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# Observations on the evolution of the contour line in animated characters.



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## Abstract

From the viewpoint of Drawing Contour constitutes the line that defines and contains the shape and volume of any drawn object. From a perceptual standpoint, it is what distinguishes a shape from its background. In the past hundred years the contour line that defines animated characters has mutated through diverse styles, many of them a direct consequence of the technologies available at the time of their creation. Technological breakthroughs in animation such as Rotoscopy, Celluloid Cels, Digital Ink and Paint or Cel Shading led to the evolution of the contour line, influencing the style and appearance of cartoon characters. How can one expect the contour line to develop, in times when the character of this line no longer has to rely on the particular drawing styles of the animator, but can be created semi-automatically through software extrapolation?

## Keywords

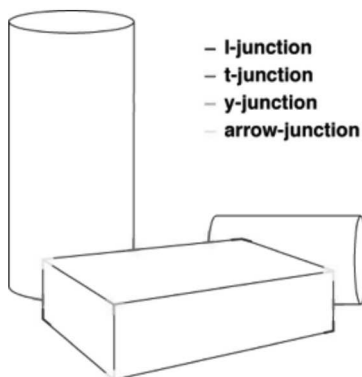
Animation, Cartoon characters, Drawing, Contour line

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## 1. Contour and Outline

The term contour can be used both in the knowledge areas of visual perception and of drawing. In visual perception, the term edge defines a discontinuity of a surface, or the passage from one object to another. It does not depend on the observer's viewpoint because it refers to specific characteristics of the object, which define it as a three-dimensional entity. In the study of drawing, the definition edge can be transposed either into a contour or into an occluding contour. The first term defines the outline of the object as seen by an observer from a certain viewpoint. This contour is specific to the point from which the object is being observed, and defines its relationship to the background, or to the other objects in a scene or group of objects. When referring to an occluding contour, one is referring to a contour that partially obstructs the view of an object that is further to the back. Outline is a term commonly used in drawing, and refers to the boundary the mark creates on the drawing surface, containing a shape, color or shading - the outline may or may not correspond to the contour or occluding contour. If the artist aims to create a realistic type of drawing, the outline will correspond exactly to the contour of the object. [1] In order to better distinguish between contour and outline as far as drawing as concerned, one can turn to the definition proposed by the artist Kimon Nicolaides: "Contour' is commonly defined as 'the outline of a figure or body' (...) We think of an outline as a diagram or silhouette, flat and two-dimensional. (...) Contour has a three-dimensional quality; that is, it indicates the thickness as well as the length and width of the form it surrounds." [2]

F1. Types of junctions  
in a set of objects



Following this definition, the word contour will be used to describe the line surrounding animated characters.

Both visual perception and drawing share a notation system, whose elements are called junctions. Their correct use in a line drawing is what represents depth when no shading is present. They are fundamental for depth perception and as such extremely important both in drawings and in animation. [3]

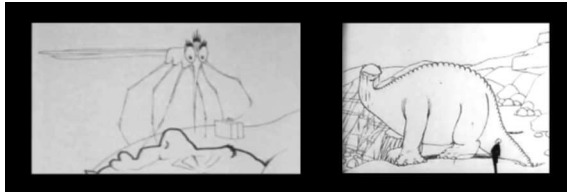
The use of junctions (especially T-junctions) in a line drawing provides depth information, so when there are a lot present the drawing tends to be interpreted as more "realistic". The contour of animated characters has evolved a lot in the past hundred years, its nature and style being affected both by innovations in technology and aesthetic trends at the time of their creation. This evolution was also punctuated by a more or less intense use of junctions in the drawings, which, paired with varying thicknesses of lines can give a more or less realistic look to cartoon drawings.

## 2. Gertie the Dinosaur and How a Mosquito Operates

Winsor McKay was one of the most distinguished pioneers of the early days of animation. An illustrator by profession, he created the Little Nemo in Slumberland comic strip series, which was published in the New York Herald between 1905 and 1911. He was an accomplished draughtsman and illustrator, with a keen eye for both accuracy and caricature. [4] His use of contour plays upon different types of line width, a very clever resource at a time when the technical limitations of animation required that both figure and background were drawn on the same sheet of paper. As there was usually not much background space represented in his films, he used a thicker line to contour his main characters, which helped them to stand out from the mostly white background.

In How a Mosquito Operates (McKay, 1912), a short animated film based on his comic strip Dream of the Rarebit Fiend (McKay, 1904-1925) one can observe that he chose not to use the dense black backgrounds he used in the printed version. The mosquito itself and what few background elements that appear in this film are drawn with a very fine contour, probably, in the case of the mosquito, to enhance its spindliness. The human "victim", seen mainly asleep, in a profile view, is contoured in a much thicker stroke. This plays well as a visual reference to the visual "border"

(the face) that the mosquito will eventually pierce with its proboscis. The use of junctions is extremely limited.



**F2.** How a Mosquito operates and Gertie the Dinosaur

In *Gertie the Dinosaur* (McKay, 1913), a short animated film whose idea probably sprung from the illustrations of pre-historic animals McKay did for the American Historical Association [5], the contour of Gertie again helps to define figure-ground relations and depth.

The background is rendered without any type of shading, and with a fine contour outlining the shapes of the pre-historic setting. Gertie, on the other hand, is drawn with a much thicker line, in order to make her stand out from the background (some black shading can be seen on her feet, a shadow adds depth when she lifts them, and the inside of her mouth is also blackened). She is drawn using a lot of occluding contours and junctions, which give her drawing a rather three-dimensional look, even though there is no shading.

When a rotoscoped Winsor McKay appears to direct Gertie, he is the only figure that is heavily shaded in black. This makes it possible to clearly see his comparatively small figure in relation to the other, larger elements such as Gertie. The other characters featured in this film, such as the sea serpent, the mammoth and the four-winged lizard are also drawn with a heavier contour than the background.

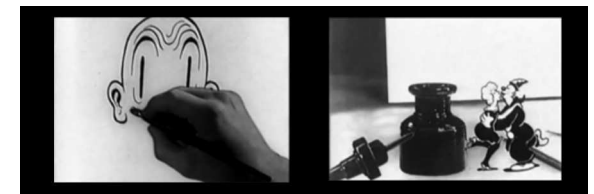
The graphic language McKay uses in his films is clearly that of a draughtsman, who creates depth in the kinematic “window” on a single sheet of paper, and where the distinction between figure and ground relies heavily on the contour thickness used. In a medium that at this time had no technical ability to reproduce multiple planes or color (even shades of gray were difficult), it is clear that the use of contour and junctions were the only available tools to create some depth. [6]

### 3 . Koko the Clown and Betty Boop

Although Winsor McKay had already used early formats of rotoscoping in the first years of the twentieth century, the patent for the device named Rotoscope, which made this technique easier to use was awarded to Max Fleischer, a commercial artist and cartoonist, in 1915. Around that time, Max Fleischer, a multi-talented man working for the magazine *Popular Science*, got the final push to develop a mechanical device to make cartoons look better from his boss Waldemar Klaempffert (editor-in-chief of *Popular Science*), who at the time was frustrated by the jerkiness of cartoons. He decided to do this through the reproduction of human movement, made possible by a machine that took a succession of pictures of objects in motion, which could then be traced in pen and ink. [7]

The first animated series produced by the Fleischer Studios was *Koko the Clown*, featured in the *Out of the Inkwell* series (the first episode was released in April of 1919). Audiences loved the mix of live action and hand-drawn cartoons. [8]

**F3.** Koko the Clown

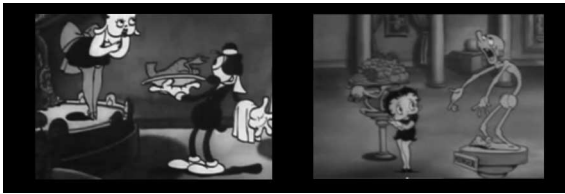


*Koko the Clown* posed a particular challenge to the artist's drawing style: as the main character (rotoscoped from footage of Max Fleischer's brother Dave dressed as a clown) often interacts with actual footage, such as Max Fleischer's hand, it would have been difficult for a normal contour drawing (black contour on white ground) to be sufficiently visible. As such, Koko is mainly drawn in an inverted style, with a white contour surrounding his body, which is colored black. This gives his shape a lot more solidity, and allows for him to contrast more clearly from his background. The interior folds of his clothing (junctions) are contoured in white, while his hands and face have a thicker black contour than, say, the interior lines that divide his fingers. Almost all other characters in this series follow the same style, with

mainly black filled in bodies. This allows for them to stand out very clearly either against white or live footage backgrounds.

When Koko the Clown lost popularity to Mickey Mouse, the new character created by Walt Disney Studios, Fleischer was working on *Dizzy Dishes* (Fleischer, 1930), a cartoon featuring a tough piano-playing dog named Bimbo. When Bimbo needed a female love interest, Fleischer created Betty Boop. [9] She became extremely popular, perhaps partly due to the rather unusual style in which she was drawn.

F4. Early version of Betty Boop in *Dizzy Dishes* and later version in Betty's Museum



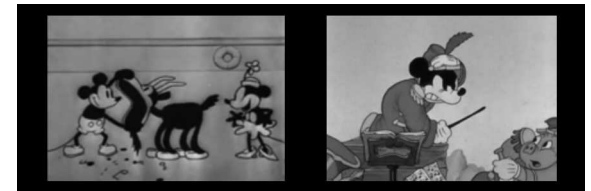
Betty is assembled from two very distinctive parts: her body and her head. While her body retains more realistic features and proportions, her head is gigantic in proportion and is drawn in a much more caricaturized style. In her films one can see a more widespread use of shades of gray and washes than in earlier films such as Koko, but the Fleischers still opted to use a very strong contour for this character. Her clothing, hair, shoes and eyes are usually black, which give her figure some solidity. When the contour defines the outside of her shape, it is much thicker than when it defines an inner element or fold (a junction). This can appear quite strange during the character's movement, as lines representing the same part of the body will change thickness as the character moves.

#### 4. Mickey in *Steamboat Willie* and the *Band Concert*

The first production of Disney Studios to be screened, *Steamboat Willie* (Ub Iwerks, Walt Disney, 1928) shows us the first draft of the character that would become Mickey Mouse, and is representative of a contour line inherited both from the earlier legacy of silent films (such as *Felix the Cat*, 1919-1936) and from technical constraints. The fact that this film is still in black and white, and that the innovation brought about by the multi-plane camera

is still some years off (it was invented in 1933 by Ub Iwerks) [10] means that use of flat black and white surfaces, allied to the contour line were the only tools available to portray both the actions and the personality of the characters. As such, in *Steamboat Willie* one can see an extremely thick contour defining the characters (the same can be observed in the other film featuring Mickey that was also released in 1928 - *Plane Crazy*). There is some use of junctions, in the folds of Mickey's shorts and the cuffs of his shoes. This contour is replicated in the other characters, and is also used in some aspects of the background, where only limited shades of grey were used. It provides a necessary contrast of the characters against the background.

F5. Mickey in *Steamboat Willie* and in *The Band Concert*



This first representation of a scrapper, thinner Mickey was to change dramatically over the years: "The Disney artists transformed Mickey in clever silence, (...) they lowered his pants line and covered his spindly legs with a baggy outfit. (His arms and legs also thickened substantially--and acquired joints for a floppier appearance.) His head grew relatively larger - and its features more youthful. The length of Mickey's snout has not altered, but decreasing protrusion is more subtly suggested by a pronounced thickening." [11]

The *Band Concert* (Wilfred Jackson, 1935) is a good representation of how Mickey's shape and contour were changing. In a period of less than ten years, his limbs started to thicken, and his face started to get rounder - visually, present day Mickey is nothing more than a distant cousin of that original character. The introduction of three-strip Technicolor in Disney films (in *Flowers and Trees*, 1932) [12] allowed for a greater differentiation between characters and background, and, as such, it also allowed for the characters contour line to grow thinner. In this example particularly, one can quite clearly observe the presence

of many occluding contours, and of a large number of junctions. They give the figures more three-dimensionality and depth, which emphasizes the frantic action that takes place during the film. The thickness of the contour stays relatively constant, except for some thinner lines on the inside of the characters. Mickey is dressed in an extremely oversized band uniform; the representation of the folds in the fabric becomes not only a matter of realism, but also part of the comedic matter. This film represents one of the many steps than Disney animators undertook in order to create increasingly more realistic and more smoothly animated characters, an achievement largely based on the refinement of the contour line and the increased use of junctions.

### 5 . Gerald McBoing Boing and Rooty Toot Toot

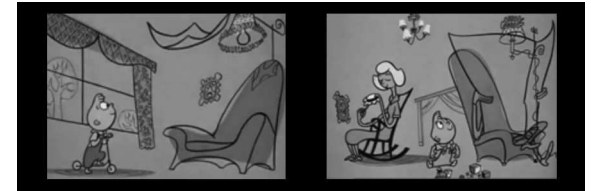
UPA (United Productions of America) studios were founded partly as a result of Disney Studios animator's strikes in 1941. This break from what was then a fully-fledged entertainment philosophy was to mean more than just a change of production methods. The founders of UPA Stephen Bosustow, Zachary Schwartz and David Hilberman were intent on creating a new style in animation, as far as possible a cry from Disney's "over-animated" productions. They aimed to integrate current aesthetics and artistic influences in their productions. Also, their films used a limited animation style, in which movements were less fluid, and there were less in-betweens.

Adapted from a story by Dr. Seuss, in the short film Gerald McBoing Boing (Robert Cannon, 1951): "(...) Walls in the background disappear; spaces are defined by a random piece of furniture or two; chandeliers dangle in mid-air. The character designs are flat, two-dimensional - unequivocally they are drawings, not meant to be mistaken for anything else. The animation is precise and balletic, and the colors shift from scene to scene expressionistically" [13]

At a first glance, the space in which this animation takes place makes little sense, as objects seem distributed in an apparently depthless setting. But, on closer inspection, most perspective cues are correct, except for the fact that many of the elements one expects to encounter in a depiction of three-dimensional space have been removed. Characters in this space still move in depth, but we

have only a change in their relative sizes to see where in the space they are.

F6. Gerald McBoing Boing



Gerald McBoing Boing is the perfect example for a new, more radical use of the contour line. Instead of doing what was usually its main function (containing areas of color or pattern, while defining the shape of a character), it constitutes more of a free line, not necessarily always coinciding with the character. In the beginning of this film, we can see the character of Gerald (and those of his parents) being constructed by rather loose and fluid brushstrokes. This action indicates than more than being a fixed reality, the character's contour is a mutating entity, traced with a thick black line. There is almost no indication of depth in these characters, a very limited use of junctions (almost no folds in clothing are represented), and a very basic use of occluding contours. The effect of this use of line is that these characters, unlike those created by Disney, for example, have a flatter, less three-dimensional presence.

F7. Rooty Toot Toot



In Rooty Toot Toot (John Hubley, 1951), another one of UPA's successful productions, Frankie's character is defined by a contour that negates its main function, that of containing a surface or a color. Her contour is often transparent, and one can often see her body through her arms. In this film, contour becomes an expressionistic resource, as it retains neither shape nor color

consistency.

Frankie's lawyer is a bold white figure with no exterior contour, while the bartender has a very thick black contour, contrasting with the white contours of the glasses and bottles around him. As in the rest of the relatively uncohesive space, junctions are used very sparingly, and often not at all.

## 6 . The Simpsons

The Simpsons (Groening 1989-present) is a TV show that portrays a dysfunctional fictional American family. When the show started, more traditional cel painting techniques were used, in which the animators' drawings were transferred to celluloid and then hand-colored. [14] Because this series has been airing for such a long time (23 years at present time), its production underwent a series of technical transformations, as more modern and less time-consuming animation techniques became available.

F8. The Simpsons



In season 14 (2002) the traditional cel painting technique was replaced by Digital Ink and Paint [15], a technique in which instead of being transferred to cels, the animators' drawings are scanned into a computer, where they are colored and processed using one or more of a variety of software packages (such as TVPaint, Digicel Flipbook, or ToonBoom). [16] Groening started using the technique of cel-shading (it renders 3D models in a way that makes them look like drawings) in his other, not quite as successful TV series Futurama (Matt Groening, David X. Cohen, 1999). This technique is used in many of the more futuristic scenes, mainly for mechanical objects such as cars, planes and spaceships, but also in more difficult perspectives and more complicated camera set-ups. It is now used in a variety of scenes in The Simpsons, as well as in Futurama. These technical evolutions also meant that the quality of the contour line in The Simpsons

has changed and evolved in step to the technical innovations used. In the earlier episodes, in which traditional cel painting was used, one can observe that the contour is a more irregular line, presenting very little junctions. The characters appear flatter and more two-dimensional. With the introduction of Digital Ink and Paint, and also of cel shading, the line, although altering little in thickness, acquires a much more regular look. Its thickness becomes consistent, and junctions appear more frequently. It is debatable which of the styles is most effective in portraying the characters.

## 7 . Paperman

Paperman (John Kars, 2012) is an animated short that tells the story of two characters falling in love in 1940's New York. What makes this a relevant film in this context is the technology used in it. It is a hybrid animation, combining 3D and hand-drawn animation techniques, a fact that in itself would not be extraordinary, but in this film the hand-drawn parts have been mostly done using a digital technique. Disney Studios developed a method that informally is referred to as "The Paperman Method", using a software called Meander, which was specifically developed for this production. This software: "(...) can predictively draw the motions of characters to speed up the animation process. (...) Once the lines could be captured correctly, they could be made dynamic. The computer nudges the hand-drawn lines of a frame into the right positions for the next frame in a process called Final Line Advection. If you can imagine all the curved lines in a rustling dress, you can suddenly see the whole animation problem as Disney's engineers did." [17] The creation of this software anticipated the gutting of Disney's hand-drawn animation division, which took place in early 2013. [18]

F9. Paperman



The visual characteristics of the contour line in Paperman result from a combination of hand-drawn lines and computer software interpolation. The contour line is drawn directly onto the 3D model, and the software “predicts” how it will behave when the scenes are animated and the figures are moving [19]. All junctions are correct both from the perceptual and from the drawing standpoint, as they are mapped directly onto the 3D model. In this case, the contour line IS the actual contour of the characters, as it is bound inextricably to their shape. Visually, this presents as an extremely “clean” and regular drawing style.

## Conclusion

In the past hundred years technical developments in animated productions have succeeded each other at a vertiginous pace. This means that the type of drawing (and subsequently the type of contour) represented in animated cartoons depended not only on the drawing skills of those who created them, but also on the introduction of these new techniques. The lone animator lost ground to large production setups, and the increased massification of animation through television and large scale cinema productions meant that these techniques tend to be evermore labor saving. The creation of the contour of the animated character tends to be increasingly automatized, and visually this has the consequence of creating a more consistent and less expressive line, although in newer production methods junctions can be portrayed with maximum correctness. In the future one will see less and less intervention from animators in individual drawings, and a more widespread use of computerized technology. At this point, and perhaps for some time to come, the contour line will correspond exactly to the contour of the animated cartoon, as it will be entirely based on 3D technology.

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