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**Innovation Project Report
Computer Visualisation and Animation
Bournemouth University**

Introduction

This project is a character driven animation limited on a minimum amount of visual information to communicate a story. All the visual elements are restrained to the simplest essence of form in space, the silhouette. Such restriction implies the lack of many of the natural visual properties, such as color, tone and texture, which are key elements for the perception of depth, volume and light. Using only black or white and the filled shape of the characters and the environments I would like to explore and demonstrate the power of shape in visual communication.

Silhouettes

When a white rectangular area of a frame is filled with a number, a mark, a recognizable shape, there is presence in the void. The white frame is no longer perceived as a white rectangular area but a place or ground where the figure can be said to “exist”. The simplest example of figure in ground is a silhouette. A silhouette is a profile view of an object, the simplest essence of form in space, recognizable as a dimensional object within the field of light.

Silhouettes can be more or less ambiguous depending on their viewing angle. In Figure 1 the three squares are ambiguous because they don't suggest specific three-dimensional forms. Figure 2 represents a slight shift in viewpoint, with less visual confusion. In Figure 3 the three silhouettes are even clearer, particularly in the case of the pyramid, which is now definite that it rests on a square base.



Figure 1: Ambiguous silhouettes.



Figure 2: Slight shift in viewpoint.

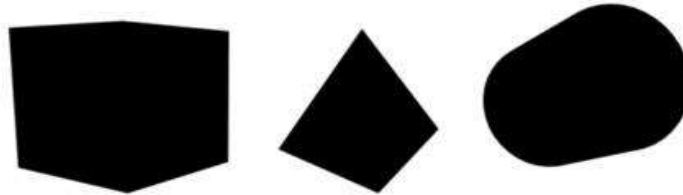


Figure 3: More definite representation

One of the most defining attributes of the silhouette is the absence of light within its shape. A slight sidestep of this property can define essential form characteristics, that the silhouettes cannot communicate, by using the simplest essence of light in space, the highlight. Although the highlight is the minimal light possible it adds the third dimension and communicates the object's outward movement into space.

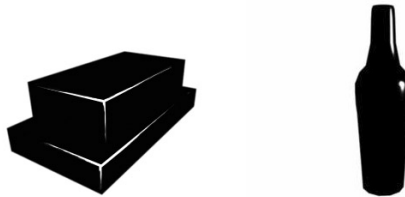


Figure 4: Edge and specular highlights.

A clear and unambiguous silhouette also depends on the presence of a ground on which the form rests. The presence of a ground plane is very powerful in the case of multiple figures within the same frame. In Figure 5 we immediately perceive the bottle to be in front of the glass while in Figure 6 the clarity of depth between the glass and the bottle is diminished.



Figure 5. Ground plane present. Figure 6. Ground plane absent.

The use of time and movement creates another set of visual information that can be used to fully describe an object within space. If each shape in Figure 7 is seen independently of the other shapes we would have a set of different objects, but if these shapes are seen as progressive frames through an animation we immediately register all the shapes as one object rotating around itself (or the camera rotating around it). In this example another aesthetic variable is added, orientation. While the first and last frame are identical, if seen as an animation we would perceive those two shapes as different sides of the same object.

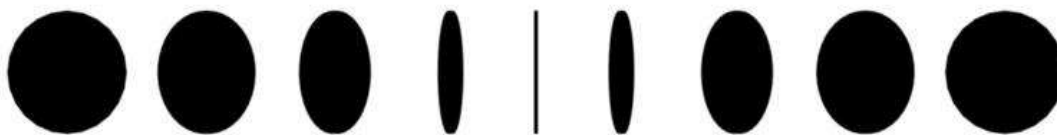


Figure 7: Progressive frames of a rotating disk.

Silhouettes can become even more complex to create a complicated sense of three-dimensional space, by using reverse silhouettes. Silhouettes can be black in white or white in black. In figure 8 the white weeds are perceived to be between the character and the camera, while the black weeds are behind her. The use of reverse silhouettes can be so subtle that we can hardly notice.



Figure 8: Reverse silhouettes.

Figure and ground

Human beings have a perceptual tendency to organize our environment into stable reference points against which we can assess and check the less-stable elements. We automatically separate an image into figure and ground. This figure-ground perception can be used accordingly, especially in the case of silhouettes, to clarify or conceal a figure in relation to its ground. This can be done based on some major characteristics of figure-ground perceptions:

- We perceive the figure as an object while the ground is part of the “uncovered” screen area.
- The figure lies in front of the background.
- The line that separates the figure from the ground belongs to the figure, not the ground.
- The figure is more likely to move while the ground is more stable.
- The ground seems to continue behind the figure.

A simple but elaborate example of these characteristics is illustrated in Figure 9. The white circle within the black rectangular frame is most likely to be perceived as the figure and black as the ground rather than a black rectangular with a circular hole. The circle seems to be an object, which lies in front of the black with its outline attached to it. Because the circle is not centered it is more dynamic— more likely to move towards the upper right side of the frame, rather than the black area move in the opposite direction. The white circle also seems finite within its suggested outline but the black area seems to extend to infinity past the borders of the frame.

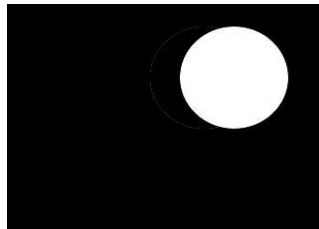


Figure 9. Black figure on white ground?

Gestalt

As discussed before human beings have a tendency to interpret visual signals into contextual information. The explanation of this tendency goes deep into our survival mechanisms. We need to mentally fill in the gaps in visual information to arrive at complete patterns, which we would easily manage. This perceptual activity is called *psychological closure*. The pattern that results from psychological closure is called a *gestalt*. A gestalt is a perceptual whole, which is larger or different from the sum of its parts.

In visual arts psychological closure plays an important part. When viewers are presented with limited amount of visual information (such as in silhouette art), constant psychological closure is required. Viewers, having to arrive at the appropriate gestalt, are more involved with the piece rather than being just spectators. While this seems to be a just intention for an artist, if not used wisely it may lead to be too confusing to hold the viewers attention.

History of silhouettes

The origins of silhouettes go back to lithographs – prehistoric on-rock drawings, drawings on ancient Greek vases, dolls of the eastern theater of shadows, architectural wood carving, and there is evidence of its emergence at the end of the seventeenth century as an art form in Europe, but its peak was through to be the eighteenth century and into the early years of the nineteenth century. The publication of Joanna Casper Lavater's *Essays on Physiognomy* in the 1770s possibly did much to stimulate the interest in silhouette, since the book was illustrated with this type of portrait. After this publication silhouettes became fashionable with admirers as diverse as the writer Johanna Von Goth (who was himself a cutter), the Empress Catherine the Great of Russia, and King George III of England. In fact there is a famous painting of Princess Elizabeth, third daughter of George III, sitting by a window at Windsor Castle, engaged in her favorite hobby - cutting silhouettes. Silhouette took its name from the French Minister of Finance, Etienne de Silhouette (1709- 1767). It was his hobby to cut profiles from black paper and even if he wasn't the "inventor" of Silhouette Art, his amateur studios have expressed themselves in one of the most remarkable phenomena in culture and fine arts. Silhouette art was also a hobby of Swift, Hoete, Lafanter and Napoleon.

Silhouette art became very popular in Russia in the middle of the XVIII century. This event is mostly owed to French artist Sido, who was specially invited for painting a portrait of Catherine the Great, which he presented it to her with an inscription "The most pleasant shadow of Catherine II, the All-Russian Autocrat". After that members of the most august family, aide- de- camps, chamberlains, ladies- in- waiting, diplomats, actors, musicians, patrons, military commanders, wished to possess their "shadows" created by the French master. The art of silhouette was immediately become a fact of the nobility's culture. The art of silhouette was learned in boarding schools. Single and group silhouette portraits decorated the chambers walls in the houses of the rich and medium class homes and numerous lady's albums were filled

with them. At the beginning of the XIX century the best master of silhouette was count Fyodor Tolstoi. His landscapes and battle-pieces or rural scenes in silhouettes, skillfully cut out of paper vividly express the entertainments of the society of Pushkin time.

The earliest silhouettes were possibly cut from black paper with scissors, but the art is thought to have achieved its greatest heights with the painted silhouette, and these became the finest miniatures. Original portraits were life size. The subject sat between a candle lamp and a glass screen, behind which was a sheet of oiled paper. The artist, working on the other side, drew around the life-size shadow on the paper. The outline was blacked in later, or cut out and backed with black material. This was called `hollow cutting'. In 1775 Mrs. Samuel Harrington invented the pantograph - a mechanical device for enlarging or reducing drawings. This device meant that the artist could produce a copy of the original silhouette at any time. By the late 1700s it was advertised by one artist that he could produce 16 different sizes down to 0.6 cm. These minute silhouettes were, no doubt, set in jewellery, since silhouettes of this size were painted on ivory and often used this way. One of the greatest Silhouettist was considered to be John Miers (1758- 1821); Isabella Beetham, who painted on the reverse side of glass, is thought to be at least his equal. `Verre eglomise', the technique of painting on the back of glass using paint with gold and silver foils was also used. At the end of the eighteenth century, silhouette went into a decline from which it was rescued by the efforts of French refugee, Augustin Amant Constant Fidele Edouart (1789- 1861). This artist cut around 3800 silhouettes.

In early nineties Lotte Reiniger made a number of short animated films using silhouettes. She used to cut out parts of a figure from black cardboard and with thin lead she would control the figures like silhouette marionettes which she moved and photographed frame by frame. In 1923, Lotte Reiniger undertook a full-length production of The adventures of prince Achmed, amongst the first all-animation feature films ever made.

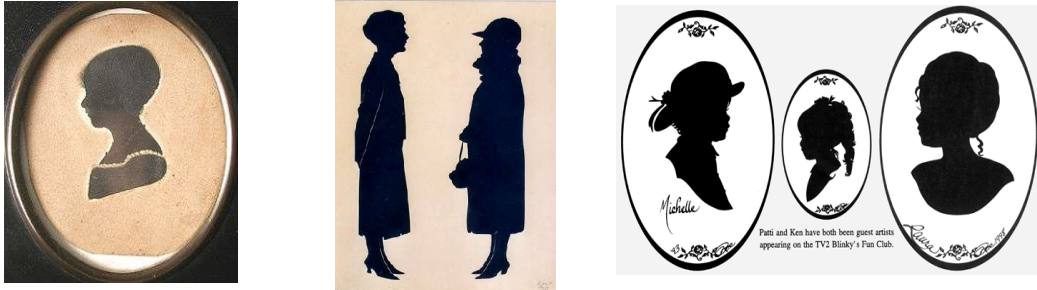


Figure 10: Silhouette art

Visual Approach

I got the idea for this project from one of the ending scenes of *Tim Burton's Nightmare Before Christmas* where the silhouettes of the two main characters are photographed in front of a full moon. That scene, as well as many other romantic scenes in films, took on a special prominence when shown in silhouette. But silhouettes are not only used efficiently on romantic scenes. Silhouette scenes can emphasize the contour of things, especially when outer movement is of the essence or it can successfully conceal the identity of a person. The question that arose was: *Could a film be made entirely in silhouettes?*

After doing some research, I only found a few animations based on the principles of silhouettes. Most of them were short animations, including a full-length animation- *The adventures of prince Achmed*, made by Lotte Reiniger in the early nineties (Figure 11) and *Humdrum*, a short animation where two bored shadow puppets play themselves at their own game, made by Peter Peake (Figure 12). A review of the *Adventures of Prince Achmed* at the time quoted:

"Films of purely visual interest in which life manifests itself only under appearances far removed from reality, provoke a nervous tension which becomes more pronounced the longer the projection".

Because of the simple nature of silhouettes, constant psychological closure is required which can be fatiguing. Based on the principles that decide the ambiguousness of silhouettes I mentioned earlier, I attempted to handle this problem by applying a contextual pattern throughout the whole animation, in which the gestalt of the visual elements is first questioned and then answered. Using entirely unambiguous silhouettes is almost impossible, so if their ambiguousness cycles within a pattern closure and non-closure will balance each other out and lead to a visually interesting and efficient result. Of course, when dealing with artistic problems we can't make calculations and arrive in an accurate result, as we do in science. What we can do is contrast the opposite polarities to make the distinction clearer. By that I mean that if the ambiguousness and unambiguousness of silhouettes are the opposite polarities that need to be balanced, if exaggerated, their odds will become more definite. In this project the exaggeration is applied on the shapes of the visual elements by slightly deforming them towards asymmetry. As an example, if I was to use a cube as an object in a scene, instead of using a geometrical perfect cube, I would use a slightly deformed cube which resembled a cube. Hence in its ambiguous view it would look like a polygon without any hint of it being a cube but when shown from a more unambiguous view the characteristics of the cube would become clearer in a more dynamic fashion.

Another issue that rises with silhouettes is the figure-ground relationship. In one of the previous examples in Figure 9 the distinction between the figure and ground is very clear because there is a white circle on a black rectangle. In this project, both figure and ground are composed of complex shapes. Because this can lead to unpredictable closure I used sharp angles and straight lines for most of the shapes in the environments, and a smooth, curved shape for the characters which is used as a system of disassociation.

The story of the piece was chosen entirely to fit the requirements of my hypothesis. The doors, stairs, fridge and the roof with a cityscape and a big moon are highly recognizable visual elements and can be dynamically distorted. The story also fits with the visual pattern I discussed earlier. A

number of events and objects are questioned until the final climax where they are put into context.

Finally I chose a female character as the main character because a female character can have a more curved shape and more complex clothing, which could contrast the simple and linear structure of the environments and because it would be a little bit more fun for me to model.



Figure 11: Lotte Reiniger's "The adventures of prince Ahmed"



Figure 12: Humdrum by Peter Peake

Technical Approach

The characters were made entirely in 3D and rendered as flat color surfaces with no light diffuse. The environments were made and animated, when necessary, in 2D and used as background plates in 3D to match the animation with.

One might argue, that since it's flat rendered, it would be faster and more efficient to make it entirely in 2D. The last few years though, since processing power has become cheaper and more accessible it a common approach to make an animation in 3D and render it with a 2D look. Modeling, setting up the characters and dealing with the technical peculiarities of sophisticated 3D software is time consuming but when it comes to redoing a bit of animation, correcting something that went wrong, or focusing on a specific problem, data reuse, which this approach is offering, comes in handy.

Because the nature of my hypothesis is more visual than technical I felt that I needed to speed up the modeling and character setup process so I can use most of the time available on the visual aspect of this piece. First, I made a clay model of the main character, which made the modeling process a lot faster. I high and low resolution version of the model was used to speed up rendering times, depending on the needs of each scene. An image of the clay model is in figure 13. The character rig for both the main character and batman character were made using a script I downloaded off the internet - called *Final Rig Pro*, which created a fully operational rig based on the proportions of the character. The skinning for both characters though, had to be done manually. Due to time constrains, the batman model was also a combination of different human- like models I downloaded off the internet. The final model is composed by four different models with a slight alternation of their geometry.

Finally, the sound was recorded and added to the piece by me and fellow animation student, George Cherouvim.



Figure 13: Clay model

Analysis

Story

A female character walks down some stairs and looks through a box until she finds a shotgun. She goes to a roof and turns on a big spotlight, which lights the batman sign on the sky. After a while batman appears on the roof and stands proudly on the edge until shot, by the main character. She then opens a fridge door and grabs a beer and as the fridge door closes, a post-it note attached to the door is revealed with the following written on it:

Things to do:

- Feed the fish
- Buy beer
- Kill superman
- Kill batman

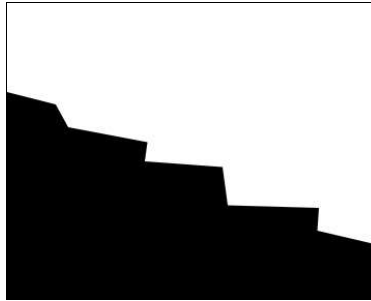
Scene break down



In the first scene the viewer is presented with a number of white polygons on a black frame. The triangles immediately form a pattern, separating them from the white polygon on the top of the frame, and even if the linear change of size of the polygons may hint perspective this image does not suggest any familiar shape. The objects within this frame are in their most ambiguous state.



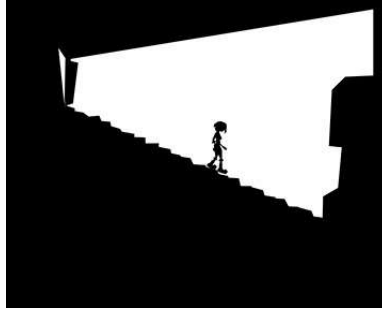
It is only when the character walks in and down the stairs, that we realize it is a door with a stairway. The pattern of the triangles and the polygon we saw earlier are now put into context by their interaction with a very familiar shape, a human shape.



The same applies in the following shot. The difference here is that viewers already have the experience of the previous shot and they are expecting the path of the character down the stairs to be continued. In this shot realization is easier but is still an abstract image the mind has a difficulty putting into context.



Again, the character's interaction with the scene results in full realization.



In this scene the door and stairs are fully recognizable, but a new element is introduced. The black shapes on the right side of the frame are yet to be explained. The character's path towards this new element intensifies its importance.



After this new viewpoint the question of the black shape remain unsolved and a new black area masking the stairs takes its place. Once more the character's interaction reveals that this black area and the black area in the previous shot are actually boxes from which she takes out a gun. As she takes out the gun she loads it holding it with one hand against the stairs. Even though the stairs are represented by vertical lines, her full movement reveals the overall shape of the gun, hence the question of what kind of object she takes out of the box is answered.



In this scene the viewer is presented with a new environment. Even though we can't see a full white circle, because most of its part is shown, it overpowers the shapes within it so we assume that it is a big white circle, which is masked by a number of objects in front of it. The arrow looking object on the right is actually an air funnel but it is not explained through the animation because it doesn't have any importance to the story. It is only used for composition reasons. The objects on the right are separated into two different objects because they differ in complexity. The detailed object is put back into distance and the cubic object is put in front of it.



Even though this shot is already hinting enough information about the nature of its objects when the character comes in the shot it very obvious that she is in a roof, with a cityscape on the background and big full moon.



As soon as the character blends in with the black area of the frame, we are not aware of what she's doing. It is only when bolts of lighting in the sky reveal her effort to turn a big lever switch. The lightings not only provide a negative area on which the action of the character can be revealed but they also add a dramatic effect. It's very interesting that even if three different shapes of lighting and a white sky frames were flashed very fast, we can easily see the character's movement as a continuation.



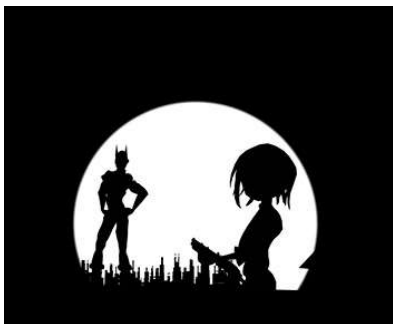
The batman sign within the newly presented circle is a highly recognizable symbol. Following the action- reaction principle, the batman sign on the sky is the result of the previous action. The switch turned on a big spotlight in the sky assumingly calling for batman.



This part is a minor sidestep of the initial constraints I set for this project. It's the only part in the animation where I use a tone other than black or white. I'm suggesting that time passes by a slight movement of the moon. Its only purpose is to anticipate the final climax of the story, which is yet to come.



This is where Batman answers the call and climbs on the roof where he stands proudly on the edge. Batman's pose is very dynamic and expressive. Even if it's only his silhouette, it successfully communicates emotion.



This part is the climax of the story. In this shot we have dual realization. The camera move removes the door and air funnel off the frame and brings the main character back in a visible part of the frame, where both the viewers and Batman realize

her intentions. The moon is now centered within the frame and both characters share the same visible space. In my opinion, this intensifies the interaction of the two characters and makes the climax more dynamic.



This is a new environment. A fridge door opens and the camera is inside the fridge. The shapes within the fridge are gradually revealed. As the door opens the amount of light in the scene is increased. In this case light is suggested by the white space. This is a relatively complex scene and the environment and action of the character had to be shown within a small duration of time. I used highlights on the bottles and the grid, and inverse silhouette on the shading of the door. This is hardly noticeable but as the door opens, its shading progresses in the wrong direction. By wrong I mean the opposite direction in which it would move in the real, physical world.



In the last scene of the animation, there is a close-up of the character drinking the beer and as she moves out of the frame, the view is left with the post-it note.

Conclusion

Using silhouettes as the only visual element in an animation is a very interesting problem to work with. It is a problem because when dealing with only one primitive visual form such as shape, it's very hard to space ourselves from all the other visual properties we've spend a lifetime learning to see. On the other hand, having a very restricted pallet results in very creative solutions.

As a conclusion I support my original hypothesis that silhouettes can communicate enough information to transmit emotion. They can provide very powerful visual signals and efficiently describe depth, volume and light. Using silhouettes efficiently though, is not an easy task to handle. If we are to understand the silhouette as real presence in the world, we must have some suggestion of the third dimension. As explored in this project this can possibly be done by using the right viewpoint- a view of the object that gives a sense of perspective, suggesting the volume and the contours within its shape with highlights, through an animation in which different views of the object are progressively revealed, with the presence of a ground plane or by the use of other powerful visual signals such as reverse silhouettes. Of course, as the complexity increases new aesthetic variables come into play, which need to be handled according to the needs of the narrative.

Bibliography and sources

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and Cecile Starr

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