A New Way to Communicate Visual Field Morphology: A Crocodilian Case Study

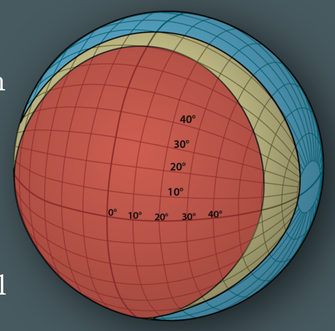
Kora Kleinman, Tyler Hunt

Introduction

Visual fields define the limits over which animals can gather near instantaneous optical information about their environment. Historically, visualizations of these data have been relegated to 2D representations that do not effectively communicate the remarkable variability found among vertebrate visual fields. Recently, it has become possible with the development of accessible 3D animation & visualization software, such as Maya and Blender, to produce accurate 3D representations of visual fields. To more effectively communicate these data, we developed a pipeline using Illustrator and Maya to generate 3D models from empirical data that more effectively depict an organism's visual field with respect to a model of the organism's skull. This new method: 1) provides a more intuitive view of visual fields, 2) enables the full visual field to be viewed in a single figure (blind spots are now visible), and 3) provides more effective communication to a broader audience than prior 2D representations.

Human Visual Fields

Think about how much our own perspective determines so much of our daily activities. How we navigate, perceive the world around us, and communicate are all influenced by our immediate visual field.

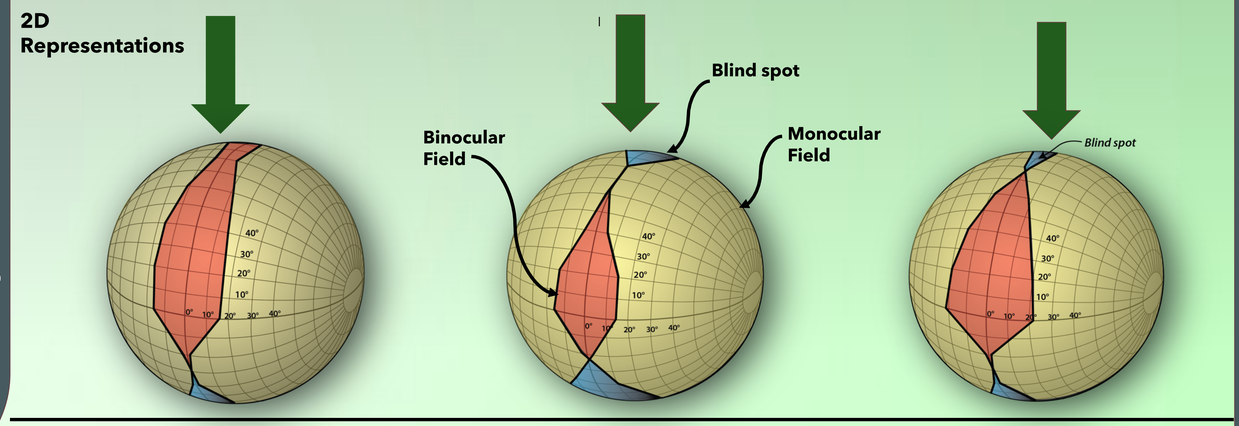


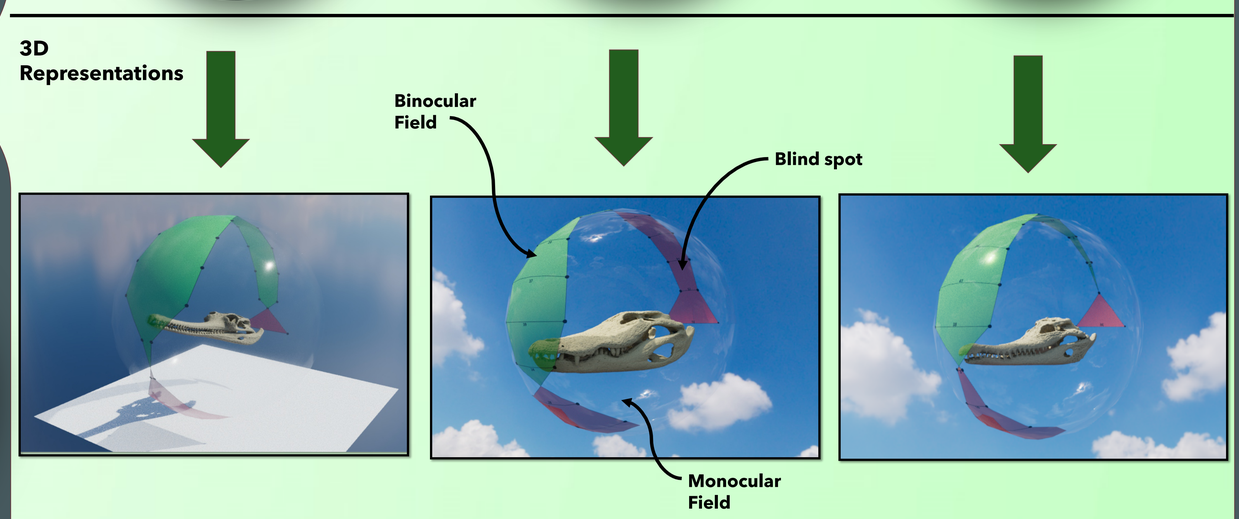
Results

Gharial Crocodile
Gavialis gangeticus

American Alligator
Alligator mississippiensis

West African Crocodile
Mecistops cataphractus





References

National Geographic. (2017). *Gharial Crocodile*. Edge. Retrieved March 1, 2023, from http://www.edgeofexistence.org/species/gharial/.

Sartore, J. (2023). *ESA002-00424*. National Geographic . Retrieved March 1, 2023.

Methods

The Crocodiles Visual fields were collected using the retinal reflex methodology. This method uses the reflection of light bouncing off of the retina in order to determine the limits of the visual field in living animals.

To digitize the visual fields, we first utilized MAYA, a 3D animation software to create a sphere. We then plotted the in vivo data in illustrator and used this template to project the animal's visual field on a 3D sphere.

Once we had created our sphere with accurate portrayals of the visual spectrum, we were then able to utilize Maya software to make the sphere transparent, apply a background, lighting, and upload the skull of the crocodilian to the scene.

Conclusions

Our models provide a new way to communicate visual field morphology in an intelligible manner that opens possibilities for further scientific advancement. These models can be applied to almost every species and can display an array of scientific data beyond visual field morphology. There is an ever growing number of possibilities that arise with this knowledge. Just imagine, we can apply our visual field data in a virtual reality setting so users may experience their surroundings truly through a crocodilians perspective.