technology puts us in charge of what we watch, where we watch it and with whom we watch it

STAY, EXPLORE + SAVOR **61**

ON THE COVER

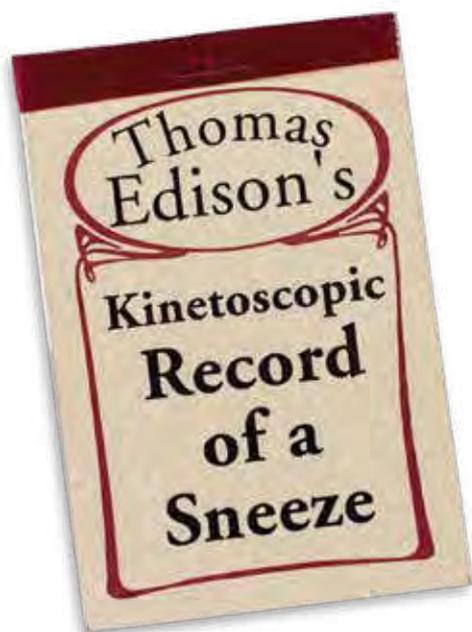
Alejandro Garcia, professor of physics and astronomy at San Jose State University, is well known in the animated movie universe. For nearly two decades, he has been introducing wannabe animators to Newton's Laws of Motion and how force, mass and acceleration can make things make-believe seem more real.

PHOTO BY JAY WATSON

DID YOU KNOW? / *Fred Ott's Sneeze* (also known as *Thomas Edison's Kinetoscopic Record of a Sneeze*) is a short, silent 1894 American documentary film shot by William K.L. Dickson. It was the first motion picture to be copyrighted in the United States. The film was produced by the Edison Manufacturing Company and was viewed through a kinetoscope.

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THE HENRY FORD: A NATIONAL TREASURE AND CULTURAL RESOURCE

The Henry Ford in Dearborn, Michigan, is an internationally recognized cultural destination that brings the past forward by immersing visitors in the stories of ingenuity, resourcefulness and innovation that helped shape America.

A National Historic Landmark with an unparalleled collection of artifacts from 300 years of American history, The Henry Ford is a force for sparking curiosity and inspiring tomorrow's innovators. More than 1.8 million visitors annually experience its four venues: Henry Ford Museum of American Innovation™, Greenfield Village®, Ford Rouge Factory Tour and the Benson Ford Research Center.® A continually expanding array of content available online provides anytime, anywhere access to The Henry Ford Archive of American Innovation.® The Henry Ford is also home to Henry Ford Academy,® a public charter high school that educates 485 students a year on the institution's campus.

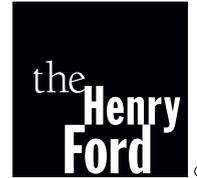
In 2014, The Henry Ford premiered its first-ever national television series, *The Henry Ford's Innovation Nation*, showcasing present-day change makers and The Henry Ford's artifacts and unique guest experiences. Hosted by news correspondent and humorist Mo Rocca, this weekly half-hour show won Emmy® Awards its first two seasons on the air. It airs Saturday mornings on CBS.

For more information, please visit thehenryford.org.

Help us inspire future change makers

The Henry Ford inspires dreamers, doers, movers and makers with stories of the greatest breakthroughs and inventions throughout history. Your support goes a long way toward unleashing The Henry Ford Archive of American Innovation and making our collections available to the world.

The Henry Ford is an independent nonprofit organization. We depend on ticket purchases, income from our stores and restaurants, and tax-deductible contributions and memberships for support. To learn how your generosity can help take it forward, visit thehenryford.org/support.



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IF YOU COULD BE A CARTOON CHARACTER, WHO WOULD YOU BE?

Our contributors tell us.



DAVID A. BOSSERT

If I could be an animated character, it would have to be Jiminy Cricket. He is a diminutive character with a big heart who said, “Always let your conscience be your guide.” Words to live by.

David A. Bossert is an artist, filmmaker and author. A 32-year veteran of The Walt Disney Company, he is a respected authority and expert on the history of Disney animation. He is a member of the CalArts Board of Trustees and a visiting scholar at Carnegie Mellon University’s Entertainment Technology Center in Pittsburgh. Bossert co-authored *Disney Animated*, which was named iPad App of 2013 by Apple and won a prestigious British Academy of Film and Television Arts award. He has also authored numerous books, including *Oswald the Lucky Rabbit: The Search for the Lost Disney Cartoons*.

Screen Time Paradigm, Page 38



FEDOR KOSSAKOVSKI

I would be Flounder from *The Little Mermaid*: always worried about the consequences, but still curious enough to go explore that shipwreck.

Fedor Kossakovski is a freelance science writer and a production assistant at Miles O’Brien Productions, which makes science TV content for the likes of the *PBS NewsHour* and *PBS’ NOVA*. He is especially interested in the connections between science and art.

Is this the real life?
Is this just fantasy?,
Page 28



LINCOLN AGNEW

Hobbes, obviously. But depends what you’re into, I guess. Mickey Mouse has all the money, and frogs get all the girls. Personally, I just need my best friend and some tuna.

Lincoln Agnew is a freelance illustrator based out of Vancouver, Canada. When he’s not reading *Calvin and Hobbes*, you can find him staring at jellyfish or getting lost in the woods.

Screen Time Paradigm, Page 38



JAY WATSON

I wouldn’t mind being the classic O.G. Pink Panther — not the modern version who can talk. The original Panther is slick and likes good music. He can troubleshoot any situation, and he’s always one step ahead of his foes. Plus, pink is the original punk rock color. Gotta respect the pink.

San Francisco-based photographer Jay Watson shoots lifestyle, sports and portrait work, and his favorite venue for photography is the printed single full-page editorial portrait. Some of his clients include *Bicycling* magazine, *Hawaiian Airlines* magazine, Nikon, Porsche and Whole Foods Market. More of Watson’s work can be seen at jaywatson.com.

Is this the real life?
Is this just fantasy?,
Page 28



POLLY LINDSAY

I’m going to go with Mabel from *Gravity Falls*. She’s a creative soul with an overactive imagination who embraces her strangeness — sounds pretty accurate to me. She also has a fantastic collection of colorful motif jumpers and pet pig called Waddles. One can only dream!

Polly Lindsay is a freelance illustrator based in London. She creates colorful layered paper artworks for a range of clients, including Verizon, MasterCard, Starwood Hotels and *Glamour* magazine.

Ask + Answer, Page 7

Collaborate. Educate.
Innovate. Inspire.
These are words often
used at The Henry Ford.
More importantly, these
are words we are putting
into action every day.

Last year was a busy year for us. In early 2017, we changed the museum's name to Henry Ford Museum of American Innovation to better reflect our commitment to inspire people through our collections and stories of innovation. We celebrated the opening of our Davidson-Gerson Gallery of Glass in Greenfield Village and the debut of our new Artist-in-Residence Program with thousands of visitors over the summer. In the fall, *Mathematica* became a permanent exhibition in the museum, and we welcomed General Motors as our new Partner in Innovation. GM contributed \$5 million to The Henry Ford, a gift that is a game changer, allowing The Henry Ford to deepen its community impact and innovative experiences.

In thanks for this historic gift, we named the flexible gallery space in the museum The Gallery by General Motors. The space will continue to host a wide variety of national traveling exhibitions, including *The Science Behind Pixar* through March 18. This interactive exhibition about the science, technology, engineering and math concepts used by artists of the award-winning Pixar studio is what inspired us to delve deeper into animation's history, creative process and social influence in this issue of *The Henry Ford Magazine*.

Evident throughout all the new news and activity at The Henry Ford last year is the spirit of working together with others and creating lasting partnerships that will inspire tomorrow's dreamers and doers. And there is so much more to come. We are partnering with Pearson — a leader in educational publishing, services and resources — to develop courses that will foster problem solving, creativity and innovation in middle school students. In addition, we announced our partnership with the STEMIE Coalition to bring the National Invention Convention and Entrepreneurship Expo to Michigan beginning June 1.

Please join us in the inspiring and change-making work ahead. With generous, invested stakeholders at our side, we can continue celebrating and promoting America's traditions of ingenuity, resourcefulness and innovation to help shape a better future for all.



PHOTO BY BILL BOWEN



PHOTO BY KMS PHOTOGRAPHY

▲ This winter, visitors to The Henry Ford can explore mathematical concepts in the museum's permanent *Mathematica* exhibition (top) and then discover the scientific and mathematic processes used by animation artists in the traveling exhibition, *The Science Behind Pixar* (above).



PHOTO BY ROY RITCHIE

Patricia

**PATRICIA E. MOORADIAN,
PRESIDENT AND CEO**



PAPER ILLUSTRATION BY POLLY LINDSAY/REPRESENTED BY FILLIN GLOBAL

ASK: How did a visit to Greenfield Village inspire the groundbreaking theme park Disneyland?

ANSWER: Greenfield Village just may be the place where all of Walt Disney's evolving ideas for Disneyland coalesced. As Walt Disney relates it, the idea for Disneyland came to him during the 1930s, watching his daughters ride the carousel in Griffith Park in Los Angeles. As he sat there, he thought, "There should be something built, some kind of family park — a park that was clean, safe and friendly — where parents and children could have fun together." He never veered from that foundational idea.

Then there was his lifelong love of steam trains. In 1948, animator and fellow steam train buff Ward Kimball convinced Disney to attend the Chicago Railroad Fair, which included a grand exhibition of old steam trains. After that fair, the two train buffs

visited Greenfield Village, where they oohed and aahed over the small-town atmosphere, the antique cars and the craft shops.

Everything seemed to add up for Walt Disney at that point. Soon afterward, he described his vision, one clearly inspired by Greenfield Village, in a memo:

"The Main Village, which includes the Railroad Station, is built around a village green or informal park ... Around the park will be built the town. At one end will be the Railroad Station; at the other end, the Town Hall ..."

Disneyland, considered the first theme park, opened in 1955. Ironically, during the early 1970s a steam railroad was added around the perimeter of Greenfield Village — likely inspired by the one at Disneyland.

DONNA BRADEN
is curator of public life
at The Henry Ford.

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(F = ma)

Modeling

(MOD-L-ING) N.

First instinct is to envision bombshell beauties like Gigi [Hadid] or Gisele [Bündchen] working the runway in designer dresses. Instead, picture a jeans-clad animator clicking his keyboard to apply fundamental forces of the universe to make what's pretend seem more real.

PAGE 30

Tentpole

(TENT-POHL) N.

We're not speaking of the infrastructure of a temporary canvas structure for sleeping under the stars. These are the mega-budget blockbusters the movie studios hope will bolster their bottom line.

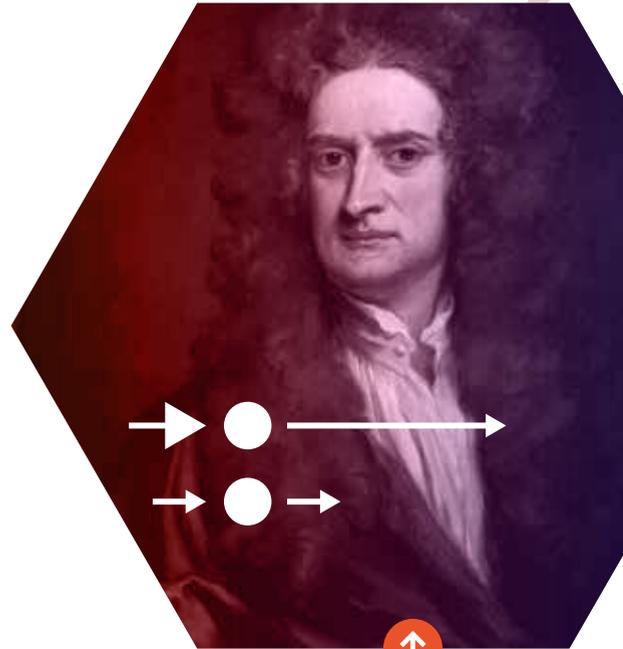
PAGE 44

Park

(PAHRK) N.

The classic definition is a public green space used for recreation. Just about every town has one. But add a little word in front of it — like theme — and it becomes something singular, something magical, something an animator named Walt dreamed up now called Disneyland Park.

PAGE 7

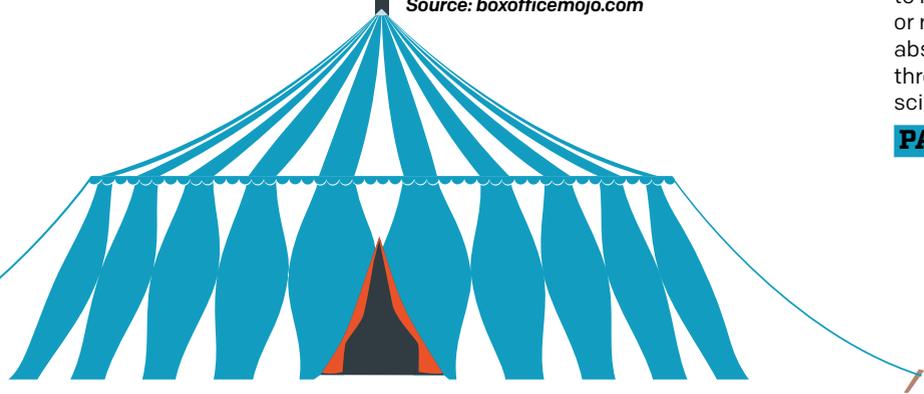


Tentpole Top 20

Animated films in the top 20 of the all-time biggest box office domestic grosses

- #9 Finding Dory (2016)
Lifetime Gross: \$486,295,561
- #14 Shrek 2 (2004)
Lifetime Gross: \$441,226,247
- #18 The Lion King (1994)
Lifetime Gross: \$422,783,777
- #19 Toy Story 3 (2010)
Lifetime Gross: \$415,004,880

Source: boxofficemojo.com



Mirror

(MIR-ER) V.

While always ready to answer the Evil Queen's question, "Who's the fairest of them all?" consider the word in its more active tense: to reflect, resemble or represent the absurdities of society through a scintillating sci-fi satire.

PAGE 10

Force

(FOHRS) N.

F=ma means the force (F) acting on an object is equal to the mass (m) of an object times its acceleration (a). It's Sir Isaac Newton's second-in-line musing on motion that helps explain the mystery behind why one man can move a monster of a machine.

PAGE 33

When dinosaurs ruled the animated world ▶ Of all the possible mixes of characters and creatures, it was animator Winsor McCay's dreamed-up dinosaur, Gertie, that became our first real cartoon star in 1914. Since then, the prehistoric reptile has taken on many animated and computer-generated visual variations — some beloved, others feared, by millions on the big, small and video-game screen: Dino, *The Flintstones* • Littlefoot, *The Land Before Time* • Yoshi, *Super Mario World* • Rex, *Toy Story* • T-Rex, *Jurassic Park* • Tiny the T-Rex, *Meet the Robinsons* • Grimlock, *Transformers: Age of Extinction* • Arlo, *The Good Dinosaur* • Buddy, *Dinosaur Train*



Ask an Archivist

#AskAnArchivist Day is a Twitter-based discussion that provides archivists the opportunity to showcase their profession. With questions fielded from around the globe, here are some of the archival materials The Henry Ford's team was proud to show off last fall.

— Lish Dorset, social media manager, The Henry Ford



Jim Orr, image services specialist:

Someone asked what the strangest photo we had was. This photo of a dog "driving" a Fordson tractor was the strangest I had seen that day.

Kathy Makas, reference archivist:

Because I geek out over Harold Lloyd and love all things classic film, my favorite item is this photo he sent to Henry Ford in 1932, inscribed: "To Henry Ford With kindest personal regards. The first car I ever owned was a Ford in 1914. Harold Lloyd"

Robin Derminer, digital imaging archivist: My family used to travel to the Great Smoky Mountains to visit with relatives quite regularly. This pennant, from the John Margolies Roadside America Collection, reminds me of all of the different types of souvenirs we would buy on every trip. Great times spent with family.



Julia Westblade, digital imaging archivist:

One of my favorite images that I digitized is a photo of disabled World War I veterans showing newly disabled World War II veterans how to use artificial limbs to operate machinery. I like these pictures because there's something so hopeful about the older men taking the time to encourage the next generation and show them that, even though their lives have changed, it doesn't have to hold them back.

Janice Unger, processing archivist:

I love this photo of "Cannon Ball" Baker on the 999. I found it during my first week on the job and was curious who he was and why he was on the car. He has a fascinating story and ended up being the namesake for the Cannonball Run races (and movies).



FROM THE HENRY FORD ARCHIVE OF AMERICAN INNOVATION



STAY CONNECTED WITH THE HENRY FORD. ▶



Futurama

JIM ORR, THE HENRY FORD'S IMAGE SERVICES SPECIALIST, GETS A BIT ANIMATED ABOUT WHY HE'S GOT A SPECIAL AFFINITY FOR AN ANIMATED SCI-FI SATIRE FROM AMERICAN CARTOONIST, ANIMATOR AND WRITER EXTRAORDINAIRE MATT GROENING.

Futurama is one of my all-time favorites. Dreamed up by Matt Groening (of *The Simpsons* fame), the animated sci-fi satire originally ran from 1999 to 2003 and was then revived from 2008 to 2013.

Futurama follows a delivery boy named Fry who was accidentally frozen in 1999 as he adjusts to life in a 31st century that manages to be both utopian and dystopian at the same time. Humans, aliens and robots live and work together peacefully but remain as shortsighted as ever.

Like other great science fiction shows, *Futurama* holds a mirror to our own society and questions what it means to be human, addressing contemporary issues in a fantastical context. Also, the robot is hilarious.

If I'm going to pick and choose episodes that are a must-watch, five come to mind immediately:

- **Anthology of Interest I:** Guest star Al Gore and his team of Vice Presidential Action Rangers are on a mission to protect the space-time continuum.
- **Jurassic Bark:** Fry debates the ethics of using science to resurrect his fossilized dog.
- **Where No Fan Has Gone Before:** This one is an especially thorough homage to the original *Star Trek* — 25 quotloos to anyone who can catch all the references.
- **The Farnsworth Parabox:** The professor creates a cardboard box containing an entire universe.
- **The Late Philip J. Fry:** Fry is forced to test out a time machine that can only go forward.



“Futurama holds a mirror to our own society and questions what it means to be human.”

— Jim Orr, The Henry Ford’s image services specialist

What are we reading + watching?

Brent Embry
SENIOR GRAPHIC
DESIGNER
The Henry Ford

Batman: The Animated Series (1992-95)

Comic books and cartoons fueled my imagination as a kid and planted the seeds of graphic design in me. While Marvel was my main source, my favorite superhero was DC Comics' Batman.

The concept of a multimillionaire-turned-masked vigilante relying only on his detective skills, cool gadgets and burning desire to avenge his parents' murders while dressed as a human bat was intriguing, if not a bit psychotic. With a few exceptions, I love just about any incarnation of Batman, from Bob Kane's in Detective Comics to the campy 1960s TV series and darker big-screen versions by Tim Burton and Christopher Nolan. But Warner Bros. and Fox Kids sealed the deal for me with *Batman: The Animated Series*. Written more like early comics or Frank Miller's Dark Knight stories, it was unlike any cartoon series I'd ever seen.

Sarah Andrus
LIBRARIAN
The Henry Ford

Ernest & Celestine (2012)

directed by Stéphane Aubier, Vincent Patar and Benjamin Renner

Based on the book series of the same name, *Ernest & Celestine* is a 2012 film that follows a bear and a mouse as they form an unlikely friendship that leads to candy, theft, running from the law and a fire.

At its heart, this movie is about finding a way not to be the square peg in a round hole. Excellent voice actors and whimsical animation combine to create a fun movie for all ages.

Donna Braden
CURATOR OF PUBLIC LIFE
The Henry Ford

Lady and the Tramp (1955)

produced by Walt Disney Productions

This 1955 Disney film was ostensibly about dogs. But I recognized — even as a girl — that it offered life lessons about things like jealousy, selflessness and loyalty. And, ah, the romance!

Lady and the Tramp's vibrant, colorful Victorian-era settings dazzled me.

Makes me wonder if this is where my interest in history began?

ALL ABOUT ANIMATION

The Benson Ford Research Center has a diverse collection of resources charting the histories of cartoon characters, comic strips and their creators. For help with access, write to research.center@thehenryford.org.

ANIMATION: HISTORY OF DISNEY, PIXAR

Cartoon: One Hundred Years of Cinema Animation by Giannalberto Bendazzi

Hollywood Cartoons: American Animation in Its Golden Age by Michael Barrier

Before Mickey: The Animated Film, 1898-1928 by Donald Crafton

To Pixar and Beyond: My Unlikely Journey with Steve Jobs to Make Entertainment History by Lawrence Levy

STILL COMICS AND POLITICAL CARTOONS

Thomas Nast: The Father of Modern Political Cartoons by Fiona Deans Halloran

TRADE CATALOGS

Walt Disney's Comics and Stories, Walt Disney Productions (1960)





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INNOVATION NATION

An Emmy Award-winning TV show that airs Saturday mornings on CBS presents inspiring stories that showcase present-day change makers and the possibilities for future progress. Each episode of *The Henry Ford's Innovation Nation* shares dramatic accounts of the world's greatest inventions — and the perseverance, passion and price required to bring them to life.

FreshPaper **14**
Ideas in Action **16**

SEASON 4 EPISODE 3

FRESH SOLUTION

Grandma's home remedy inspires middle school student to overcome one of food's greatest obstacles

It's been a problem since the beginning of time: How do we make food last longer? Early solutions like freezing, drying, pickling and curing certainly solved the problem of meat spoilage, but raw fruits and vegetables have a much shorter shelf life. How can we save them and in turn help solve food shortages around the globe? Innovator Kavita Shukla found her solution to this age-old problem in simple spices.

After downing a glass of tainted water while visiting her grandmother in India, Shukla drank her awa's spice tea concoction and staved off sickness. That experience jump-started her journey into food science.

Back home in her family garage, a middle-school-aged Shukla — now in her early 30s — began experimenting with those same spices, mixing them with dirty pond water that mimicked the contaminated H₂O she drank at grandma's house. Her aha moment came when she dipped a moldy strawberry into her latest spice elixir and watched as the mixture inhibited the bacteria's growth. Armed with success, Shukla's idea for FreshPaper was born, and she set about finding a way to convert her homegrown science experiment into a global product that can help keep fruits and veggies fresh longer and help feed the world.

DID YOU KNOW? /

Kavita Shukla's company, Fenugreen, forgoes traditional advertising and marketing in favor of grassroots campaigning to keep product costs down. Learn more at fenugreen.com/freshpaper

WATCH

See the full episode thehenryford.org/explore/innovation-nation/episodes/globe-maker



► Kavita Shukla, now in her early 30s, is the food science genius behind FreshPaper.

PHOTO COURTESY OF FENUGREEN

THF Magazine ► What exactly is FreshPaper?

Shukla ► It's a little sheet of paper that is infused with organic spice. It can actually keep food fresh for longer periods in a natural way, inhibiting mold growth and extending the shelf life of produce up to two to four times.

THF Magazine ► It smells incredible.

Shukla ► I know. It's this delicious maple scent that's naturally occurring. It's the smell that actually helps people know it's active. In about a month, the smell fades, and then you just recycle it. It's made with edible, organic spices, so it's something that people feel comfortable putting together with their food. You are taking your food as you store it and adding in a little tool that makes it much easier for you to eat fresh food.

THF Magazine ► Can you take us through the process of creating FreshPaper?

Shukla ► I was a kid, so I used what was available in our kitchen. That's why I started with paper. I figured out how to infuse spices into paper and would actually make it in my kitchen. Each sheet would take me about 15 to 20 minutes to make. I describe it as a lot like baking cookies. Eventually, we had to learn to go from making 100 sheets to 500, so we figured out little hacks along the way, like buying paper cutters from Staples and looking to whatever equipment was already on the market — machinery we could find on eBay or maybe a factory that had lost its work. Today, we make millions and millions of sheets right here in the United States — which was really important to me.

THF Magazine ► Globally, where do you see FreshPaper?

Shukla ► I never imagined that FreshPaper would be available in more than 180 countries, that it would be used by farmers, families and retailers at every step of the way from farm to fork. It's amazing to see where we've come in a couple of years. I really want to start to do more to realize our goal of making it something that is available across the developing world.

THF Magazine ► Does FreshPaper have other purposes?

Shukla ► People ask me that all the time. I have a grandpa who puts it in his shoes. If you think about natural mold inhibition, there's actually a lot of applications. People really struggle with baked goods, so I recently created a product for that. I'm looking at flowers, cheeses and breads, and even some different categories. I would love to bring more innovations into people's homes that are natural, simple and sustainable, and help solve challenges.

THF Magazine ► What kind of advice would you share with other young inventors?

Shukla ► Take the first step. It took me almost 10 years to find the courage to take the first step with my idea. The day I did changed everything.



YOU'VE GOT TO KEEP 'EM SEPARATED

Fruits produce a gas called ethylene that becomes a ripening hormone responsible for the ripening process in fruits. Keep ethylene producers away from ethylene-sensitive items — whether stored in the fridge or set out on the counter — for longer-lasting freshness.

ETHYLENE PRODUCERS

- apples • apricots • avocados • ripened bananas • cantaloupe • figs • honeydew • kiwi • mangoes • nectarines • papayas • passion fruit • peaches • pears • persimmons • plantains • plums • prunes • quince • tomatoes

ETHYLENE-SENSITIVE EATS

- unripe bananas • green beans • Belgian endive • broccoli • Brussels sprouts • cabbage • carrots • cauliflower • chard • cucumbers • eggplant • leafy greens • okra • parsley • peas • peppers • spinach • squash • sweet potatoes • watercress • watermelon

IDEAS IN ACTION

A sampling of cool inventions and crazy notions

PROBLEM:

Stress bringing you to your knees.

SOLUTION:

Find tranquility in a tree.

LIVIN' THE HIGH LIFE

People seek peace and solitude through walks in the wilderness and camping in canyons, but treehouse artisan Peter Nelson has literally taken sleeping under the stars to a new level: UP! Designing gorgeous digs that can safely sway while still allowing a tree to grow in girth has been Nelson's life's work. Marrying nature and engineering, Nelson and other treehouse builders have devised a series of bolts and mechanisms that allow trees to move with the wind while the cabin stays safe and stable. A night at TreeHouse Point, his treehouse-style bed and breakfast in Issaquah, Washington, gives guests a bird's-eye view of the world from a luxury cabin in a copse of trees.

treehousepoint.com

WATCH thehenryford.org/explore/innovation-nation/episodes/luxury-tree-houses ►



▲ Temple of the Blue Moon

PHOTO BY ADAMCROWLEY.COM

PROBLEM:

A lack of sight can deny you private time with time.

SOLUTION:

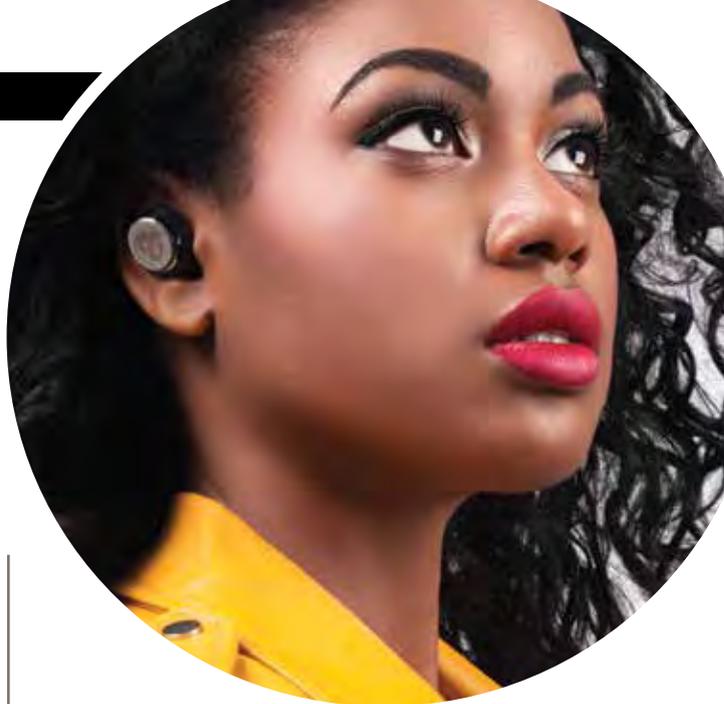
Wear a tactile watch on your wrist.

QUIET TIME

Many of us sneak peeks at our time-telling machines so we know when to slip out, slip in or sit still. For most, our relationship with time is a private matter. We can check it once, check it twice, check it a hundred times, and no one is the wiser. For those who can't see, that love/hate relationship with the clock is way more communal. The sight challenged often rely on devices that use sound to tell the time, making every urge to know the hour a matter of public record. Enter the Bradley by Eone, a tactile timepiece created by Hyungsoo Kim, a young inventor inspired to help after he watched a visually impaired classmate struggle with not knowing how much time was left. Kim branched out beyond the blind's basic Braille and designed a wristwatch made of magnets and ball bearings. It enables the wearer to "tell" time without the talk, just the touch of a finger.

eone-time.com

WATCH thehenryford.org/explore/innovation-nation/episodes/inland-surf-park ►



PROBLEM:

Can't talk the talk.

▲ Mymanu Klik

PHOTO COURTESY OF MYMANU

SOLUTION:

Master foreign phrases with an easy earbud.

NO LONGER LOST IN TRANSLATION

Many travelers face a similar trial: How do you navigate without knowing the language? Now you can ditch the dictionary and don a discreet earbud to hear different dialects. Audio engineer Danny Manu developed the Mymanu Klik after difficulties communicating with cross-country colleagues at a conference. His wireless earbud uses a smartphone and tech-to-speech technology to translate 37 languages in real time right to your ear. No more fumbling around foreign lands to find your words.

mymanu.com

WATCH thehenryford.org/explore/innovation-nation/episodes/gloving ►



▲ Bradley Element

PHOTO COURTESY OF EONE

Learn about these great ideas in action and much more on *The Henry Ford's Innovation Nation* with Mo Rocca on Saturday mornings during CBS Network's block of educational programming called CBS Dream Team... It's Epic. Check your local listings.

The background of the advertisement shows a museum exhibit. At the top, a red sign reads "Heroes of the Sky" with a photo of a pilot. Below, a group of children are gathered around a small electronic device. One boy in the center wears a black t-shirt with "RULE THE FIELD" printed on it. The scene is lit with warm, indoor museum lighting.

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Animation in Motion

From ancient cave drawings to Saturday morning cartoons and films like *Frozen*, many steps have been taken to master the illusion of movement

Animation: The art of making inanimate objects appear to move. While the billion-dollar behemoth we now know as the animation industry may owe its true beginnings to the humble drawings early man once sketched on cave walls, it was the back-to-back, parallel and piggyback innovations of the early 20th century that took the art form to another dimension of entertainment.

Here is The Henry Ford's brief look back and forward thoughts about some of the animation industry's biggest moments.

By Kristen Gallerneaux and Jennifer LaForce



FROM THE HENRY FORD ARCHIVE
OF AMERICAN INNOVATION

17TH CENTURY-1940s

Magic Lantern

The magic lantern was a forerunner of the slide projector. In use since the 17th century, it survived into the 1940s.

Images painted on glass were projected by using candles or gas lamps, and later, photographic images (some hand-colored) were projected using arc and incandescent lamps. Some slides were animated by turning a crank. They illustrated everything from exotic journeys around the world to scientific discoveries; from political issues (temperance was a big theme) to a curator favorite at The Henry Ford — a creepy phantasmagoria of images of monsters and ghosts.

◀ Magic lantern slide themes ranged widely from exotic travel, folklore and advertising to history, science and art.

1832

Phenakistoscope

Belgian Joseph Plateau invents the phenakistoscope, a spinning cardboard disk that creates the illusion of movement when viewed in a mirror.



PUBLIC DOMAIN VIA WIKIPEDIA

“Magic lanterns are a good example of adaptation — they shifted formats as lighting technology improved.”

— Kristen Gallerneaux, *The Henry Ford*



1834

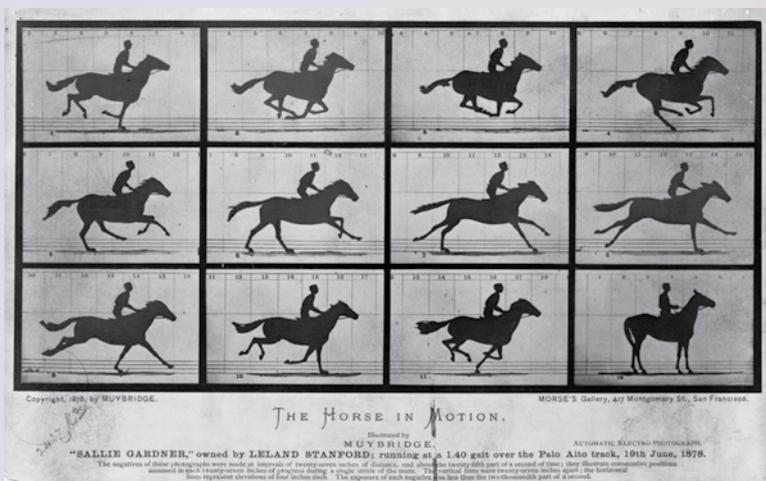
Zoetrope

Mathematician William George Horner invents the zoetrope, a rotating drum lined by a band of pictures that could be changed.

Before it was possible to animate with film, people used paper to create short animated sequences. To see a zoetrope in action, a short loop of images with subtle variations is placed on the inside of a cylinder. The cylinder is spun while the viewer looks through a slot. Thanks to the process known as "persistence of vision," the images come to life.

▲ The zoetrope was variously known as "The Wheel of the Devil" and "The Wheel of Life." This zoetrope from the 20th century is in The Henry Ford's collection.

FROM THE HENRY FORD ARCHIVE OF AMERICAN INNOVATION



1878

Motion Studies with Photography

Eadweard Muybridge photographically records a series of images depicting the locomotion of a running horse. Animating believable characters relies on accurate depiction of movement. Muybridge in the U.S., along with Étienne-Jules Marey in France, each find ways to render the subtle elements of movement in a series.

PROVIDED DIRECTLY BY LIBRARY OF CONGRESS PRINTS AND PHOTOGRAPHS DIVISION

THE HENRY FORD'S COLLECTION OF CARTOON CHARACTERS

FROM THE HENRY FORD ARCHIVE OF AMERICAN INNOVATION

From Popeye to Peanuts and a pudgy pink sea star named Patrick, The Henry Ford has a playful collection of toys, trinkets and totems that pay tribute to cartoonish characters much loved over many decades.



1894

Kinetoscope Parlors

The first “peep show parlor” opens in 1894, containing 10 of Thomas Edison’s kinetoscopes, which had been in prototyping phase since 1889. These wooden boxes contained a strip of moving, perforated film inside, viewed by one person at a time (for the cost of a nickel per film). Produced in the Black Maria studio, these silent films included *Fred Ott’s Sneeze* and *Butterfly Dance*, along with shorts about boxers and blacksmiths. Edison’s films began as novelties, but they helped to advance cinema’s growth into an industry.

In 1895, Edison sold kinetoscope cabinets with concealed phonographs inside. This first version of the kinetophone was an early attempt to synchronize sound with moving images. A second version that made use of projected images was invented in 1913.



PUBLIC DOMAIN VIA WIKIPEDIA

DID YOU KNOW? /

In the late 1880s, Edison was inspired by Eadweard Muybridge’s photographs. After the two met, Edison filed a pre-emptive patent for what would become the kinetoscope in 1888.

DID YOU KNOW? /

More than 900 kinetoscopes were sold between 1894 and 1895.

1908

Fantasmagorie

A Frenchman named Émile Cohl produces *Fantasmagorie*, one of the earliest truly animated films. The film has the appearance of lines drawn on a chalkboard, beginning and ending with the appearance of the animator’s hand creating the drawings.



PUBLIC DOMAIN VIA WIKIPEDIA

1911

Winsor McCay

American cartoonist and animator Winsor McCay’s *Little Nemo in Slumberland* and *Dream of the Rarebit Fiend* enthrall audiences. McCay creates a hand-colored short film of *Little Nemo* for use during his vaudeville act.



PUBLIC DOMAIN VIA WIKIPEDIA



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1902

Fun in a Bakery Shop

Thomas Edison produces the stop-motion animation film *Fun in a Bakery Shop*, directed by Edwin Porter. This film is considered one of the first examples of Claymation thanks to the invention of the pliable modeling medium Plasticine in 1897.

1902

Trip to the Moon

French illusionist and filmmaker Georges Méliès premieres his “trick film” *Trip to the Moon*, which transforms magic tricks into special effects. While Méliès’ work may not fit within the standard constraints of animation proper, his fantastical visual effects expanded the creative applications of cinema.

1914

Gertie the Dinosaur

Winsor McCay transforms the art of keyframe animation. McCay’s draftsmanship, fluid sense of movement and great feeling for character gives viewers an animated dinosaur that seems to have a personality, a presence and a life of her own. The first cartoon star is born.



©DISNEY

Mickey Mouse ▶ 1928

The legendary Disney cartoon *Steamboat Willie* introduced us to animation with sound and marked the first public appearance of Mickey Mouse and his girlfriend Minnie, two of the most recognized cartoon characters worldwide. This handkerchief wears an image of *Steamboat Willie*’s rendering of Mickey Mouse.



Popeye ▶ 1929

The one-eyed sailor who loved to eat his spinach — and created a childhood fondness for the leafy green veggie — first appeared as a supporting character in a cartoon strip. Here, he poses as a weatherman made of vinyl to help kids learn how to dress for the day.

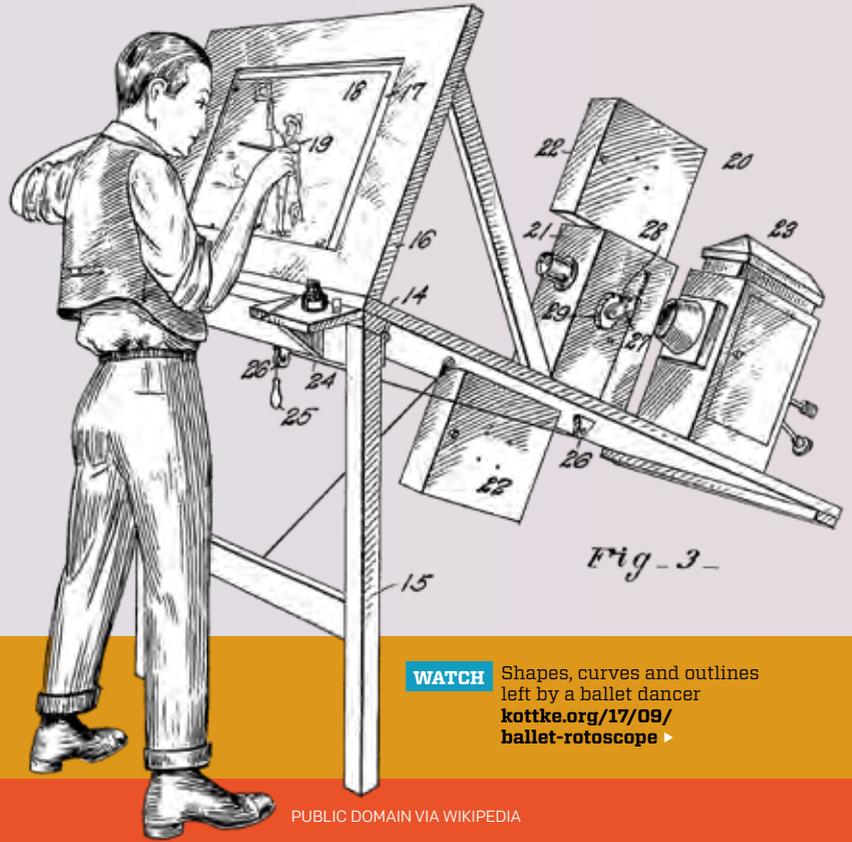
1915

Rotoscoping

Max Fleischer invents the rotoSCOPE, a device that allows animators to trace over live-action movement, frame by frame, for use in animated films. Recorded live-action film images are projected onto a frosted glass panel and redrawn by an animator. Rotoscoping is still a staple in realistic animations because it's so difficult to imagine a complicated movement in one's head and draw it accurately.

"Rotoscoping was used in the production of Disney's *Snow White* in 1937, once Max Fleischer's patent expired. The technique was also used in the Beatles' *Yellow Submarine* (1968) and to create the light-saber effect in *Star Wars* (1977)."

— Kristen Gallerneaux, *The Henry Ford*



PUBLIC DOMAIN VIA WIKIPEDIA

DID YOU KNOW? /

In 1915, Max Fleischer patented the rotoSCOPE after he used it to animate his series of cartoon shorts titled *Out of the Inkwell*.

WATCH

Shapes, curves and outlines left by a ballet dancer kottke.org/17/09/ballet-rotoSCOPE ▶



PUBLIC DOMAIN VIA WIKIPEDIA

1920-28

Felix the Cat

Otto Messmer creates animated character Felix the Cat. Eight years later, when electronic television is in its experimental phase, engineers place a Felix figurine on a record turntable as a "test image" to be calibrated for transmission. Felix the Cat, in a sense, is the first TV star.

1922

Walt Disney

The 20-year-old Disney begins his first animation film studio, Laugh-O-gram Films. It fails after only a short time.

1928

Steamboat Willie

Walt Disney releases a short film called *Steamboat Willie*, featuring Mickey Mouse and using synchronized sound in an animated film for the first time.

1937

Snow White

Walt Disney produces the first feature-length cel animation film, *Snow White and the Seven Dwarfs*.



Howdy Doody Puppet ▶ 1952

The Howdy Doody Show was the leading children's TV program in the U.S. from 1947 to 1960. This now-ubiquitous version of the Howdy Doody marionette, which debuted in 1949, is authentically costumed with sliding eyes, a moving mouth and 6-inch strings.



Gumby ▶ 1955

The Claymation star was introduced to kids on *The Howdy Doody Show* in 1955. A year later, Art Clokey's creation had its own show on NBC. In the '80s, the lovable green glob enjoyed a revival of sorts, leading to the manufacture of a whole new set of bendable toys in his likeness.



1961

Xerography

Chester Carlson invents the xerography process in 1938, but it isn't until 1959 that the Xerox 914 copier allows his ideas to emerge into the commercial world. An unforeseen outcome of the invention of the Xerox machine is its ability to make the process of animation more efficient. By photocopying the basic shapes of characters and backgrounds, the time and cost to produce an animated feature is reduced. The Xerox produces half-finished drawings on cels, which artists would fill in with the subtle variations that create movement. This technique gives films such as *One Hundred and One Dalmatians* (1961) that sketchy, distinctive look.



ONLINE

Display your video, gif or animated art in flip-book style flipbookit.com ▶

COURTESY OF FLIPBOOKIT

1982

Tron

Steven Lisberger's imaginary world of a computer programmer getting trapped on the inside of a video game is partly inspired by playing Pong. With more than 200 scenes produced on a computer, *Tron* uses more computer-generated imagery than any other film to date.



©1961 DISNEY



©1982 DISNEY

1972

Computer Animation

At the University of Utah, graduate student Ed Catmull produces *A Computer Animated Hand*. Catmull forms a digital framework of his left hand using hundreds of polygons and triangles. The 3-D image of the hand flexes and points, controlled by a computer animation program written by Catmull.

1983

John Lasseter

Disney animator John Lasseter unsuccessfully pitches his idea for a hybrid traditional/CG-animated adaptation of Thomas Disch's book *The Brave Little Toaster*. After Lasseter is let go by Disney, he joins Ed Catmull at the Lucasfilm Computer Division. When the computer division is spun off from Lucasfilm to become Pixar, Lasseter becomes its creative leader.

DID YOU KNOW? /

Pixar was founded in 1986 when Steve Jobs bought the Lucasfilm Computer Division and established it as a graphics hardware company selling the Pixar Imaging Computer.

Sesame Street ▶ 1969

One of the longest-running children's television programs, *Sesame Street* premiered in 1969 with a cast of master puppeteer and cartoonist Jim Henson's unforgettable creations, including Big Bird, Ernie, Bert, Cookie Monster and Oscar the Grouch. This music box plays the song *The People in Your Neighborhood* while a *Sesame Street* scene moves horizontally across the screen.



ONLINE

To see a set of Peanuts comic strip art and artifacts in the collections of The Henry Ford, visit thehenryford.org/peanuts ▶

“The award-winning video for A-ha’s song *Take on Me* (1984) was the first use of rotoscoping in a music video. This pop culture touchstone combines pencil-sketch animation, rotoscoping and live action.”

— Kristen Gallerneaux, *The Henry Ford*

1980s

Animation in Music Videos

A golden age of stop-motion worldwide. Cable television networks like MTV hire artists to make their stations’ ID completely out of stop-motion, an animation that is captured one frame at a time with physical objects that are moved between frames. Artists such as Peter Gabriel opt to have music videos completely produced in stop-motion.



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1995

Toy Story

Pixar releases *Toy Story*, its first film, and the world’s first computer-animated feature film. *Toy Story*, a milestone success, changes animation with the introduction of CG as a medium ready for the feature-film landscape.



©DISNEY/PIXAR

DID YOU KNOW? / Films such as *Star Wars* (1977), *Empire Strikes Back* (1980), *Dragon Slayer* (1981) and *RoboCop* (1987) entertain audiences with stop-motion visual effects.

DID YOU KNOW? / *The Science Behind Pixar* exhibition runs through March 18 in Henry Ford Museum of American Innovation.

1986

Will Vinton

Portland, Oregon-based Will Vinton and his animation studio produce iconic characters, including the singing California Raisins clay-animated commercial personalities that become bigger than the brand they were trying to promote.

GAME DAY



In the face of big Hollywood films, we often forget about the parallel world of video game animation. From that moving pixelated paddle and ball of Pong to the lush virtual worlds that gamers immerse themselves in today, video games have pushed the boundaries of digital play and animation.

Companies have also experimented with making virtual reality a tenable option for gamers for decades, including some letdowns along the way like Nintendo’s 1995 Virtual Boy system. Today’s systems like Oculus Rift, Vibe and Google Daydream (at right) are learning to harness the graphics processing power of computers, which is finally catching up to the more hopeful applications of the technology.



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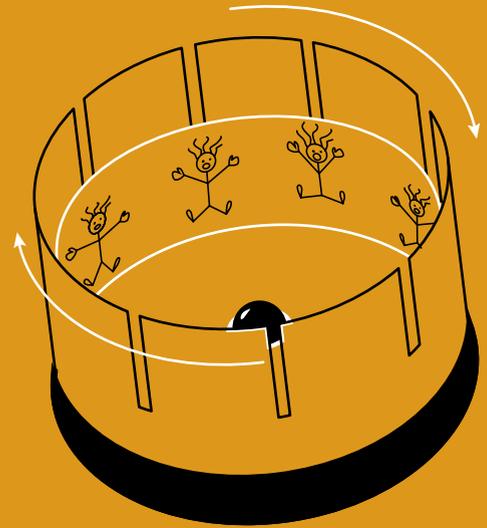


Build Your Own Zoetrope

A zoetrope creates the illusion of a single animated image. Here's how to make your own little zoetrope animation.

MATERIALS

- _____ circular box lid
- _____ wide adhesive tape
- _____ scissors
- _____ craft knife
- _____ white and black poster board or construction paper
- _____ large glass marble
- _____ drawing utensil



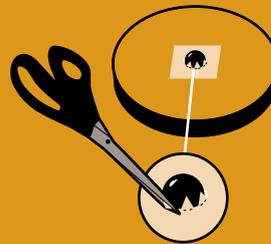
1 Make a hole in your box lid with a craft knife. The hole should be centered and slightly larger than the diameter of your glass marble.



2 Cut a piece of tape about 2 inches long, place it over the hole on the outside and then cut the tape radially from the inside.



3 From the inside of the lid, insert and glue the glass marble into the hole. The marble should extend through the hole beyond the lid's rim (so the lid can sit on a surface and spin).



4 Cut off the tape overlapping the marble.



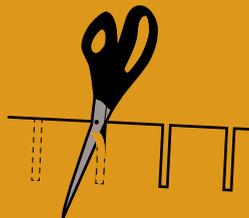
5 Using the white poster board or paper, cut a thin strip about the same length as the circumference of the circular lid.



6 Draw an illustration, repeating it the same distance apart on the paper strip — similar to what you would do when drawing images to create a flip book.



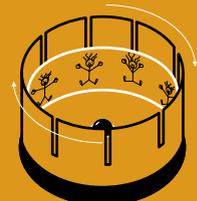
7 Cut a black paper strip that is double the width of the white paper strip and slightly smaller in circumference than the lid.



8 Cut small slits in the black paper strip that are the same distance apart as the pictures on the white paper strip and insert inside the lid.



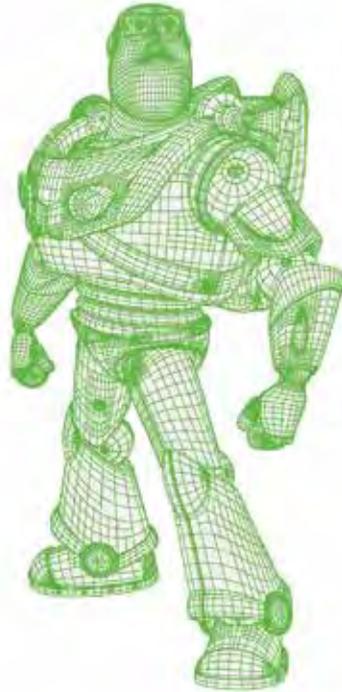
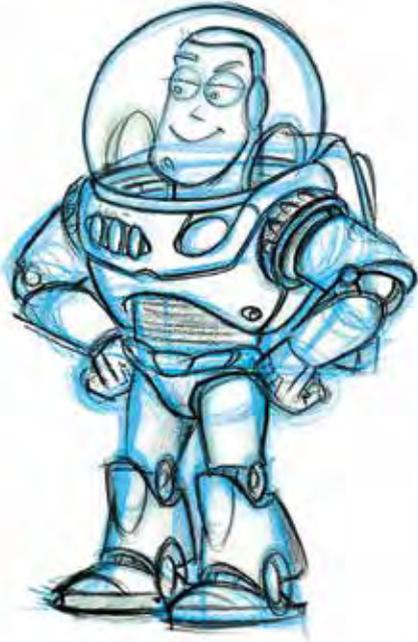
9 Set the illustrated white paper strip on the inside of the black strip, with the illustrations facing inward between the slits.



10 Spin your zoetrope and look through the slits to enjoy the show!

NOW until **MARCH 18**

Learn about the filmmaking process through hands-on activities inspired by some of Pixar's most treasured films, from *Toy Story* to *Inside Out*.

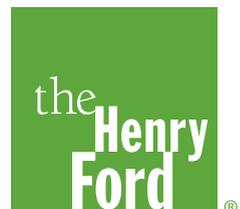


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This exhibition was developed by the Museum of Science, Boston in collaboration with Pixar Animation Studios.
Image © Disney / Pixar

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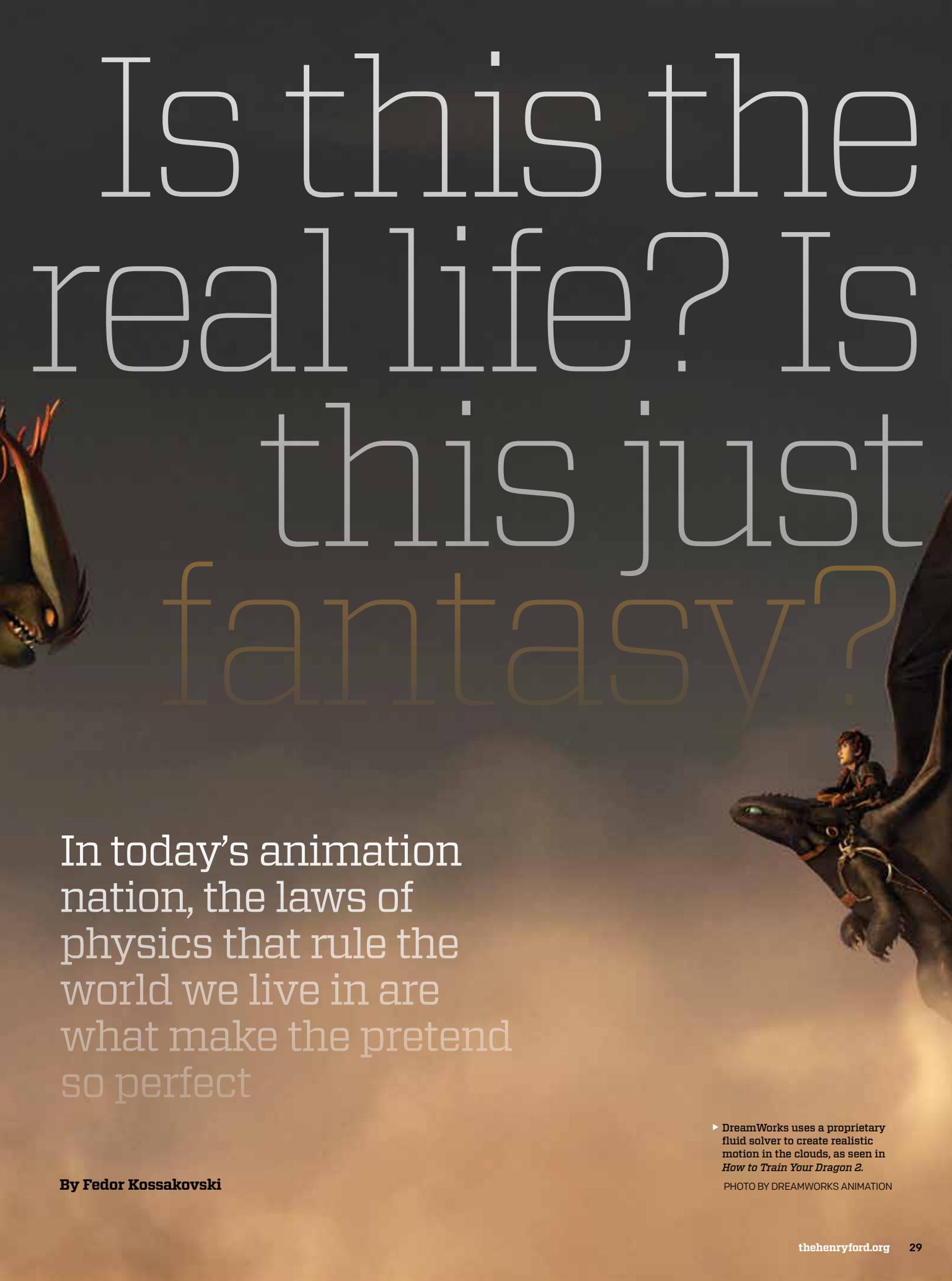
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A large, dark dragon is flying in a cloudy sky. A young boy is riding on its back. The dragon's head is visible on the right side of the frame, and its tail is on the left. The background is a soft, hazy orange and yellow, suggesting a sunset or sunrise.

Is this the real life? Is this just fantasy?

In today's animation nation, the laws of physics that rule the world we live in are what make the pretend so perfect

By Fedor Kossakovski

► DreamWorks uses a proprietary fluid solver to create realistic motion in the clouds, as seen in *How to Train Your Dragon 2*.

PHOTO BY DREAMWORKS ANIMATION

For

me, the first time an animated film passed the Turing test and seemed utterly indistinguishable from the real thing was when I sat down to watch Pixar's *The Good Dinosaur* in a theater.

I was floored by the sweeping landscape shots as the opening credits rolled: The expansive Arizona-esque desert had such depth; the shadows in the thunderclouds portended rain; the roiling river had a palpable power. These shots looked like Ansel Adams photographs, colorized and come to life. It was so real that until I saw the cartoonish characters, I forgot that I was watching an animated film.

I grew up on animation. I watched *The Lion King* every day for a year straight when it came out on VHS. The opening sunrise of that movie is beautiful and still moves me deeply, but it is a far cry from the photo-realistic opening of *The Good Dinosaur* or any number of other animated features that are now hitting theaters.

How did we get from there to the here and now? How has the animation industry evolved to incorporate realistic physics into its films? And how does the tech even work?

A PASSION DISCOVERED

Alejandro Garcia is a professor of physics and astronomy at San Jose State University in California's Bay Area. His research focus is computational fluid mechanics and statistical mechanics, the sort of physics modeling that gives us our weather forecasts.

As he found out almost two decades ago, his expertise is also useful in creating realistic animated

worlds. "Around 2000, I was well-established with tenure, a school professorship and everything. About that time, I thought, 'I'd like to do something different,'" Garcia shared over Skype.

He chose to take a sophomore-level drawing class, mostly because it was so outside his wheelhouse. Garcia remembered his father, an architect with a discerning drafting hand, saying, "This kid is good at mathematics, but he can't draw a straight line to save his life."

He took one class, and then another. And another after that. Garcia was hooked.

Word got around campus that there was a physics professor taking art classes, and the director of the program came to discuss an interesting proposition. "She said it would really be helpful for students if they understood how things move," Garcia recalled. "They're trying to do animation and we're trying to show them how to do things, but we're not trained as scientists," she told me. "We're just sort of guessing what it's supposed to look like. But you know what it's supposed to look like."

Garcia was up for the task. He took an intro physics course he was already teaching and tailored it to the students in San Jose State University's burgeoning animation/illustration department. He teaches that course, Phys 123: Physics for Animation, to this day. ▶



©2015 DISNEY•PIXAR



DID YOU KNOW? /

Wyoming's Grand Teton National Park, known for its majestic mountain range, lush valleys and alpine lakes, was the geographical inspiration for the animated hit *The Good Dinosaur* (2015). Animators were so detailed in their virtual creation of the movie's landscape that they built in nearly 200 different types of clouds for their pretend land, each based on actual weather data and images obtained from government satellites.

IS THIS THE REAL LIFE? IS THIS JUST FANTASY?



◀ When physics professor Alejandro Garcia started taking art classes with students at San Jose State University nearly 20 years ago, he was the topic of much campus gossip. Today, he leads conversations with would-be animators, teaching them how force, mass and acceleration can make a cartoon character's movements feel real.

PHYSICS FOR NONMAJORS

In Garcia's homegrown course, future animators are introduced to the basics of physics that will be especially useful to their art.

Foundational, of course, are Newton's Laws of Motion (see sidebar at right). These provide a framework that unifies how everything moves, from falling apples to planets. In the context of animation, Garcia teaches how force, mass and acceleration all interact to make a character's movements feel relatable.

In the "Jump Forces" lesson, for example, he shares that the force of impact on landing from a jump can be reduced by extending the stop height — when the animated airborne character would start to fall back down to the ground from a jump.

Equate it to a circus act human cannonball flying high in the air and landing in a net. In an animated world,

characters landing on the ground and falling flat on their faces after an extended jump would feel strange to a viewer, but by extending the stop height, or how far they continue to fly through the air, and having them crash into a cart of apples (aka the net), like in a scene in the animated film *Mr. Peabody and Sherman*, the effect seems more realistic and relatable.

It's basic Newtonian physics principles that are a critical component for making objects interact organically in a computer-generated world. And once that is squared away, making the environment look correct is a big step toward boosting believability.

To help achieve believability, Garcia also teaches a module on how waves work. If you remember your high school physics, the frequency of waves is proportional to their speed and inversely proportional to their length. You always have to keep these relationships in mind when you are animating waves like those that crash on a shoreline. "As ocean waves enter shallow water, they slow down," Garcia shares in a tutorial video for his class. "The frequency stays the same, so the wavelength shortens and their shape changes."

A BRIEF HISTORY

Garcia was by no means the first scientist enlisted to help create animated films. Long before animated movies were developed on a computer, animation studios brought in scientists to help understand how to make characters look more realistic.

One popular story is that Walt Disney, in preparation for *Bambi*, would have his artists practice sketching animals and consult with zookeepers in the nearby (and now defunct) Griffith Park Zoo. Disney even had two orphaned fawns delivered by train all the way from Maine to live on the studio lot in Los Angeles.

The need for consulting scientists really jumped dramatically when computer-generated animation hit

the market. "*Toy Story* was the big breakthrough film that kind of established the industry," said Garcia. "That was at a point where computer graphics were good enough that

people would sit through a feature-length animated film."

At that time, Matt Baer, now the visual effects supervisor at DreamWorks Animation, had just landed an internship at a major computer graphics software company that would later be absorbed by industry titan Autodesk. "I was training companies and teaching people that knew way more than I did about the software," Baer told me during a visit with him at DreamWorks' campus in Glendale, California. "I would have to call the programmer at lunch and ask him, 'How do I explain this, how do I explain that?'"

Eventually, Baer's skills and on-the-job training earned him a position at DreamWorks creating computer-generated effects. He's been with the company ever since and has a long list of credits, including *How to Train Your Dragon*, *The Croods* and the *Shrek* films. "Back then, the effects department was kind of sitting in the middle of everything, where you did normal effects like fire, smoke and clouds, but you also were the ones creating clothing for the characters," Baer reminisced. "Little by little, as the appetite of the movies got bigger and bigger, these became three separate departments — crowds, effects, and clothing and finaling." ▶

DID YOU KNOW? /
The Turing test was a test proposed by the English mathematician Alan M. Turing in 1950 to determine whether a computer can "think."

NEWTON'S LAWS OF MOTION

Jumps. Rolls. Skids. Any kind of movement you see on screen comes down to Newton's Laws. Animators pay special attention to them because they are so deeply ingrained in how we experience the world. If Newton's Laws aren't obeyed, your brain automatically picks up on it, and your suspension of disbelief is shattered.

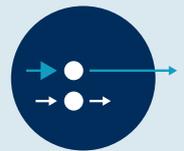
Isaac Newton introduced these three laws more than 300 years ago, and, remarkably, they still hold true today.

1



An object at rest stays at rest; an object in motion stays in motion (along a straight line) unless acted upon by an outside force.

2



If a force is applied to an object, it accelerates that object ($F=ma$).

3



For every action, there is an equal and opposite reaction.



Watch a video interview with Alejandro Garcia using the Layar app

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A BOOST TO BELIEVABILITY

Professor Alejandro Garcia (below) leans heavily on basic Newtonian physics principles when teaching future animators how to make objects interact organically in a computer-generated world.

PHOTO BY JAY WATSON



OBSERVATION AND SIMULATION

Nowadays, many of the programs used to create animated worlds are incredibly complex, with many of the influences of physics built directly into their modeling capabilities. At this point, the improvements are marginal, at least for the average viewer.

At a recent computer graphics conference Garcia attended, an entire panel discussion focused just on hair, specifically on the film *Moana*. "It's amazing how you can watch the movie and just watch the hair of the characters: when it's wet, when it's dry, how they move it around," said Garcia. "They really captured the physics of the hair simulations extremely accurately and beautifully, to such an extent that you don't even think about it. It's just beautiful."

"Simulations" is the key word here. Many scenes in an animated film are created in simulators — suites of computer programs, each with its own strengths and weaknesses, which are linked up to model different components of a single environment.

At DreamWorks Animation, Baer walked through how he, as a visual effects supervisor, would pick and choose where a simulator would help hit the desired motion aesthetic needed to create a simple fixture such as a gurgling fountain — with all of the detail of foam, spray and splashes — on film.

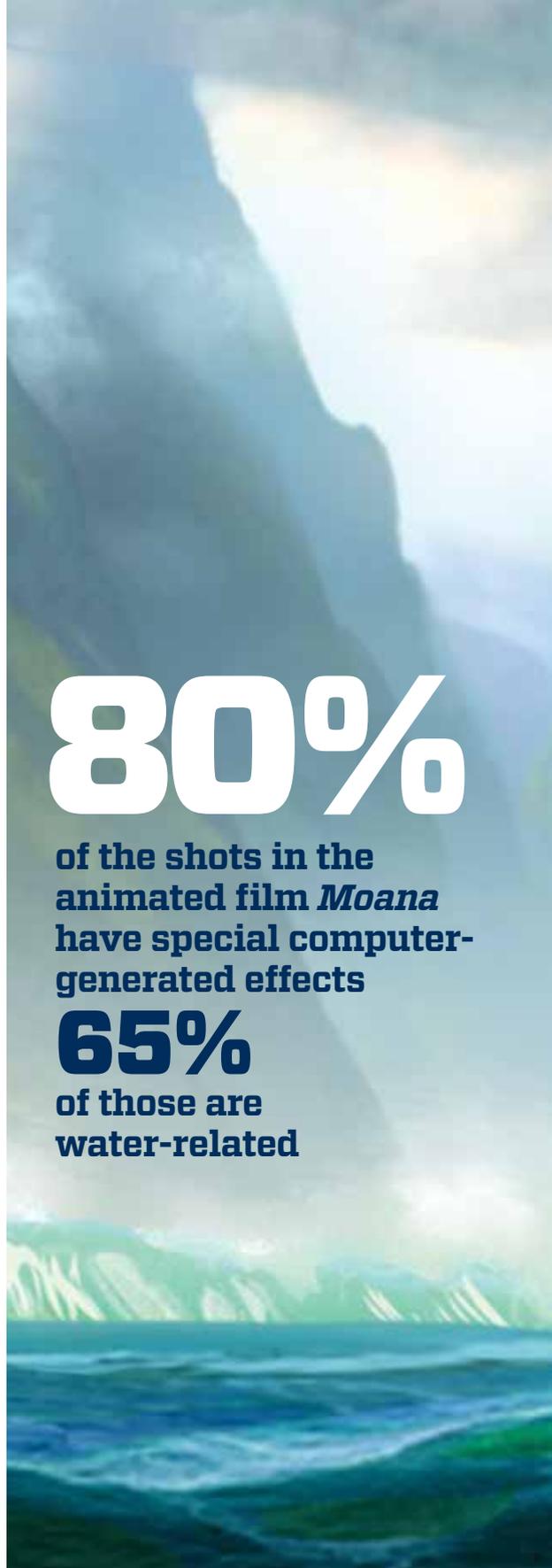
"In my mind, small splashes are way more challenging than huge explosive splashes," he said. "You're so used to seeing a small splash in your head that if something's wrong with it — either the way the light reacts to it or the way the simulation looks or even the shapes, silhouette of it — instantly your head says, 'Something's wrong here.'"

Baer noted that he would probably use a recently developed suite of in-house tools that allows today's animators to create a very fine mesh to represent objects and imbue their volume with realistic physical lighting properties and reactions. Using this technology, animators wouldn't have to use a particle-rendering technique to model the little breakaway droplets and a geometry render to model the bulk of the fountain, which is how Baer's teams have done it in the past. ▶

80%

of the shots in the animated film *Moana* have special computer-generated effects

65% of those are water-related



RESEARCH

Hyperion, Splash, Matterhorn, Quicksilver — simulators and engines used inside the Walt Disney Animation Studio — and DreamWorks Animation's Apollo technology ▶



©2016 DISNEY

WATCH

Videos about motion in animation with extreme engineer and associate professor Eitan Grinspun of Columbia University. Technologies developed by his laboratory are licensed and/or used today in Adobe Photoshop and Illustrator at major film studios, including Disney, Pixar, Lucasfilm and Weta Digital ►

RESEARCH

Fish biologist Dr. Adam Summers of the University of Washington. He served as a science adviser on the hit animated films *Finding Nemo* and *Finding Dory* ►

The key, though, is being observant. "If someone launched you on that fountain and needed it done in a few weeks," Baer explained, "you'd probably find yourself watching a lot of water and just kind of staring at it, trying to figure out how am I going to make that thing?"

While animators are observing to replicate, physicists are observing to understand. "One of the discoveries I made is there are very close similarities between physicists and artists," Garcia said. "Probably the most important similarity, especially with digital artists, is being extremely observant of the world."

THE LIMITS OF PHYSICS

Though simulators nowadays give highly photo-realistic results, corraling the different physics components to work together is often difficult. They're like digital Rube Goldberg machines: They obey physics but have to be finely tuned in order to go off just right.

Said Baer, "You might create a tree and it's being controlled by this system of springs, and you set the tension on the springs just right so the rebound looks pretty good. But, after a while, if one of them just gets too tight and can't quite resolve itself in a frame, then that can

cause this almost catastrophic ripple effect through all the springs. It looks great for 12 frames, but, if I run it long enough, I'm pretty sure there's going to be some instability somewhere that's going to have this crazy effect and the whole thing is going to blow up."

In other words, the ability to represent the physics of something is sometimes stretched to the limit and snaps, sowing destruction on a virtual set. "You just get used to looking at stuff that's somewhat broken," lamented Baer with a chuckle.

In the end, having a perfectly scientific representation of our world is not always the goal in the pretend world of animation. Fulfilling a director's vision of storytelling is, of course, much more important.

"A director is not asking for things randomly," Garcia said. "They often have a very good reason. Maybe it's an important story element, and they can't have the smoke over the character's face. They want it here, not there."

Garcia doesn't mind the occasional animated anomaly. "People will ask me if I'm bothered when the physics are not correct, and I usually say, 'No, you have to realize that in our world, animals can't talk.'" •

"One of the discoveries I made is there are very close similarities between physicists and artists. Probably the most important similarity, especially with digital artists, is being extremely observant of the world."

— Alejandro Garcia

ONLINE Learn more about Walt Disney Animation Studios' award-winning projects, innovations and latest developments in animation technologies disneyanimation.com ▶

Animation a la Retail

"Virtual reality is the cutting edge," said Alejandro Garcia, professor of physics and astronomy at San Jose State University. While Garcia is looking at how wearing a virtual reality (VR) headset could tell a more entertaining story within an animated film, companies such as Chicago's InContext Solutions are using animation and VR to create more engaging consumer experiences outside the theater — like in your local Walmart or Walgreens.

Think about the times you've walked into your neighborhood grocery store and the bread or canned beans are suddenly in a different aisle. Why? The reorg isn't random. Your grocer is rearranging merchandise in an attempt to create the best consumer experience possible.

Today, retail reset practices still seem a bit archaic. Store refreshes are seldom real-world tested on a large scale and often have limited research behind them. It's no wonder, said InContext Solutions CEO Mark Hardy, that animation and VR are presenting themselves as potential saviors in the competitive retail arena's battle for more buyers.

"VR allows us to create a hyper-realistic environment that mimics the real world, but within it we can make infinite changes, test prototypes and collaborate with team members across the country," said Hardy. "It provides retailers a risk-free space to experiment with new ideas and gain insight about what resonates with shoppers. And because you don't need to actually build out anything, it's faster and more cost-effective."



InContext Solutions takes the guesswork out of perfecting product placement — among many other types of in-store concept planning — by using VR and animation to help its retail clients align their bricks-and-mortar with innovative consumer experiences. As Hardy explains, they use a fully immersive cloud-based platform, collaborating with retailers to build multiple store concepts with new shelf arrangements, product facings, signage and displays. Then the InContext team sends test shoppers, as well as the client's internal teams, on virtual shopping missions to gather feedback.

Undoubtedly, the powerhouse combination of animation and VR has yet-untapped potential, whether it's exploring the cutting edge in how we wow moviegoers in the theater or how we tempt mom to purchase the latest ready-made pasta product at the market.

"By leveraging VR for branding and in-store experiences, retailers and manufacturers can make confident go-to-market decisions instead of just guessing on the results for a new product or concept," added Hardy. "This is where VR is proving to serve as a game-changing way to change business processes for the better."

DID YOU KNOW? /

Retailers such as The North Face and Ikea are already leveraging VR and augmented reality, immersing shoppers in simulated hikes and climbing expeditions and creating apps that allow you to virtually view how a piece of furniture would look in your living room.

PHOTO COURTESY OF INCONTEXT SOLUTIONS



Animation + Physics: The Basics

Seasoned animators stretch the rules of physics on film but try never to break them completely

→ You Might As Well Jump!

The simplest part of making a jump “look right” is understanding the time in the air and how it relates to the height of the jump. Basic premise: Little jumps should have little height and little air time, while bigger jumps should have bigger height and longer air time. The path of action is like the parabolic arc you learned about in algebra or geometry — mirror symmetrical on each side. Unless you’re someone like the Incredible Hulk, of course, and then every jump is huge, high and unnaturally long in the airborne department and amount of film frames it requires.



Push height

the distance a character’s center of gravity rises from the start of the jump (crouch) to the takeoff

Jump time

the time in the air from takeoff to landing

Push time

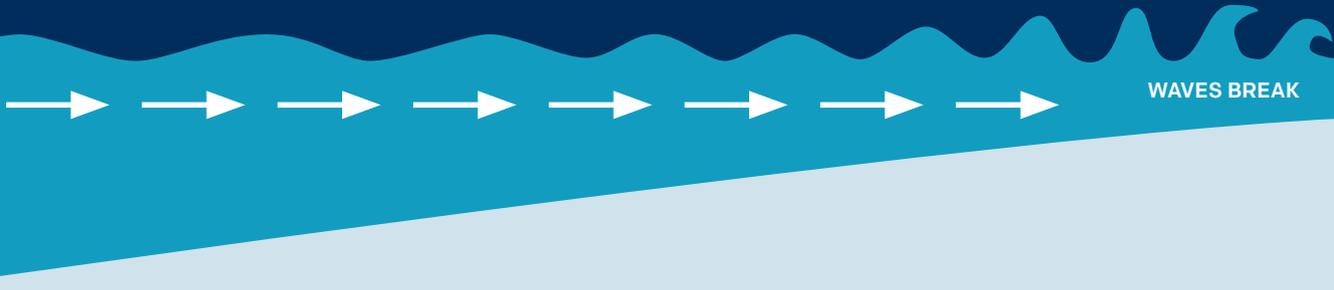
the jump time divided by the jump magnification (how high the animator wants the jump to go)

A jump’s ratio of time is equal to its ratio of height

$$\frac{\text{JUMP TIME}}{\text{PUSH TIME}}$$



$$\frac{\text{JUMP HEIGHT}}{\text{PUSH HEIGHT}}$$



→ Wave Relations

As water waves enter the shallows, they slow down, but their frequency stays the same. As waves slow down, their wavelength also shortens. That means if an animator is making waves and he/she wants to get it just right, as the waves get very close to shore, the animator must change their appearance because their shapes distort as they shorten, causing the waves to “break.”

$$\text{Wave speed} = \text{wavelength} \times \text{frequency}$$



Screen Time Paradigm

Technology puts us in charge of what we watch, where we watch it and with whom we watch it

By David Bossert
Illustrations by Lincoln Agnew



I can remember seeing a re-release of Disney's *Pinocchio* in a local movie theater with a few neighborhood friends when I was a kid.

I didn't know it then, but it made an indelible mark on my career choice to become an animator in later life. Seeing that film was one of those moments where my imagination was captivated by the images playing before my eyes. Those gee-whiz, how'd-they-do-that screen moments when fantasy and reality blend, creating a sense of awe and wonder. It was a social experience, too. Talking with my friends about what might happen in the film and then afterward giving our own assessment of what was cool, scary or hilarious was as much a part of seeing the movie as was "seeing" the movie.

The way we watch media has changed over the decades, with technology shifting the social experience from theaters and the home to the anywhere/everywhere afforded by mobile devices. Our watching habits are being driven as much by technological innovations as they are by our changing tastes as we decide when and where we want to watch movies as well as our favorite TV shows and sitcoms. It is, after all, all about choices — isn't it?

GOLDEN VARIETY

Today, we're lucky. Options for how we digest media and entertainment abound. In the 1920s, there were far fewer choices for information and entertainment. Newspapers were filled with yesterday's news, opinions and comics. Radio did offer a variety, albeit limited, of entertaining serials and music shows. And then there was the cinema.

In the early days of theater, movies were presented in black and white in a squarer format. Plus, they were silent. Eventually, with technological innovation, synchronized sound was added to films. It was the beginning of the golden age of movie palaces — those opulent single-screen theaters that held large audiences.

By the mid-20th century, movie theater audiences commonly anticipated the preshow newsreel footage of important events going on in the country and around the world. Each week, a compilation of news, current events and entertainment projected on the theater screen was par for the course before the feature film began. Seated spectators would see firsthand film footage from the frontlines of battles in the Pacific and Europe during World War II — the harsh realities of war. Theaters also played commercials for local businesses and public service announcements for buying war bonds, volunteering and recycling for war efforts. Shorts such as Disney's *Out of the Frying Pan Into the Firing Line* (1942) advocated saving meat drippings in a can to be turned in at the local butcher shop in exchange for ration coupons. Glycerin, distilled from these drippings, was used in the manufacture of munitions.

Theater audiences were also treated to several short cartoons and serials, known as one-reelers, which were about 10 minutes long. The cartoons reflected the mood and tone of popular culture. In 1928, for example, theatergoers raved over



DID YOU KNOW? /

In the early 1950s, movie theaters started dropping newsreels and serial short subjects, opting to have more screenings per day of feature films. Ironically, while the production of those short cartoons began to decline, Disney released its short *Susie the Little Blue Coupe* (1952). More than 50 years later, it was *Susie* who helped inspire the hit Disney/Pixar animated film *Cars*.

WATCH *Mary Poppins*, *Who Framed Roger Rabbit*, *One Hundred and One Dalmatians* (1961), *The Little Mermaid* and *The Jungle Book* (1967), to see how xerography is used to create their imagery and effects ▶

RESEARCH Barco Escape, a new immersive cinema experience
ready2escape.com ▶

RESEARCH CinemaScope, a filming process that gives the illusion of three-dimensional images without the need for wearing special 3-D eyewear ▶

RESEARCH Appointment television, the practice of scheduling your life around what's on TV ▶

Disney's *Plane Crazy*, which starred Mickey Mouse as a wannabe Charles Lindbergh and paid homage to Lindbergh's 1927 first transatlantic solo flight. In similar fashion, Disney released its *Barnyard Olympics* to coincide with the 1932 Olympics in Los Angeles; *Mickey's Service Station* in 1935 to piggyback on the popularity of the automobile; and, in 1937, the short *Modern Inventions* to reflect on the world's ever-increasing technological advances.

Movie theaters were undeniably a, if not the, primary and premier hub for social experiences across America.

But the theater's dominance as a social, informational and entertainment mecca didn't last long. Enter the television. By the mid-1950s, the television set had penetrated enough households that it was impacting how audiences consumed entertainment and news. Major networks were broadcasting nightly news shows and a variety of entertaining programming into the home. Thousands of families across the nation hunkered down weekly in the comfort of their own living rooms to laugh together at the comedic genius of Lucille Ball in *I Love Lucy* and root for the gun-toting hero in classic western adventure shows such as *Gunsmoke*. It was the dawn of appointment television.

Theater owners and movie studios didn't silently relent to TV's growing popularity, however, responding in kind by changing to a wider-screen format (rectangular or an elongated rectangular image as in CinemaScope) and experimenting with 3-D movies. Disney's 1955 film *Lady and the Tramp*, for instance,

started out in the squarer format and midway through production was converted to CinemaScope to try and satisfy the changing tastes of movie-going audiences.

The postwar baby boom coupled with the mobility of the automobile added another interesting facet to movie-watching habits as people started to make the exodus from city living to the suburbs. While the first drive-in movie theater opened in Camden, New Jersey, in 1933, its popularity (for the social scene as much as the big screen) peaked in the late 1950s with more than 4,000 drive-ins sprinkled across the United States (see sidebar at right).

FIGHTING FOR ATTENTION

As television expanded and added color programming, movie studios responded with epic films, including wide-screen spectacles such as *Lawrence of Arabia* in the early 1960s. The technology of moviemaking saw continued innovations such as the xerography process used at Disney for *One Hundred and One Dalmatians*, which reduced the labor-intensive hand-ink-and-paint process of cel animation. The process later helped proliferate inexpensive animation for television, most notably from the Hanna-Barbera Studios, which dominated TV with shows such as *The Flintstones*, *The Jetsons* and *The Huckleberry Hound Show*.

By the 1970s, cable TV and the video home system (VHS) were introduced, providing yet more watching options. The VHS format took off in the 1980s with video rental stores popping up on every other street corner, from local one-off mom-and-pop shops to the eventual takeover of mega-chains such as Blockbuster. ▶

Movie theaters were undeniably a, if not the, primary and premier hub for social experiences across America.

DID YOU KNOW? /

The first movie palace, Regent Theatre, opened in 1913 in New York City.



DRIVE-IN DIVERSION

MOVIES-ON-THE-GO LOVE AFFAIR SOON FIZZLED

After World War II, the timing was perfect for a new market of families and teenagers to enjoy drive-in theaters. For both of these groups, going to the drive-in meant much more than simply seeing a movie. It was an evening out, full of fun and entertainment. Families arrived early to play a round of miniature golf, ride the miniature train or take the kids to the playground. Some drive-in theater owners even warmed baby bottles, put up the family dog in a kennel for the evening or did laundry "while you wait."

Teenagers, of course, flocked to the drive-in to get away from parents, hang out with friends or pursue their latest romance in the dark and comfortable privacy of their cars. In response, drive-in films were increasingly geared to this previously largely untapped audience.

Undoubtedly, the real cash cow for drive-in theater owners was the concession stand, where hot dogs, french fries, sodas, popcorn and candy bars were eagerly purchased at considerable markups. Colorful intermission films — featuring dancing hot dogs, clocks counting down and upbeat music — tempted moviegoers to leave their cars and catch a quick bite before the second film started.

After peaking in 1958, drive-in theaters quickly declined. Not only did the novelty wear off, but the seasonal business hurt theater owners, maintenance was expensive and land values started to increase as the suburbs expanded.

Fortunately, the fun of the drive-in theater can still be experienced today at a scattered group of survivors across the country.

— Donna Braden, curator of public life, *The Henry Ford*



PHOTO BY GETTY IMAGES/ NEW YORK TIMES CO.



SCREEN TIME PARADIGM



VHS was pivotal to our evolving movie-watching habits, representing an exchange of power, if you will. No longer were we forced to watch only what the movie studios released, the theaters showed and the TV networks broadcast at a particular time. We could go to a video store seven days a week and select the movie or movies (both newer releases and favorite classics) we wanted to watch. Plus, we could watch them where we wanted to — the living room, den, garage, bedroom — at a time of our choosing with whomever we wanted. No individual tickets or overpriced buttered popcorn required.

Of course, the release window, or the time between when a film was in the theater and released on VHS tape for home viewing, was sometimes long. Back in the day, we had to wait patiently for four to five months or more before a movie advertised on the theater marquee made it to the shelf at the neighborhood video store.

While the VHS was replaced in the 1990s by digital video disc (DVD), which has since been replaced by HD-DVD and Blu-ray disc formats during the 2000s, all of these formats act in the same vein, as ready-made escapes for children — and a lot of adults too, — who can, at their convenience, repeatedly watch their favorite feel-

good films like *The Lion King* and *Beauty and the Beast* while wearing their PJs and covered up on the couch.

SOCIAL SHIFT

Since the introduction of home-viewing formats, movie theater attendance has steadily declined. In 1930, more than 70 percent of the U.S. population went to a movie theater weekly. That figure has dwindled to below 10 percent today. As theaters continue to raise ticket prices and more digital streaming platforms are created, theater audiences will likely continue to erode.

The social experience has also shifted from taking in a flick in a theater full of strangers to watching it at home with friends and family. It's a trend that will only continue to grow with the availability of premium home theater systems and on-demand viewing or streaming services such as Netflix, Amazon and Hulu that are focused on convenience and customer service — basically your best-imagined neighborhood video store gone virtual. This homebound trend has also greatly impacted the release window of movies. Forget that four- or five-month wait time we had to put up with in the '90s. Today, films are often released simultaneously for theater and home viewing. ▶

DID YOU KNOW? /

In a scientific study posted on nature.com, researchers reported that movie audiences smell (and it's not like popcorn or perfume). The study monitored the levels of CO₂ and volatile organic compounds in theaters while films were playing and discovered that particular kinds of films elicit a particular type of overall audience odor. Moviegoers watching a comedy together, for example, will smell differently than the group watching a suspense next door.





**IN
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MORE
THAN
70%**

of the U.S.
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went to a movie
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That figure has
dwindled



**TO
BELOW
10%
TODAY.**

Theater owners have responded slowly to these changes because of a myopic view of the evolution of the audience. Some upstart theaters are trying to differentiate themselves by offering reserved seating with premium food and beverage services but at ridiculous cost. Staying in the comfort of your own home to watch a movie or even binge-watch a full season of a television show has become the new entertainment normal.

Personally, I think the local movie multiplex is an endangered species because of the increasing competition from other available entertainment platforms. For me and many other film fanatics, 80 percent of the movies being made by studios can be fully appreciated on a great home entertainment system. But there is that remaining 20 percent — those epic or tentpole movies that really need to be viewed on a larger screen to achieve the full experience. Take Christopher Nolan's 2017 war film *Dunkirk*, for example. I believe this one should only be seen on an IMAX or other custom high-resolution, reflective giant screen. It's the only way to fully grasp the scope of the subject matter, which would be diminished if consumed on a small screen, computer or mobile device.

While it's possible the movie theater will come full circle, with some multiplexes being converted into movie palaces to truly accommodate epic films and create a more immersive audience experience, only time will tell as the art of film watching continues to transform with our evolving tastes and innovations. ●

ONLINE Visit author and former Disney animator David Bossert's website davidbossert.com ►

GIANT SCREEN CAN'T BE BEAT

"We think coming to the Giant Screen Experience at The Henry Ford is always better than staying home," said Amy Louise Liedel, senior director of guest operations at The Henry Ford, when asked about the growing trend among moviegoers to stay put rather than venture out to the theater.

What gives the Giant Screen Experience an upper hand in this home vs. theater war, according to Liedel, is a focus on offering content and encounters with films that only institutions like The Henry Ford can. "To escape the churn and burn of day-and-date Hollywood entertainment, Giant Screen Experience specializes in unique content in a unique setting," she added.

Come to the Giant Screen Experience on a Throwback Thursday Night, for example, and you'll have the opportunity to rediscover popular classics and cult films from the '70s, '80s and '90s like *The Sandlot* (1993) or *Jaws* (1975) with added social interactions thanks to Alex Gojkov, Giant Screen Experience theater manager turned trivia boss. Gojkov has creatively embedded trivia competitions into a popular preshow event. Theatergoers play via their mobile devices courtesy of a free game-based learning platform called Kahoot. The live competitions are all the rage, with guests sometimes vying for prizes but, more importantly, the bragging rights.

For the latest list of feature films, showtimes and special programming events at The Henry Ford's Giant Screen Experience, please visit thehenryford.org.



Video On Demand

Subscription video-on-demand (SVOD), which is dominated by Netflix, Hulu and Amazon Prime, is the streaming media service that is the latest challenge to traditional movie theaters and network television. Streaming services have surpassed the use of physical home video, i.e. HD-DVD and Blu-ray, which has been in a precipitous free fall for the last several years.

SVOD allows for streaming anytime, anywhere, on any device, and that has put added pressure on appointment television, which is a specific day and time to watch a show. Now we can download shows to a tablet or mobile device and watch them when we want to, where we want to, and we can even binge-watch an entire season in a weekend.

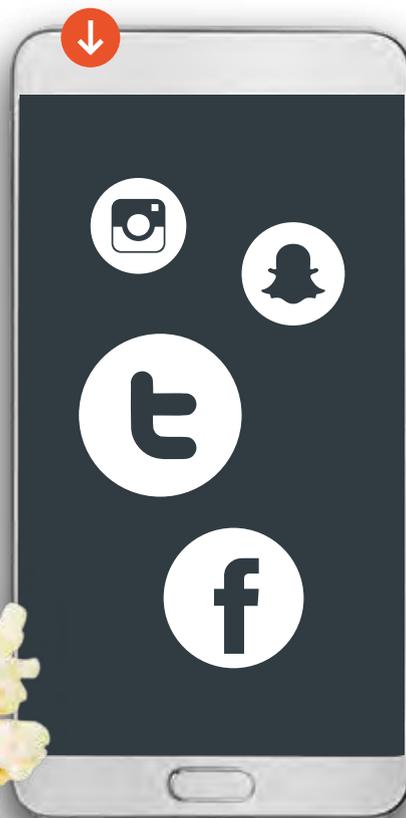
As the SVOD services mature, we can expect to see further impact on network television and movie theaters, especially as each service produces exclusive content.

SOCIAL MEDIA MATTERS

The rise of social media has allowed for far-flung communities of fans to interact with one another in online chat rooms. Friends can text one another or use Instagram or Snap Chat while they watch a favorite show in their respective homes as well as share half-crazed or intelligent fan theories bound to solicit hundreds of comments. In fact, in recent years some TV shows such as NBC's *Friday Night Lights* and *Community* have been saved from cancellation because of social media campaigns. Even the super-popular TV show *Scandal*, which got off to a shaky first season, can give credit to Twitter for its solid finish in the ratings. And make no mistake, fans today have a major impact on how films are being marketed, and the studios are super keen on leveraging the power of these fan bases to their advantage.

Studios are now regularly tapping into Facebook, Instagram, Twitter and other social media platforms to drive demand for films to enter wider releases and for screenings in specific locations. They are also using these platforms to create viral marketing campaigns encouraging fans to spread the word with friends.

Many of the most successful films and film franchises today (think *The Hunger Games* and *Transformers*) have had strong social media campaigns, a trend we can all expect to continue as movie studios further embrace these platforms in the future.



Join. Renew. Enjoy.

A membership at The Henry Ford comes with loads of benefits, from unlimited admission to select venues and free parking to food and retail discounts. The greatest member perk, however, might be your ability to help next-generation innovators find their path. Join a community centered on progress, and help support our mission to provide inspiring experiences to future makers. Become a member or renew your membership today. To see how you can save with a membership, visit thehenryford.org/membership/membership-math.

FIRST DIBS ON TICKET SALES

Summer Camps on sale February 28
Day Out With Thomas™ on sale March 7
Railroader's Breakfast on sale March 7
Salute to America on sale April 25
Maker Faire® Detroit on sale May 30

KEY DATES TO REMEMBER

The Science Behind Pixar
closes March 18
The World of Charles and Ray Eames
opens May 5
Rockwell, Roosevelt & the Four Freedoms
opens October 13

MEMBER APPRECIATION DAYS FEBRUARY 21-24 APRIL 13-15

Mark your calendar for these dates when members receive a double discount (20%) off food, drinks and select in-store and online shopping purchases, free admission to Ford Rouge Factory Tour, plus exclusive experiences listed below.

FEBRUARY 21-23*

Free Member Movie Night at the Giant Screen Experience

*Film, date and time will be announced at a later date.

APRIL 13

Join us for an **EXCLUSIVE MEMBER PREVIEW** of Greenfield Village before it opens to the public.

ENJOY THESE MEMBER PERKS



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Free admission to Henry Ford Museum of American Innovation, Greenfield Village and traditional movies at the Giant Screen Experience.



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Hydrone | Shell Eco-marathon



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INSIDE THE HENRY FORD

The Henry Ford is 250 acres of innovation, 300 years of history and 26 million artifacts. Flip through the following pages to find out what's happening inside this mind-blowing cultural institution during the winter and spring.

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MADE OF METAL

Vehicles in *Driving America* exhibition are real-life versions of the animated family of autos in popular film franchise *Cars*

Walk

through *The Science Behind Pixar* exhibition in Henry Ford Museum of American Innovation this winter, and you're sure to get an education in how the characters of the

famous animation studio's film *Cars* were imaginatively drawn.

The reality is that the autonomous talking vehicles that inhabit the pretend town of Radiator Springs are actually based on very

real historic vehicles — many of which can be seen on the exhibit floor of Henry Ford Museum of American Innovation.

"Most of the people behind the story [of *Cars*] were car guys — they loved cars and wanted to build a movie around them," said Matt Anderson, The Henry Ford's curator of transportation. "I think it's interesting the way real cars give personality to the movie itself."

Here are some of the *Cars* characters with real-life counterparts that can be found in Henry Ford Museum of American Innovation:

LIGHTNING MCQUEEN: The racing star's look is inspired by several real-life race cars, including the Ford GT40. The Henry Ford's Mark IV, a GT40 variant, earned the only all-American victory at the 24 Hours of Le Mans in 1967. Aerospace techniques were applied to the Mark IV's chassis, and its shape was refined in a wind tunnel. "There's a real cult following around the GT40," said Anderson. "People will come to the museum just to see our Mark IV, which has never been restored or modified." Lightning McQueen also has a little NASCAR in him, similar to the museum's 1987 Ford Thunderbird stock car driven by Bill Elliott.

SHERIFF: Radiator Springs' local lawman was based directly on a 1949 Mercury and licensed by Ford. "This is a car that is beloved among customizers," Anderson said. The car's curves and streamlined appearance inspired tweaking in the '50s, when owners would lower the suspension, chop the top and reshape the body with lead, inspiring the nickname "lead sled." Sheriff may be a more standardized police cruiser version of a '49 Merc than the The Henry Ford's flashier, customized model, but you can still see the resemblance.

FILLMORE: The groovy Hendrix fan and purveyor of organic fuel is a close cousin of Volkswagen's famous Type 2 Bus. "Fillmore is a classic hippie wagon," Anderson said. The van is also well known to fans of animated canine sleuth Scooby Doo and the meddling kids' ride, the Mystery Machine. The museum has a 1959 Volkswagen Westfalia Camper, a somewhat upscale version of the iconic van.

SARGE: During World War II, the auto industry converted its production to wartime items, including the Willys-Overland Jeep, the basis for the animated film's patriotic veteran Sarge, who earned the Grille Badge of True Metal for towing a tank to safety in the Battle of the Bulge. The museum has a 1943 model of the sturdy, utilitarian Willys-Overland Jeep.

LIZZIE: A feisty old lady who sells Route 66 memorabilia from her Radiator Springs Curios shop, Lizzie is based on a closed-body Ford Model T similar to The Henry Ford's 1919 model, which was once used by Henry Ford himself.

DOC HUDSON: An animated replica of a Hudson Hornet, Doc may not have a real-life counterpart at The Henry Ford, but the car's character has an interesting connection to the museum. Actor and race car driver Paul Newman, the voice of the wizened Doc Hudson, once visited The Henry Ford. He even had the rare opportunity to drive the museum's Old 16 Race Car, which won the Vanderbilt Cup in 1908 — the first American-built car to win what was at that time the largest international race held in the United States.

ONLINE For more information, hours and pricing, visit thehenryford.org/museum ▶

DID YOU KNOW? / Barris Kustom Industries' George Barris, considered the dean of car customizers, built many famous Hollywood cars, most notably the 1966 Batmobile.

FROM THE HENRY FORD ARCHIVE OF AMERICAN INNOVATION





▲ 1967 Ford Mark IV



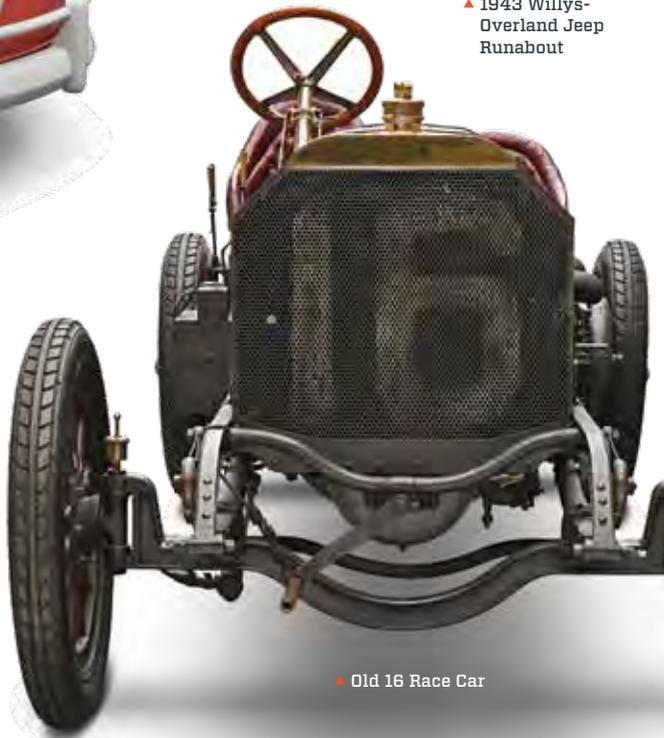
▼ 1949 Mercury



▲ 1959 Volkswagen Westfalia Camper



▲ 1943 Willys-Overland Jeep Runabout



▲ Old 16 Race Car



▲ 1919 Ford Model T

ANIMATION EXPOSED

The Science Behind Pixar showcases the science, technology, engineering and math (STEM) concepts used by the artists and computer scientists who help bring Pixar's award-winning films to the big screen.

Visitors to this exhibition in Henry Ford Museum of American Innovation can engage in hands-on activities, listen to first-hand accounts from members of the studio's production teams and even come face-to-face with re-creations of their favorite Pixar characters.

If you're searching for more information after your time in the exhibition concludes, visit The Henry Ford's website for links to a host of Pixar-approved resources and materials. You can explore activities and videos about creating a story and art, modeling, rigging, surfaces, sets and cameras, animation, simulation, lighting and rendering.

In addition, educators can download helpful activity sheets and cards for use with students before, during and after the exhibition. There are even online activities that give would-be future animators a taste for how to create a short animation and a virtual 3-D model.



The Science Behind Pixar
Through March 18
Henry Ford Museum of American Innovation



PHOTO BY KMS PHOTOGRAPHY

The Science Behind Pixar was developed by the Museum of Science, Boston in collaboration with Pixar Animation Studios. © Disney/Pixar. All Rights Reserved. Used Under Authorization.

GIANTS IN MOTION

The turntable that can move 1,000-ton locomotives in Greenfield Village helps demonstrate Sir Isaac Newton's notable notions

This

winter, visitors to The Henry Ford can experience *The Science Behind Pixar* exhibition to get an insider's look at how animators translate fundamental forces of nature and

Newton's Laws of Motion to help create their "realistic" pretend worlds and beloved characters (see story on Page 28). Those same laws can also be seen in action daily in Greenfield Village April 14-October 28 near the Detroit, Toledo & Milwaukee Roundhouse.

Ask most people how many adults it would take to manually push and turn around a multiton steam locomotive, and they will say it can't be done. The truth is that it can, and the answer is it just takes one.

Turntables are the reason. These handy mechanical wonders were invented to rotate steam locomotives to turn them around at the end of a rail line or to allow access to various stalls in a roundhouse.

The Henry Ford obtained the century-old turntable that now operates in Greenfield Village in 1984. It's used today to turn the village's steam engines and to facilitate their entrance into the roundhouse for maintenance and repairs.

"There are fewer than 10 working roundhouses in the U.S. open to the public, so we get a number of people who come just

to see our trains and to get in our roundhouse," said Matt Anderson, The Henry Ford's curator of transportation. "It's a rare experience."

How is it possible for one person to manually rotate a steam engine on a turntable? When a locomotive enters the turntable and is parked correctly — or spotted, as railroaders say — it will be dead center in the span, with considerable space at both ends. It effectively floats on the bearing and doesn't touch the guide rail underneath, which means less friction. From there, it's all about torque. Torque is the rotational force — the measure of the force used to rotate an object about an axis. Think about opening a door. Push a door ajar on the side closest to the doorknob, and it easily swings open. Push that same door closer to its hinges, and more effort is needed to make it swing wide.

Similarly, lean directly against a steam engine on a turntable to make it move, and the locomotive won't budge. Hold a long bar extending at an angle horizontally from the turntable's span, however, and push, and pretty soon the locomotive starts to rotate.

"Guests are surprised that starting the turntable isn't the hard part," said Anderson. "It's stopping it. A lot of momentum builds really quickly!"

DID YOU KNOW? /

Weather permitting, visitors to Greenfield Village can take a turn at rotating the 40-ton turntable near the Detroit, Toledo & Milwaukee Roundhouse daily at 10:50 a.m., 1:45 p.m. and 3:50 p.m. Must be 6 years or older.

DID YOU KNOW? /

Detroit Bridge & Iron Works built the turntable currently operating in Greenfield Village in 1901.

▼ Young visitors take a turn at rotating the 40-ton turntable near Greenfield Village's Detroit, Toledo & Milwaukee Roundhouse.



PHOTO BY BILL BOWEN

ONLINE For more information, hours and pricing, visit thehenryford.org/village ▶



**MEMBER
PERK**
Member tickets
go on sale March 7

TRAVELING THOMAS

Greenfield Village hosts its share of rail fans, and perhaps none are more enthusiastic than the pint-sized visitors who come to ride Thomas the Tank Engine every year. The iconic character first appeared in book form in 1945 and then came to life in a bigger way thanks to the 1984 eponymous TV series, which is produced via live-action model animation. Today, Thomas the Tank also travels the country as a real train, sometimes appearing as a steel replica front with an engine in the back or as the real deal — a full steam locomotive — as he does in Greenfield Village in the spring.

“Greenfield Village is all about being as authentic as possible, and so from day one, we’ve gone with the real steam Thomas,” said Jim Johnson, The Henry Ford’s curator of historic structures and landscapes. “I love the fact that it’s real. It blows smoke in the kids’ faces; they can feel the heat coming off it and hear the whistle.”

Thomas the Tank comes to Greenfield Village on a lowboy trailer from the Strasburg Rail Road in Pennsylvania, widely viewed as masters of steam locomotive operations. His face is always covered to avoid spoiling the magic of first seeing him on the tracks. “Thomas has been a boon to railroad museums,” said Matt Anderson, The Henry Ford’s curator of transportation. “If not for him, I think a lot of children wouldn’t be as acquainted with trains as they are. There’s something inherently fascinating about big trains — once people see them, they fall in love.”



SAVE THE DATE
Day Out With Thomas™
April 28-29,
May 5-6, 12-13

REAL GENIUS

A fearlessly creative animator gives added depth to the F-150's story of innovation

When

most of us think of animation, we think about cartoon characters and movies: Mickey Mouse, Bugs Bunny, Homer Simpson, *Cinderella*, *Cars* and *The Lion King*. But animation is

also used to bring real objects and processes vibrantly to life — as in the Ford Rouge Factory Tour's *Manufacturing Innovation* film experience shown in the Manufacturing Innovation Theater.

The opening sequence of the theater's 10-minute film, which depicts the conceptualization and production of the aluminum-body Ford F-150, uses animation to tell the story of how consumer input helped shape the new truck's design. It was created in partnership with Los Angeles-based BRC Imagination Arts, which entrusted the film's animation sequences to a young concept artist named Mikey Nitro. A Los Angeles native, Nitro has done bold, progressive work around the world, from acting as production artist for the Story Garden visitor center in South Korea to environmental designer for

the Bud Selig Experience at Miller Park (where the Milwaukee Brewers play baseball) in Milwaukee, Wisconsin.

"We had filmed Ford's market researcher doing her job gathering customer ideas that really did become part of the F-150. We wanted the story to pop and feel to the viewer like the information was bubbling up during the design process," said Cynthia Jones, general manager of Henry Ford Museum of American Innovation and Ford Rouge Factory Tour. "We left it to Mikey to figure out how to do all that on-screen. And he did. When you see the film, it doesn't feel contrived; it feels very high-tech," noted Jones.

Nitro also worked on the projection mapping on the F-150 that appears as part of the theater experience. "It's the depth and detail that the animation provides to present our story," said Jones. "I think what works is there's this constant layering of information that gets to the complexity of the design process. That was Mikey's goal — to take very complex information and portray it in a fast, digestible way."

▼ Animator Mikey Nitro is the artistic mastermind behind the *Manufacturing Innovation* film's immersive sequences that bring the design process of the aluminum-body Ford F-150 to life.

FACTORY FILM FACTS

Number of people who were part of the on-site *Manufacturing Innovation* film crew:

6

Number of visitors who have seen *Manufacturing Innovation*:

**NEARLY
300,000**

Year-over-year growth in visitors since the film's release:

25%

ONLINE For more information, hours and pricing for the Ford Rouge Factory Tour, visit thehenryford.org/rouge ▶

PHOTO COURTESY OF BRC IMAGINATION ARTS



NOTES FROM MR. NITRO

Mikey Nitro, environmental designer for BRC Imagination Arts, spoke with *The Henry Ford Magazine* about what inspired his work on the *Manufacturing Innovation* film visitors see in the *Manufacturing Innovation Theater* during the Ford Rouge Factory Tour.

THF Magazine: How did your artistic style play into your work for the *Manufacturing Innovation* film project?

Nitro: I like to design off of people's emotions and experiences. My peers know me for being on the more modern and edgy side. As a concept artist, when I started this project I wanted to capture the Ford attributes in a fresh way, tell the story, carry its main essence and make it bold.

THF Magazine: What did you most enjoy about creating this film?

Nitro: When I met the [F-150] design team. They showed me the processes and thought they put in from the beginning. All the passion — the sketches and model making. As a designer, I could totally relate.

THF Magazine: Any unexpected challenges you had to conquer during the process?

Nitro: The time limit. It was a nine-month turnaround. But I like challenges and working under pressure. We were not only telling the story through animation but trying to sync the music to the animation and the robotic arm [used for the truck projection] as well. Plus, the floors were moving. It was like orchestrating a choir.

THF Magazine: What aspects of the project are you most proud of?

Nitro: Having this really out-there vision and executing it. And the fact that it's permanent. I watched the film with a regular audience, and to see their reactions was probably the best part of being an environmental designer.

GRAPHICS GAME CHANGER

A computer symbolizes how one group's decision to take things into its own hands helped change the face of the animation industry

Pixar:

We know it today as the successful computer animation studio behind award-winning film favorites like *Toy Story* and *WALL-E*. The company's nascent years as a computer hardware

developer, however, are less apparent.

In 1979, Pixar found its origins as the graphics group within the computer division of Lucasfilm, led by Edwin Catmull and Alvy Ray Smith. Spurred on by high expectations from their boss George Lucas (yes, the man behind the *Star Wars* and *Indiana Jones* film franchises) to produce future-forward technology — and struggling with limitations in graphics processing at that time — the group took the bull by the horns and developed its own computing hardware.

The first prototype of the Pixar Imaging Computer (PIC) was demonstrated at the renowned computer graphics conference SIGGRAPH in 1984. Throughout 1985, these machines appeared at computer and industry trade shows everywhere. While the computer demonstrated the ability to handle advanced 3-D graphics, it was not until the division was acquired by Steve Jobs of Apple Inc. in 1986 that the team was able to commercialize the technology on a wider scale.

The first commercially available iteration of the PIC was marketed as a high-end graphics and visualization computer for commercial and scientific use. The PIC did not contain application software — it was intended that the purchaser of the equipment would develop

specialized programs to suit the task at hand.

Oddly, or maybe not, it wasn't just the entertainment industry that latched on and ran with the technology. The U.S. government's departments of Defense and Forestry found the PIC's transparency-rendering capabilities to be excellent for cloud simulation; space and engineering firms used it for complex animation models and prototype testing; medical imaging applications allowed for lower-cost 3-D CAT scans of the human body. Overall, the PIC's superior and rapid performance in rendering texture, light and transparency for 3-D images outshone general-purpose and supercomputers of that time.

The Henry Ford's computing collections can be used to explore the application of technology toward creative and expressive activities. The PIC — a PII — acquired in 2014 by The Henry Ford was a "test computer" owned by a Pixar employee from 1986 to 1989. During the company's heyday of hardware production, this Pixar field service representative was responsible for all operations east of the Mississippi and within Europe. He installed approximately 60 percent of all PICs made and traveled with the computer to technology trade and demonstration shows around the country.

The first version of the PIC sold for \$135,000, with the addition of a \$35,000 mainframe workstation. When the PII became available commercially in 1987, it cost \$30,000.

Pixar closed its hardware division in 1990; a total of 312 PICs were manufactured — 143 PIs and 169 PIIIs.

ONLINE To see more computers in the collections of The Henry Ford, visit thehenryford.org/collections-and-research/digital-collections/expert-sets/12170 ▶



▼ The Pixar Imaging Computer II (PII) represents an important milestone in the growth of computer-generated imagery. Its high-end visualization capabilities completely broke all conventions of what was thought possible in the realms of scientific imaging and animation production.

COMPUTER STAR

While early computers such as the PII played a big role in making animated films what they are today, a few computer models have actually had starring roles on the big screen — like the IMSAI 8080.

This computer was Matthew Broderick's co-star in the popular 1983 film *WarGames*, which told the story of David Lightman (Broderick), a high schooler who hacks into a military supercomputer while searching for new video games and finds himself embroiled in a strategy game with real-life consequences.

"*WarGames* is a popular culture touchpoint of the 1980s, capturing Cold War-era paranoia," said Kristen Gallerneaux, curator of communications and information technology for The Henry Ford. "Matthew Broderick's character uses an IMSAI 8080 computer and acoustic modem to 'war dial' into what he believes is a computer game company, but it turns out to be the fictional WOPR supercomputer at NORAD. If Broderick loses the game, WOPR has the potential to start World War III with the release of nuclear warheads."

The boxy IMSAI 8080 was a clone of the Altair 8800, the first mass-marketed personal computer. It was a popular "kit computer," requiring assembly and programming. With no keyboard, toggle switches allowed input and LED lights signaled output.

Only about 20,000 IMSAI 8080s were ever produced. The Henry Ford acquired its IMSAI 8080 (which isn't the actual computer that appeared in *WarGames*) from donor O.S. Narayanaswami, a mechanical engineer interested in the educative power of computers. He assembled it in 1977.

DID YOU KNOW? /

The Walt Disney Company collaborated with Pixar in the late 1980s to develop the Computer Animation Production System (CAPS) for the PIC; the shift from traditional to digital animation was first realized by the company on this platform.



2018 Events

Celebrate.
Play.
Imagine.

THE WORLD OF CHARLES AND RAY EAMES

MAY 5-SEPTEMBER 3
Henry Ford Museum of American Innovation

Charles and Ray Eames are among the most important designers of the 20th century. Their enduring influence is widely acknowledged and continues to be celebrated worldwide.

The World of Charles and Ray Eames is a major exhibition surveying the careers of Charles (1907-1978) and Ray (1912-1988) Eames and the extraordinary work of the Eames Office: a laboratory, active for more than four decades, where the Eameses and their collaborators and staff produced pioneering and influential work — from architecture, furniture, graphics and product design to paintings, drawings, film, sculpture, photography, multimedia installations and exhibitions, as well as new models for education.

Bringing together hundreds of works, this exhibition presents the world of Charles and Ray Eames through the projects produced during their lifetime, offering an opportunity to re-examine their work and legacy, and the legacy of postwar modernism. The Eameses moved fluidly between the mass-production of objects for everyday use and the transmission

of ideas through exhibition, film or installation, in anticipation of the global 'information age'. The exhibition features a wealth of documentation and contextual material from the professional archive of the Eames Office as well as artifacts from their personal collections and the collections of The Henry Ford. Alongside a rich array of Eames designs, the exhibition will also highlight the importance of their collaborations and associations with some of the leading artistic figures of the 20th century, including Buckminster Fuller, Alexander Girard and Eero Saarinen.

Visitors to the exhibition will also get a better sense of the Eameses' impact on 20th-century concepts of modern living: their editorial eye and mastery of form and material have yielded some of the most iconic designs of all time. *The World of Charles and Ray Eames* promises to be an unforgettable exhibition for all Eames admirers and a joyful discovery for anyone interested in the basic principles of good design.

ONLINE To learn more, visit thehenryford.org/world-of-eames ▶



▼ Charles (right) and Ray Eames selecting slides.

© EAMES OFFICE LLC



Exhibition curated and organized
by Barbican Centre, London

barbican

In collaboration with



Supported by

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FOUNDATION FOR AMERICAN ART

THE WORLD OF CHARLES AND RAY EAMES IS
CURATED AND ORGANIZED BY BARBICAN CENTRE,
LONDON, IN COLLABORATION WITH EAMES OFFICE
AND SUPPORTED BY TERRA FOUNDATION

2018 Events

YEAR-ROUND

Throwback Thursday Nights*

Most Thursdays,
7 p.m. (Giant Screen Experience
thehenryford.org/TBT

Make Something: Saturdays

September-May,
Every Saturday,
10 a.m.-3 p.m.
Museum

Tinkering for Tots Preschool Program

Second Monday of each
month, 10 a.m.-noon
November-April: Museum
May-October: Village

JANUARY

The Science Behind Pixar Exhibition*

Running through
March 18
Museum

Presented by Meijer

Engines Exposed

January 13-February 28
Museum

MLK Day

January 15
Museum

Admission fee waived
courtesy of The Henry Ford

FEBRUARY

Engines Exposed

Running through
February 28
Museum

The Science Behind Pixar Exhibition*

Running through
March 18
Museum

Celebrate Black History

February 1-4, 7-11, 14-18
and 21-25
Museum

Presented by Ford Motor
Company Fund

National Engineers Week Celebration

February 17-24
Ford Rouge Factory
Tour/Giant Screen
Experience/Museum

Member Appreciation Days

February 21-24
The Henry Ford

MARCH

The Science Behind Pixar Exhibition*

Running through
March 18
Museum

Sensory-Friendly Saturday*

March 17
Museum

Michigan Invention Convention Showcase

March 19
Museum

APRIL

Member Appreciation Days

April 13-15
The Henry Ford

Rockwell, Roosevelt & the Four Freedoms

October 13, 2018-January 13, 2019



NORMAN ROCKWELL (1894-1978), *THE PROBLEM WE ALL LIVE WITH*, 1963. OIL ON CANVAS, 36" X 58". ILLUSTRATION FOR LOOK, JANUARY 14, 1964. NORMAN ROCKWELL MUSEUM COLLECTION.

Day Out With Thomas™*

April 28-29
Village

Railroader's Breakfast*

April 28-29
Village

MAY

Outdoor Living Lab Tour*

May 1-September 30
Ford Rouge
Factory Tour

The World of Charles and Ray Eames Exhibition Preview*

May 3
Museum

Sensory-Friendly Saturday*

May 5
Village

The World of Charles and Ray Eames Exhibition

May 5-September 3
Museum

Day Out With Thomas™*

May 5-6 and 12-13
Village

Railroader's Breakfast*

May 5-6 and 12-13
Village

Civil War Remembrance

May 26-28
(Open Saturday 'til
9 p.m.) (Village

JUNE

The World of Charles and Ray Eames Exhibition

Running through
September 3
Museum

National Invention Convention

June 1
Museum

Cinetopia International Film Festival*

June 1-10
Giant Screen
Experience

National Get Outdoors Day

June 9
Village

Historic Base Ball Games

June 9-10, 16-17
and 23-24
Village

Historic Base Ball in
Greenfield Village is
made possible through
the generous support of
Cynthia and Edsel B. Ford II

Motor Muster

June 16-17
(Open Saturday 'til
9 p.m.) (Village

Sensory-Friendly Saturday*

June 23
Ford Rouge Factory Tour

Summer Camps*

June 25-29
The Henry Ford

Annual Salute to America*

June 30 (Village

PIXAR
FAVORITES ON THE
GIANT SCREEN

Popular film picks from Pixar will be showing at The Henry Ford's Giant Screen Experience through March 18. Take in one of these animated blockbusters this winter, and then head on over to experience *The Science Behind Pixar* exhibition in Henry Ford Museum of American Innovation, which also runs through March 18.

MEMBERS

SAVE

15%

on all Pixar movie
screenings at
Giant Screen Experience.



JULY

The World of Charles and Ray Eames Exhibition

Running through September 3
Museum

Annual Salute to America*

July 1, 3 and 4 (Village

Historic Base Ball Games

July 7-8, 14-15, 21-22 and 28-29
Village

Summer Camps*

July 9-13, 16-20, 23-27, 30
The Henry Ford

Maker Faire® Detroit*

July 28-29 (Open Saturday and Sunday 'til 6 p.m.) (The Henry Ford

In collaboration with Maker Media

AUGUST

The World of Charles and Ray Eames Exhibition

Running through September 3
Museum

Summer Camps*

August 1-3 and 6-10
The Henry Ford

Historic Base Ball Games

August 4-5, 11-12 and 18-19
Village

World Tournament of Historic Base Ball®

August 11-12
Village

National Aviation Day

August 19
Museum
Admission fee waived courtesy of Delta Air Lines

SEPTEMBER The World of Charles and Ray Eames Exhibition

Running through September 3
Museum

68th Annual Old Car Festival

September 8-9 (Open Saturday 'til 9 p.m.) (Village
Member Appreciation Days
September 20-21
The Henry Ford

Fall Flavor Weekend

September 29-30
Village
Farmers Market
September 29
Village

OCTOBER

Fall Flavor Weekend

October 6-7
Village
Farmers Market
October 6
Village

Hallowe'en in Greenfield Village*

October 12-14, 18-21 and 25-28 (Village
Hallowe'en in Greenfield Village Dinner Package*

October 12-13, 18-20 and 25-27 (Village

Rockwell, Roosevelt & the Four Freedoms

October 13, 2018- January 13, 2019
Museum
NOVEMBER Rockwell, Roosevelt & the Four Freedoms
Running through January 13, 2019
Museum

Member Appreciation Days

November 17-19
The Henry Ford
Members 25th Annual Holiday Lighting Ceremony*
November 19 (Museum

Visits with Santa

November 23- December 24
Museum
Holiday Nights in Greenfield Village*
November 30 (Village

Holiday Nights in Greenfield Village Dinner Package at Eagle Tavern*

November 30 (Village
Holiday Nights Supper with Santa Package at A Taste of History**
November 30- December 2 (Village

DECEMBER

Visits with Santa

Running through December 24
Museum
Rockwell, Roosevelt & the Four Freedoms
Running through January 13, 2019
Museum

Holiday Nights in Greenfield Village*

EE BERGER

December 2, 7-9, 14-16, 19-23 and 26-29 (Village
Holiday Nights in Greenfield Village Dinner Package at Eagle Tavern*
December 2, 7-9, 14-16, 19-23 and 26-29 (Village

Holiday Nights Supper with Santa Package at A Taste of History**

December 2, 7-9, 14-16 and 19-23 (Village
Holiday Nights Supper Package at A Taste of History*
December 26-29 (Village

2018 HOURS

Henry Ford Museum of American Innovation
Open 7 days a week, 9:30 a.m.-5 p.m.

Greenfield Village
April 13: Opens exclusively to members plus guests covered by their membership

April 14-October 28: Open to the public, 7 days a week, 9:30 a.m.-5 p.m.

October 29-November 25
Open Friday-Sunday, 9:30 a.m.-5 p.m.

November 26, 2018- April 13, 2019 Closed; open select evenings in December

Giant Screen Experience
Open daily with extended hours

Ford Rouge Factory Tour
Open Monday-Saturday, 9:30 a.m.-5 p.m. Call for bus times and seasonal hours.

Benson Ford Research Center
Reading room open Monday-Friday, 9:30 a.m.-5 p.m.

For the latest updates and more information on special events and programs, call 313.982.6001 or visit thehenryford.org.

All attractions closed Thanksgiving and Christmas days.

All programs and dates are subject to change.

The Henry Ford is an independent nonprofit organization. We depend on ticket purchases, income from our stores and restaurants, and tax-deductible contributions and memberships for support.

*Additional fee and/or advance reservation required.

(Special evening hours during these events.

Connect 3

Curators uncover curious connections between artifacts and ideas

→ Wartime Innovation of Common Goods

How do canned milk and facial tissue connect to a classic toy?



▲ BORDEN'S EAGLE BRAND CONDENSED MILK, 1900-1915

Before airtight canning came about, soldiers on the battlefield resigned themselves to eating spoiled food. When inventor Gail Borden figured out a way to preserve milk by canning, military men were some of the first to drink it down en masse.

MAKE THE CONNECTION:

Figuring out a way to preserve things to eat for those who were fighting for freedoms helped change the way people around the world experience food.

▶ BOX OF KLEENEX FACIAL TISSUE, CIRCA 1955

As cotton became harder to come by in World War I, those tending wounded warriors needed a cotton-like substance to use as a bandage. Kimberly-Clark's kind-of-like-cotton creation quickly fit the bill. Not ready to scrap the after-war surplus of the substance, the company later repurposed it as Kleenex, a name now synonymous with soft, throwaway facial tissue.

MAKE THE CONNECTION:

Wartime's demand for quick thinking and even quicker live-saving substitutes helped create common household products we never knew we needed.



▲ SILLY PUTTY, CIRCA 1962

Facing a rubber shortage in World War II, the U.S. government started searching out scientists to develop synthetic similars. While one of these solicited substances ended up being too soft for missions of war, it sure satisfied as a highly sought-after kids' toy.

MAKE THE CONNECTION:

Not all wartime innovations are necessarily applicable to times of war, but many stumble upon a practical purpose — whether serious or silly.

“Wartime throughout the centuries has created situations of severe necessity and great innovation ... Common goods such as Kleenex, Silly Putty or canned food have wartime roots.”

— Katherine White, associate curator, digital content, The Henry Ford

WATCH The *Wartime Innovation of Common Goods* Connect 3 video authored by Katherine White, associate curator at The Henry Ford thehenryford.org/explore/stories-of-innovation/connect3/wartime-innovation ▶



STAY, EXPLORE + SAVOR

Ready to plan your visit to The Henry Ford? All you need to know about available lodging options — including hotel names, locations and contact information — is here. When you book with one of The Henry Ford's official lodging partners, be sure to ask about available double and family vacation packages, which include attraction tickets and overnight accommodations. **Packages start at under \$139.**

Don't wait, book your date with America today at thehenryford.org/vacations.

CALL CENTER:

313.982.6001 or 800.835.5237.

Save time: order tickets online at thehenryford.org.

Discount tickets available at Meijer.

Packages available at thehenryford.org/vacations.

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HISTORIC



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Accommodations at a Glance

HOTEL	LOCATION AREA	DRIVE TIME*	SLEEPING ROOMS	POOL	PETS	MEETING ROOMS	MEETING SPACE (sq. ft.)	AD ON PAGE	
FULL SERVICE	Best Western Greenfield Inn	Dearborn (I-94 corridor)	10	209	Indoor	•	4	1,047	65
	DoubleTree by Hilton Detroit-Dearborn	Dearborn	10	347	Indoor		16	12,000	70
	Edward Hotel & Convention Center	Dearborn	5	773	Indoor	•	30+	62,000	70
	Holiday Inn Southgate Banquet & Conference Center	Downriver (I-75 corridor)	15	160	Indoor		8	9,000	73
	The Henry, an Autograph Collection by Marriott	Dearborn	5	323	Indoor	• \$	14	26,000	68
	Sheraton Detroit Metro Airport	Airport (I-94)	15	359	Indoor	•	14	14,000	67
HISTORIC	The Dearborn Inn, a Marriott Hotel	Dearborn	3	229	Outdoor		17	17,000	75
	The Westin Book Cadillac	Downtown Detroit	15	453	Indoor/Spa	•	13	26,000	74
LIMITED SERVICE	Comfort Inn & Suites - Allen Park	Dearborn (I-94 corridor)	10	163	Indoor		2 (15 each)		75
	Comfort Inn & Suites - Dearborn	Dearborn	4	116	Indoor		1	250	66
	Comfort Inn & Suites - Taylor	Dearborn (I-94 corridor)	10	78	Indoor		1 (15)		65
	Comfort Suites - Southgate	Downriver (I-75 corridor)	15	78	Indoor		1 (50)		69
	Country Inn & Suites - Dearborn	Dearborn	7	100	Indoor	•	1 (55)		66
	Courtyard by Marriott - Detroit Dearborn	Dearborn	10	147	Indoor		2	1,274	68
	Hampton Inn - Detroit/Dearborn	Dearborn	3	96	Indoor		0		67
	Hawthorn Suites by Wyndham	Detroit	10	128	Outdoor	• \$	0		73
	Holiday Inn Express & Suites - Southgate	Downriver (I-75 corridor)	15	114	Indoor		1	400	73
	Marriott TownePlace Suites - Dearborn	Dearborn		148	Outdoor	• \$	0		73
	Red Roof Inn - Detroit-Dearborn	Dearborn	7	111		•	0		67
Staybridge Suites - Dearborn	Dearborn	7	99	Indoor	• \$	1 (35)		67	
BED & BREAKFAST	York House Bed & Breakfast	Dearborn	10	3			0		72
CAMPING	Camp Dearborn	NW Oakland County	45	191	Outdoor		0		72
	Detroit Greenfield Campground/RV Park	I-94 corridor	20	212	On lake	•	Outdoor pavilion	600	72

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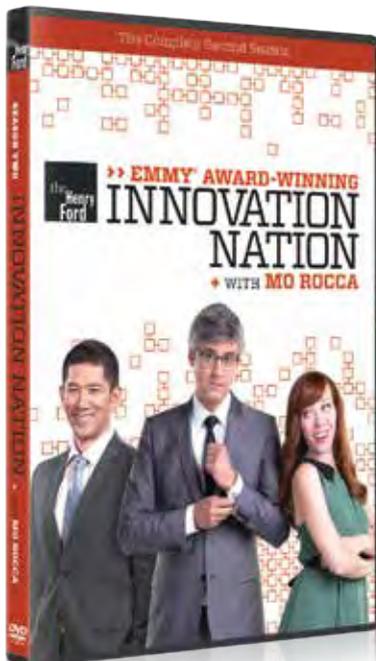
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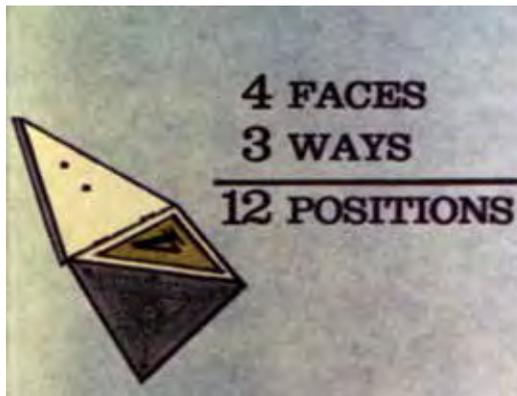
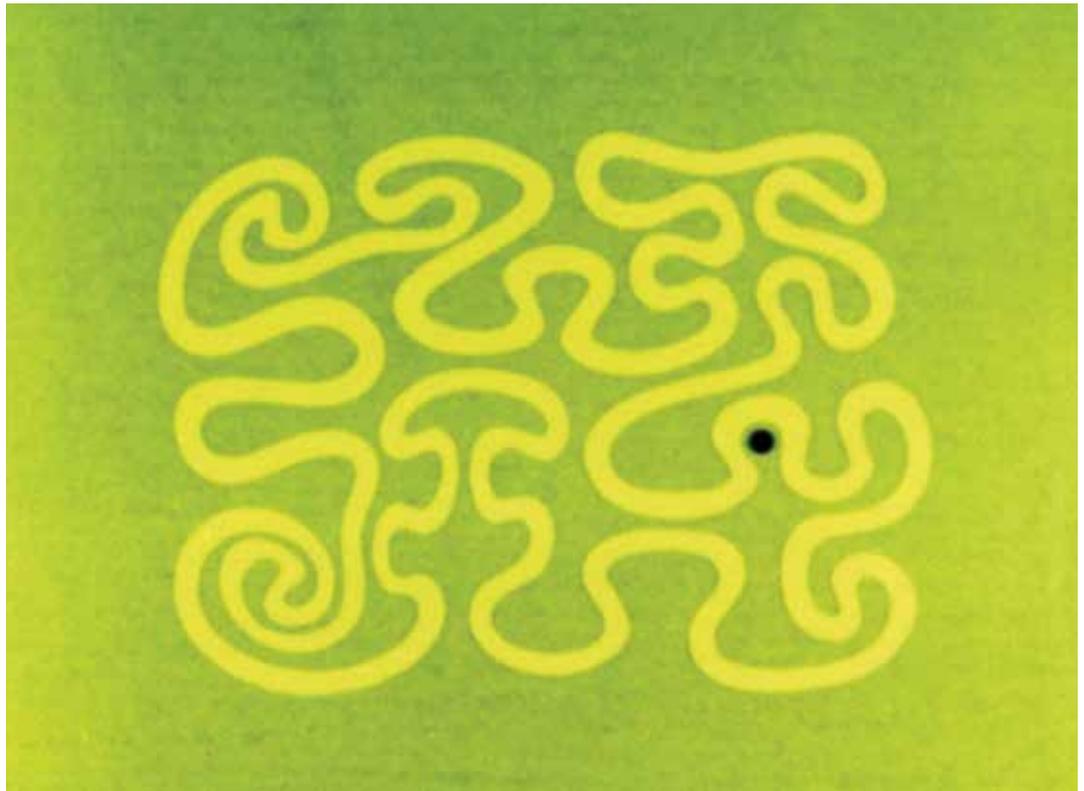
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A LOOK BACK

MATHEMATICA PEEP SHOWS, 1961

Mathematica is an interactive exhibit designed by Charles and Ray Eames in 1961, filled with a kinetic wash of sound: the clatter of balls dropping along the pins of the Probability Machine, bells ringing on the Multiplication Cube and the whoosh of metal spheres funneling their way down the cone of Celestial Mechanics. At the back of the installation, the whisper of a playful soundtrack and the measured words of a narrator cut through the din to draw curious guests near a singular screen.

Alongside the central experiences of *Mathematica*, five 2-minute-long "peep show" films further amplify concepts in the exhibit. Four of the films are animated, bringing the distinctive drawing style of Eames Office employee Glen Fleck to life. The soundtracks are composed by Elmer Bernstein, with narration on several films by Charles Eames himself. The peep shows were meant to provide yet another friendly entry point to the consumption of mathematical concepts like circumference, curves and symmetry.

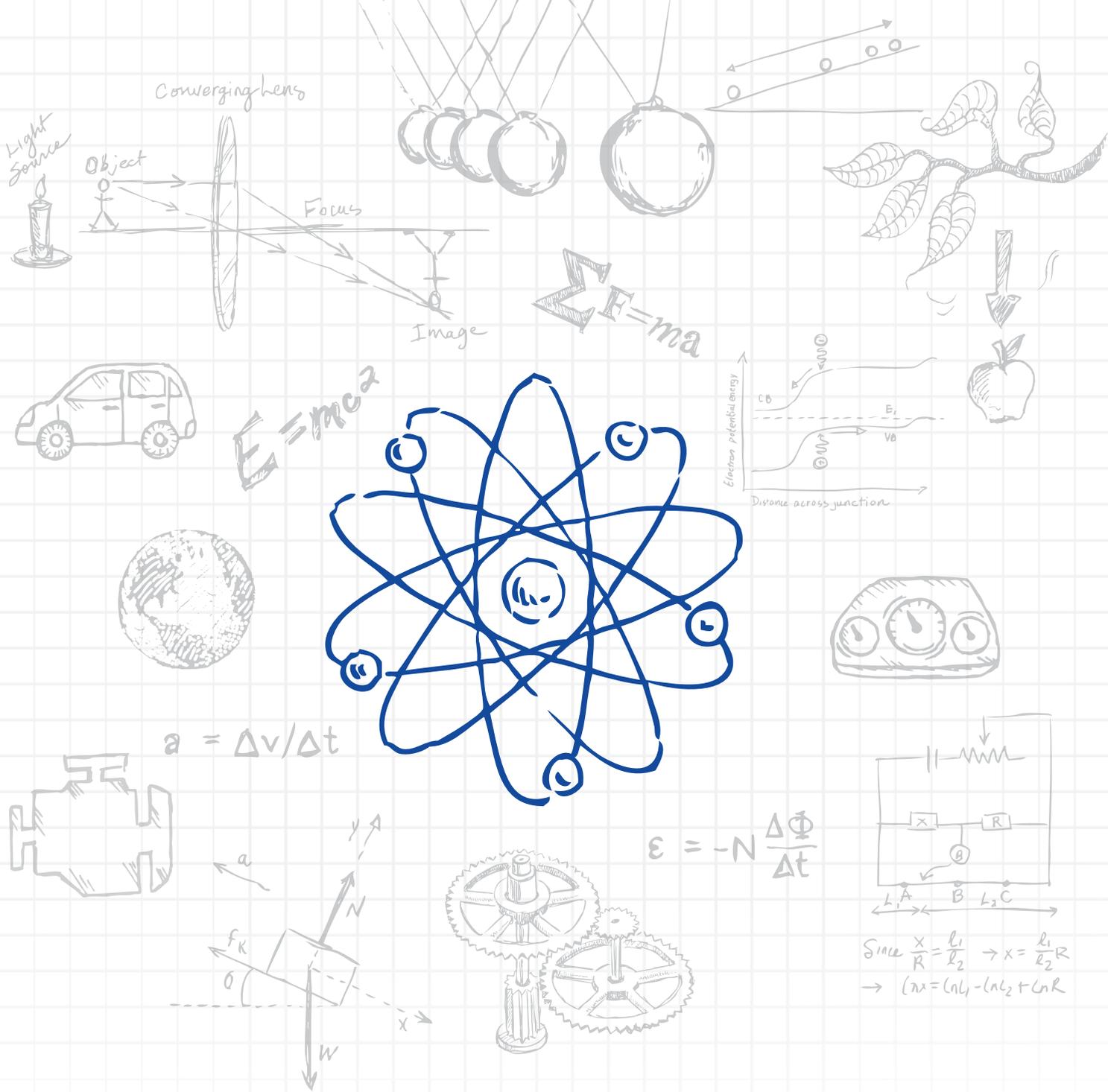


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DID YOU KNOW? /

Much like the Edison kinetoscope parlors of the 1890s, the Eames films were initially installed to be watched by one person at a time through a viewing portal. Their popularity (combined with difficulties maintaining the film loops) forced the Eameses to replace these viewing devices with small theater areas.

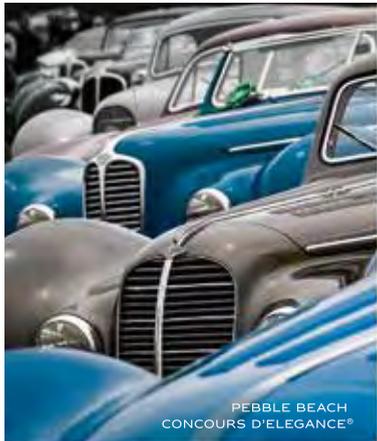
◀ *Mathematica* in Henry Ford Museum of American Innovation features fully restored versions of the exhibition's original five peep show films, four of which are animated and highlight the drawing style of Eames Office employee Glen Fleck.



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