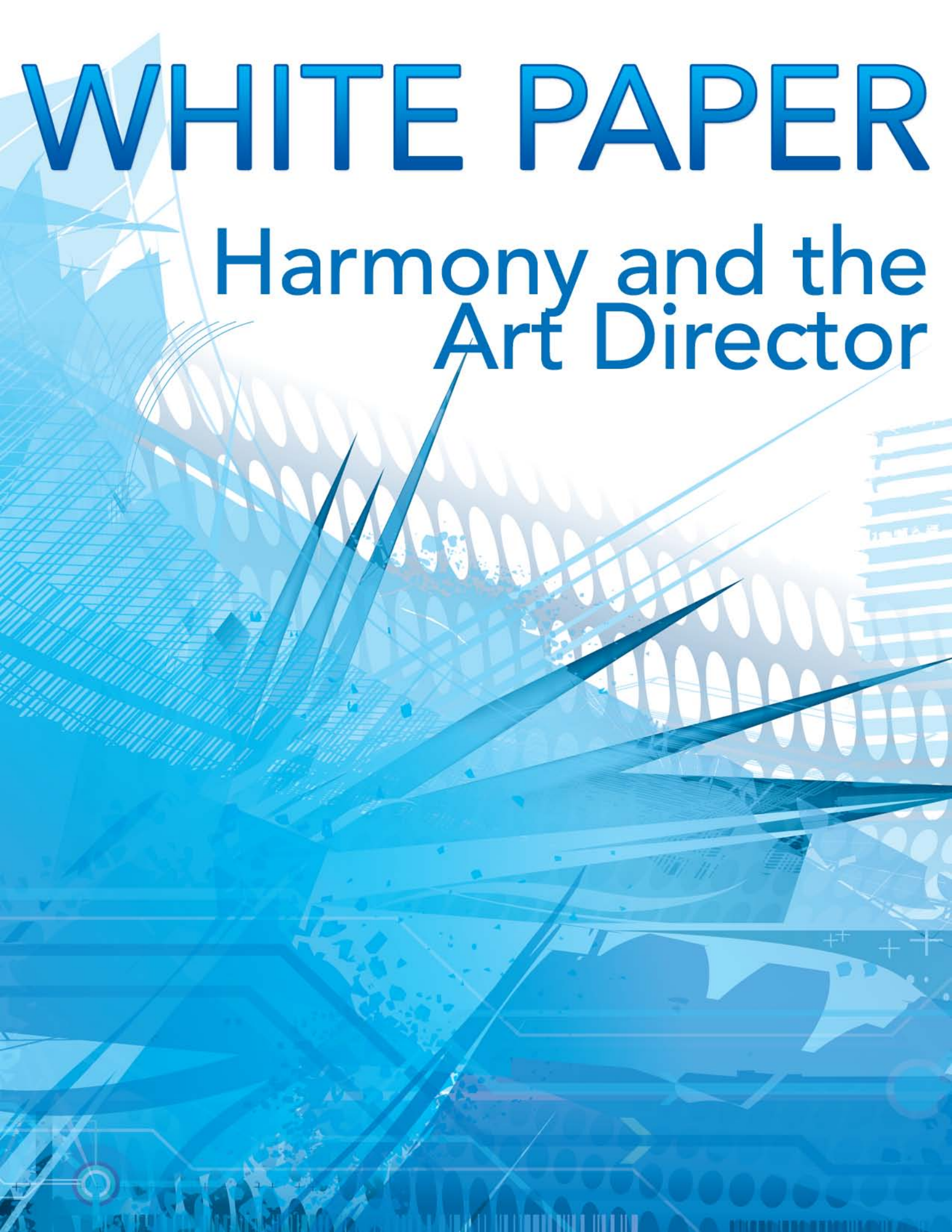
WHITE PAPER

Harmony and the Art Director



Toon Boom Animation Inc.

White Paper:
Harmony and the Art Director

This paper presents an overview of the benefits the Art Director can get from using the Harmony Solution.

Publication Date

July 2009

Introduction

Regardless of the production they are working on, Art Directors need to be flexible, open to change, and as knowledgeable of digital tools as they are proficient in art design fundamentals. In the animation business, the role of the Art Director evolves as the studios want to keep a unique style for the production to preserve their characters and brand recognition.

Traditionally, animation style was constrained by the analog production techniques. Now, with the greater availability of digital tools, the sky is the limit. From an artistic point of view, different media can be mixed together (video, 2D, 3D, etc.) in a single environment; ideas and concepts can be developed quickly. While the possibilities of digital animation are almost limitless, the Art Director must maintain a realistic balance to keep the production both on schedule and on budget.

With the Harmony Solution, the envelope of creation and production can be pushed even further. This cutting-edge technology offers such a wealth of possibilities that from the design and concept development stage, the Art Director has the confidence that the Harmony Solution will support their creative ideas and remain transparent throughout the whole process. Keeping the artistic essence in the heart of every project, the Harmony Solution paves the way to richer, more impressive and greater quality animation.

"The role of the Art Director is the same as in any other animation film, but knowledge of the software is essential... In the future more and more films will be produced by digital [means]. More animation can be produced with shorter time and less cost. Using animation technology enables us to deliver the requested amount of animation! Knowledge of the software has become essential in this profession."

Réka Temple, CEO, Executive Producer, Cinemon Entertainment.

"The Art Director has to have a strong visual knowledge of architectural styles, as well as having an excellent grasp of composition, colour, staging, lighting and any other tools you may bring to the table to achieve the look of the show."

Dave Merritt, Art Director, Mercury Filmworks.

Technology

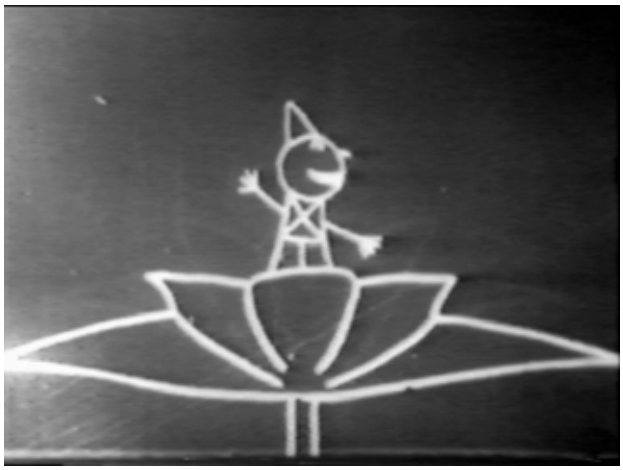
Animation has been around since before the 20th Century and to some extent the paleolithic cave paintings where animals were drawn with superimposed positions was an attempt to reproduce motion.

The 20th Century

The 1900's - Animation on Film

The principles of animation really took place around 1900 with the first movies from Emile Cohl using the traditional animated film with hand drawn images. Each image was shot directly onto negative film stock.

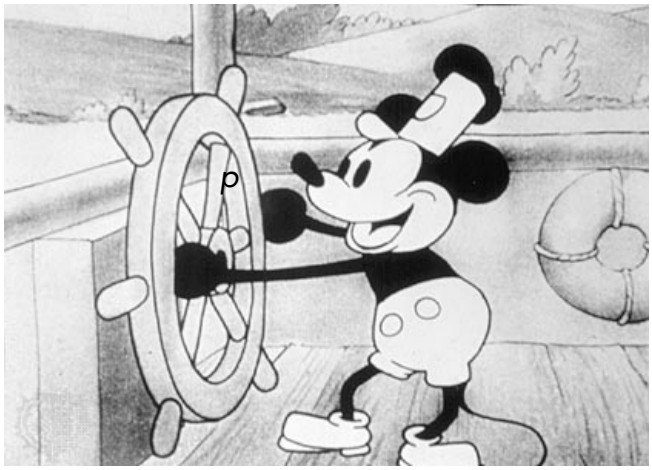
Based on the success of Cohl and other pioneers, many artists started to experiment with animation.



© Emile Cohl

The 1920's - Synchronised Sound

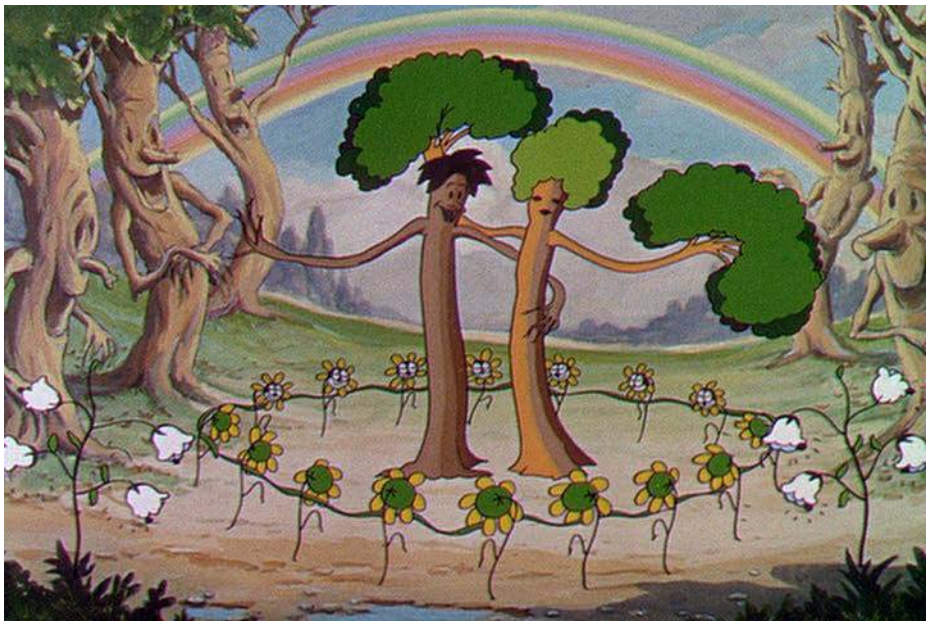
In 1928, Walt Disney released the short film *Steamboat Willie*. It was his first movie with Mickey Mouse and used two-tone technicolor film. This was the first cartoon with synchronised sound. The storyboard concept in the form it is known today was also started by Disney at this time.



© Walt Disney Company

The 1930's - Tooning in Technicolor

In 1932, the first cartoon using colour, Disney's *Flowers and Trees.* was released. It featured a three-tone technicolor process.



In 1937, *Snow White and the Seven Dwarfs* was the first animated colour feature-length film.

Several new techniques were applied during the creation of *Snow White* such as the use of; Soft Trace (lines were inked), Rotoscoping, Effective Character Animation, Special Effects (mirror, rain, storm, sparkles, etc.) and the famous multiplane camera (introduced originally in *The Old Mill*, one of Walt Disney's *Silly Symphonies*).

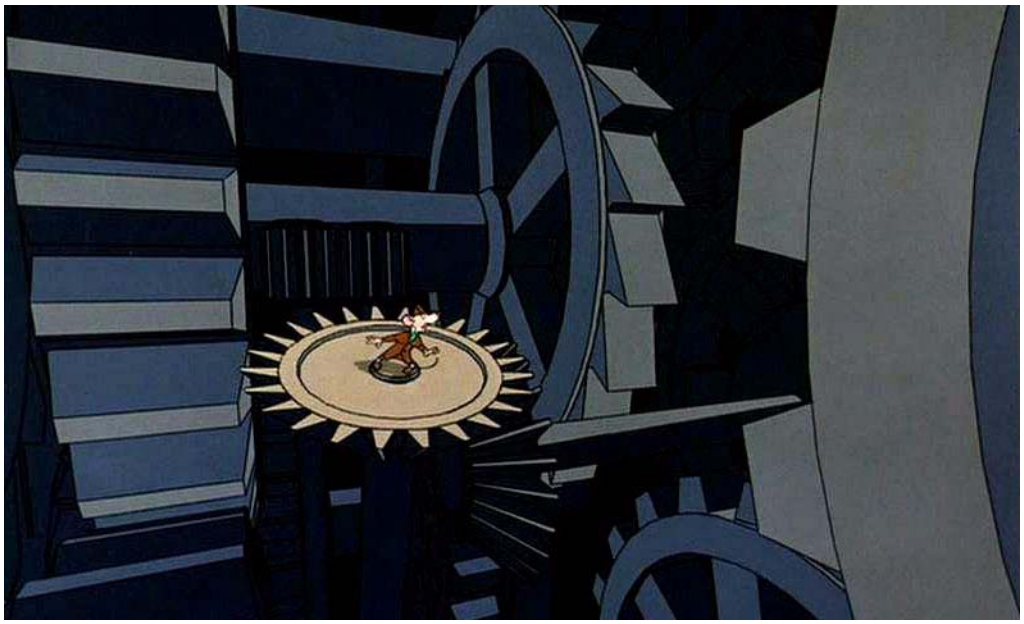
The 1950's and 60's - Cinemascope and Xerox

In 1955, *Lady and the Tramp* became the first animated feature film using the Cinemascope widescreen process. Then in 1961, with the release of Walt Disney's new all-cartoon feature *One Hundred and One Dalmatians*. the world was introduced to a new more sketchy animation style far from the full-bodied, rounded style which Disney had used in previous films. Walt Disney also broke from tradition by making this the first animated feature to utilise the Xerox-copy process, introduced to cut down on the type of costs which had been so prohibitive in some of the earlier feature length cartoons.

© Walt Disney Company

Between the 1960s and the mid-80s, technology did not change too much in traditional animation. Don Bluth and his team developed impressive techniques for *The Secret of Nimh* (Airbrush contact shadows, backlite animation, improved multiplane camera,etc.).

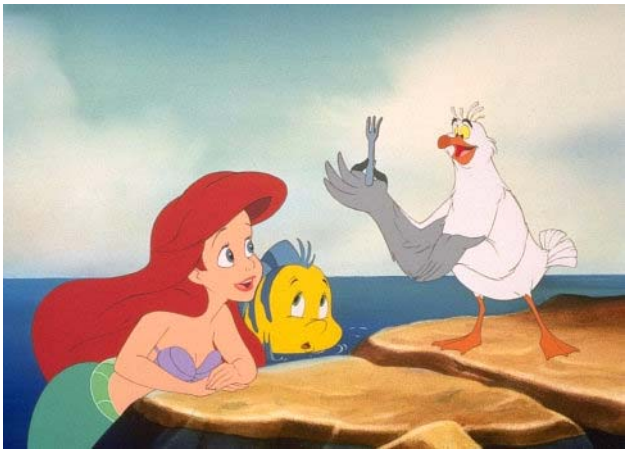
1985 - The Rise of the Machine



© Walt Disney Company

1985 saw the rise of the machine. Initially with the first 3D element added to a feature animated film in *The Great Mouse Detective.*

Then at the end of the 80's with the first digital Ink and Paint animation seen in the final sequences of *The Little Mermaid*.



1990 - Digital Ink and Paint

The first movie entirely created using digital Ink and Paint was *The Rescuers Down Under* in 1990, this used the Disney proprietary software CAPS.

21st Century - Brave New Animation

The new century began with computer animation becoming more and more present in 2D animation. However, this did not mean that traditional animation disappeared, far from it, *Les Triplettes de Belleville* and *Looney Toons: Back in Action* were the first traditional animated features to use vector texture lines to create a unique sketchy style.

3D Integration

The use of 3D integration also increased and was used throughout entire animated features such as in Don Bluth's sci-fi adventure *Titan A.E.*

or more recently in *The Simpsons Movie*.

Tradigital Animation

Fully tradigital animation first appeared using cut-out style technique to reduce production costs, mostly in TV series and Saturday morning cartoons such as Atomic Cartoons' *Atomic Betty*,

Nelvana's *6teen*

© Nelvana Limited

or Cartoon Network's *Foster's Home for Imaginary Friends.*

© Cartoon Network Studios

Using the tradigital animation technique, since animators are moving puppets, only a few drawings are required compared to the many necessary for traditional animation. Extra features are often available to save production time such as morphing, automatic lip-sync or rigging with inverse kinematics.

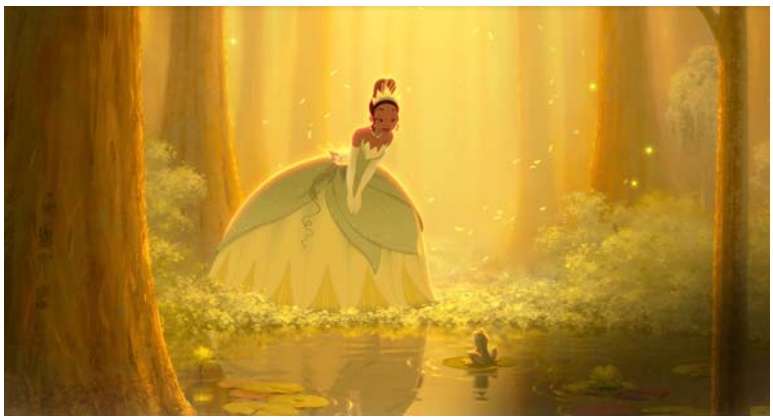
" With the introduction of software, such as Harmony, an Art Director has to be far more technically aware and knowledgeable when planning what it is they wish to achieve within a production. In short, to utilize Harmony effectively in production it's important to understand what the Harmony is capable of."

Adrian Thatcher,
Art Director, Nelvana.

© Animex

With the improvement of the digital drawing tools and the availability of new drawing devices such as Wacom's Cintiq, tradigital hand drawn frame-by-frame animation reached the screen.

You can see this in feature films such as, *La leyenda de la Nahuala* produced in Mexico and the upcoming *The Princess and The Frog* from Disney.



© Walt Disney Company

The End of Caps

Caps, or Computer Animation Production System, is a collection of software, cameras and network developed by The Walt Disney Company and Pixar in the late 1980s. At the base, this solution was meant to replace the expensive and complicated process of traditional celluloid animation such as the ink and paint and post-production steps on Walt Disney Feature Animation's animated movies.

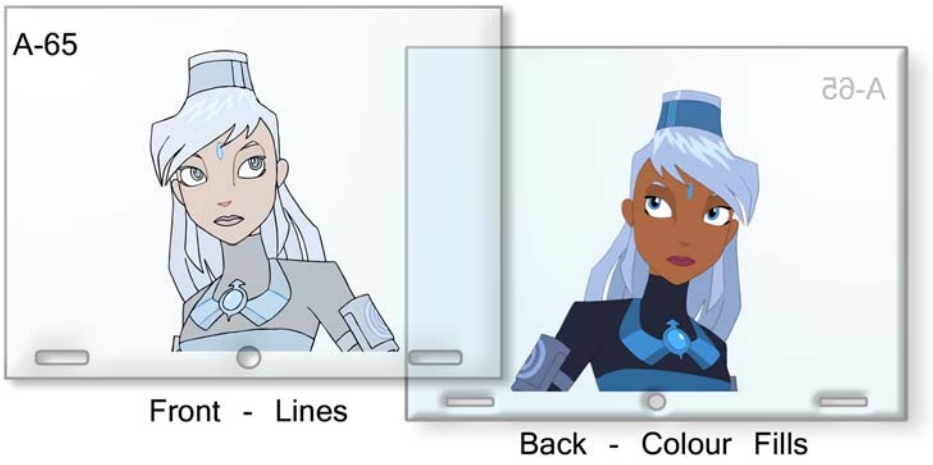
The era of Caps is now resolved as Toon Boom Animation is bringing on its expertise with the Harmony Solution which is taking over on the different production processes of the Walt Disney Company animated feature: *The Princess and the Frog*.

Artistic Benefits of Working with Harmony Stage and the Harmony Solution

Toon Boom Harmony contains all the major improvements made for the 2D animation industry.

Multi Layer Drawings

Before the advent of computers, animation was done manually. There was no process of scanning and painting digitally. Once the animation was completed and cleaned on paper, the drawings were traced with a brush or a quill onto cels.



The cel transparency permitted many layers to be superimposed, composing the scene elements together.

The first step in the cel process is to ink the lines on the front side of the cel, either in black or with different colours. In the late 1950s, this step was changed to photocopying the drawings on the cels, called the Xerox process. Once the lines are inked, it is time to fill in the colours, usually painted with a brush. Painting on the same level as the lines makes it all too easy to accidentally go over the line or not apply the colour densely enough, so light passes through the drawing. To remedy this, colours are painted on a second level onto the back of the cel.

This protects the lines from any colour stains and the colour filling can go under the lines covering the whole zone. Painting on the reverse side of the cel helps cover the whole colour zone and protect the inked lines.

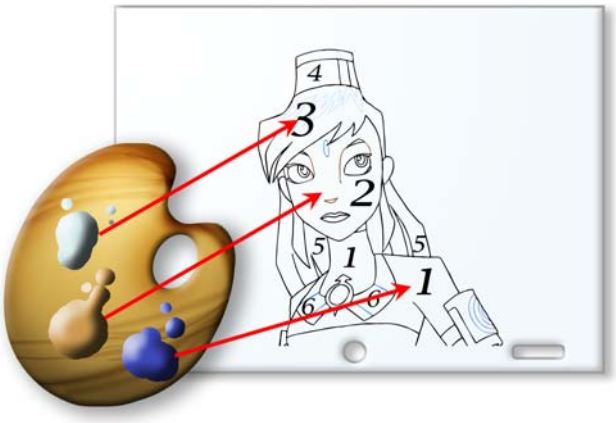
Working digitally produces a similar process. Once you have scanned drawings into the system, you can colour the lines without ruining the colour filling, or you can paint complete zones without staining the lines. If there is some transparency (alpha) or texture in the lines, the colour filling is allowed to go under the lines to create the correct look.

Harmony Stage provides the ability to maintain and manipulate several drawings in a single drawing. By doing so, you can preserve line ink, colour filling, sketch, etc. This also allows you to apply effects on specific drawing levels without having to manipulate different drawings during the compositing phase.

These multi-layer drawings increase the Ink and Paint speed and quality. It also allows you to add transparency and texture with alpha without seeing through the drawing since the colour zones are extended under the lines.

Colour Palettes

In colour animation, precise colours are often used to paint each particular character. In order to maintain absolute consistency during the production, a colour palette is created for each character, prop and effect throughout the production.

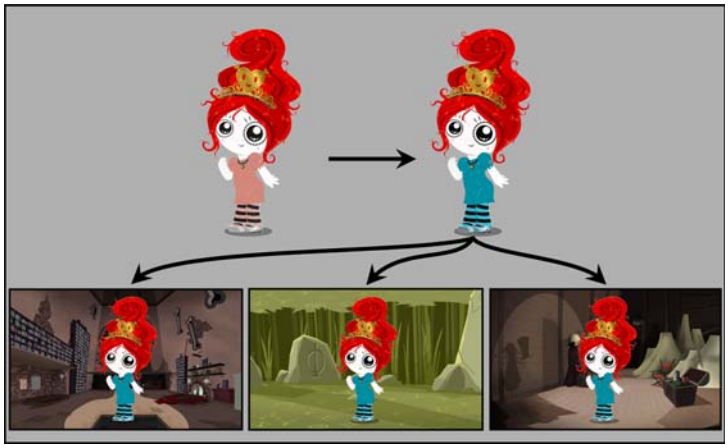


Before computers, painters used real colour pots mixed by a Colour Palette Artist and the studios carefully guarded their colours' recipes. Now, using a computer process, a digital colour palette is created. This allows absolute colour accuracy by always having the same group of colours associated with each character.

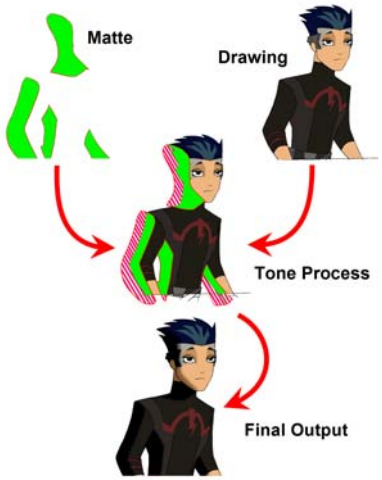
Harmony colour palettes are made of colour pots containing either a solid colour, a gradient or a texture which are referenced with an unique number (ID number).

Once the elements are painted, this provides the Art Director the ability to create different palette styles for the elements and replace them instantly without having to repaint. This also provides the ability to create colour ambiances and mix them in real time (day and night, weather, etc.).

The Art Director can also balance the character's colours after the animation is painted. If during the production the Director notices that some colours do not match the rest of the environment, he can modify the colour tint and the modification will update throughout the whole project.



During the compositing phase, the colour pots can be easily manipulated independently from the drawings or the other colours to create matte (mask), replace them in time (by other palettes, gradients, textures), or change the attributes over time (colour values, transparency).



To be able to manipulate each colour independently facilitates the compositing process since the colour zones can be quickly used as; a mask, cutter, transformed into a glow, highlight or tone or even be excluded from a global effect.

Because of the unique ID associated to each colour pot, a character can use individual colour pots for the shoes and the shirt using the same RGBA values and even if they are the same colour, the colours can still be changed independently later. If the red shoes have to be changed to blue, the red shirt will remain red since they are painted with a different colour swatch.

Bitmaps and Vectors

In computer graphics, two main concepts co-exist for 2D images, Bitmap and Vector. While both technologies have their own advantages and disadvantages, Harmony Stage can handle and mix both bitmap and vector in the same scenes to provide a total freedom of creation.

While Harmony Stage can easily handle bitmaps, the heart of the technology is based on a high-quality real-time vector engine. All the drawing tools create vector strokes, which provide the best quality possible for camera motion since drawings are resolution independent and always remain accurate whatever the zoom level used.

"Harmony benefits are very tangible. Going paperless is one of the most time saving things we've ever done and having everybody working on the same interface and tools is very helpful."

Paul Rodoreda, Animex, Mexico.

Harmony Stage comes with a unique patented technology to create vector textured lines to preserve the unique quality of the hand-drawn lines made on paper like it was the with Xerox process.

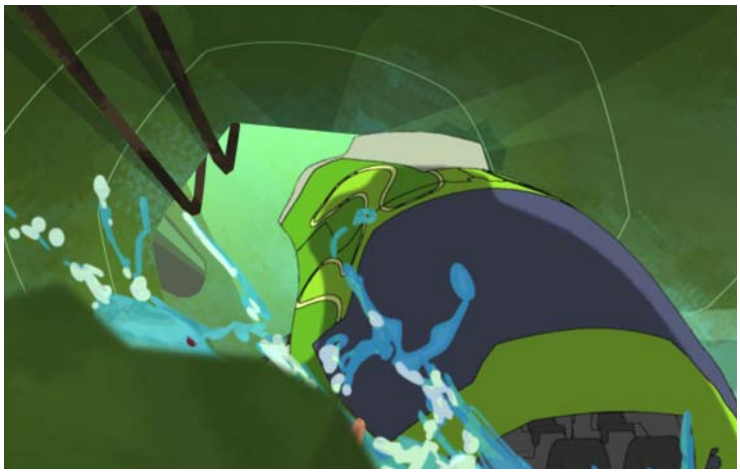
Texture lines can also be used to add different techniques such as drybrush, airbrush, charcoal effects and so on to create special elements.

If you are looking for a highly stylized look that you created or coming from an illustrator impose by the production, made using natural drawing tools made on paper or with third party drawing applications such as Adobe Photoshop or Corel Painter, Harmony Stage supports animation with bitmap images as well as multi-layer PSD files to give the animation in general a distinct visual appearance.

Mixing Techniques

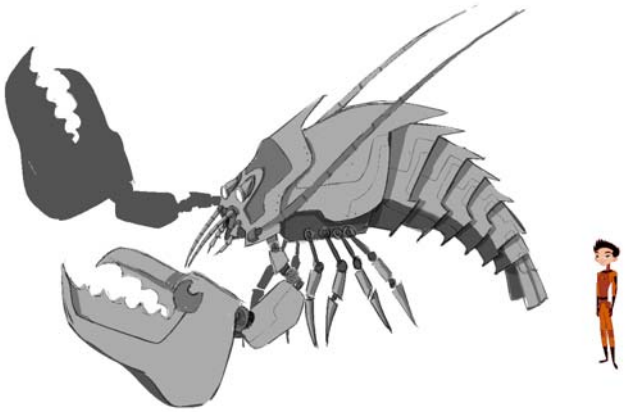
Harmony Solution s designed to handle traditional, tradigital and cut-out animation. Each technique has its own advantages and disadvantages.

Some animators are more comfortable drawing some elements on paper. Harmony Solution can handle all three animation techniques, so there is nothing to stop an animator from animating something on paper and then scanning it to incorporate in a tradigital or cut-out scene. However, it is often quicker and requires fewer materials to hand draw digitally.



If your project contains a car chase or a robot attack, you could use the Cut-out animation to help yourself. Both a car and a robot can often be complex to draw; there are many bits and pieces that take time and precision to animate on paper. Not everyone has the time, budget and knowledge to model them in 3D software, which is a popular technique used in these cases. The Cut-out puppet and animation is very useful for this.

You can create a puppet in many pieces such as wheels, doors, windows, antennas, etc., and animate it directly in Harmony Stage. You can scan in your traditional animation and mix the cut-out animations together.



Even if you draw everything on paper or animate with Cut-out puppets, you can use the digital hand-drawn advantages for:

Effects Animation

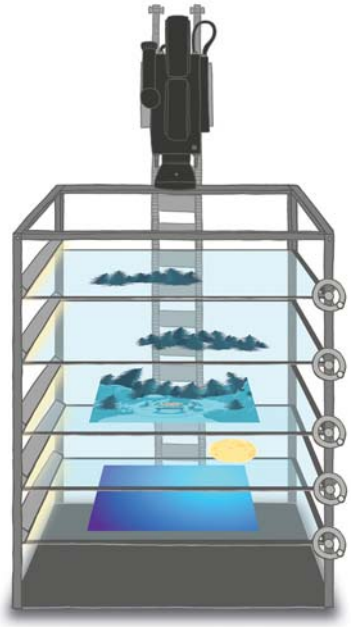
Effects animation, such as smoke or water, can take a long time to draw and use a lot of paper for the many in-betweens. Instead of doing it on paper, you can hand draw it digitally and use the Morphing feature to accelerate the process and create the in-betweens.

Tones and Highlights

Tones and highlight levels use a lot of paper and can easily be drawn digitally. It does not require much skill to draw them with the pen tablet and this will save a great deal of paper and scanning time.

For a Cut-out character, tones and highlights can be generated automatically through the compositing step, but for a higher quality look, draw them by hand on an extra layer once the animation is completed.

Multiplane Camera



In the animation context, multiplaning is used to create a scene with multiple planes placed at different distances from the camera to recreate a perspective illusion. A plane is a layer or an element. In regular flat 2D scenes, all the elements are at the same distance superimposed one on top of the other. So, when the camera moves, all the elements are moving at the same speed. In real life, all objects and elements are placed at different distances from our eyes so when we walk past, the closest objects appear to be moving away faster. The farthest ones, like mountains, are barely moving. In animation, that perspective effect has to be reproduced manually.

Harmony Stage works in a true 3D space where the multiplane camera effects can be created automatically. It is no longer necessary to use the cumbersome multiplane camera. Multiplane shots are normally used to add depth to a scene, to reproduce perspective effect more easily. They can also be used on smaller scale to make elements pass in front of and behind certain objects like trees or chair. The multiplane camera automatically calculates the different focus effects for each element to make camera motion even more realistic.

Full 3D

The evolution of the animation industry never stops and is bound to keep pushing technology further. Now, more than a multiplane camera giving the illusion of depth, the need for real 3D space as grown over the years.

Harmony Stage delivers full control on all 3 axes in a true 3D space where you can move, scale and rotate any of your elements to create amazing 3D scenery with real-time playback as well as impressive 3D camera movements.

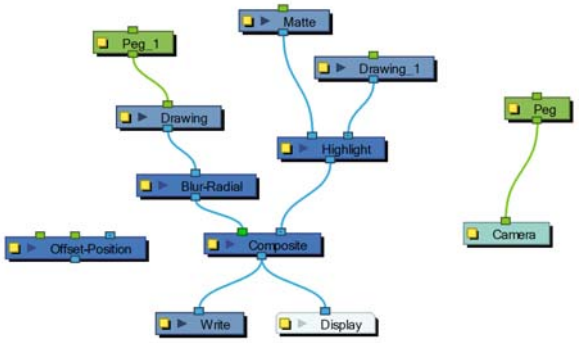
3D Object Integration

Since the first integration of 3D elements into the Disney feature The Great Mouse Detective in 1986, a lot of movies have gone along this expensive road to increase the viewers' visual experience such as in Don Bluth's Titan A.E., Disney's Tarzan, and more recently Fox' The Simpsons Movie. Even television series are now mixing 2D and 3D.

Toon Boom is once again at the top of the wave with the first true 3D integration into its 2D flagship animation solutions. Forget about complex workflow and tedious 2D/3D drawing registration! You are now able to import your 3D models and 3D scenes into a unique application, manipulate all your 2D and 3D elements into a unified environment and render them all together. It also supports the import of 3D files compatible with major 3D applications and authorize compositing with external Z buffer sources such as IFF images.

Effects

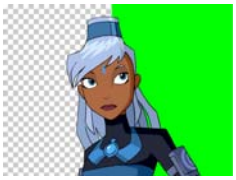
In the past century artists were very creative and invented new special effects using all kinds of methods. Most of them were optically based and required much research and experimentation as well as being expensive and time consuming, that was one of the reasons why special effects were mostly present in animated features.

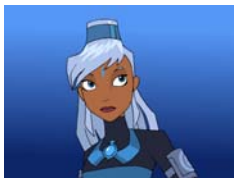


A lot of special effects software is available on the market, but none of them are integrated with an animation software. Harmony Stage contains a complete special effects environment available through a network view where over 50 effect modules can be combined and assembled to create an unlimited number of styles.

Moreover, the Harmony Solution come with a Software Development Kit (SDK) to enable the creation of new or missing effects by software developers from your production team (or from Toon Boom Consulting department).

Here is a list of just some of the effects available in Harmony Stage:

Effects	Description	Sample
Blur Directional	Use the Blur-Directional Module to create a specific directional blur on an image.	
Blur Radial	Use the Blur-Radial module to create an effect that blurs evenly in all directions.	
Blur Variable	Use the Blur-Variable Module to create a radial blur that varies within a single image based on the matte you supply.	
Brightness Contrast	Add a Brightness-Contrast Module to your network to modify the contrast or brightness of an image.	
Colour Screen	Filter out specific colours from a bitmap image to create a matte.	
Composite Generic	Use the Composite Generic to blend elements together, you can choose from several blending mode options.	
Contrast	Increase or decrease the level of contrast in an image.	
External	Use the External Module to process images through external programs and input the resulting images back into the network.	

Effects	Description	Sample
Focus	Use the Focus Module to set up depth-of-field effects for your scene. The Focus Module is used to determine how much blur will be applied to images, based on their distance from the focal point.	
Glow	Use the Glow Module to add a bright, soft-edged light or to diffuse a light region around an image.	
Gradient	Use a Gradient Module to create a transition of colour or alpha values between two areas of colours.	
Grain	Use the Grain Module to add a film grain to an image; the film grain looks like video noise.	
Greyscale	Use the Greyscale Module to convert a colour image to grey-scale.	
Highlight	Use a Highlight Module in your Network View to add a highlight to the drawings in an element.	
Motion Blur	Use the Motion-Blur Module to create three types of effects: Motion Blur, Blur with a Matte and Particle like effect.	
Negate	Use the Negate Module to invert the colour and/or alpha values.	

Effects	Description	Sample
Pixelate	Use the Pixelate Module to apply a mosaic effect to an image and its matte.	
Refract	Use the Refract Module to create effects such as ripples, rustling leaves, and heat waves.	
Sparkle	Add a Sparkle Module to your network to add a sparkle effect to your scene.	
Tone	Use a Tone Module in your Network View to add a dark coloured region to the top of drawings in an element.	

Accurately Controlling Image Quality

16-bit Rendering Engine

When painting was done by using gouache on cels, the colour transitions were controlled by the mix and density of ink applied. In the digital world however, the colours are quantized (sub-divided into small amounts) at certain levels which define the accuracy of the colour transitions.

This problem, known as “banding”, is visible with subtle colour changes, especially with gradient. It is caused by the fact that software is using an 8-bit rendering engine. While 8-bits can be tolerable when the final project is output to SDTV and broadcast on the air (the conversion and the analog compression blur the final images), the effect becomes visible in HDTV and Film.

16-bits gradient

8-bits gradient

Other issues can also appear when several special effects and colour corrections effects are applied in 8-bits, rounded errors are added during the compositing which damage the final quality of the images.

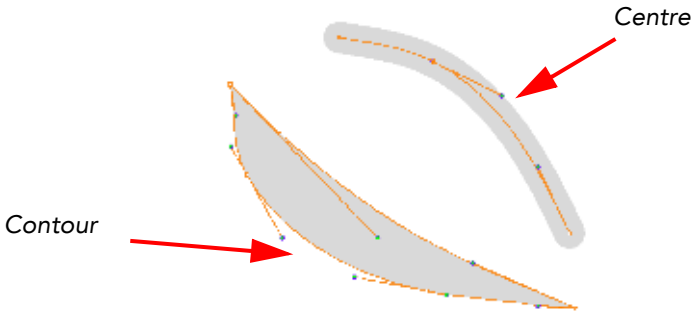
Toon Boom Harmony Solution performs all the operations on the image using a 16-bit rendering engine to keep the most superior image quality available during compositing to avoid banding or rounding errors. Add the dither effect module to add a subtle grain in your images exported in 8-bit format (mostly for TV or Web) to avoid the banding effect on SDTV while preserving the true 16-bit compositing pipeline.

High-Quality Vector

Toon Boom Harmony is based on a vector technology designed to provide a high-quality representation of drawings that have been created on paper and tradigital drawings that have been drawn directly on the computer with a digitizing tablet.

Toon Boom vector technology is based on 2D curve segments called Bézier curves. These curves include control points, which easily shape the curve to fit any need. Bézier curves are fundamental to providing the resolution-independence needed for rendering final frames and for interactive preview. They can be rendered at any resolution or any magnification level and remain smooth.

To create the strokes and the shape, multiple Bézier curves are connected to define the outline, this is called the 'contour line' and is today the only vector solution to provide natural looking strokes whatever you are scanning or drawing paperless. Vector technologies found in common animation software provide "centre line' shapes which cannot behave like traditional drawings.

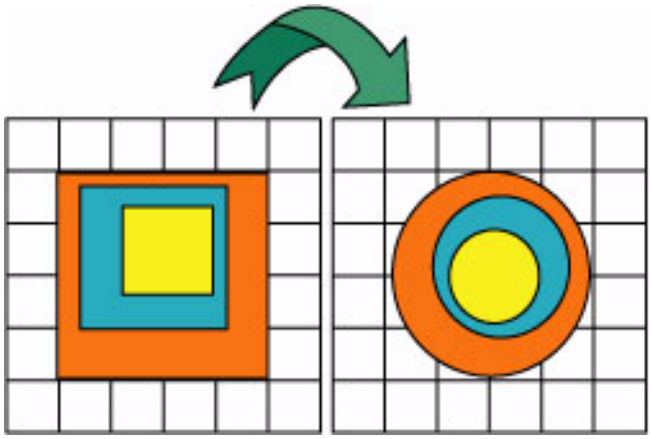


Harmony Stage also offers a unique morphing technology entirely vector based. Other technologies are based on a simple geometry-pairing algorithm or are based on image morphing. Toon Boom developed a sophisticated geometry-pairing algorithm, called "shape matching", that performs a detailed topology and colour analysis of the two drawings to find zones that can be morphed.

"An Art Director should be a highly creative guy. Also he needs to learn new trends in technologies and software. He should be flexible and unafraid of change. He should have a fair knowledge of different software in addition to good creative skills."

Hari Varma
Chief Creative Officer,
Toonz Animation India.

For example, the first drawing contains three squares embedded in each other; the second drawing contains three embedded circles.



The algorithm will correctly match the three squares with the three circles. The actual size, position and scale of any of these circles or squares are not relevant.

Unlimited Styles - You Define The Limits

Here are some examples of styles and techniques you can achieve with the Toon Boom Harmony. This just the tip of the iceberg. Many variations and combinations are possible.

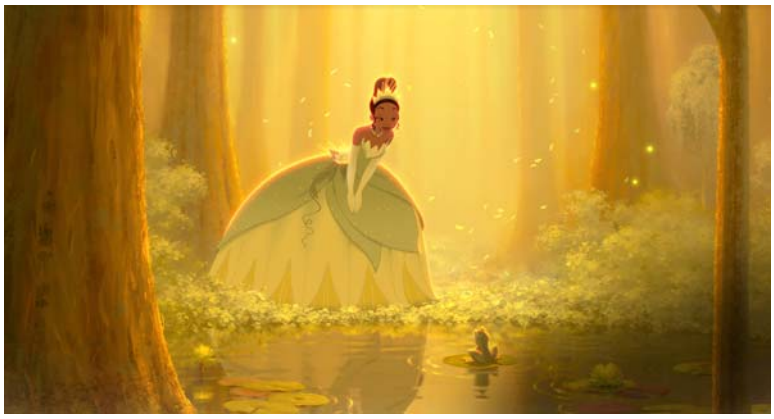
Flat Colour

Monochrome line

This is the typical traditional style encountered in many TV series and Direct-to-Tape videos. Lines are scanned or hand-drawn digitally on the line art level and the painting is done on the colour art level. This is one of the easiest styles that you can achieve. Backgrounds can be made externally or directly using the vector drawing tools.

© Subsequence Entertainment/ Zoe Mae Productions

Soft trace



© Walt Disney Company

This technique involves colouring the line. It provides more freedom of style and look and softens the characters (vs. a constant monochrome line). Moreover, it provides a higher overall visual quality of the drawings. Soft trace is often combined with a Tone and Highlight technique.

© Xilam

No line

This technique is not used often, but it provides nice looking results, close to a painting. The creation principle is identical to the monochrome lines ones, except that during the compositing process the line is removed and replaced by a variable blur.

© Nelvana Limited

Dynamic outline

This technique is used on cut-out characters that has no outline. The dynamic outline is used to automatically create an outline when two pieces of the same colour are overlapping. For example, when the hand of a character goes over his face, the shape of the hand would be lost. This effect is made possible using the compositing network.

© Xilam Limited

Texture

Tradigital line

This technique is a mix of bitmap and vector. The user can create bitmap texture in bitmap editing software and import it in Harmony to draw with it. This technique creates a sketch-like style and gives the illusion of drawing on paper.

Scanned line

© Les Armateurs/ Production Champion/ Vivifilm

This technique is done by scanning paper drawings that were drawn in a rough style or with a grainy line. Scanning and vectorizing those drawings with texture will preserve the paper and line texture of the drawing instead of turning it into a solid black line. This technique is a mix of vector and bitmap.

Tone and highlight

For cut-out animation, it can take along time to draw all the tones and highlights matching the animation, especially if the animation is modified several times. Harmony Stage allows you to create an automated tone and highlight by applying an offset to the animation and using a Tone or Highlight module.

Natural media look

© Enanimation

By creating different levels, applying effect and combining them together with blending modes, you can create a natural media look such as oil paint effects. Toon Boom Harmony can work with external applications connected seamlessly in the compositing network if the effects you are looking for are not available.

Auto shadow

© Alphanim

With this technique, there is no need to draw all the drop shadows matching the animation. A simple use of the Quadmap module combined with the Shadow module creates a drop-shadow matching the animation. The shadow's position can also be animated and distorted over time and if the animation is modified, the shadow will update.

Soft colour

Mostly used in Anime cartoon, soft colour technique is a mixture of colour shading and tone blurred at the border of the colours (like an airbrush) with an uniform finish (unlike a manually applied airbrush). Colour separation line (often done in red or blue on paper) can be handled properly during the vectorization phase.

© The Answer Studio Co.,Ltd

Bubble vectorization

This technique is done scanning paper drawings and using the bubble vectorization parameters. During the vectorization process the system will create a vector line filled with bumps and bubbles. The parameters can be adjusted to create evenly spaced bubbles or scattered all over the line. They can also be the same height and width or randomly sized.

Rubber hose style

This technique is done using the Glue module on cut-out animation. Certain styles require circular joints similar to the 1920s rubber hose style. The Glue module allows you to recreate that joint style and stretch the parts.

Rotoscoping

Rotoscoping is an animation technique in which animators trace over live-action film movement, frame-by-frame. Harmony Stage can import live-action footage to allow animators to trace over in a new drawing the live elements.

© Jungle Pictures

Bitmap Picture Cut-out

This technique is done using bitmap pictures that were previously cut apart in a bitmap editing software. They are imported in Harmony Stage and assembled as a puppet. The pieces are vectorized a colourful textures so they can benefit most of the vector puppet advantages and tools.

© The Canning Factory

Share Your Style With Your Team

Master Palette

Once the master palette is created for a character it can be shared not only between the scenes, but also the projects and even studios. This way the characters preserve their exact colours and everybody works from the same model.

This ensures a perfect colour consistency between scenes, sequences, projects and studios.

Library

Toon Boom Harmony has a library that can be used to share and reuse a large amount of elements. Cut-out puppets, colour models, master palettes, effects, animation, drawings, sketches, sound files, timing, backgrounds and more can be stored in the library as templates. These templates can be shared over the network or between studios. Templates can be isolated on the hard drive and sent to other studios. Templates are not encapsulated in projects.

Each individual user can have a personal library on the computer or on the server. Also, a global library can be created and shared among all users. The templates imported in the scenes are independent from the library. So if a user modifies the content imported in the scene, the original artwork contained in the library is safe.