

# Sliding the Pieces into Place: Rigging the Pigeons of *Spies in Disguise*

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Figure 1: Birds in *Spies in Disguise*

## ABSTRACT

The birds of *Spies in Disguise* required several technological advancements and techniques to achieve the simple graphic style of the film. One technology was a re-designed wing rig with unique mechanics that allowed for clean lines and graphic shapes rather than our previous anatomical based wing rig. The production style also required extreme posing involving sliding limbs, large open

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SIGGRAPH '19 Talks, July 28 - August 01, 2019, Los Angeles, CA, USA

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ACM ISBN 978-1-4503-6317-4/19/07.

<https://doi.org/10.1145/3306307.3328171>

mouth ranges and jiggly eyes. These requirements were achieved with a combination of new workflow techniques, updates to the pipeline and the creation and updating of proprietary deformers.

## CCS CONCEPTS

• Computing methodologies → Mesh geometry models.

## KEYWORDS

rigging, animation

## ACM Reference Format:

James Gu, Ozgur Aydogdu, and Steven Song. 2019. Sliding the Pieces into Place: Rigging the Pigeons of *Spies in Disguise*. In *Proceedings of SIGGRAPH '19 Talks*. ACM, New York, NY, USA, 2 pages. <https://doi.org/10.1145/3306307.3328171>

## 1 WING RIG

For *Spies in Disguise*, a single universal wing rig was developed for and shared between all the pigeons in production. It was also decided the shared wing rig would help reduce some of the rigging schedule per pigeon based on previous experiences with bird heavy films. One of this rig's goals was to simplify the interface for animation so the characters could be posed more efficiently. This simplification also made it easier for animators to stay on model for key poses, providing consistency throughout the film. The wing design for *Spies in Disguise* also required the feathers to slide over each other in a cleaner way when closing, yet maintain an organic smooth flow when being posed.

Developed in partnership with our research and development team, our proprietary deformer that allows deformation to take place in UVN space was updated [Burr et al. 2015]. A new mode was added that allowed the long flight feathers to maintain their shape in Cartesian space while being driven in UVN space.

We adopted the shrinkwrap deformer in Maya to maintain the cohesive deformation of multiple wing meat geometries, flight feathers and finger feathers. This allowed the various wing elements to slide over each other when going from an open to closed state. It also allowed the wing elements to maintain a cohesive planar nature when posed for acting.

As part of our proprietary skin deformer, we developed a deformation mode that uses a polygonal influence object which is internally subdivided within the deformer. This feature allowed us to build a low resolution driver object which produced a smoothed deformed driven surface.

A new system was developed for driving our proprietary joints on surface plugin. Combined with the UVN deformer this system allowed us to deliver a more stable fanned tail rig with more cohesive deformations in the characters of complex designs.

## 2 ATTACHING AND SLIDING LIMBS

The universal wing is attached to the body using rivets. It travels along the UV coordinates of a NURBS driver surface to achieve the swing motion. To give the the wing a feeling of being attached, the skin around the attachment point can also slide along the body. This effect could be dialed in and out by the animator. To achieve this control without breaking the silhouette, the body that included the sliding deformations was shrink-wrapped to a duplicate body that did not include the sliding deformations. Thus the wings can be brought to any point on the surface, the fur at the base of the wing follows the deformation, and the silhouette is not affected.

Another request from the animation team was to have the ability to slide the wing on the body independent from the body/neck pose. The idea is to isolate the wing motion from the highly expressive neck area. This means no matter if the body is bent forward or backwards, moving the wing upwards should bring it up in world coordinates. In order to achieve this, a NURBS cross section of the body (in X-axis) is generated, placed at the center of the body and moved with the rig. The input from the animation control is projected onto this surface, revealing where the wing should be in 2D space. The UV values are extracted from the surface and applied on the Wing Attach function to place the wing in the correct position on the driver surface.

## 3 SLIDING JAW

Since these birds needed to have a tremendous range of motion in their necks, a jaw space blending control was created for a few of the characters. As the jaw drops, the jaw blends through the neck spaces to keep it in the correct deformation space. This is achieved by reading the UV coordinates of an underlying NURBS surface track to obtain the positional and rotational space while retrieving the scale space from a corresponding NURBS ribbon that runs through the neck joints. The system could then be blended between the matrix of the jaw in the standard head space and this derived space.

## 4 WING PLACER

We designed the wing to be used on all of the birds in the movie. However each bird needed the wing to be scaled and placed relative to its specific body. So we created what we called the Wing Placer which compares the geometry of the original wing rig and geometry that is placed by the modeling department and then moves the rig accordingly to fit each individual bird design.

## 5 FEATHER PENETRATION

Even with all of the work and care that went into the engineering and mechanics of the universal wing there were some poses and transitions that would cause interpenetration. To solve this a deformer was written that would run, post animation, to clean up any interpenetration that occurred during a shot. This deformer works by using a layered system that detects collision and removes any undesired interpenetration by offsetting geometries in local space.

## 6 JIGGLY EYES

On one of the birds, animation requested a very loose, jiggly feel to the eyeballs. This effect was achieved by using a proprietary follow through plugin to deform a lattice that was applied to the eye socket regions.

## 7 CONCLUSION

The birds in *Spies in Disguise* were an extremely difficult artistic and technical challenge. It took the work of an entire team of artists to create these extremely stylized creatures. From the mechanics of a synthesised wing to the sliding parts that allowed the animators to achieve very unique poses. The innovation and hard work put into the birds has made them some of the most unique characters ever created at Blue Sky.

## REFERENCES

- Adam Burr, Steve Gressak, Matthew Doble, Christian Haniszewski, Ignacio Barrios, Brian Anderson, and Ferris Webby. 2015. "It's a UVN face rig, Charlie Brown": facial techniques for peanuts. In *SIGGRAPH Talks*.