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QUEBEC FILM AND TELEVISION COUNCIL 15 YEARS MONTREAL

# THE IMPACT OF ARTIFICIAL INTELLIGENCE ON VISUAL EFFECTS AND ANIMATION PROFESSIONALS

OVERVIEW AND ACTION PLAN – VFX | AI SYMPOSIUM 2021

# PREAMBLE

This document provides an overview of the integration of artificial intelligence technology in the visual effects and animation industry in Quebec, and more specifically of the current or expected impact of AI on the industry's workforce.

**The information comes from workshops held at the VFX | AI Symposium organized by the Quebec Film and Television Council (QFTC) on April 28, 2021, and from consultations with Quebec visual effects and animation companies and organizations held after the event.**

This project was made possible through the financial contribution of the Conseil emploi métropole.

The QFTC would like to thank the VFX | AI Symposium's partners: École des arts numériques, de l'animation et du design [School of digital arts, animation and design] at Université du Québec à Chicoutimi (NAD – UQAC), SYNTHÈSE – Pôle Image Québec and Montréal International.

The QFTC also wishes to thank the members of the steering committee, the members of the event's program committee, the stakeholders who participated in the consultation and everyone who attended the VFX | AI Symposium.

# THANK YOU TO OUR PARTNERS

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# ACKNOWLEDGEMENTS


## PROJECT MANAGEMENT

**Quebec Film and Television Council (QFTC)**

Valérie Daigneault, Director, Secretariat of the Audiovisual Cluster

Anne Fossier, Project Manager

Aurore Lagonotte, Communications Agent

Christine Maestracci, Chief Executive Officer

Julie Silva, Coordinator, Special Projects

*Special thanks to Pierre Moreau*

## PRODUCTION AND COORDINATION

**KALIKO**

Kawtar Cherti, Graphic Designer

Eden Côté-Magloire, Graphic Designer

Agathe Dessureault, Project Coordinator

Tanya Grenier, CEO

Camille Hesnard, Logistics Coordinator

Laurence Lévesque, Project Coordinator

Gabrielle Pariseau, Project Manager

Marielle Pauwels, Client Experience Coordinator

Agathe Préfontaine, 3D Artist

Patricia Robin, Editor

## STEERING COMMITTEE

Christian Beauchesne, Business Development, **École NAD-UQAC**

Martine Bertrand, AI Lead, **Sama**

Mélanie Bosc, Executive Director, **TECHNOCompétences**

Tim Fournier, Metropolitan Economist, **Conseil emploi métropole**

Albane Français, Communications and Partnerships Director, **SYNTHÈSE – Pôle Image Québec**

Pascale Landry, Executive Director, **Compétence Culture**

Romain Paulais, Development and Partnerships, **École NAD-UQAC**

Guillaume Pelletier, 3D Animator, **Framestore**

Aubert Sigouin-Lebel, Project Manager, **TECHNOCompétences**

## PROGRAM COMMITTEE

Roy C. Anthony, Global Head of Research, **DNEG**

Christian Beauchesne, Business Development, **École NAD-UQAC**

Martine Bertrand, AI Lead, **Sama**

Julien Coll, Research and Innovation Consultant, **CDRIN**

Kim Desert, Director of Communications, **Forum IA Québec**

Albane Français, Communications and Partnerships Director, **SYNTHÈSE – Pôle Image Québec**

Anne Le Bouyonnec, Project Director, **SYNTHÈSE – Pôle Image Québec**

Jordan Soles, Vice-President Development & Technology, **Rodeo FX**

# A WORD FROM THE CONSEIL EMPLOI MÉTROPOLE

I am proud and excited to commend this overview and action plan for the integration of artificial intelligence (AI) technology in the visual effects and animation industry.

This project was born as the pandemic fast-tracks the digital transformation, which makes it all the more relevant, especially in a fast-growing industry that is constantly creating new positions that call for new skills. This action plan offers insight on AI's infinite potential and its impact on the workforce.

To make the most of this technological revolution, companies and workers need to invest in training and learning. In a field like visual effects and animation, technical skills quickly grow obsolete, and if professionals don't keep up, they risk lagging behind.

This action plan charts the course toward a near future in which workforce training keeps pace with an evolving job market. It proposes developing the AI skills of the future, upgrading the qualifications of the current talent pool, and adapting the available training so that professionals can thrive in the ecosystem of the future.

The project also highlights the impact of AI on the nature of the work being done by Montréal's visual effects and animation artists. By identifying the training and skills they'll need in the future, the action plan is certain to create benefits for the region's labour market and drive the industry's growth.

This initiative is a shining example of how agile and resilient this innovation hub can be when it comes to tackling the many challenges coming down the pike for the job market. The CEM is proud to support this work.

This plan sets the stage for Montréal and Quebec artists to learn to leverage the myriad possibilities of AI and to push the bounds of their creativity, producing prestigious work that will continue to be a calling card for our homegrown talent beyond our borders.

Investing in our artificial intelligence know-how and in this diverse and crosscutting sector will be a boon to the entire Quebec economy!

**Audrey Murray,**
**President,**
**Conseil emploi métropole**

# A WORD FROM THE QFTC

**Christine Maestracci,**
**Chief Executive Officer,**
**Quebec Film and Television Council (QFTC)**

Quebec's visual effects and animation industry is a creative hub recognized by the audiovisual industry worldwide. Over the past 10 years, these sectors have grown by an impressive 28% in Quebec, generating economic impacts of nearly $800 million in 2019. Our studios have worked on highly creative and innovative projects and made a name for themselves among the best studios in the world.

This presence of Quebec talent and creativity on the world stage has produced tangible benefits for the entire ecosystem here at home: new investments, new jobs, new expertise, fine-tuned training programs and, ultimately, a more attractive and vibrant metropolitan community.

Montréal and Quebec have achieved global recognition for the quality and creativity of their professionals. If we want to hold on to that position, we will have to constantly adapt our skills and knowledge in a fast-paced industry that is all about anticipating client needs and remaining at the cutting edge of technology.

For several years now, artificial intelligence (AI) and its applications have been gaining traction in the world of visual effects and animation, spurring advances that create enormous opportunity for innovation and automation. If Montréal's creative industry is to remain agile, it needs to come together to prepare for the impact of these new technologies on our professionals and to open up channels of communication with the AI industry, and it needs to do that now.

This report is an important step toward quantifying and qualifying the impacts of these new innovations on our professionals and identifying the specific actions we need to take in the coming years. Quebec has everything it needs to position itself as a leader in this new technological revolution, especially since Montréal is already a world-renowned AI hub. It is now up to companies, educational institutions, industrial clusters, and public and private partners to work together to act on the report's recommendations.

The QFTC would like to thank the Conseil emploi métropole for its support for this action plan, which is sure to become an invaluable tool for the future of the industry. We are proud to have contributed to it, and we also wish to thank all the companies and organizations who worked with us to make it happen.

We hope you enjoy reading it!

# IN THIS REPORT

## FEATURED IN THIS REPORT:

1. A qualitative study that reflects the opinions of the people interviewed and provides a broad overview of the trends in the development of artificial intelligence in Quebec's visual effects and animation industry.

2. A qualitative overview of the conclusions about the general impacts (both current and future) on visual effects and animation arts, and suggested actions to develop skills to help our professionals adjust.

3. Recommendations on tailoring training to job requirements that apply to all initial college and university education programs.

4. Conclusions on funding and networking with the potential to drive innovation and growth in Quebec's visual effects and animation industry.

## NOT FEATURED IN THIS REPORT:

1. An in-depth analysis of artificial intelligence technology for the visual effects and animation industry. The report does not provide information on the specific effects of these technological changes (such as changes to certain software functions) beyond the general conclusions on trends in industry jobs and skills.

2. A comprehensive statistical analysis of current and anticipated technological advances in artificial intelligence for the globalized visual effects and animation industry. This report is qualitative and does not include industry-specific statistical research.

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# INTRODUCTION AND METHODOLOGY

# A.1 | THE VISUAL EFFECTS AND ANIMATION INDUSTRY

The visual effects and animation economic sector in Quebec is one of the three largest hubs in the world.

This innovation and creative hub has experienced strong growth in the past 10 years and now includes nearly **6,000 professionals** across approximately 40 companies working on all types of projects, including film and television, 2D and 3D animation, and visual effects.

Every year, some of the most prestigious, ambitious and challenging creative projects are conceived, developed and/or produced in Montréal. These include *1917*, *The Lion King*, *Tenet*, *The Mandalorian*, *The Little Prince*, *Captain Marvel*, *Stranger Things*, *Westworld*, *The SpongeBob Movie: Sponge on the Run*, *Ad Astra* and *Dune*, Denis Villeneuve's latest feature film coming soon to theatres.

*Photo credit: THE MANDALORIAN – SEASON 2 © 2020 & TM Lucasfilm, Ltd. All Rights Reserved*

# A.1 | THE VISUAL EFFECTS AND ANIMATION INDUSTRY (cont.)

*Photo credit: Mikros Animation – TM AND © SPONGEBOB SQUAREPANTS - VIACOM INTERNATIONAL INC*

Quebec's talent and know-how are sought after by some of the world's most prestigious producers, and this is a boon to the province's economy as a whole. This growth, however, is not without challenges, such as expanding the pool of qualified and available workers in record time to keep pace with the industry's non-stop growth.

Meanwhile, Quebec is also at the centre of a new technological revolution with the ongoing deployment and exploration of the potential of artificial intelligence (AI). Because it is almost entirely computer-based, the visual effects and animation industry is also being swept by this revolution.

This report addresses how AI technology could be leveraged by the industry and, more specifically, how it could impact the workforce.

AI is not a death knell for artists. On the contrary, it has the potential to enhance and multiply their skills, free them from repetitive tasks and allow them to focus on the beating heart of their work: creativity. Realizing this potential will require open collaboration, proper training and unwavering commitment.

# A.2 | METHODOLOGY: HIGHLIGHTS OF THE VFX | AI SYMPOSIUM

**The QFTC mandated the event planning firm Kaliko Productions to help them put together a day of online conferences and workshops on April 28, 2021.**

The schedule and key topics were set in collaboration with the event's steering and program committees. Nearly 100 participants from 43 companies took part in the VFX | AI Symposium and the consultations, alongside a number of representatives from educational institutions and organizations active in the industry. Organizers attracted participants in management and supervisory roles, such as producers, VPs of development & technology, heads of rotoscoping, 3D department heads, VFX supervisors, R&D directors, etc.

Throughout the day, participants attended two sessions showcasing advances in the field, including a discussion between important players in AI research about the use of AI in the production of visual effects and animation. Following these presentations, participants broke out into several discussion groups, with each one focusing on a different topic related to the benefits of AI tools and resources and their potential impacts on the industry's professionals.

In each breakout group, participants were asked to discuss the information and ideas shared in the morning activities. The moderators, all from the visual effects and animation industry; guided discussions on real or perceived changes—whether positive or negative—that new tools may bring to the industry. All of these discussions were recorded so that the ideas, suggestions and comments could be used in this report.

# A.2 | METHODOLOGY: HIGHLIGHTS OF THE VFX | AI SYMPOSIUM (cont.)

**98**
PARTICIPANTS

**44**
ORGANIZATIONS

WITH POSITIONS IN:

| | |
|---|---|
| **LEADERSHIP** | R&D directors, VPs of development and technology, etc. |
| **MANAGEMENT** | Producers, heads of rotoscoping, 3D department heads, etc. |
| **SUPERVISION** | VFX supervisors, rotoscoping supervisors, etc. |

BROKEN DOWN AS FOLLOWS:

| | |
|---|---|
| **28** | Companies |
| **7** | Educational and research institutions |
| **4** | Public organizations |
| **5** | Industry associations or groups |

ORGANIZATION SIZE:

| | |
|---|---|
| **18** | 1–50 employees |
| **8** | 50–200 employees |
| **18** | Over 200 employees |

# A.2 | METHODOLOGY: HIGHLIGHTS OF THE VFX | AI SYMPOSIUM (cont.)

## SYMPOSIUM PROGRAM

### 11 A.M. – KEYNOTE PANEL
*PANEL D'EXPERTS*

WATCH

*Impact of AI on the VFX and animation workforce, and latest innovations*

**DOUG ROBLE**
SENIOR DIRECTOR OF SOFTWARE R&D
**DIGITAL DOMAIN**

**PAUL SALVINI**
CHIEF TECHNOLOGY OFFICER
**DNEG**

**MORGAN MCGUIRE**
CHIEF SCIENTIST
**ROBLOX**

**SARAH WATLING**
CEO
**JALI RESEARCH**

**MATHIEU MAZEROLLE**
DIRECTOR OF PRODUCT – NEW TECHNOLOGY
**FOUNDRY**

---

### 12:15 P.M. – QUICKFIRE SESSIONS
*SESSIONS QUICKFIRE*

WATCH

*Speakers and topics:*

Julien Coll | **CDRIN**
-- Funding | R&D

Florent Cohen | **Felix & Paul**
-- Innovation

Jacques Levesque | **Felix & Paul**
-- Innovation

Jean-François Lalonde | **Université Laval**
-- Research

Mathieu Mazerolle | **Foundry**
-- Service | Product

Jean-François Lefort | **Scale AI**
-- Funding | R&D

Gavan Gravesen | **RADiCAL**
-- Innovation

Matteo Giuberti | **RADiCAL**
-- Innovation

Doug Roble | **Digital Domain**
-- Innovation | R&D

Chris Landreth | **JALI Research**
-- Innovation

Guillaume Gilet | **Université de Sherbrooke**
-- Research

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### 2:30 P.M. – DISCUSSION ROOMS TO 5:30 P.M.
*SALONS DE DISCUSSION*

*Topics :*

Automation

AI and creative processes

AI and work pipelines

Economic impact

New skills

New jobs

Senior roles

Training

R&D

# A.3 | METHODOLOGY: SURVEY AND INDIVIDUAL CONSULTATIONS


*Photo credit: Avenue 5, VFX by Cinesite, © HBO. All Rights Reserved*

Participating companies raised concerns about the anonymity of the information discussed on several occasions. While some concepts or ideas do not pose a problem, others may affect the confidentiality of projects.

To better understand certain production contexts, a survey was developed and sent to companies in the industry.

Responses were anonymous, in order to encourage companies to share as much helpful information as possible. This step, along with consultations, made it possible to get more out of the ideas and conclusions that came out of the Symposium.

# A.4 | METHODOLOGY: DATA COMPILATION

A first data classification step was completed with the information from the discussion rooms and the survey responses. The goal of this step was to identify the ideas that came up the most and group them by theme. The resulting ideas, pillars and themes were organized into **chapters 1 to 3 of this report**.

Conclusions were then drawn from each of these chapters to form the backbone of the action plan presented in chapter 4. The action plan details the steps required to develop the skills that Quebec's visual effects and animation industry will need to be able to count on to effectively integrate AI, adapt its workforce and thereby increase its appeal and competitiveness.

***Note:*** *The actions suggested in this report are recommendations. It is up to each organization whether or not to implement them.*

*Photo credit: Respect, VFX by Cinesite, © MGM. All Rights Reserved*

# AI FOR VISUAL EFFECTS AND ANIMATION: BACKGROUND

# B.1 | THE PROCESS OF CREATING VISUAL EFFECTS AND ANIMATIONS

Visual effects are part and parcel of every audiovisual project, whether for film or television. These productions can be a combination of live action shots and computer-generated content (visual effects, or VFX), or they can be entirely computer-generated (animation).

Many professionals and specialists have to come together in these productions to create the final result the audience sees on the screen. Some of them create fictional elements from scratch using modelling and texturing techniques. Depending on the visual required, they may have to create or recreate the environments in which live action shots were filmed, in order to get reflections and volume right or simply to make sure characters react to actions or movements in the original footage.

Simulations are also very frequently used. This involves reproducing real physical behaviours in fictional elements, such as by simulating fluids (water, smoke, fire, etc.), solid objects (shattering glass, fabrics, buildings, etc.), or hair and fur (animal fur, hair, body hair, etc.), for instance.

Some of the fictional elements created can even represent full-fledged beings, such as humans, animals or other creatures, in which case animation will be needed to make them move realistically. This may involve animators doing the work manually or, more often, motion capture (or MoCap) technology.

# B.1 | THE PROCESS OF CREATING VISUAL EFFECTS AND ANIMATIONS (cont.)

The last step in the process consists of assembling the set and character layers, creating the camera effects, animating some movements and effects, and combining these elements with the original live action footage if necessary.

This is called compositing, and this is where all the specialized tasks we mentioned come together. A compositor's main job is to make sure all the shots, effects and animations come together as seamlessly as possible.

Since visual effects and animation work is entirely computer-based, it depends on a complex, robust IT infrastructure that needs to keep up with the latest technological advances.

**This means that creating visual effects and animations requires a production team and a broad range of both artists and technical specialists to run the software, network and computer infrastructure necessary for each project.**

# B.2 | TOOLS

The industry uses a wide variety of tools, some of which can produce real-time outputs, while others require some processing time. Some of these tools are multi-purpose and used by a number of trades; others are much more complex and used only for specific steps in the process.

The steps involved in creating visual effects and animations include, among others: creation of 3D models, animation, motion capture, simulation, masking, and image rendering and compositing.

These computer tools are created, updated and licensed to studios by developers (for example: Autodesk, Foundry, etc.). Some studios then adapt these tools in-house with their own research and programming team to meet the specific needs of their production pipeline.*

SYNTHÈSE** led a survey that resulted in an inventory of the most commonly used software (see table*** opposite).

| SPECIALIZATION | SOFTWARE |
|---|---|
| Modelling | ZBrush, Maya, Blender, Houdini |
| Textures and lighting | Substance Painter, Mari, Maya, Blender, Houdini, Katana |
| Animation and armature | MotionBuilder, Maya, Harmony 2D, TV Paint 2D |
| Motion capture | MotionBuilder, Capture system |
| Simulation and visual effects | Houdini, Massive, RealFlow |
| Image rendering | Renderman, Arnold, Clarisse, Redshift |
| Tracking and rotoscoping | 3DEqualizer, Nuke |
| Compositing | Nuke, Flame, After Effects |
| Colouring | DaVinci Resolve |
| Editing | Media Composer, Premiere, Final Cut |

***GRAPHICS PIPELINE (DEF.)**

Series of stages that calculate the transformations necessary to render synthesized 3D images on a two-dimensional screen in real time.

*** Source**: Office québécois de la langue française. (2014). Graphics pipeline. In *Fiche terminologique*. Retrieved from: http://gdt.oqlf.gouv.qc.ca/ficheOqlf.aspx?Id_Fiche=26529736
**** Key player**: SYNTHÈSE is one of the key players mentioned in the appendices
***** Source**: SYNTHÈSE survey (2021). *Travailler en création numérique aujourd'hui et demain* [Working in digital creation today and tomorrow. Quebec: SYNTHÈSE – Pôle Image Québec, p. 61

# B.3 | AI AND VISUAL EFFECTS: MACHINE LEARNING

**The most important conclusion to come out of the April 28 VFX | AI Symposium is that artificial intelligence, understood as autonomous intelligence capable of creating complex iterations without assistance in the field of visual effects and animation, does not exist.**

The term **machine learning (ML)** or "automated machine learning" is preferred. This refers to new technologies that use big data to help make artists and creators faster and more productive, and to eliminate some tasks and automate others. **Machine learning enhances artists' abilities but does NOT replace them.**

Considering this insight, one AI researcher suggested renaming artificial intelligence **"augmented intelligence."**

It is important to understand the basics of how these new technologies work and how the industry could use them in order to fully grasp their potential contribution.

# B.3 | AI AND VISUAL EFFECTS: MACHINE LEARNING (cont.)

The use of machine learning tools is divided into two distinct phases, the first of which is the most important.

## PHASE 1: TRAINING THE ALGORITHM

The first step is to train the algorithm by feeding it a host of examples where the desired work has already been done. This training or learning phase enables the algorithm to guess the steps needed to reproduce the results in a different context. It is important to use complete data, including **data labelling**, for this phase.

Data labelling helps the tool categorize and sort data and helps it learn how to find similar information when it creates new models or acquires new data. This step is time-consuming, but it is crucial for the algorithm in the context of supervised learning. It requires the **intervention of humans** to meticulously identify all the "targets" in images that the algorithm will eventually be asked to reproduce or interpret. Non-supervised learning can also be used, in which case labelling is not required and the algorithm will be tasked with sorting the source material by itself and finding the patterns identified in new data. Of course, in this case, the information the algorithm is able to understand and analyze will be much less precise.

The most commonly used machine learning method in the industry is semi-supervised learning, which entails guiding the algorithm's learning without labelling all of the source data. This way, artists and creators can leverage the tool's ability to learn with little information but still guide the models generated by the algorithm depending on the results they're looking for.

# B.3 | AI AND VISUAL EFFECTS: MACHINE LEARNING (cont.)

## PHASE 2: USING THE ALGORITHM'S LEARNING

The second phase of the process involves applying what the algorithm has learned to a new set of data so that the new data can be processed similar to the way the source data was processed. This is the step that supports and speeds up teams' work, as the algorithm is now able to automate part of it.

Once the algorithm has been properly trained, it can understand and reproduce tasks such as the creation of new 3D models, the creation of masks from live action sequences, and the animation of 3D models. This step is sometimes used to help the algorithm continue to learn in a semi-supervised environment.

A vast number of complex tasks and variations become possible during the creation of animated content or visual effects. These machine learning tools allow some of the more repetitive steps of the process to be automated so that they can more easily be handled by an algorithm.

# B.4 | INTEGRATION OF AI AND INDUSTRY ADAPTABILITY

**The second takeaway from the VFX | AI Symposium and subsequent consultations is that the integration of artificial intelligence into the visual effects and animation production pipeline is still in the very early stages.**

The vast majority of studios have not yet begun taking steps to integrate these technologies into their production processes, although some initiatives are currently in development. For example:

- Some developers are integrating AI into their VFX/animation tools to optimize product performance and offer new functionalities.
- Young start-ups are developing their own innovative algorithms in response to specific problems in the production pipeline.
- University researchers are working on projects to develop applied AI tools for computer-generated images.
- A number of studios are already investing significant resources in R&D for AI solutions for visual effects and animation. A few success stories have come up over the past few years, such as the Digital Domain studio's "Digital Humans,"* and some studios have already incorporated AI solutions into their production pipeline.




* **Source**: Digital Domain (n.d.) Digital Humans Lab. Retrieved from: https://digitaldomain.com/digital-humans-lab/

# B.4 | INTEGRATION OF AI AND INDUSTRY ADAPTABILITY (cont.)

These efforts are just the first developments in a long-term process, but there is a consensus among industry players that artificial intelligence technology has huge potential when it comes to computer-generated images.

With this backdrop in mind, it is important to consider the potential consequences of AI for VFX and animation professionals. For the past few decades, AI has been seen in a largely negative light, due largely to the fear that automation may put many people out of work and render whole professions obsolete, a fear reinforced in the popular imagination by cultural works that show production chains in which humans have been replaced by machines.

Advances in AI in recent years, however, have led industry professionals to rethink this perception. While new technology is constantly allowing computers to perform more and more complex tasks, it is also putting into sharp relief the unique and irreplaceable qualities of human intelligence.

Far from compromising human ingenuity, AI is opening up a space to reconsider established processes.

> *AI can enhance human creativity, but cannot replace a human's creative spark.*
>
> Adobe. (2018, November) *Creativity and technology in the age of AI*. Pfeiffer Consulting

# B.4 | INTEGRATION OF AI AND INDUSTRY ADAPTABILITY (cont.)

The situation is no different when it comes to applying AI to visual effects and animation.

The digital creative industry is agile and is constantly adapting and reinventing itself. The conversations during the Symposium confirmed the industry's capacity for innovation: participants agreed that industry professionals would be able to integrate Ai into their work processes just as they have embraced other innovations over the years.

There are many examples of such integration that show how machines always support artists' creativity without replacing it. For instance, this pattern can be seen with the advent of MoCap software and the integration of the video game engine Unreal to create real-time visuals. Both of these innovative technologies were quickly adopted by industry professionals.

Artists and creatives should thus see AI as a tool to help them improve their performance: **humans are in the driver's seat when it comes to supervising machine learning because their creativity and subjectivity are essential for continuing to innovate and produce high-quality work.**

# B.4 | INTEGRATION OF AI AND INDUSTRY ADAPTABILITY (cont.)

*Our work is haute couture, created and fleshed out for a precise moment and in response to a clear demand.*

*Mathieu Boucher, Vice President of Operations, Hybride (Free translation from the French)*

AI can produce iterations based on existing data, but this data absolutely has to flow from the specific vision of a creator or producer before it can be brought to life. **Humans will always be at the heart of this process**, as their contribution is vital to bringing an organic and random feel to the sometimes "disembodied" outputs of AI and machine learning.

Owing to its capacity for iteration, though, and its ability to take over repetitive tasks from artists during the creation of a segment or sequence, AI can play a crucial role in offsetting labour shortages, keeping productivity on track and feeding artists new and novel ideas. Without a doubt, AI presents an opportunity that the industry can't afford to miss.

**But before smart technology could be implemented, an overview of the current state of affairs and available resources was needed.**

# INTEGRATING AI INTO THE VISUAL EFFECTS PROCESS: FIRST STEPS

# INTEGRATING AI INTO THE VISUAL EFFECTS PROCESS: FIRST STEPS

## INTRODUCTION

Several of the companies consulted said they had already started to integrate artificial intelligence into their work processes. These companies, however, are in the minority and include almost exclusively very large companies.

For the companies that have not yet started this process, integrating AI into the production of visual effects and animations will entail some fundamental changes within their teams and in the way they operate. These changes include adding to their teams' skillsets, planning how to adapt the internal pipeline and work processes, implementing learning management processes, and adapting infrastructure.

# 1.1 | INTEGRATING AI: POSITIONS TO CREATE AND FILL

AI has been a widely recognized scientific field since the 1950s, but it remains an **emerging technology**.

It has seen exponential growth in the past decade, and its possible applications now seem endless—as long as the people behind the technology have the necessary skills.

Creating these complex algorithms requires **highly qualified professionals** who understand the specific mechanisms and operating principles of data science and who will support technicians and artists as they learn how to use AI in their work:

***"I think all future work pipelines will need to have an AI specialist who can understand the various unique tools the company uses."***

- 3D animator, visual effects studios, 500+ employees

*With these new technologies, the skill we really need is analytical thinking: the ability to understand and interpret the information published by researchers. The ability to communicate this information to our own teams is also vital.*

Sarah Watling, CEO, JALI Research Inc.

# 1.1 | INTEGRATING AI: POSITIONS TO CREATE AND FILL (cont.)

As a result, any effort to incorporate AI and machine learning into VFX and animation work processes will require **adding specific skills internally**. Most visual effects and animation companies consulted said they did not have any in-house AI specialists yet, but the studios that are already working to develop their own internal AI solutions all mentioned that they have already hired specialists or will soon.

Moreover, artificial intelligence as an area of applied knowledge does not exist in a vacuum; it pulls concepts and technologies from a variety of scientific fields, which means that most AI specialists have an academic background in physics, math or a related branch of science, and go on to specialize in data science. The recent surge in popularity of AI has, therefore, led to a **shortage of qualified professionals** in Quebec and around the world. When we add to this constraint the fact that a specialist/researcher hired by a studio needs to be familiar with the visual effects and animation industry, or at least with digital imagery, the result is a set of criteria that reduces the pool of qualified people to an extremely small group. Given how scarce these resources are, it is vital to make it as easy as possible for companies to find and hire them.

**This means that we need to retain specialized resources in Quebec, develop internship and research programs that facilitate collaboration and networking between companies and educational institutions, create training programs focused on AI applied to digital creativity and, more generally, train as many qualified professionals as possible in data science.**

Photo credit: Wandavision © Marvel Studios (Courtesy of Rodeo FX)

Photo credit: Jingle Jangle: A Christmas Journey © Netflix (Courtesy of Framestore)

# 1.2 | INTEGRATING AI: IMPACT ON AN ESTABLISHED PIPELINE

## BY INTEGRATING MACHINE LEARNING, WE ARE TRYING TO ANSWER THIS QUESTION: HOW CAN WE MAKE WORKFLOWS BETTER, FASTER AND MORE EFFICIENT?

A company that wants to integrate AI into its production chain will have to not only, as previously mentioned, add new specialized skills to its teams' toolboxes, but also re-examine its production process to identify automation opportunities and priorities and optimize its production flow. **AI is not a blanket solution to all problems, but rather a personalized tool where each model must be adapted to the desired task and result.**

On this note, the studios consulted pointed out that each company has its own unique pipeline adapted to its specialization and projects, so there is no one-size-fits-all method. They also highlighted a difference in the general goal of integrating AI depending on the studio's specialization: the animation industry wants to automate the transfer of the drawing style, while the visual effects industry is looking for authenticity (the ability to replicate the real world).

**The development of artificial intelligence technology was long and costly, so it is up to each company that wants to start integrating AI to define its priority objectives based on its pipeline.** To make sure that AI is properly integrated, companies can add certain steps to their pipeline, including labelling their data, adjusting models based on the data set to be processed or the progress of the work, and creating a feedback step to improve future iterations.

# 1.3 | INTEGRATING AI: MANAGING THE LEARNING OF NEW TOOLS

Successfully integrating artificial intelligence technology into work processes also requires that this technology be built with user-friendliness in mind: **artists must be able to understand how the tool behaves in order to use it effectively.**

For AI tools to be adopted takes time and requires an understanding of certain basic principles.

When asked about this at the VFX | AI Symposium, the director of development for La Forge, the research centre of video game studio Ubisoft, said he relied on multidisciplinary internal teams (including both junior and senior employees) for research. Including artists in the process tends to encourage teams to adopt these new tools, reducing potential resistance to change. This internal collaboration has the added advantage of making it easier to identify processes that could be improved or sped up as well as to correct models to optimize workflow.

**Any effort to develop AI technology—from designing and adopting the tools to training the professionals who will use them—must, therefore, be carried out hand in hand with artistic teams.**

Photo credit: Flora and Ulysses © Walt Disney Pictures (Courtesy of Framestore)

# 1.4 | PURCHASING AND ADAPTING EQUIPMENT

**Integrating AI requires not only adding new skills, but also investing in equipment by buying new tools or adapting existing materials.**

The extremely fast evolution of computer technology forces companies to regularly upgrade their computer hardware and update their software to stay competitive when it comes to feasibility and delivery. This is why small companies cannot always afford the computer resources necessary for AI research.

For example, graphics processing units (GPUs), originally developed to accelerate graphics processing, can also considerably speed up the calculations used in deep learning. They are essential components of a modern artificial intelligence infrastructure, and new GPUs have been developed and optimized specifically for deep learning. However, replacing traditional processors (CPUs) with GPUs is a substantial investment. According to a study conducted by TECHNOCompétences, only nine visual effects and animation companies mentioned GPUs in their job listings in the past year, suggesting that their integration remains rare.

| GPU – Graphics processing unit (DEF.) * | CPU – Processor (DEF.) ** |
|---|---|
| A graphics processing unit is a microprocessor on graphics cards in computers or video game consoles, used to manage graphics display and manipulate graphic data.<br><br>The processors in modern graphics cards have a highly parallel structure that makes them efficient for a broad range of graphics tasks, such as 3D rendering, tasks in Direct3D and OpenGL, managing video memory, processing video signals, and decompressing MPEGs. | A processor, or central processing unit (CPU), is a component of numerous electronic devices that executes machine instructions for software.<br><br>Along with memory, it is one of the few functions that has existed since the first computers. A processor built as a single integrated circuit is a microprocessor. |

*** Source**: Graphics processing unit. (2022, January 24, 2:48 p.m. UTC). *Wikipedia, The Free Encyclopedia.* Retrieved on February 10, 2022, from https://en.wikipedia.org/wiki/Graphics_processing_unit

**** Source**: Central processing unit. (2022, February 9, 10:43 p.m. UTC). *Wikipedia, The Free Encyclopedia.* Retrieved on February 10, 2022, from https://en.wikipedia.org/wiki/Central_processing_unit

# 1.4 | PURCHASING AND ADAPTING EQUIPMENT (cont.)

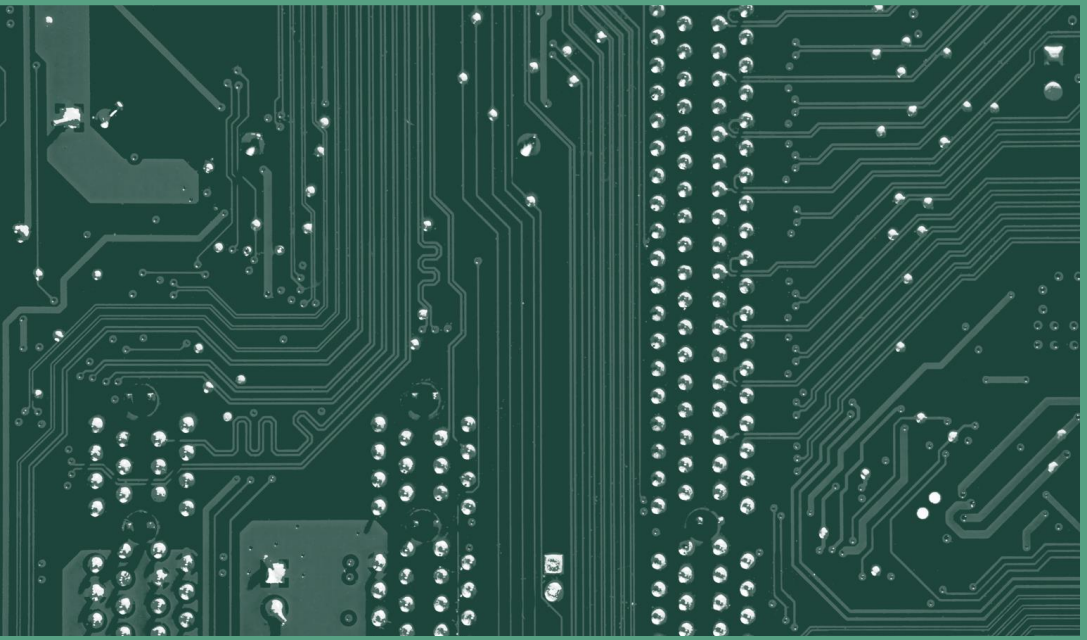


Photo credit: Michael Dziedzic

In addition, the visual effects industry (and the animation industry in the case of some companies) is a service industry, so the intellectual property of projects belongs to the production studio awarding the contract (e.g., Disney, Amazon).

This means that VFX and animation companies do not earn additional income when a production ends up being very successful.

In this context, **the investment resources available for innovation and research are usually more limited, as they are not part of regular operations**, unlike other industries, such as the ICT industry, which is the largest private sector performer of research and development in Canada, with R&D making up 41.2% of its total spending in 2019.*




*** Source**: TECHNOCompétences study. (2021) *Diagnostics sectoriels 2021-2024 : Portrait de la main-d'œuvre dans le secteur des technologies de l'information et des communications*. Quebec. TECHNOCompétences, p. 45

# 1.4 | PURCHASING AND ADAPTING EQUIPMENT (cont.)

Nevertheless, companies need to invest in the future. Artificial intelligence holds out the promise of improving the quality of a company's work while also reducing costs and production delays.

Given that the competitivity of Quebec's VFX and animation industry is inextricably linked to its ability to provide services using cutting-edge technology, companies face a dilemma: they want to invest in human resources, but they are held back by the capacity of their internal infrastructure.

Unfortunately for these companies, upgrading to the latest hardware and software is a significant recurring expense. **Financial support from public institutions would make it easier for companies to adapt their existing infrastructure.**

In the spirit of a circular economy, some VFX | AI Symposium attendees suggested that this support could be **conditional on companies' demonstrating that they have made efforts to donate their old material to educational institutions** that have expressed a need.

> *People cost more than computers, but right now they're being held back by computers' capabilities.*
>
> - Craig Zerouni, Chief Technology Officer, Reel FX

# ADOPTING AI: ADAPTING TEAMS AND PREPARING THE NEXT GENERATION

2

# ADOPTING AI: ADAPTING TEAMS AND PREPARING THE NEXT GENERATION

## INTRODUCTION

**To integrate artificial intelligence into the visual effects and animation process, teams will require supplementary training that accounts for the difference between artistic and technical positions.** A team member's position determines the level of understanding they will need to work with machine-learning tools in the pipeline.

**There is industry-wide consensus that artists do not need extensive knowledge of AI tools** in order to use them. Simply grasping the basics is enough. As described in Chapter 1.3, user-friendliness is key to the integration of AI tools. Artists must be able to continue to flex their creative muscles without being held back by technology.

**As for technical teams, they will need to acquire data science knowledge as soon as possible**, at a more or less in-depth level depending on the position held.

# 2.1 | TRAINING EXISTING RESOURCES

During the consultations, studios that are currently developing their own in-house AI solutions said that at this time, they cannot determine exactly how artists' day-to-days might be impacted in the long term and what specific skills they should be taught to help them adapt.

However, all the studios agreed that **these technologies will not require a total overhaul of existing processes; rather, artists will simply need to adapt as tools evolve.**

"There have already been so many technological developments in the last few years, and yet team sizes have remained the same while film production times have lengthened. I don't feel threatened by this new technology." - Digital Imaging Director, animation studio, 50+ employees.

**Visual effects and animation tools are constantly evolving and will continue to do so. Artists will need to keep up with the latest developments.**

*Photo credit: Cracké, Squeeze Studios (Courtesy of Squeeze Animation Studios)*

# 2.1 | TRAINING EXISTING RESOURCES (cont.)

As noted earlier, AI is not a one-size-fits-all solution, but rather a tool than can be used to address specific problems in cases where the expected outcome can be clearly defined and taught to the computer.

Industry professionals put together a list of tasks with the potential to be automated (see table). **Automating these processes does not, however, mean that human skills will become obsolete**.

The goal here is to delegate to the computer repetitive tasks that, based on estimates given by the professionals consulted, can occupy **up to half of an artist's time**. Far from replacing artists, AI offers the opportunity to free them from non-creative tasks, allowing them to focus on what they do best: creative work.

That said, it was also determined that all artists would benefit from **training on the basics of machine learning**, which is different from the technologies typically used in a traditional production pipeline. This would give them a basic grasp of what AI tools are, what they can do and what bugs they may encounter, even if they are not responsible for fixing them.

| TASKS THAT COULD BE AUTOMATED |
| --- |
| Camera tracking |
| Simulations |
| Rendering |
| Motion capture |
| Character animation |
| Image processing |
| Rotoscoping |
| Compositing |

## 2.1 | TRAINING EXISTING RESOURCES (cont.)

As for technical teams, the respondents generally agreed on the need to develop **a course on AI techniques for visual effects and animation**, similar to existing courses in the field of video games (e.g., 8IAR125 - artificial intelligence for video games, offered at UQAC).

Such a course would help technical staff upgrade their skills by centralizing and structuring the current body of knowledge about the various possible applications of AI in a visual effects or animation pipeline.

More advanced courses on machine learning technologies (for example: CSE7370 - machine learning, offered by UQAM) could also be an effective solution for people with key positions in research and development of algorithms based on these technologies.

**Ideally, this type of training would be offered by institutions that provide continuing education for visual effects and animation companies in Quebec.**

# 2.1 | TRAINING EXISTING RESOURCES (cont.)

**23%**
WORK-LIFE BALANCE

**16%**
PROFESSIONAL GROWTH

**23%**
SALARY

**16%**
TRAINING

In addition, according to TECHNOCompétences, 23% of employees say work-life balance is their main focus, with salary at 23% and professional growth and training coming in at 16%.* **In an industry where talent retention is an issue, continuing education is an important lever for retention.**




***Source**: TECHNOCompétences study. (2021) - *Diagnostics sectoriels 2021-2024 : Portrait de la main-d'œuvre dans le secteur des technologies de l'information et des communications*. Quebec: TECHNOCompétences, P. 72

# 2.2 | ADAPTING CURRICULA FOR FUTURE PROFESSIONALS

Adapting human resources to the changes brought about by AI also requires updating introductory course curricula to familiarize emerging artists with new work processes.

**As a first step, industry professionals recommend adding basic programming skills to current visual effects and animation programs** (whether college or university level) to make future artists more highly adaptable and independent.

This recommendation was also included in the report submitted by SYNTHESE as part of the recent consultation on the review of college programs. *

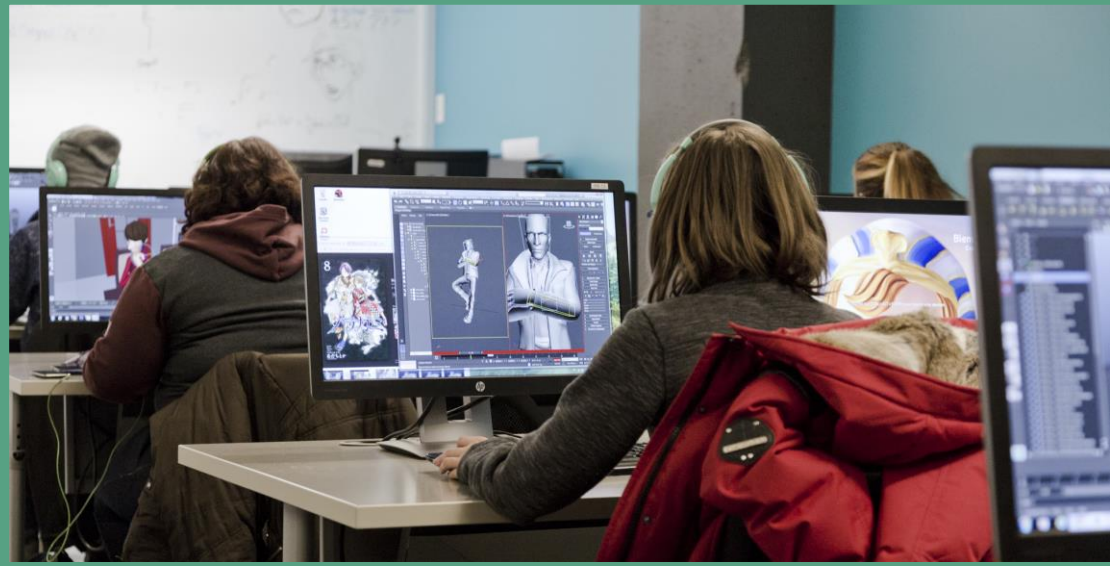


Photo credit: @Campus Montréal, École NAD-UQAC.




* **Source**: SYNTHÈSE study (2021, June). *Travailler en création numérique aujourd'hui et demain*. Quebec SYNTHÈSE-Pôle Image Québec.

# 2.2 | ADAPTING CURRICULA FOR FUTURE PROFESSIONALS (cont.)

Photo credit: Tales From The Loop ©Amazon Studios (Courtesy of Rodeo FX)

As visual effects and animation tools evolve, schools will need to **update the practices they teach**, in collaboration with companies and developers, to keep up with changes in the industry. Of course, this is already common practice in educational institutions.

It is also recommended that educational institutions add an **introduction to the fundamentals of machine learning** course to their curricula, as suggested for artists already working in the industry. This topic will need to be addressed at the educational institution concertation tables led by SYNTHÈSE between January and May 2022.

Educational institutions and businesses in the industry will need to jointly establish an educational standard recognized by education systems for the specific skills related to artificial intelligence technologies, as noted by one of the Symposium participants: "There also needs to be collaboration with companies to set an educational standard. Companies are the driving force behind the needs of educational institutions." - Head of Growth, visual effects studio, 500+ employees.

In addition, a number of professionals and educators stressed the need for **closer relationships between educational institutions and companies** to better **prepare juniors for their entry into the industry**. Many industry professionals recommended setting up **internship programs** to help prepare students for the reality of working in a studio. It was also suggested that an annual survey of companies' skill needs be established.

# 2.2 | ADAPTING CURRICULA FOR FUTURE PROFESSIONALS (cont.)

*New talent will be coming in with more transferrable skills. Companies need to communicate with schools so that schools can adapt their programs.*

- Program Coordinator, Institut Grasset

*Knowledge sharing sessions that bring together the art and development teams should be added to education programs so they can learn about each others' needs and work out ways to collaborate.*

- Liaison Officer, École NAD-UQAC

*There need to be bridges between business and universities to train skilled workers.*

- Project Manager, SYNTHÈSE

*Juniors who come in already trained will have an easier time using these new tools.*

- VFX Supervisor, visual effects studio, 500+ employees
- (Free translation from the French)

# 2.3 | ESTABLISHING RELATIONSHIPS WITH THE AI EDUCATION ECOSYSTEM

**$622M**

Growth in volume of business for the **visual effects** sector in 2019*

**$353M**

Growth in volume of business for the **animation** sector in 2019 and 2020*

**In addition, it is important to establish relationships between specialized AI academic programs and visual effects and animation companies, for example, by developing internship programs for student researchers, supported by scholarships offered by the Quebec government.**

Lastly, there is currently no AI education program specifically for the visual effects and animation sector, which is a robust and well-established industry in Quebec, bringing in more than $622M (visual effects) in 2019 and $353M (animation) in 2019–2020. **Industry professionals therefore recommend developing a specialized education program for AI applied to visual effects and animation in the medium to long term.**

This could take the form of a new specialization for AI doctoral programs, as currently exists for video games.

**In any case, networking between research centres, educational institutions and visual effects and animation studios should be encouraged to foster skill development and support the training of highly qualified specialists whose skills will be invaluable for Quebec's growth and competitiveness.**




* **Source**: QFTC. (2021) *Annual Report 2020-2021*. Retrieved from: http://www.qftc.ca/about-qftc/annual-report/

# CONDITIONS FOR THE SUCCESSFUL ADOPTION OF AI/ML TOOLS

3

# CONDITIONS FOR THE SUCCESSFUL ADOPTION OF AI TOOLS

## INTRODUCTION

The findings and recommendations set out in the previous two chapters provide an overview of the integration of AI into visual effects and animation work processes and the skills that need to be developed by the industry's workforce.

At the same time, professionals we consulted pointed out that integrating AI into work processes has both benefits and risks. Certain conditions must be established to support companies in their innovation efforts and facilitate industry adaptation: adequate support for research and development, collaboration with research centres, protection of intellectual property and, last but not least, cross-sector collaboration.

# 3.1 | BENEFITS AND RISKS

## BENEFITS

Artificial intelligence technologies have tremendous potential for making the visual effects and animation industry in Quebec more competitive.

By integrating these technologies into their pipelines, companies could considerably increase their productivity. AI can:

- Accelerate processes, thereby reducing time and budget constraints
- Enhance the capabilities of artists and raise the quality of their work to new heights, thus enhancing the reputation of Quebec talent
- Free professionals from repetitive tasks, thereby reducing their workload

**AI can also play a role in attracting and retaining talent by promoting job satisfaction. Industry professionals see it as a way to focus on what they do best: creative work.**

Moreover, AI in its current form does not constitute a radical change in the way the industry operates: **professionals remain skilled in their trade and training programs remain relevant, provided they are updated.**

# 3.1 | BENEFITS AND RISKS (cont.)

*The world has a **huge appetite** for media right now, so there are more artists and more work than ever before. I have seen no evidence to suggest this will lessen. As the use of AI expands, it may simply change the way certain jobs are done. Currently, artists can spend a great deal of time on simpler, more mundane tasks. That type of work can potentially be done by computers so humans can spend more time on what they're good at – **ideation and creativity**. AI has the potential to change the industry in many ways, but perhaps one of the most important will be allowing creatives to focus on the parts of the job they love and thereby **reigniting a passion for visual effects**.*

Nic Hatch, President, Ncam (Hogg, T. (2021, April 12). "AI, Machine and Deep Learning: Filling Today's Need for Speed and Iteration." *VFX Voice*, https://www.vfxvoice.com/ai-machine-and-deep-learning-filling-todays-need-for-speed-and-iteration/)

# 3.1 | BENEFITS AND RISKS (cont.)

## RISKS

**Developing tools and features that rely on AI technologies can be risky business:**

- Research is very costly and requires a great deal of technological and human resources, as well as highly specialized skills. The investment is therefore considerable for companies and recruiting qualified talent can be a challenge.
- It can take a very long time to go from research to integrating a functional tool into the production pipeline.
- Successful research outcomes are never guaranteed, and the tools developed from research are not always suitable for the end use.
- There is no guarantee that the resulting tool will be useable or user-friendly and may not allow for the desired degree of flexibility. To be fully effective, the tool must be completely transparent to the end user.
- AI tools often do not have a perfect track record. However, professionals agree that an imperfect machine learning tool is still better than a traditional "manual" method.
- AI is only as good as the reference data that tools are trained with.
- As artificial intelligence evolves rapidly, tools can quickly become obsolete if they are not updated regularly.
- The moral and ethical ramifications of AI must be considered (e.g., deep fake technology).

In light of this information, several companies expressed their reluctance to invest heavily in AI R&D. **Therefore, the successful integration of artificial intelligence into visual effects and animation creation processes relies on a set of conditions and parameters that will allow it to reach its full potential**.

# 3.2 | CONDITION 1: SUPPORT FOR R&D

AI research and development is costly and risky, as noted by the president of a Quebec animation company: “The problem is, if we want to scale up and have ongoing access to this type of knowledge, we’re going to need money… but how can we move forward if we don't have the people to develop the vision for future tools?”

However, global competition is fierce and Quebec, as a visual effects and animation hub, must invest in the future and remain at the leading edge of technological developments. It is therefore important to support companies by developing R&D funding programs adapted to their needs to support innovation and training.

The survey of Quebec visual effects and animation companies sent out following the Symposium revealed that more than 50% of respondents have not yet integrated AI into their processes, though they are currently conducting research and development into it.

One insight that came out of the talks and conversations at the VFX | AI Symposium is that **visual effects and animation companies were largely unaware of all the funding resources available for AI development**, though many mentioned that Canada offers a favourable economic environment for research and innovation. This disconnect is undoubtedly a barrier to innovation that needs to be addressed.

Photo credit: The Falcon and The Winter Soldier © Marvel Studios (Courtesy of Rodeo FX)

# 3.2 | CONDITION 1: SUPPORT FOR R&D (cont.)

A critical first step, then, would be **to compile a list of the programs available to businesses in the industry (direct funding, human resources, training, other) in one document, including their parameters and criteria**.

This could be done by SYNTHÈSE, whose main mission is to foster the growth and development of leading-edge expertise in the digital creation industry and promoting synergies between private companies, CEGEPS, universities, and researchers across Québec through forward-looking, practical initiatives.

Next, **the resulting document could be shared with businesses** so they can benefit from the information and give feedback on how relevant and tailored these programs are to their needs. Workshops to present resources to businesses could also be organized.

Lastly, based on this feedback, **the federal and provincial governments should complete an assessment of program performance and analyze gaps between business expectations and available resources and adapt these resources accordingly.**

# 3.3 | CONDITION 2: COLLABORATION WITH RESEARCH CENTRES

**Data from the VFX | AI Symposium and subsequent consultations also show that there are excellent opportunities for collaboration between research institutes and visual effects and animation companies in Quebec, which allows for resource pooling and mitigates the risk for companies investing in R&D.**

These collaborations can take different forms depending on the research body involved, for example college (e.g., CDRIN*, Cégep de Matane) or university (e.g., CeRVIM, ULaval) academic research centres, research institutes (e.g., IVADO*), and the Scale AI supercluster.

Some research centres and institutions will loan out researchers and students for research projects conducted by a company, thus facilitating innovation and knowledge sharing:

"All our projects are funded by the government. When a company comes to us for research support, all the documentation and source code is handed over to them at the end of the project. We only keep the scientific stuff (scientific papers and educational aspects). But other than that, all the intellectual property is retained by the company." - Julien Coll, Research and innovation advisor, CDRIN

Research centres may also provide direct funding or support in finding funding.

Here again, businesses raised a concern that the services offered by these bodies are still poorly known, and expressed a strong interest in learning more about them. In particular, these collaborations can provide smaller companies with the means to invest in R&D so they can become more competitive.




*** Key players**: the CDRIN and IVADO are two of the key players listed in the appendices.

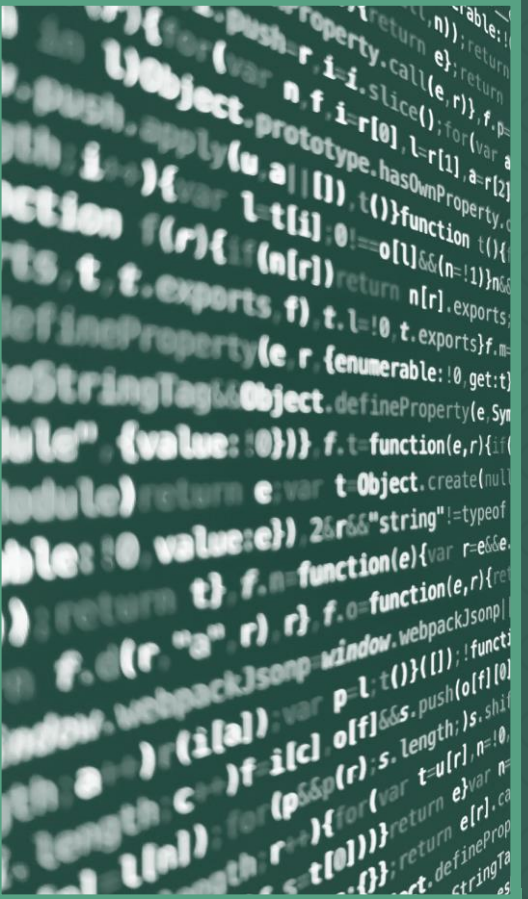


Photo credit: Ali Shah Lakhani

# 3.3 | CONDITION 2: COLLABORATION WITH RESEARCH CENTRES (cont.)

In addition, some companies with studios in multiple countries reported leading joint research projects with foreign universities, particularly in the United Kingdom. One example is the studio DNEG, which developed a research project on the application of AI in rotoscoping in collaboration with the developer Foundry and the University of Bath*.

These types of projects should be encouraged in Quebec in order to support innovation, the industry's reputation and knowledge sharing. The QFTC will explore the possibility of jointly facilitating such collaborations with SYNTHÈSE and Scale AI.

It was also suggested that a joint multidisciplinary research chair be created that brings together companies and college and university digital imaging research centres with the goal of developing and sharing AI tools that can be used in visual effects and animation. Half of the respondents to the post-Symposium survey were in favour of this initiative.

It should be noted that the CDRIN is currently developing a project along these lines.

*** Source**: University of BATH. (n.d). SmartROTO. Retrieved from: https://researchportal.bath.ac.uk/en/projects/smartroto-resubmission

# 3.3 | CONDITION 2: COLLABORATION WITH RESEARCH CENTRES (cont.)

**Multiple companies and organizations also raised a concern about the lack of a dedicated digital creativity research line in major Quebec AI research institutions such as the MILA.**

In addition to the issue of collaborative projects, conversations at the Symposium highlighted a general need for better communication between the research and business communities.

Businesses expressed a desire to be better informed about new developments, but acknowledged the complexity of research products, which often requires a high level of reading analysis skill to interpret.

Researchers, for their part, would like to be better informed about the reality of companies and the evolution of practices in the field. **Setting up forums for sharing and exchanging information, within Acfas* for example, or launching an annual event dedicated to digital image research, would facilitate knowledge sharing and prove beneficial for the entire ecosystem.**

Photo credit: Star Wars: The Rise of Skywalker © & TM Lucasfilm, Ltd. All Rights Reserved.

*Acfas : Association de promotion et défense de la recherche en français, https://www.acfas.ca/

# 3.4 | CONDITION 3: PROTECTING INTELLECTUAL PROPERTY

The AI community operates largely on the principle of knowledge sharing and open source data. The reasons often cited for this are: community, quality, security, customization and cost. Researchers are able to rely on the work of the community to develop their own algorithms, at a lower cost. This also facilitates mass data collection.

“Replicability has always been a problem in science. And it has only gotten worse since the rise of deep learning. In many cases, the devil is in the details. If you don't have the code, you can almost never reproduce it.” - Jean-François Lalonde, Associate Professor, Université Laval (Free translation from the French)

However, the question of intellectual property comes into play when it comes to developing AI for the visual effects and animation sector. This is for two reasons: one, data cannot be shared without approval from the producer under a service contract, as the producer owns the intellectual property related to the project; two, the artistic quality of the work done by visual effects and animation studios directly relates to their competitivity on the market.

Two types of projects were cited as examples by studios at the VFX | AI Symposium:

- Research projects involving universities and tool developers, but with only one visual effects or animation studio among its collaborators. This protects the intellectual property and gives the studio a competitive edge, and the collaborators, including university researchers and students, benefit from the knowledge gained.
- Collaborative projects involving multiple studios, but whose research focus is on technical aspects that are not a source of competition between companies. The intellectual property of the tools resulting from the project is shared and benefits the whole industry.

# 3.4 | CONDITION 3: PROTECTING INTELLECTUAL PROPERTY (cont.)

**In order to be viable, any collaborative initiative to develop AI tools for the industry must be very sensitive to the issue of intellectual property as it relates to data and the use of any tools resulting from the project.**

In fact, there is a recognized organization dedicated to collaboration and the open source ecosystem in the visual effects and animation industry: the Academy Software Foundation (ASWF). Powered by the Linux Foundation and supported by the Academy of Motion Picture Arts and Sciences, it has a mission to advance the open source ecosystem in the animation and visual effects industry by:

- Increasing the quality and quantity of contributions to the content creation industry's open source software base
- Providing a neutral forum to coordinate cross-project efforts
- Providing a common build and test infrastructure
- Providing individuals and organizations a clear path to participation in advancing our open source ecosystem

The ASWF makes it possible for studios to collaborate within a clear and specific framework. **Opportunities for collaboration between the Quebec industry and the ASWF should be explored, such as hosting an annual conference or event centred around knowledge sharing.**

Finally, ethics must be considered when planning research projects for developing any algorithms. Several stakeholders have proposed drafting an ethics manual for the entertainment industry as a framework and reference for organizations.

# 3.5 | CONDITION 4: CROSS-SECTOR COLLABORATION

The AI and visual effects and animation industries in Quebec are two particularly high-performing growth sectors. However, conversations and consultations held over the past few months revealed that these two sectors operate in silos, i.e., there is no platform for collaboration between the two ecosystems.

The professionals consulted expressed a strong interest in creating strong and lasting relationships between these industries.

To support the success of the measures proposed in this document, and in the interest of promoting the economic growth and influence of Quebec, **a consultation body bringing together key players in the AI and visual effects and animation hubs should be created as soon as possible to facilitate knowledge and skill sharing.** It would also be pertinent to explore networking, learning and sharing opportunities for the VFX industry at the World Summit AI Americas in May 2022 in Montréal.

Photo credit:The Umbrella Academy © Netflix (Courtesy of Folks VFX)

# 3.5 | CONDITION 4: CROSS-SECTOR COLLABORATION (cont.)

Photo credit: Blazing Samurai ©Aniventure (Courtesy of Cinesite)

In addition, there is currently international interest in AI's potential to shape the creative industries.

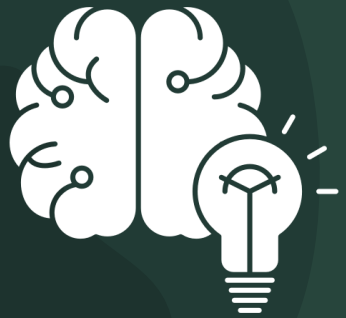
For example, an open letter penned by industry leaders and addressed to the British Chancellor of the Exchequer (finance minister) in October 2020 calls for the creation of a UK centre for AI the creative industries.*

The goals of this initiative are to:

- Provide training and skill development in AI for the creative industries
- Provide a gateway for creative businesses wanting to develop AI tools
- Expose academic researchers to the technical issues of applying AI in creative settings
- Provide commercial development for AI creative start-ups

**Quebec is by all accounts in a prime position to excel in this sector, and we need to strike while the iron is hot**, as countries around the world are rapidly ramping up their investments in digital creativity.

*__Source__: DAVIES J. and EASTON E. (2020, Octobre) .*Calling for a UK Centre for AI and the Creative Industries* [open letter]. Creative Industries Policy & Evidence Centre. https://www.pec.ac.uk/news/calling-for-a-uk-centre-for-ai-and-the-creative-industries



# CONCLUSIONS AND ACTION PLAN

4

# 4.1 | GENERAL OBSERVATIONS FROM THE SYMPOSIUM AND CONSULTATIONS

- In summary, the Symposium, the survey and the subsequent consultations identified a number of general observations about the integration of artificial intelligence into the visual effects (VFX) and animation sector and the impact on these professionals:

- First and foremost, AI is clearly the future of visual effects and animation, as it is for all industries that produce a mass of exploitable data. **Quebec has the resources to be a leader** in this technological revolution, thus propelling the growth of the industry and jobs while enhancing its international reputation.

- However, AI technologies should not be seen as omnipotent algorithms that can provide one-size-fits-all solutions, but rather as a form of **augmented intelligence** that expands the capabilities of artists, speeds up specific processes and boosts productivity.

- The potential of applied AI in the creation of visual effects and animation is immense, and research is still in the **development stage**. A number of tools have already been created and successfully integrated, but many possibilities remain to be explored.

- AI as an area of applied knowledge does not exist in a vacuum; it pulls concepts and technologies from a variety of scientific fields. Skilled professionals in this area are a scarce and sought-after resource worldwide. Those with both advanced AI skills and knowledge of VFX and animation are even rarer.

- Jobs in the VFX and animation industry will not necessarily change radically, but will evolve as AI tools are developed and integrated into company production pipelines. Existing tools are already constantly evolving, so artists will have to continually update their knowledge, as is currently the case. However, it is important to ensure that specific skills are enhanced by adding programming courses and introductory courses to the principles of machine learning. Technical teams, on the other hand, need to acquire data science knowledge as soon as possible.

# 4.1 | GENERAL OBSERVATIONS FROM THE SYMPOSIUM AND CONSULTATIONS (cont.)

- AI can also play a role in attracting and retaining talent by contributing to job satisfaction, as industry professionals see an opportunity to return to the what artists do best: creativity.
- For companies that have not yet begun the process, integrating AI into visual effects and animation production involves fundamental changes to teams and how they operate, such as adding skills, planning to adapt the internal pipeline and work processes, implementing learning management processes and adapting infrastructure.
- The successful integration of AI relies on a number of conditions and parameters that allow it to reach its full potential. Artificial intelligence R&D is expensive, risky and requires specialized skills. As a result, few small and medium-sized companies in the sector have, at this point, been able to begin integrating these technologies into their pipelines.
- At the same time, the data collected revealed a lack of communication and knowledge sharing:
  - Visual effects and animation companies are mostly unaware of all the funding resources available for AI development
  - Many professionals and educators have emphasized the need for closer relationships between educational institutions and businesses
  - There are untapped opportunities for collaboration between companies, research and educational institutions and developers
  - Quebec's VFX and animation industry and its AI industry, both of which are high-performing growth sectors, operate in silos. There are no collaboration platforms, research lines, or academic programs focused on AI for the VFX/animation industry.
- Lastly, it is important to note that there is currently international interest in the potential of AI in the development of creative industries. Quebec must act quickly to remain competitive on the world stage.

# CONCLUSIONS AND ACTION PLAN

## INTRODUCTION

The action plan proposed on the following pages incorporates all of the recommendations made in the previous chapters. It flows directly from the recommendations made by the professionals and researchers consulted during the VFX | AI Symposium, the survey and the individual interviews. It consists of a series of concrete steps intended to foster the development of skills needed to integrate AI into the VFX and animation creation process. However, these are merely suggestions, and it is up to each organization to decide whether or not to implement them.

Moreover, the rapid pace at which AI knowledge is evolving means that this plan will have to be revisited in the medium and long term to reassess and reorient priorities according to the reality of the sector and to measure the impact of the actions taken.

Quebec must invest in training, attracting and retaining artificial intelligence resources. AI skills are the skills of the future, and they are currently in short supply around the world. This means it is crucial to take action to maintain the province's status as an AI hub. For this action plan to succeed, companies will need to actively seek out the initiatives available so they can take advantage of the resources offered by the local ecosystem.

# 4.1 | SHORT-TERM ACTIONS – Timeframe: 6 to 12 months

| RECOMMENDED ACTIONS | STAKEHOLDERS | REF. |
|---|---|---|
| **SKILLS AND EDUCATION** | | |
| Adapt visual effects and animation academic programs in line with the recommendations made by SYNTHÈSE during the consultations for updating college programs, namely by adding basic computer programming skills to current curricula | Educational institutions | p.35 |
| Develop AI skills within educational institutions specializing in visual effects and animation by training professors and hiring experts | Educational institutions | p.36 |
| Develop in-house AI skills by:<br>o Hiring specialists and/or collaborating with applied research centres to use their resources (student researchers)<br>o Training technical and research teams | Companies<br>In collaboration with:<br>Research centres | p.23 |
| Address the question of adding AI skills at the SYNTHÈSE-led educational institution concertation tables held between January and May 2022 | SYNTHÈSE<br>In collaboration with:<br>Educational institutions | p.36 |

# 4.1 | SHORT-TERM ACTIONS – Timeframe: 6 to 12 months (cont.)

| RECOMMENDED ACTIONS | STAKEHOLDERS | REF. |
|---|---|---|
| **RESEARCH AND INNOVATION** | | |
| Identify tasks that can be automated and set priorities for each pipeline to increase productivity. This will allow businesses to identify and tag relevant data sets. | Companies | p.24 |
| Bring together key players by creating a cross-sector (IA + VFX/animation) collaborative organization:<br>o Establish a committee of key players from government, clusters and other collaborative organizations, businesses, schools, research centres and software and hardware vendors to jointly determine the format for collaboration<br>o In collaboration with the Guilde du Jeu Vidéo du Québec and IVADO, support the CDRIN in the implementation of a research project that brings together creative industries and AI as part of the federal Applied Research and Technology Partnership grant (ARTP) | QFTC<br>CDRIN<br>Guilde du Jeu Vidéo du Québec<br>IVADO<br>CSMO | p.51 |
| **FUNDING AND DEVELOPMENT OF THE ECOSYSTEM** | | |
| Jointly develop a guide listing all resources available to support the development of AI in visual effects and animation companies (direct financing, human resources, training, etc.):<br>o Hold a consultation period with companies to present and comment on the guide (this could take place during the Vitrine event - see page 61) | SYNTHÈSE<br>In collaboration with: QFTC | p.44-45 |
| Provide financial support for investment in technologies (software) and hardware; in exchange for this financial compensation, companies should donate their old equipment to schools that express a need for it | Government of Quebec | p.28 |
| Explore networking, learning and sharing opportunities for the VFX industry at the World Summit AI Americas in May 2022 in Montréal | QFTC | p.51 |

# 4.2 | MEDIUM-TERM ACTIONS – Timeframe: 12 to 24 months

| RECOMMENDED ACTIONS | STAKEHOLDERS | REF. |
|---|---|---|
| **SKILLS AND EDUCATION** | | |
| Continuing education:<br>○ Create, as soon as possible, an introductory AI training for existing VFX/animation technicians and artists: Existing courses such as UQAC - 8IAR125* and UQAM - INF7370** may be used as inspiration to build a body of knowledge that meets the industry's needs; some courses could be added to the EXPERTS training platform managed by SYNTHÈSE, which is accessible to QFTC members free of charge<br>○ Create a change management course for HR professionals to support them through this transition | Educational institutions<br>SYNTHÈSE<br>CSMO<br>In collaboration with: Companies | p.32-33 |
| Introductory education - General revision of curricula (at all levels: DEC, AEC, undergraduate, master's) in accordance with the evolution of industry practices (apply the SYNTHÈSE recommendations):<br>○ FOR ARTISTS: No more repetitive tasks<br>Introduction to the fundamentals of machine learning<br>○ FOR TECHNICAL TEAMS: More courses on machine learning and artificial neural networks<br>Collaboration with software developers to adapt programs to the latest technological advancements | Educational institutions<br>In collaboration with: Software developers | p.36 |
| Create a bridge between companies and AI training programs by offering internships to student researchers:<br>○ To carry out this project, the government will have to ensure that scholarships are in place to finance these internships<br>○ Explore the opportunity to integrate the field of AI into SYNTHESE's ARRIMAGE program, which offers customized internships as part of an education curriculum | Government of Quebec<br>In collaboration with: The QFTC and SYNTHÈSE | p.38 |
| Set up an annual survey of companies' skill needs | QFTC<br>In collaboration with: CSMO | p.36 |

*UQAC - 8IAR125 (Intelligence artificielle pour le jeu vidéo) : https://cours.uqac.ca/8iar125
** UQAM – INF7370 (Apprentissage automatique) : https://etudier.uqam.ca/cours?sigle=INF7370

# 4.2 | MEDIUM-TERM ACTIONS – Timeframe: 12 to 24 months (cont.)

| RECOMMENDED ACTIONS | STAKEHOLDERS | REF. |
|---|---|---|
| **RESEARCH AND INNOVATION** | | |
| Encourage collaborative research projects between companies, tool developers and universities — networking could be facilitated through a collaboration between the QFTC, Scale AI and SYNTHÈSE<br>o Special attention to intellectual property: the goal of developing tools is to give a potential competitive edge to Quebec companies, so they must be free to take advantage of them. | QFTC<br>Scale AI<br>SYNTHÈSE | p.47<br>p.50 |
| Create a multidisciplinary research centre supervised by experts (researchers and professionals in the field) in order to share and develop applied AI tools — It will be important to promote collaboration between research bodies (CEGEPs, universities, companies) to leverage the expertise available in the ecosystem in both visual effects and artificial intelligence:<br>o Building on the PRAT project developed by the CDRIN | Research centres<br>Educational institutions | p.47 |
| Add the field of Creative Industries to the areas explored by artificial intelligence research centres. | Research centres<br>Government of Quebec | p.48 |
| Create a research line dedicated to AI applied to Creative Industries within Acfas:<br>o Facilitate knowledge sharing: invite industry experts to participate in conferences to stimulate research and student interest using inspiring real-life examples | SYNTHÈSE | p.48 |
| Explore opportunities for collaboration between the Quebec industry and ASWF, such as organizing conferences or an annual knowledge-sharing event | QFTC | p.50 |

# 4.2 | MEDIUM-TERM ACTIONS – Timeframe: 12 to 24 months (cont.)

| RECOMMENDED ACTIONS | STAKEHOLDERS | REF. |
|---|---|---|
| **FUNDING AND DEVELOPMENT OF THE ECOSYSTEM** | | |
| Based on the results of the consultation with businesses on the guide to resources for funding and innovation:<br>o Assess whether resources are appropriate and sufficient by conducting an assessment of current services based on company feedback<br>o Analyze the gaps between what companies want and what tools are available<br>o Adapt resources as needed | Government of Quebec<br>Government of Canada | p.45 |
| As part of the planning for a Showcase event in Montréal (professional event with an international scope dedicated to visual effects and animation):<br>o Include a follow-up to the Symposium: overview and action plan update<br>o Include an activity to introduce companies to the AI resource guide developed by SYNTHÈSE<br>o Organize workshops to present services for companies to support the development of AI technologies (e.g. CDRIN, MITACS, etc.)<br>o In collaboration with SYNTHÈSE: organize an activity to develop an ethics manual for the use of AI in digital creativity | QFTC<br>In collaboration with: SYNTHÈSE | p.45<br>p.48<br>p.50<br>p.56 |

# 4.3 | LONG-TERM ACTIONS – Timeframe: 3 to 5 years

| RECOMMENDED ACTIONS | STAKEHOLDERS | REF. |
|---|---|---|
| **SKILLS AND EDUCATION** | | |
| Develop a specialized graduate program in AI applied to visual effects and animation. This program could take the form of a new specialization for AI Ph.D. programs, as already exists for video games. | Educational institutions | p.38 |
| **RESEARCH AND INNOVATION** | | |
| Support the establishment of a recurring R&D event similar to SIGGRAPH Montreal. | QFTC | p.48 |
| **FUNDING AND DEVELOPMENT OF THE ECOSYSTEM** | | |
| Measure the impact of the action plan and its contribution to the industry's growth. | QFTC<br>In collaboration with: CSMO | p.56 |

# Appendices

# SURVEY OVERVIEW

## COMPANY DETAILS

1. Please specify your company's main field of activity
2. Studio size
3. Type of production
4. How do you use AI in your company?

## WORKFORCE IN PLACE / TO BE HIRED

5. What are the missing skills you are looking to hire to drive innovation in your studio?

5.B Please expand on your answer

6. Does your company provide access to continuing education programs for technical skills/positions?

6.B If yes, please list the programs

7. At the Symposium, many mentioned the lack of available talent to fill their teams. In your opinion, what are the reasons for this shortage?

7.B Please elaborate on your answer

## JUNIOR TALENT

8. In your opinion, what are the problems identified as a reason for the lack of retention of junior workers in the industry?

8.B Please expand on your answer

9. What would be the ideal solution for retaining junior talent?

9.B Please develop your answer

10. What would be the elements to review in the initial training curricula to give juniors the missing knowledge that could meet your needs?
11. What are the tasks usually assigned to juniors during their first months in the industry?
12. What tasks, if any, do you never delegate to junior artists?

12.B Why are these tasks not delegated?

## R&D AND AI DEVELOPMENT

13. Many mentioned the difficulty of doing research in-house for smaller companies. What are the missing elements for smaller studios to integrate AI into their work pipeline?
14. Many of you told us that you were not aware of the resources available for AI Innovation/Development in Quebec. What do you think would be the best vehicle for the transmission of information?
15. Research and development of AI technologies is costly and risky. In this context, the idea of creating a joint research chair to share costs was proposed at the Symposium: Is this an interesting avenue for your company?

15.B Please elaborate in a few words

16. Should tool developers be included in these approaches?

16.B Please elaborate in a few words?

17. The key requirement for the development of AI technologies is access to a sufficient amount of data. If the management of this data was entrusted to a third party (University, Hub) offering guarantees of security and anonymity, would your studio be interested in sharing its data?

17.B Please elaborate in a few words

17.C If you answered no to the previous question: Would there be a context in which data could be shared while maintaining privacy concerns?

18. Have you begun to integrate AI into your pipeline?

18.B If so, what changes have you had to incorporate into your teams / tools / hardware to adapt?

19. Creating training programs: What skills do you need to develop in your team to enable AI in your pipeline?
20. Do you have AI specialists on your team?

20.B If so, where do these specialists come from? What was their educational background? What was their professional background?

# COMPANIES AND ORGANIZATIONS THAT PARTICIPATED IN THE VFX | AI SYMPOSIUM, SURVEY AND CONSULTATIONS

IATSE 514
Amazon
Autodesk
Quebec Film and Television Council (QFTC)
CDRIN
Cégep de Jonquière - ATM
Commission parlementaire du marché du travail
Conseil emploi métropole
Digital Domain
DNEG
Entertainment Partners Canada
Exogène Films
Felix & Paul Studios
Fish Think Thank
Canada Media Fund
Forum IA
The Foundry
Framestore
Hampa Studio
Hybride
Institut Grasset
ISART Digital
JALI Research
MELS
NAD - UQAC
On Animation Studios
RADiCAL
Raynault FX
Rayon VFX
Reel FX
Roblox
Rodeo FX
Scale.AI
Scanline VFX
Squeeze Animation Studio
Studio Singing Frog
SYNTHÈSE
Technicolor
TECHNOCompétences
Tonic DNA
Ubisoft
Université Laval
Université de Montreal
Weta Digital

# RESOURCES AND KEY PLAYERS

**QUEBEC FILM AND TELEVISION COUNCIL (QFTC)**
info@qftc.ca
http://www.qftc.ca/

The Quebec Film and Television Council (QFTC) is a non-profit organization whose mission is to contribute to the development and competitivity of Quebec as a world-class film and television production centre. It generates investments in Quebec by relying on competitive tax incentive programs, the expertise of the sector's members, geographical and architectural diversity, the quality of its infrastructure and the industry's ability to export its products to foreign markets.

**CENTRE DE DÉVELOPPEMENT ET DE RECHERCHE EN INTELLIGENCE NUMÉRIQUE (CDRIN)**
info@cdrin.com
https://www.cdrin.com/

The Centre de développement et de recherche en intelligence numérique (CDRIN), located in Matane, conducts research and leads technology transfer initiatives for small, medium and large companies in the field of digital imaging, particularly in motion capture and augmented reality. It also provides skills development and professional development services for this constantly evolving sector.

**CONSEIL EMPLOI MÉTROPOLE (CEM)**
cem.secretariat@mtess.gouv.qc.ca
https://www.emploi-metropole.org/

The Conseil emploi métropole is the largest association of labour market representatives in the Montreal census metropolitan area. It brings together members and partners to discuss the region's major employment issues. Through a collaborative approach, it proposes action strategies and advises the Commission des partenaires du marché du travail and the Minister of Labour, Employment and Social Solidarity.

**IVADO**
luc.vinet@ivado.ca
https://ivado.ca/en

IVADO is dedicated to accelerating Quebec's digital transformation by acting as a catalyst for progress in research into harnessing big data for decision-making, expanding scientific and industry-based talent in digital intelligence, developing world-class knowledge and technologies and accelerating the adoption of digital intelligence.

# RESOURCES AND KEY PLAYERS (cont.)

**MILA**
medias@mila.quebec
https://mila.quebec/

Based in Montreal, Mila's mission is to be a global pole for scientific advances that inspire innovation and the development of AI for the benefit of all. A non-profit organization, Mila is internationally recognized for its significant contributions to machine learning, especially in the areas of language modelling, machine translation, object recognition and generative models.

**SCALE.AI**
info@scaleai.ca
https://www.scaleai.ca/

A consortium of private entities, research centres, universities and high-potential start-ups, Scale AI is the central pillar of Canada's AI ecosystem. As Canada's AI supercluster, it identifies cross-sector collaborations and provides funding and expert guidance to help Canada stay ahead of the AI curve.

**SYNTHÈSE – PÔLE IMAGE QUÉBEC (SYNTHÈSE)**
info@polesynthese.com
https://polesynthese.com/en

SYNTHÈSE – Pôle Image Québec fosters the development of digital creativity by promoting synergies between educational institutions, businesses and researchers. It is a national and international showcase for Quebec-based expertise and training in computer graphics.

**TECHNOCOMPÉTENCES**
info@technocompetences.qc.ca
https://www.technocompetences.qc.ca/

TECHNOCompétences is dedicated to supporting and promoting the development of talent and employment in information and communication technologies (ICT) in conjunction with industry partners. They are also a trusted resource for companies in the sector and those employing information and communication technology professionals.

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**QUEBEC FILM AND TELEVISION COUNCIL**

60 Saint-Jacques Street, suite 502
Montréal, Quebec, Canada  H2Y 1L5
Phone: 1-866-320-3456 (toll free) / 514-499-7070
info@qftc.ca