

A close-up, artistic view of a camera lens. The lens is the central focus, with its intricate internal elements and glass surfaces visible. The lighting is dramatic, with a warm, golden glow emanating from the lens, creating a sense of depth and focus. Several colorful bokeh light spots are scattered across the lens, adding a vibrant, abstract quality to the image. The overall composition is circular, emphasizing the lens's shape and the circular bokeh patterns.

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**The future of content
creation: Virtual production**

Unlocking creative vision
and business value

Pressure is building in the industry as traditional and disruptive content creators compete for not only customers, but also production, visual effects, and postproduction talent and resources. As the COVID-19 global pandemic introduces further complications, virtual production capabilities may become a competitive advantage for content creators.

What is virtual production?

Every director and visual effects (VFX) professional will define virtual production slightly differently, but at its core, virtual production is modern content creation: **It is an agile process characterized by starting VFX earlier and leveraging technology throughout the entire production life cycle to enhance the way content is created.**¹

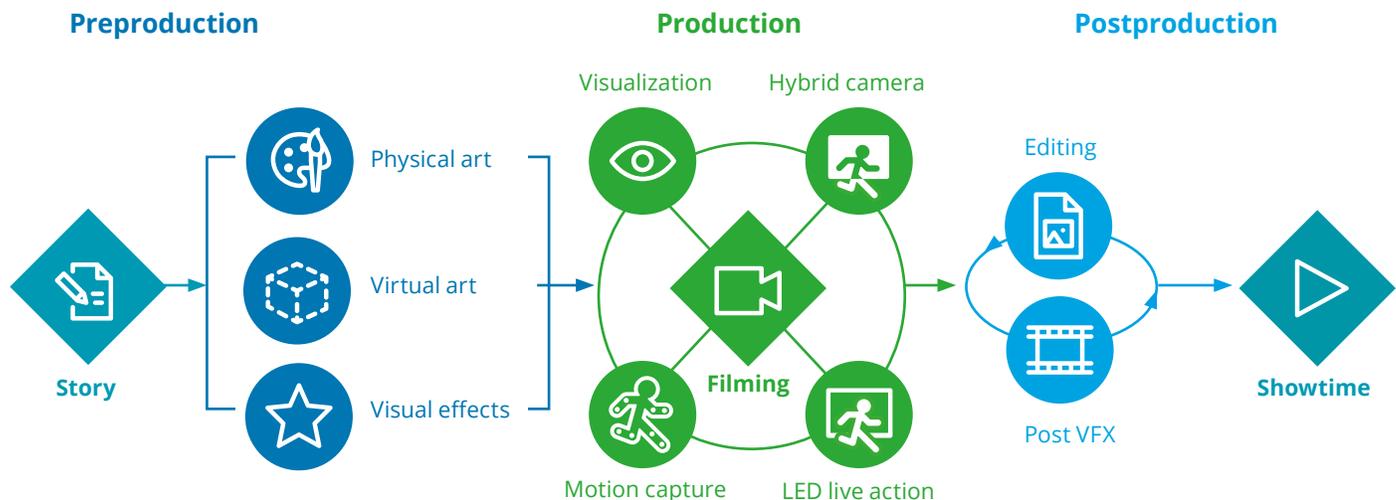
Traditional production is highly linear: Directors and cinematographers plan scenes using storyboards and shot lists; actors are filmed on sets, on locations, and against green screens; and editorial and VFX development starts and finishes after filming is complete.² This one-way procession through preproduction, production, and postproduction can encourage negative outcomes, such as a “fix-it-in-post” mentality, destructive or duplicative VFX labor, and expensive reshoots.

Virtual production is iterative and creative: Beginning VFX in preproduction makes digital assets available for planning and shooting, making it easier to continuously refine the final look and feel throughout the course of production. Virtual production is an expansion of the traditional filmmaking playbook, enabling studios to pursue greater experimentation while controlling the time and cost of production.



There are four key use cases that fall under the umbrella of virtual production:

- Visualization:** Using 3D VFX assets to visualize and plan a task. There are many types of visualization (for example, pitchvis, techvis, and postvis), but the preeminent form is previs: planning a scene in 3D before shooting.³ While experienced VFX professionals may say previs has been commoditized,⁴ only a handful of VFX studios have developed a reputation for providing visualization services on tentpole productions like *Guardians of the Galaxy* (2014)⁵ or *Pacific Rim: Uprising* (2018).⁶
- Motion capture (aka mocap):** Capturing the movements of people to animate VFX assets. Mocap systems have been used in film since the 1980s, but over time, hardware form factors have shrunk, and software has become increasingly automated.⁷ Excellent motion capture is still technically and artistically challenging, but it can be critical for realistic animations of digital humans and creatures such as in *War for the Planet of the Apes* (2017)⁸ and *Game of Thrones* (2019).⁹
- Hybrid camera (aka Simulcam, green screen hybrid):** Compositing digital VFX with live-action camera footage in real time. Simulcam was originally developed and coined by Weta Digital and James Cameron for the first *Avatar* movie in 2009.¹⁰ It is a direct improvement over shooting against green screens, because visualizing the digital and physical simultaneously with accurate parallax helps directors gain a better spatial understanding of the scene.¹¹ Actors also benefit from seeing a preliminary view of the visual effects instead of acting against a green wall. Hybrid cameras have been used on films like *Blade Runner 2049* (2017)¹² and *Ready Player One* (2018).¹³
- LED live-action:** Replacing shooting against green screens with shooting against LED panels that display final-quality VFX. LED is a natural progression from the technique of 2D video screen projection, and LEDs' ability to cast light for accurate reflections is a significant benefit to post-production. LED panels have been used to replace windows in projects like *Murder on the Orient Express* (2017)¹⁴ and *Nightflyers* (2018).¹⁵



“Our latest developments enable final pixel quality in real time, which empowers content creators across all stages of production, and equip them to shoot their visual effects in camera. It’s a game changer.”

– **Marc Petit**, general manager at Epic Games

Why now?

Virtual production isn’t exactly new, and some use cases have already seen significant adoption. However, a combination of industry, tech, and macroscopic developments is accelerating Hollywood’s interest in virtual production:

- **The popularity of VFX-heavy genres and recent virtual production breakthroughs:** The highest-grossing films of the past decade generally fall into VFX-heavy genres like action/adventure and sci-fi/fantasy.¹⁶ Virtual production techniques have been a critical enabler for both feature films and episodic content, as demonstrated by the aforementioned titles. However, in late 2019, *The Mandalorian* was released and widely lauded as the world’s first show to be virtually produced using an LED volume: a semicircular LED wall and ceiling spanning an entire soundstage.¹⁷ The technical difficulty and potential benefits associated with this technique have helped reinvigorate conversations about virtual production.

- **Increasing accessibility and jockeying between game engines and studios:** Development in consumer augmented and virtual reality has brought down costs and reduced barriers to experimenting with virtual production.¹⁸ Game engines provide the real-time rendering that powers virtual production; Epic Games’ Unreal Engine 4 (UE4) was used for *The Mandalorian*, and Epic has stated that virtually all the functions used for that show will soon be built directly into the engine.¹⁹ At the same time, leading VFX studios like ILM and MPC are going to market with their proprietary virtual production platforms, StageCraft²⁰ and Genesis,²¹ respectively.
- **Competition between streaming platforms and film studios:** Episodic content and feature films are converging in terms of budget, talent, and VFX quality. In 2019, Netflix spent \$15B on original content creation, which is the same amount as ViacomCBS, the parent of Paramount Pictures.²² These players are competing not only for customers, but

also for content production resources. In our interviews with industry players, they described a global squeeze on media production resources, including acting talent, VFX talent, and even sound stages.²³ In these times, virtual production’s proposition to support more efficient production can be especially attractive.

- **COVID-19, physical production, and avoiding a “content desert”:** The global pandemic has halted film and episodic production, and this lapse in content generation could lead to a “content desert” further down the road.²⁴ Governments around the world are cautiously looking to reopen with new safety measures set in place.²⁵ Virtual production could be such an opportunity: Virtual sets shift crews from the risks of travel and on-location shooting to the controlled environment of a sound stage.²⁶ Taking it even a step further, digital humans and motion capture could enable completely remote productions.^{27,28}

So far, virtual production has been driven by the creatives

Across the many use cases and virtual production tools, there are common themes, including:

- **Improving storytelling:** Visualization spans the entire production life cycle and is used to plan scenes and shots. This helps ensure that the storyline, captured footage, and VFX being produced accurately reflect the director's vision.
- **Resolving ambiguity:** Historically, actors and directors shot against green and had

to wait until post-production to see the output. Hybrid cameras and LED volumes allow creatives and talent to see what they're interacting with and producing in real time.

- **Unlocking possibilities:** Photogrammetry and 3D scanning enable virtualization of real-world sets and environments. Inside game engines, filmmakers can reshape mountains, move the sun, and create a 12-hour-long sunset.



Adoption of virtual production can support desirable business outcomes, like cost savings and accelerated time to market

According to our interviews with VFX producers, VFX artists, and film studio producers, Hollywood may be reaching the limits of efficiency using the traditional production methodology. The mindset and toolset of virtual production can support not only better creative outcomes, but also potentially significant time and cost savings.

Visualization can help enhance planning, increasing shooting efficiency and reducing the occurrence of expensive reshoots. Based on our research, reshoots are common with high budget films and can account for 5 to 20 percent (and sometimes more) of the final production cost.²⁹ Although not every story or director is a good fit for LED live-action production, virtualizing sets saves on travel, transportation, and location costs and reduces risks. VFX costs on a high-budget sci-fi/fantasy film can be as high as 20 percent of the total film budget; shooting

against an LED wall significantly reduces postproduction VFX costs like compositing and rotoscoping and helps filmmakers get ready for test screening more quickly.^{30,31}

Virtual production may also have cost benefits further downstream from principal photography: LED volumes and virtual sets can be used by marketing teams to shoot commercials, and VFX assets can be reused for sequels, subsequent seasons, and other media. While reusing digital assets is not impossible today, it's not the norm: most organizations have many digital versions of the same asset (such as the White House) that are not shared because each asset is tied to an individual show, and even within a given show, production and marketing budgets are siloed.

With great opportunity comes great challenges

There's a wide range of strategic questions for business leaders to consider:

- **Stakeholder alignment:** How do we develop a shared understanding of virtual production among VFX supervisors, directors, and film producers? What parts of the value proposition need to be clarified in greater detail?
- **Production strategy:** What are the technical strengths and limitations of virtual production? Based on those trade-offs, is it a good fit for the content we produce? Which virtual production techniques are most suitable for our portfolio?
- **Business case development:** How do we justify an investment in virtual production or assess using it for a specific project? What are the costs to execute, and where can we expect cost savings? How long will it take to break even, and what's my ROI?
- **Capability building:** Which capabilities should we build internally versus contract externally? What people, processes, and technology do we need in order to stand up a virtual production unit? What software, hardware, and services are necessary?
- **Organization transformation:** What organization-wide shifts would help us unlock the maximum value from an investment in virtual production? What departments or budgets could be merged to unlock synergies?



Virtual production is an attractive opportunity amid mounting competitive pressures

Creative leaders in film and episodic have shown that virtual production can yield incredible outputs. Visualization, motion capture, hybrid camera, and LED live-action are virtual production techniques that belong to the toolset of modern content creation. As with every new technology, there is an initial learning curve, but the costs of execution will likely ultimately come down over time. Virtual production can be used across both high- and low-budget projects to improve quality, increase efficiency, and reduce costs. As the global media and entertainment industry is forced to pause production due to COVID-19, now may be an opportune time to set your organization on a path to innovate the way stories are told.

Endnotes

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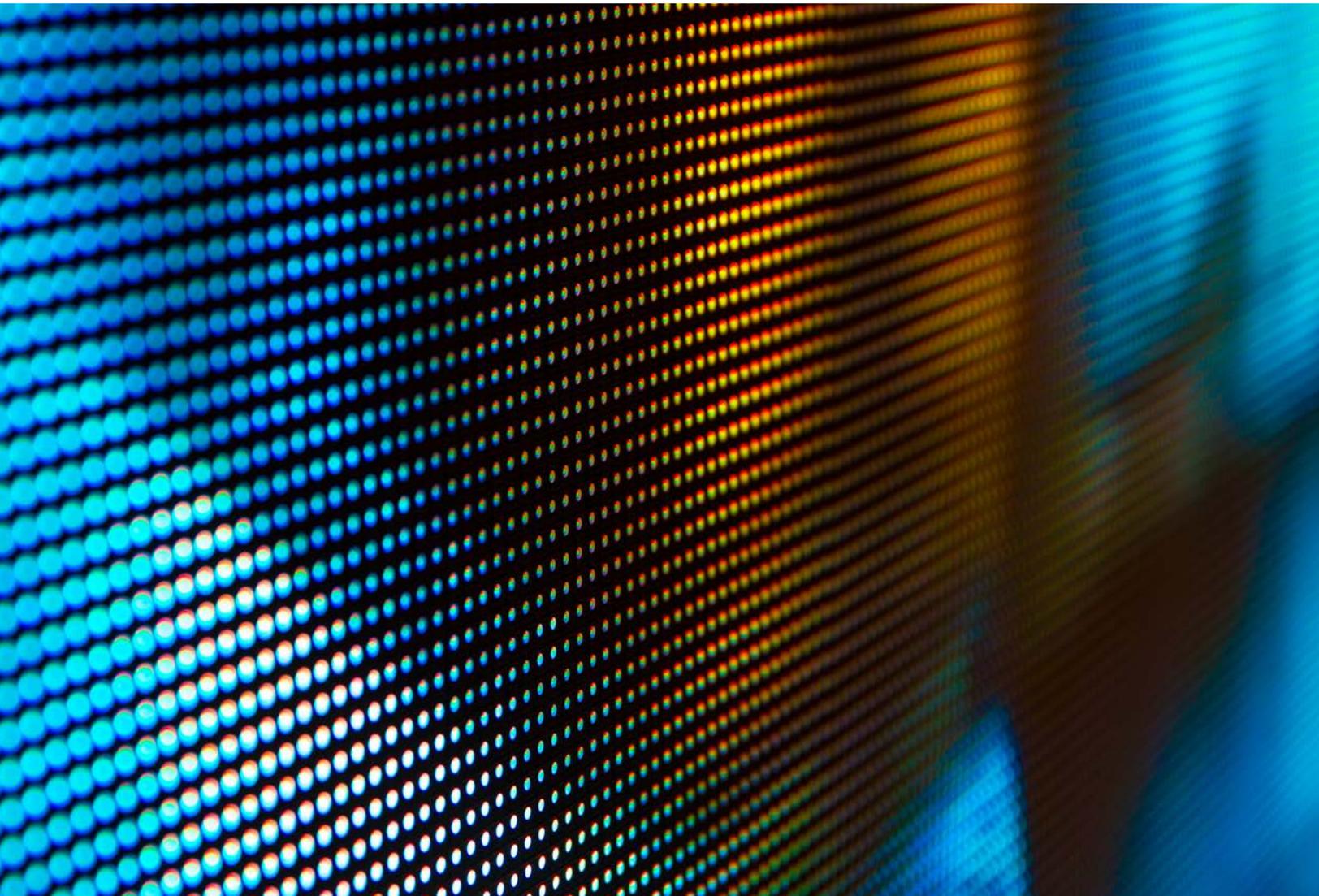
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