Goldsmiths, University of London

Introduction to Modelling & Animation: IS53067A

Game Character Animation

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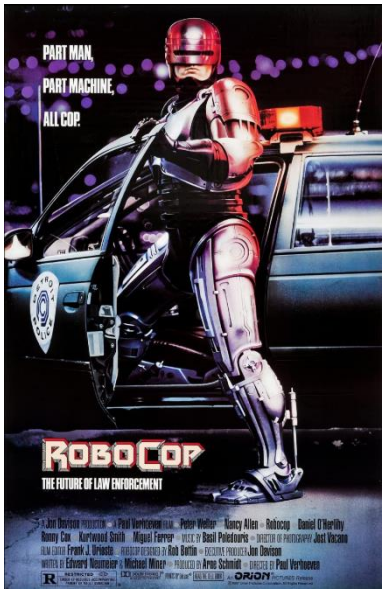
Notes from previous coursework.

During my short time using Maya I have developed my skills in modelling, workflow, and texturing and have learnt valuable lessons in the importance of creating a stable mesh, grouping, and parenting which can prevent problems later in the project. Taking note of previous errors has led me to methodically plan development of this project hence I am beginning this report before I have done any modelling.



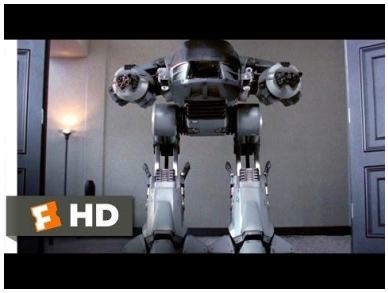
*RoboCop Movie Poster **[1]***

Concept and Inspiration: RoboCop [1].

For my final coursework I have decided to take inspiration from the film Robocop [1] and will model the ED-209 [2].

The director uses stop motion animation and physical models to create the scenes in the movie. Whilst this film has dated the designs are still iconic and have been replicated in model replicas, games, and movie sequels.

Watching the clip from the film [3] provides an understanding of the movements the character will need to display as well as different components, joints and rigging that may need to be considered during development in the modelling process.



*RoboCop "It's Only a Glitch", Video **[3]**.*

ED-209

"Enforcement Droid, Series 209, or ED-209, were a fully automated series of peacekeeping machines created by Omni Consumer Products. The Units were programmed for urban pacification, but OCP also negotiated contracts with the military for use in war." [4]

*ED-209, image of model **[2]**.*

To create the ED-209 I plan to use a hard modelling technique based on photographs from models for aesthetic design and perspective views.

These designs have many details so it may be necessary to develop a simplified version making use of the most recognisable features and adding further details after if there is time.

Hard Modelling

To setup the project in Maya I used a selection of images from my research. For concept art and style, I selected photographs taken from a scale model [5], whilst for hard modelling I was able to find orthographic views [7], these were edited into separate pieces and applied onto planes in the scene (figure 1).

Taking into consideration the height of the model in the film I attempted to scale the images to a similar size (around 2 meters).

I began the modelling process on the toes, and this was relatively straight forward, followed by the ankle joint however at this point it was necessary to change the rotation of one of the reference images to be able to design the leg straight up. I created a physical pivot joint at the ankle to help visualise how the robot would move.

The next stage involved creating the shin armour however this was difficult to shape and after a few unsuccessful attempts I decided to revisit this section and work on the upper leg connection.

It was at this point I realised I needed to design each part as if I was creating a mechanical object this helped me to visually breakdown each component of the model.

Figure 2 & 3 shows the upper leg struts and knee joint including the change in orientation of the reference image to easily design in world space. The struts have been created from a cube and using the Boolean control to cut out shapes. It was important to closely match vertices to reduce time fixing non manifold geometry. I have softened the edges using the bevel tool and used extrude to shape pieces carefully. I have used the smooth tool on specific objects and have included this in my workflow, inserting edge loops as I build and checking smooth preview.

From the knee joint I built out to the central body with rubberised connectors.

*ED-209 Model used for concept art **[5]***

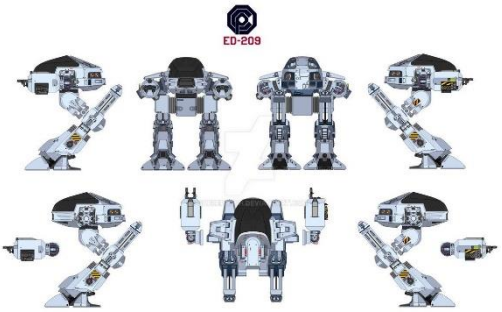


*Image used for hard modelling technique **[7]***

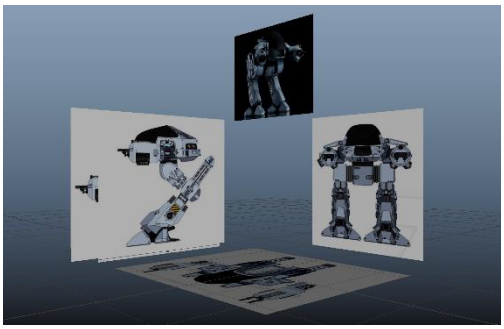


Figure1: Setting up Maya project

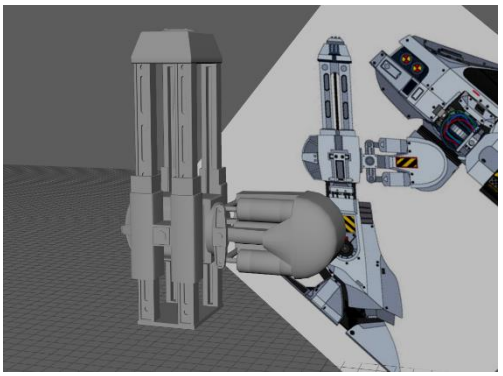


Figure 1: Upper leg and knee joint

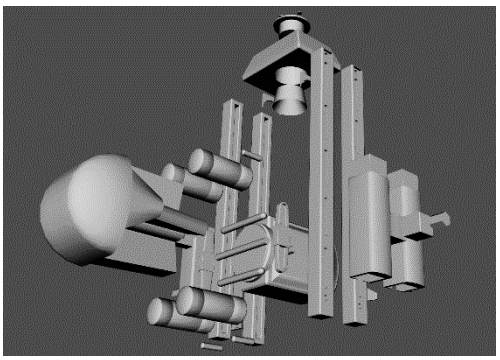


Figure 3: Knee parts

With the model beginning to take form I returned to construct the shin armour. Starting with a cube then progressively adding edge loops and changing their position a basic shape was formed. I began to experiment with extrude to try and create an armour-plated look and further extruded the base, finally some edges have been bevelled. Figure 4 shows the progression of the mesh.

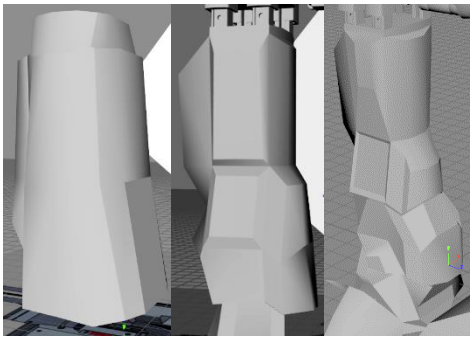


Figure 4: Shin armour development

The next challenge I faced was building the head. Using the orthographic view and my reference images I created the base of the head using a cylinder and slicing half of it off to create a square end. This was then shaped, and edge loops inserted whilst viewing smooth preview to create a rounded base (figure 5 middle). The rear part of the head was created by extruding upwards from the base then separating and shaping (figure 5 left). The cockpit screen was created using a sphere then cutting in half and shaping.

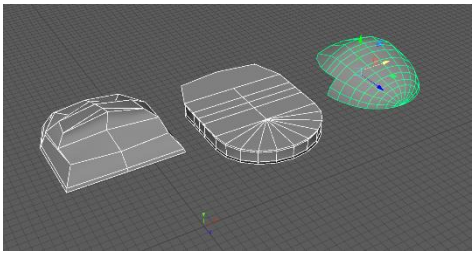


Figure 5: The head separated into pieces

Figure 7 shows the rear section and rim being reworked by extruding from a smooth base and shaping. This was quite difficult to shape, and it was necessary to smooth, adjust vertices and sculpt sections to get an acceptable finish. Finally, the cockpit section was adjusted and fitted to the rim and later smoothed (figure 8).

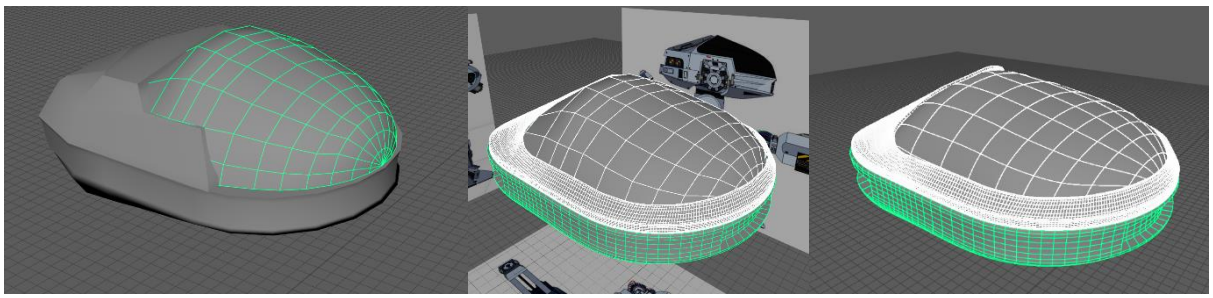


Figure 6: Basic Head

Figure 7: Head smoothed v.1

Figure 8: Shaped and fitted cockpit

To create the arm and gun I built the separate components using a combination of techniques mainly extruding with carefully placed edge loops. I decided to include cables in the gun as they are visible in the reference image

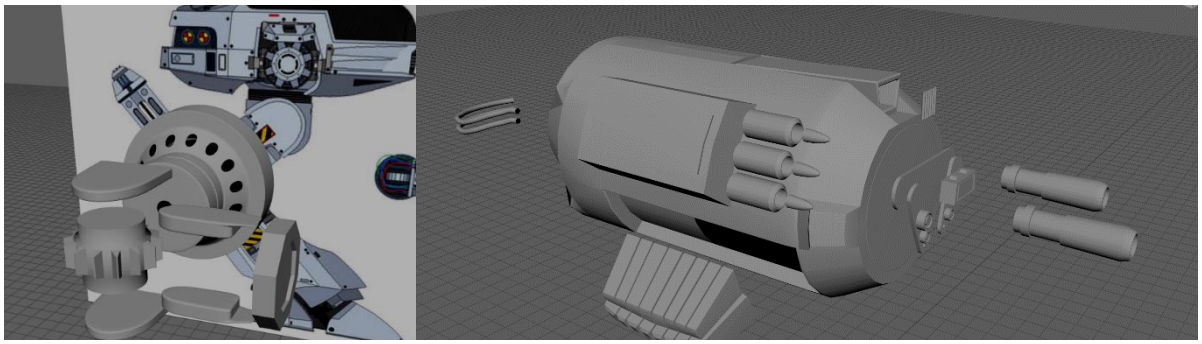


Figure 10: Constructing the arm and gun

Final detailing of the body included adding exhaust vents at the rear, piping, wing section, and extruding detail into the base and rear of the head

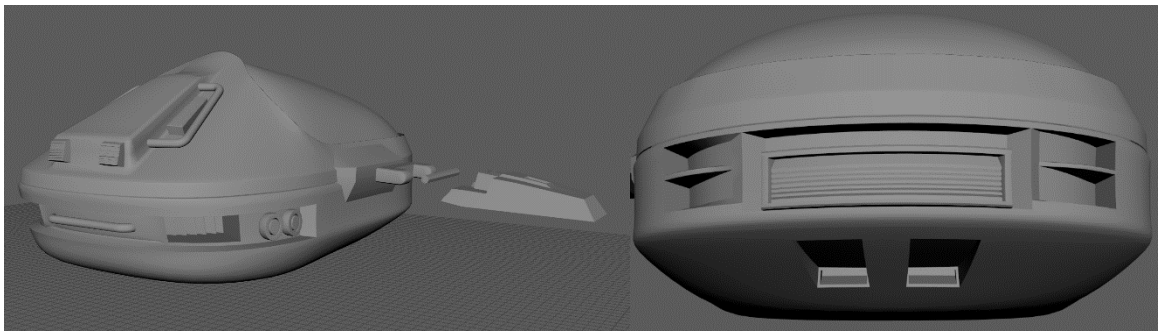


Figure 10: Final detailing

With most of the mesh complete it was only necessary to duplicate the left side of the body

Conclusion

Overall, I am happy with the model in its current untextured form and my workflow, problem solving, and organisation has greatly improved throughout this process.

I have learnt from previous mistakes and made sure to constantly check if mesh's were clean, freeze transforms, centre pivots, and correctly parent, group, and name parts.

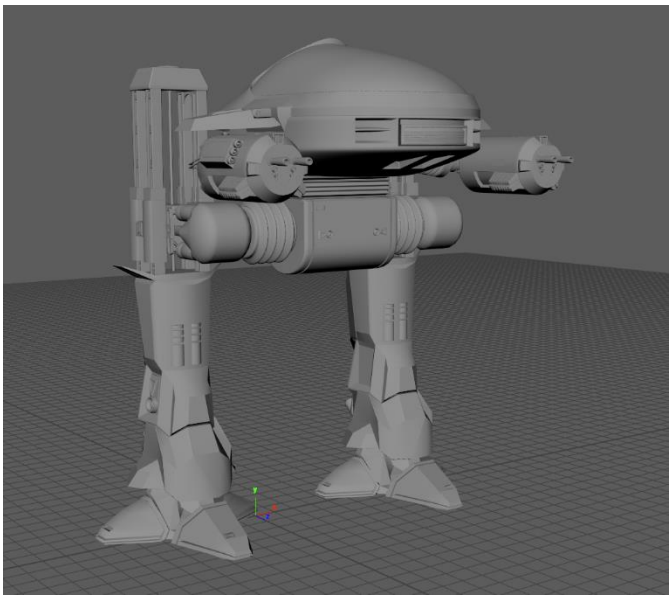


Figure 11: Final Mesh

Rigging

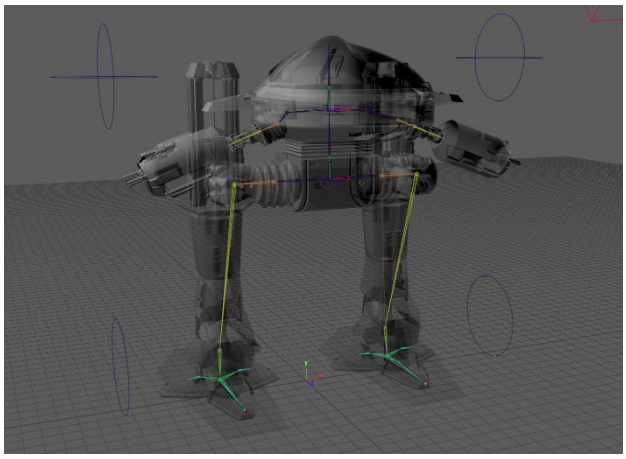


Figure 12: Final rig

This was the most complex part of the process and I decided to attempt this before the texturing.

This took a few days to understand how rigging works and a few attempts to correctly place the joints. I used online resources to research how to apply mechanical joints in Maya [8]. Following a tutorial to help understand placement I built the skeleton (figure 12). It took some time to understand the orientation of the joints and how they should orient when moving from the central position (down the leg or arm). With the skeleton mapped out and sections I mirrored the opposite parts of the body and then placed an IK handle from the ankle to the hip joint (rubberised connection to the body). This took some time to figure out due to the awkward movement of the robot, it was also necessary to regroup and parent parts, so the leg is parented to the knee. The second IK handle attaches the ankle to the heel and the third the heel to the toe. Four more joints have then been added at the base of the foot, the heel, toe, ball of foot, and ankle. The corresponding initial IK handles are then parented to the new position, this is to allow a simple control point for translation and rotation.

To bind the mesh, I used a parenting technique as the mechanics would not deform. For the hip and arm connectors I used the bind skin control to mimic a rubberized connector.

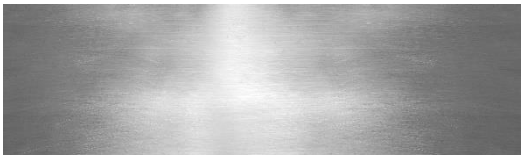
The arms where much simpler and used forward kinematics however I had to reset the arms, so they were level, then apply the joints, rotate the joints, and freeze transformations.

Control points were created using nurbs primitives I then used the connection editor to apply the selected parameter to the control point.

Finally, I made sure to group and parent the joints and mesh's correctly, so they are all together.

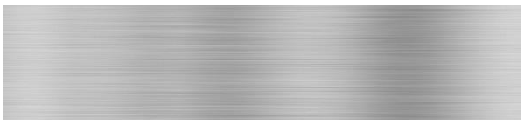
Texturing

Texture 9 used for base colour of most metallic objects



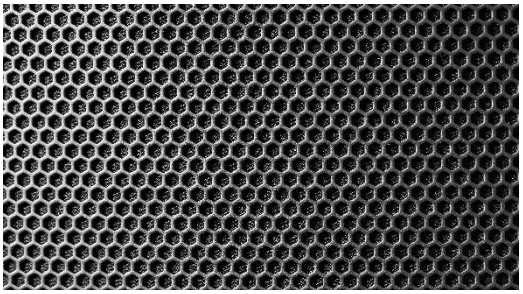
[9]

Chrome plating for the struts used ai standard chrome pre-set with texture 10.



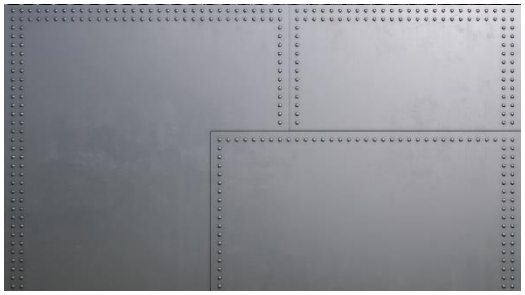
[10]

The cockpit used texture 11 with the same material applied as a bump map providing a textured rubber feel. This shader was used multiple times for detailing.



[11]

Texture 12 used as a bump map for the head and base to apply rivet detail combined with brushed metal shader and texture 9.



[12]

Texture 13 applied to a small area for detail

[13]

Texture 14 used as a bump map and colour for the guns also used on the central body.

[14]

Texture 15 used as a bump map for the armoured legs to make use of its futuristic design and seamless pattern and to amplify the armour plating.

[15]

Texturing Progression

For the final render I decided to hide the Skydome and remove the turntable this allowed me to reduce render time and create a clearer image.

Animation

I tried to recreate the same motion as seen in the movie clip [3] and tried to follow the outlined principles.

Anticipation:

I decided to use curved lines to slow the movement of the legs as linear movement was too sharp. I also rotated the main body to follow the legs and anticipate the next leg moving.

Follow through:

Tilting the hip and adjusting the toe movement helped to make the robots movement continuous and flow and slightly adjusting the main body translation and rotation helped to make the appearance of the robot swing its heavy legs

I applied slight movements with the head and guns to give the effect of swaying.

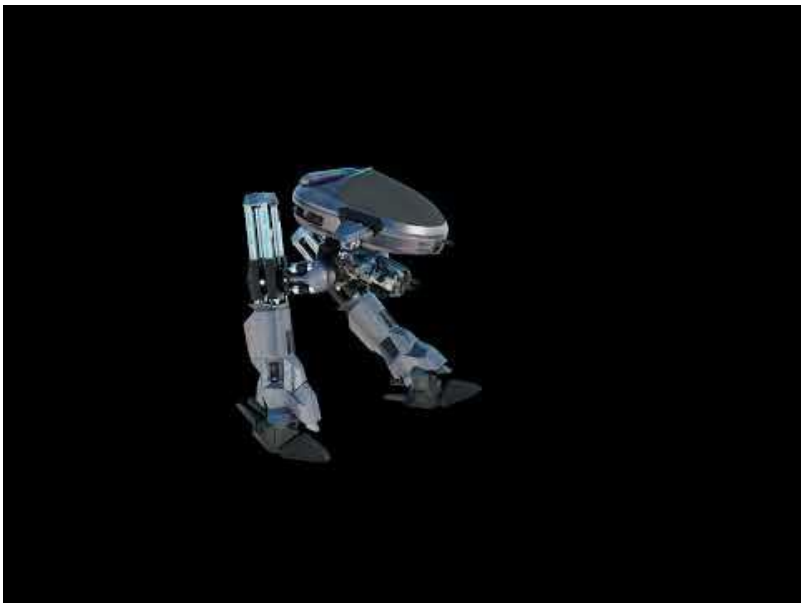
Stretch:

As the hip joints bind with skin this allowed for a natural stretch as the legs and body rotate replicating a rubberised connection.

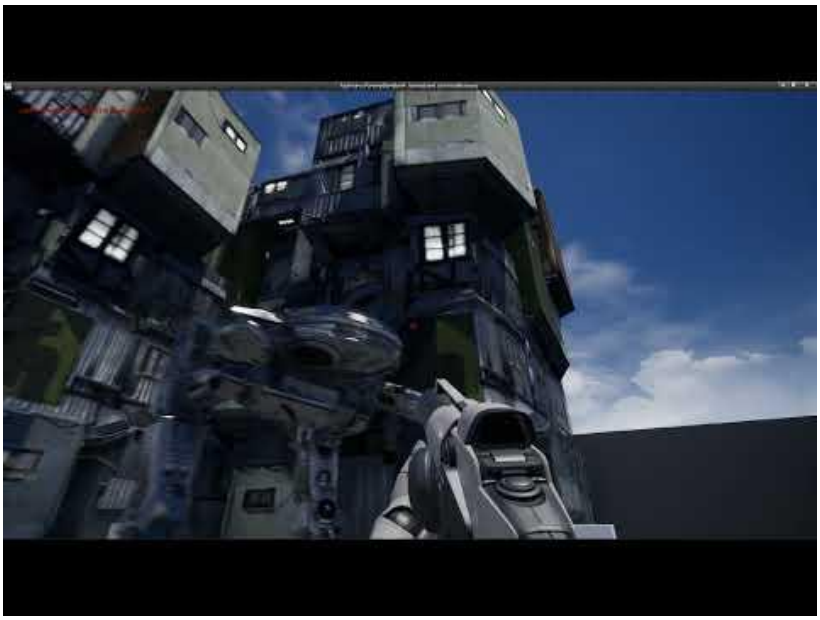
I did notice some errors with the rear struts clipping the head but overall, I am happy with the movement. I did have to duplicate the keyframes to allow a complete rotation of the camera.

I really enjoyed the animation and as the rig was solid, I ran into few problems but could happily spend more time learning this skill.

Video Documentation



Animated character, you tube



Unreal 4 with imported model, you tube

I have attempted to import the model into unreal however the textures did not work correctly, and I was unable to make the animation work, I was able to apply hit detection and build a small scene and ED 209 does scale well.

References:

[1] Verhoeven, P (Director). (1987). “RoboCop” [Film]. Orion Pictures

[2] Hot Toys, RoboCop Movie Masterpiece ED-209 Collectible Figure [model] URL: http://www.hottoys.com.hk/productDetail.php?productID=180

[3] Verhoeven, P (Director). (1987). “RoboCop Movie CLIP – it’s only a Glitch”. Orion Pictures. [You Tube]. URL: https://www.youtube.com/embed/TstteJ1eIZg?feature=oembed

[4] RoboCop Wiki, ED-209, [website]. URL: https://robocop.fandom.com/wiki/ED-209

[5] Good Smile Company, Moderoid, (2021), “ED-209”, [Model images] URL: https://www.goodsmile.info/en/product/9954/MODEROID+ED+209.html

[6] Derek Frost, (2010) Robocop’s OCP LOGO [OCP Logo] URL: https://www.deviantart.com/derekfrost/art/Robocop-s-OCP-Logo-178982504

[7] Supdeepdash, 2011, ‘ED- 209’, [website] Deviant Art URL: https://www.pinterest.co.uk/pin/37154765654459515/

[8] Lester Banks, 2011, ‘Robot Rigging in Maya’ [online tutorial] URL: https://lesterbanks.com/2011/04/robot-rigging-in-maya/

Textures:

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[10] Sergey Panychev, Adobe Stock, ‘Large metal grey background’, [online] URL: https://stock.adobe.com/

[11] nickkytok, Adobe Stock, ‘metal mesh of speaker grill texture’, [online] URL: https://stock.adobe.com/

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[13] brovarky, Adobe Stock, ‘Black and yellow warning line striped rectangular background, yellow and black stripes on the diagonal’, [online] URL: https://stock.adobe.com/

[14] Юрий Парменов, Adobe Stock, ‘Geometric camouflage seamless pattern. Abstract modern camo, black and white modern military texture background. Vector illustration [online] URL: https://stock.adobe.com/

[15] Юрий Парменов, Adobe Stock, ‘Geometric futuristic camofluage pattern, seamless background. Urban clothing style, masking camo repeat print, blue shades colours, Vector Texture [online] URL: https://stock.adobe.com/