Why **Real-Time Technology** is the Future of Film and Television Production

UNREAL ENGINE

Image courtesy of Imaginarium

PREMISE

As artistic demands on computer graphic technologies continue to increase in the face of ever-tightening schedules and smaller budgets, the film and television industry is undergoing a new paradigm shift. This shift is being driven by real-time technology. The next evolution in content production will unquestionably rely on being real-time, interactive, immersive, programmable, non-linear, and viewer-customizable.

Introduction

Technology drives art and art drives technology

When Eadweard Muybridge rigged a series of twelve cameras together in the 1870s to study the movement of galloping horses, the concept of a motion picture was born. Since then, the film and television industry has benefited from a myriad of technological advances and, in turn, has driven them.

In 60 years, the industry went from simple, silent imagery shot and presented to the audience in monochrome to the inclusion of sound in the 1930s and the advent of talkies. This technological advance helped create new genres such as action films, musicals, comedies, westerns, and horror movies. Then solutions appeared that allowed filmmakers and, eventually, television producers to shoot in colour.

Throughout this time, the production process barely changed–it was linear in nature and consisted of five phases of production:

1. **Development**
2. **Preproduction**
3. **Production**
4. **Post production**
5. **Distribution**

These phases were drawn from the techniques used in various manufacturing industries and were simply applied to film production. As a result, each phase had to be completed before the product could be passed to the next phase.

This fit the technology of the time and allowed Hollywood to churn out movies at an incredible rate during the Golden Age of cinema. It was also the model that drove the animation industry and, eventually, the broadcast industry. But in the 1970s and eighties, computer graphics (CG) changed all of that.

Problem
Breaking point

Today's content creators have a more modern outlook on the five phases of production. Non-linear editing and CG-heavy films like Jurassic Park helped usher in a more interdependent workflow. Very quickly, producers realized the action taken in one phase could dramatically alter the preparations in another phase.

The results were four-fold. It allowed the entire production team to start thinking of the film as a holistic entity. It also allowed directors to conceptualize and deliver previously impossible visions - from virtual worlds to lifelike beasts and, ultimately, photorealistic digital humans. Producers responded by backloading budgets - blurring the lines between production and post

production - while adopting the mantra “fix it in post.” The resulting pressure on the visual effects industry has been seen around the world through bankruptcies and studio closures.

Art is now driving technology, and the level of sophistication demanded by audiences and creatives alike has pushed the model to its breaking point. Technology has to respond, and that response is the game–or real-time–engine.

Solution
Real-Time Engine

A real-time engine, such as Unreal Engine 4 (UE4), is a software framework that allows users to create, manipulate, and interact with CG environments and objects in real-time. There are no boundaries or limitations to that interaction, as the intensive graphics work is handled primarily by powerful graphics processing units (GPUs).

Notwithstanding the complexities of changing workflows in the context of film and TV production, real-time technology allows creatives to develop new ways of working that speed up processes, reduce hardware requirements, and facilitate creativity–to the benefit of directors, lighting supervisors, digital artists, and even writers.

In order to better understand the benefits and challenges of using a real-time game engine in a production setting, Epic created a three-minute cinematic trailer for one of its games, Fortnite, using Unreal Engine.

The animated short consists of six sequences, which includes 130 individual shots, and runs at 24 frames-per-second. It was completed in 20 weeks, a reasonably aggressive schedule, by a team that ranged in size from five to 20 people, depending on workload. Epic Games Solutions Engineer Brian Pohl discusses the creative process in detail **here.**

In addition, a number of other studios recognize the benefits of adopting real-time technology in production. Here, four companies (Darkside Studios, Digital Dimension, Imaginarium, and Original Force) give their take on the benefits of real-time production. The results of those conversations can be grouped under four key headlines:

1. **Reduced production time**
2. **Faster iteration and revision process**
3. **Earlier creative decision-making**
4. **Reusable assets and brand consistency**

Benefits

REDUCED PRODUCTION TIME

One genre that is quick to innovate is children's TV. Using current techniques, the production time for the first 20-minute episode of a character-driven, 3D animated TV show could be somewhere in the region of 24 weeks:

Modeling 2 weeks

Storyboarding /Previs 2 weeks

Layout 4 weeks

Animation 4 weeks

Compositing 2 weeks

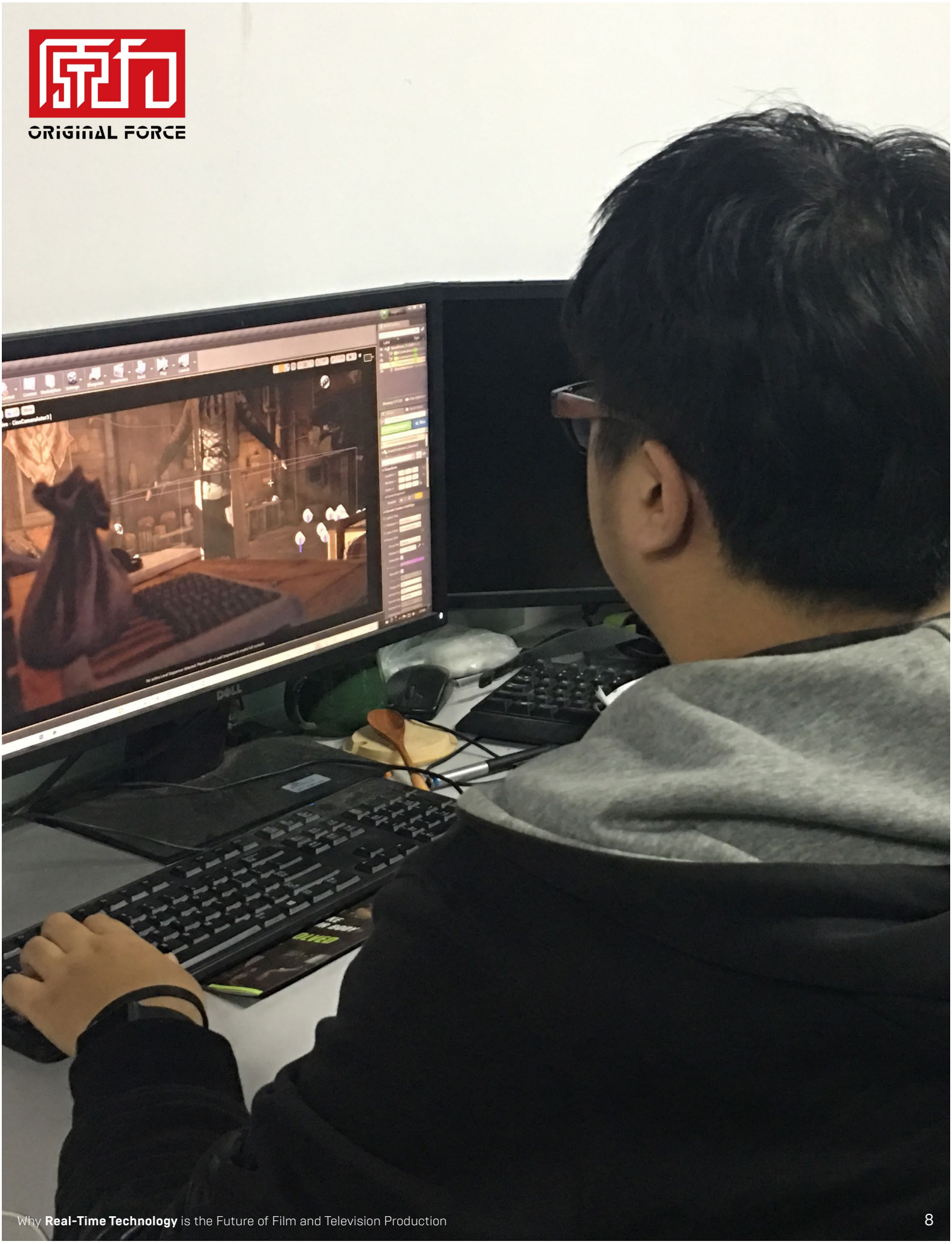
Final output 2 weeks

Additional (post etc.) 8 weeks

TOTAL - 24 weeks

Of course, there are some shows where this is shorter, and others where the initial episode is longer to produce yet production times for subsequent episodes are much shorter.

ORIGINAL FORCE



Regardless, small delays at any stage can cause ripples that set the production back weeks. And the more steps there are, the more chance there is of introducing errors that have to be tracked and corrected. Anything that can be done to mitigate that is of benefit. **On average, clients are reporting time savings of between 30% and 50%.**

Peter Skosvbo, Producer at Montreal-based Digital Dimension, has streamlined the production process, cutting out many of the steps seen in a traditional workflow by adopting Unreal Engine. He says:

> *"**Zafari**, which we're producing for NBC Universal and Dreamworks, is 10,000 shots output in 18 months. That's the equivalent of six animated feature films, and we're delivering it in the time it would usually take a studio to do one feature!"*

That sentiment is echoed by Simon Percy, Head of Studio at **Darkside Studios** in London: *"Directorially, when you're doing an animated show using traditional methods, you might get two-to-three shots done in a day. But with a real-time solution, you can sit with an animator and deliver 50 shots in a day. That's the power of a tool like Unreal Engine."*

Unreal's Sequencer tool is where layout and editorial decisions can be made in real time. If rendered characters, for instance, need to be slid back two or three frames, in the old paradigm, they would have to be re-rendered then dropped back in at the correct time. But in a real-time 3D environment, they can simply be swiped back a few frames and the editor immediately sees

the final result. There is no need to open a different application, render the assets, and re-import them to the editor.

Skovsbo expands on the time savings of using a real-time engine like Unreal, saying it would take days to render each episode of *Zafari* by traditional means:

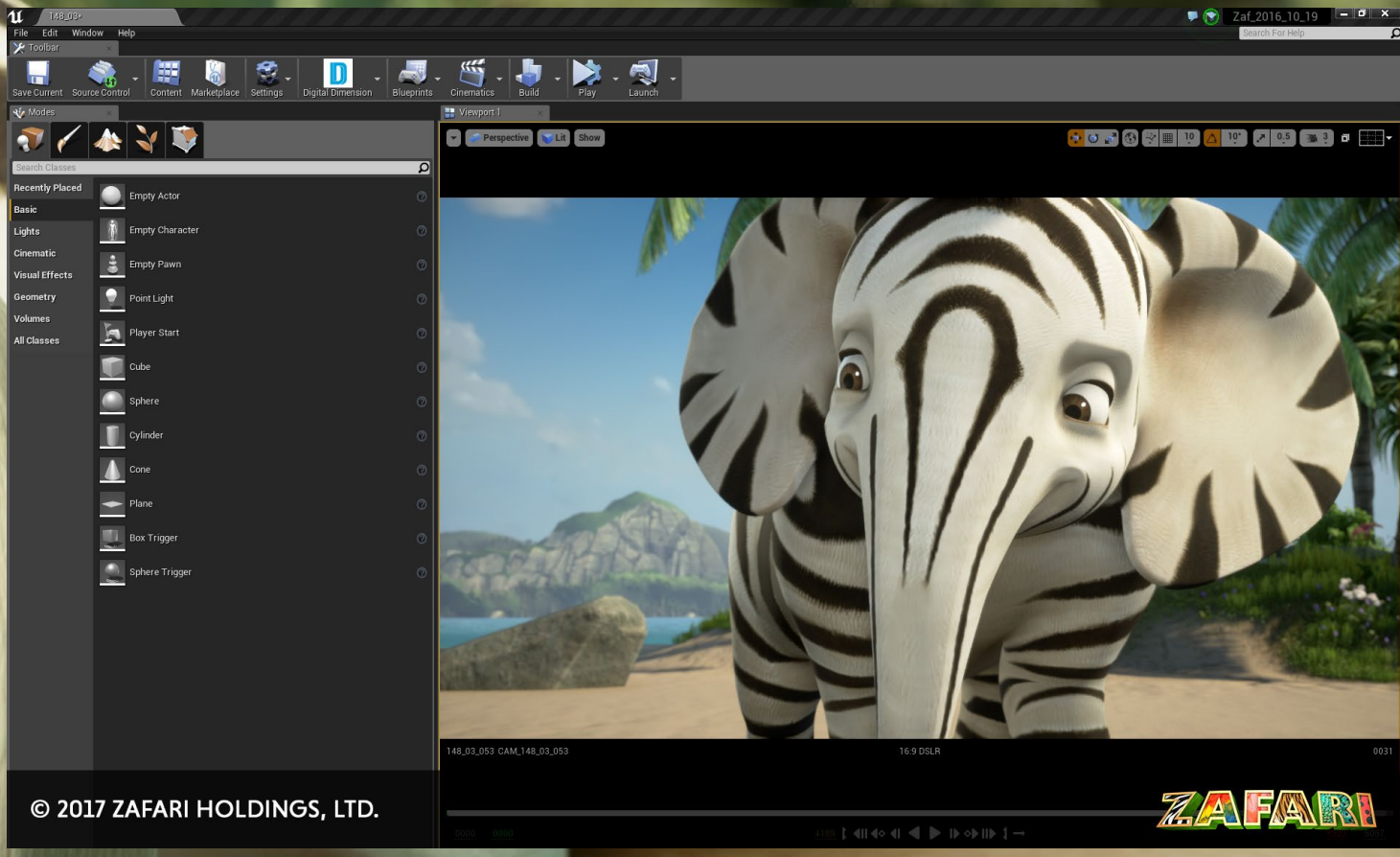
Peter Skosvbo
Producer at **Digital Dimension**

"Rendering a complete episode of Zafari, end-to-end in real-time, takes us about three-to-four hours on one computer. It's crazy. To do this on a render farm we'd be loading it up wall-to-wall for days."

FASTER ITERATION AND REVISION PROCESS

It's generally accepted that more iterations lead to better results, so the ability to iterate faster leads either to more iterations, or time saved. Or both.

With assets in-engine, directors can make decisions on lighting and composition much quicker, as Skovsbo explains: *"When we light the shot, we have an instant view of what the shot is like when it's output. Using Unreal Engine allows us to light render, composite, and do all our effects in one go. What's being output from the engine is being sent to the broadcaster."*



DIGITAL DIMENSION

The ability to see the results in real-time means there is no need for additional passes, Skovsbo adds:

> *"We're not compositing it, we're not layering effects into it. It comes out as one layer, and because we have instant feedback on what we're doing, we can work on a sequence, making sure it's consistent throughout."*

To put this in perspective, real-time production is defined as having a maximum render time of 41.67 milliseconds per frame. For those who come from film, this is the new 24 frames-per-second.

EARLIER CREATIVE DECISION-MAKING

The development of previs 15 years ago was a direct response to the need to prevent costly mistakes during production and to manage expectations better than traditional storyboards could. Previs took the weight off the production phase, helping improve the creative design process during pre-production.

In the same way, real-time technology is now taking the weight off the post production process, allowing directors to make creative decisions earlier. Three areas in which real-time previs can facilitate the creative decision-making process are script writing, motion capture, and set building:

Previs for script writing

The quality of the finished product arguably starts way back during the writing stage. If a writer can get their head around the set, the characters, the layout–all the things that go to make the finished content–then they are in a better position to create a great script.

Andrew Bishop, Director at **Darkside Studios**, explains: *"At the start of the writing process there is often very little for the writers to work from. No storyboard. No previs. They are, in essence, working blind."* Traditionally, assets are built at the start of production, not before. Writers may have access to base artwork but not a detailed view of the world their characters inhabit. As Bishop says: *"This prevents them from being able to tell the story in the absolute best way that it can be told."*

Percy agrees:

> *"If a writer could write within the confines of a real-time world, then it would reduce the error rates incurred at this stage of the process. A large portion of writing at the moment is done at least three times per show, which is a lot of error correcting."*

Previs for set building

The benefits of real-time production extend to live-action shoots as well as CG production. Shawn Dunn, CTO of **Original Force**, says: *"If you're shooting on stage, you have no idea where the director is going to look when composing a shot. Stage work has more associated up-front costs because building a set is expensive. And, because you don't know where the director is going to point the camera, you have to ensure that everything is ready, just in case."*

But with real-time previs, the director and his team know which shots they're going to want to capture ahead of time, meaning that set build costs and potential disruptions to the shoot schedule are minimized.

Shawn Dunn
CTO of **Original Force**

"Imagine not building out part of a set and then having the director decide that, for this scene, he wants to shoot in that part of the stage," says Dunn. All of a sudden, you have to shut down shooting for a day, and you're incurring hundreds of thousands of dollars in costs. That's really not an option, so the ability to use a real-time previs solution has massive benefits."

Previs for motion capture and animation

Capturing human movement using motion capture allows for incredible visuals on screen but the inability to see the final result at the time of shooting can result in spiralling post production costs. With real-time production, the actor sees themselves as they will appear on screen, and the director sees their vision come to life while on set.

Johl Garling, **Imaginarium Studios** Head of Studio, describes the benefits:

Johl Garling
Head of Studio for **Imaginarium**

"The real-time character is driven by the actor, and it means they have a sense of where they are, how the character is reacting to environmental stimuli, and how the actor needs to perform in order to deliver the scripted lines. If you don't have that, then there is a massive cost in post production when you're trying to adjust all the small performance quirks and nuances that don't quite fit with how the on-screen character would have behaved."

On occasion, due to the combination of previs and real-time technology, those early creative decisions can be so good that they become the blueprint, if not the final pixels in their own right, as seen in films such as **War for the Planet of the Apes** and **Rogue One: A Star Wars Story**.


THE IMAGINARIUM STUDIOS
MONITOR 7.1
MONITOR 8
SIMULATING
LEVEL BLUEPRINT
face team

Reusable assets and brand consistency

A film or a TV show today is not simply a one-off experience. There are a multitude of other outlets that leverage existing assets such as:

- **Merchandise**
- **Marketing assets** (print, online, media)
- **Social assets** (clips, b-roll)
- **Interactive & VR content**
- **Online content** (spinoff episodes, vlogs)

The benefit of having the engine at the heart of the pipeline is the ease with which assets can be repurposed, says Bishop: *"TThe phrase 360 degree brand-ready is used within our industry all the time, but it's only now, using a real time engine, that I believe we can truly deliver against that expectation."*

Magnus Hollo, Managing Director of **Darkside Studios**, agrees: *"If you see a film character in a magazine and it's exactly the same as you see on TV or on the big screen then, from a consumer perspective, that's a great thing. The brand is consistent. And because the central source of output is from the engine, you can be 100% certain there will be no differentiation."*

Conclusion

The "fix-it-in-post"' mantra, fuelled by the computerization of the last 30 years, compounds the age-old challenges of decreasing budgets and tighter schedules. While some studios and post houses have the resources–and inertia–to keep current processes going, the more innovative are turning to real-time engines for their animation or visual effects pipeline.

A real-time production pipeline is transformational and can reap savings in both time and money. It can help with marketing, merchandising, and advertising. It allows the director to achieve shots that are otherwise unachievable, and to obtain them quickly. It also cuts down on editing and rendering.

As Skovsbo says:

> *"It's just a question of time before this kind of engine becomes a mainstay in the industry. Is that one year? Two years? Five years? I don't know, but I do know that it's coming."*