#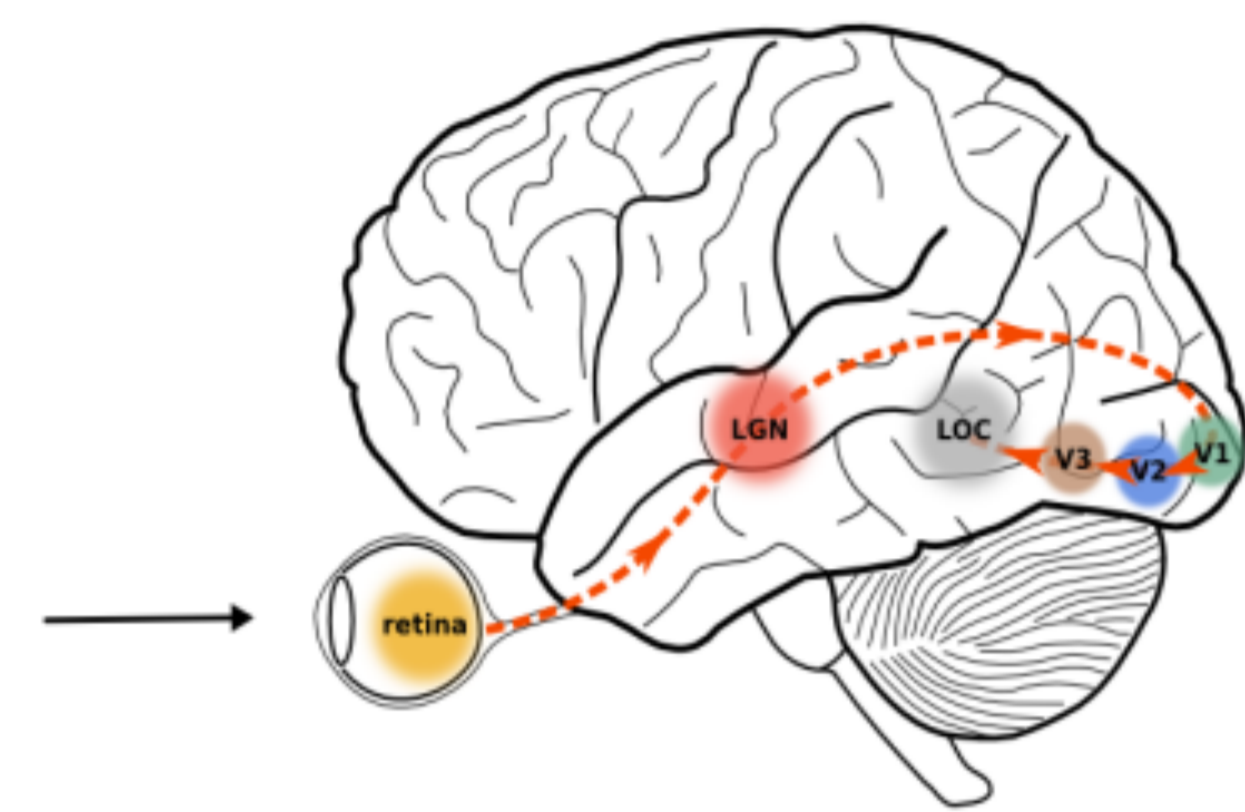 Accelerated Texforms: Alternative Methods for Generating Unrecognizable Object Images with Preserved Mid-Level Features

Arturo Deza[1]   Yi-Chia Chen[1]   Bria Long[2]   Talia Konkle[1]

[1]Harvard University   [2]Stanford University

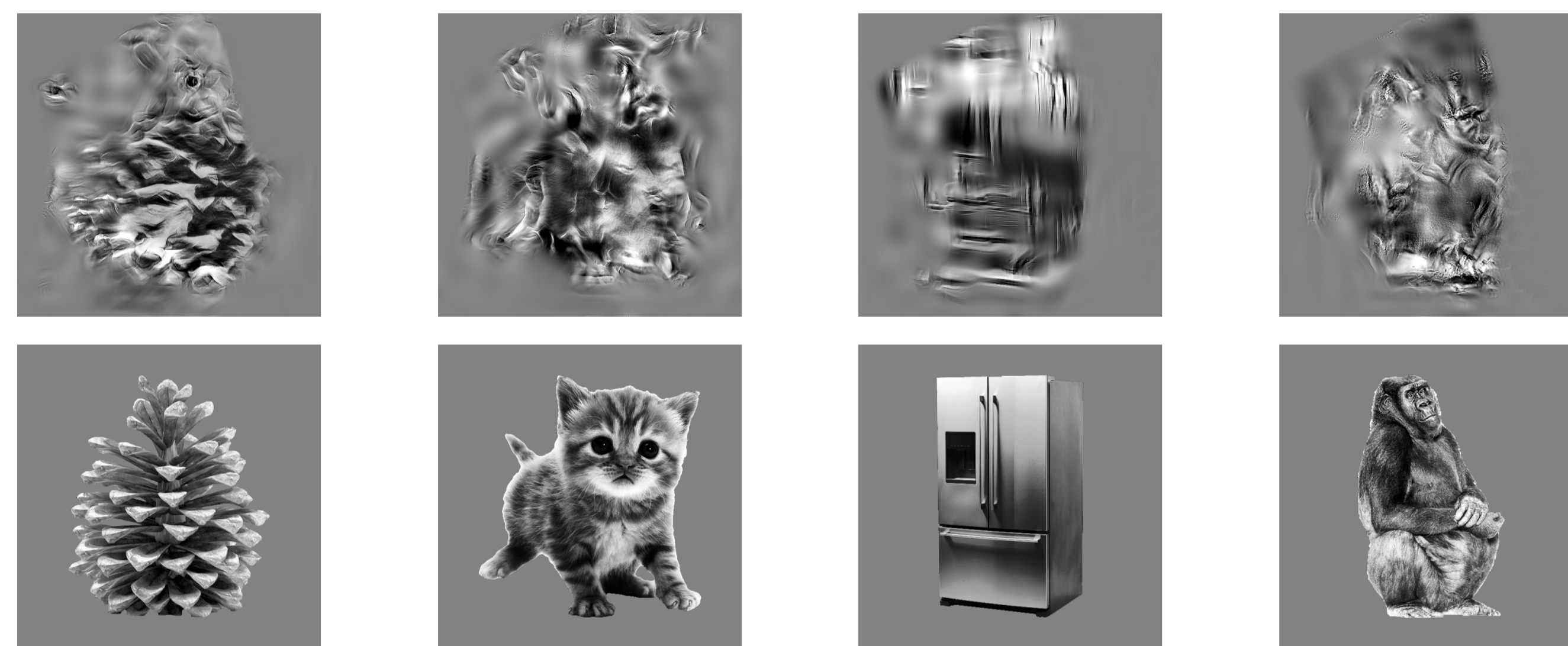## Introduction
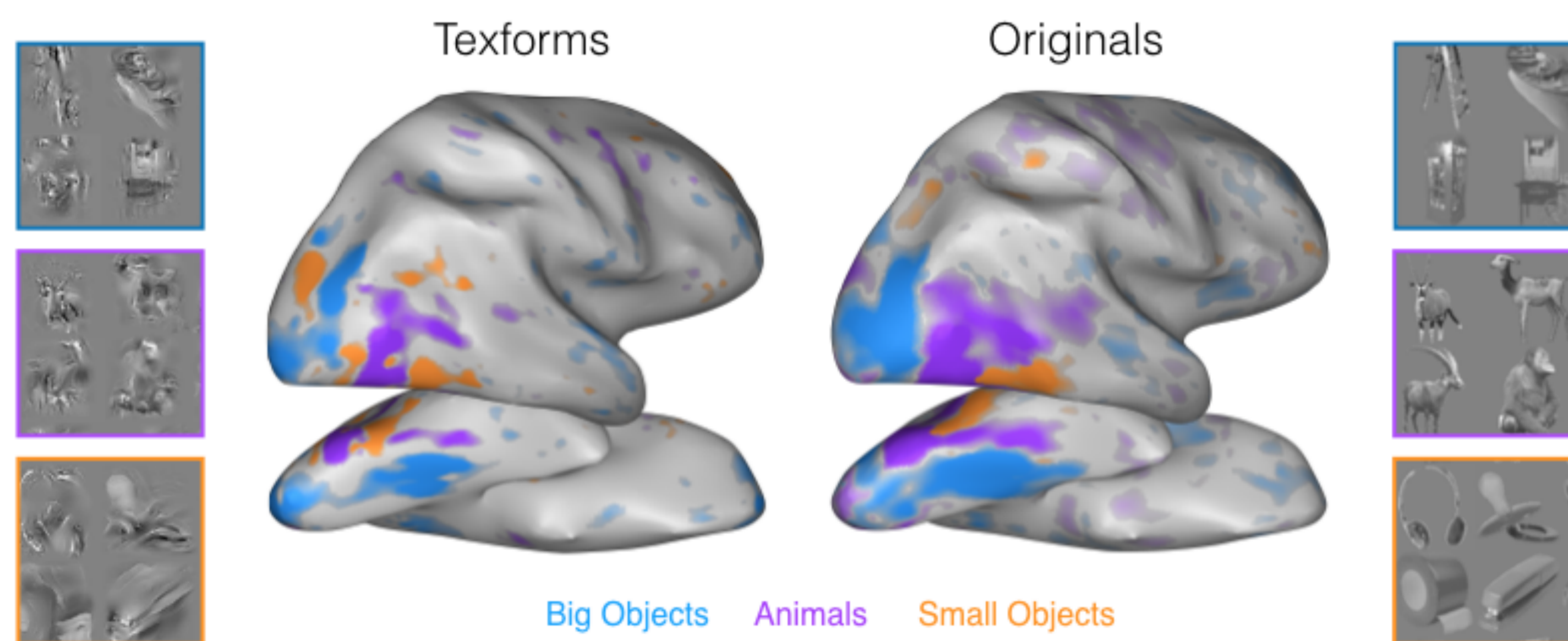
How do we create stimuli that probe for transformations done in the visual system?

Texforms:

Tripartite Organization

Texforms   Originals

Big Objects   Animals   Small Objects

Texforms extensively drive the ventral stream by animacy and size

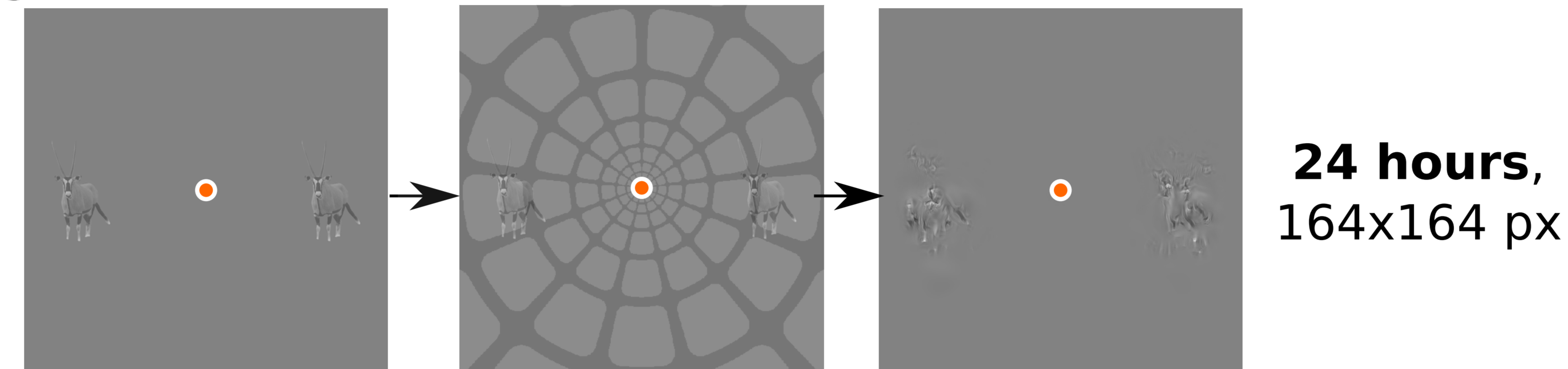Long et al. (2019)

Goals

1) **Accelerate** the rendering process and increase **Texform** resolution

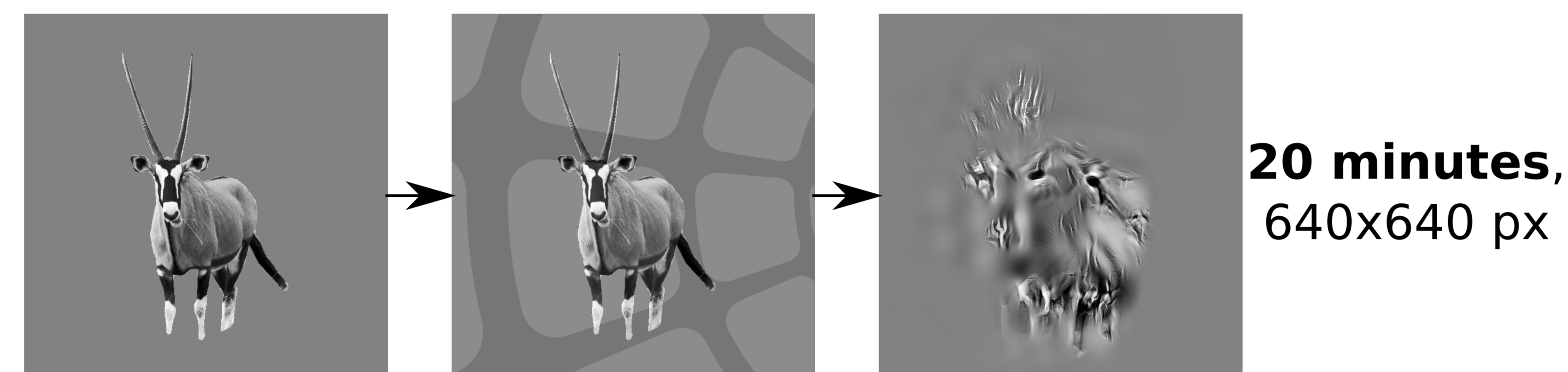2) Create **variations** of images with similar "mid-level" features: **Distortlets**
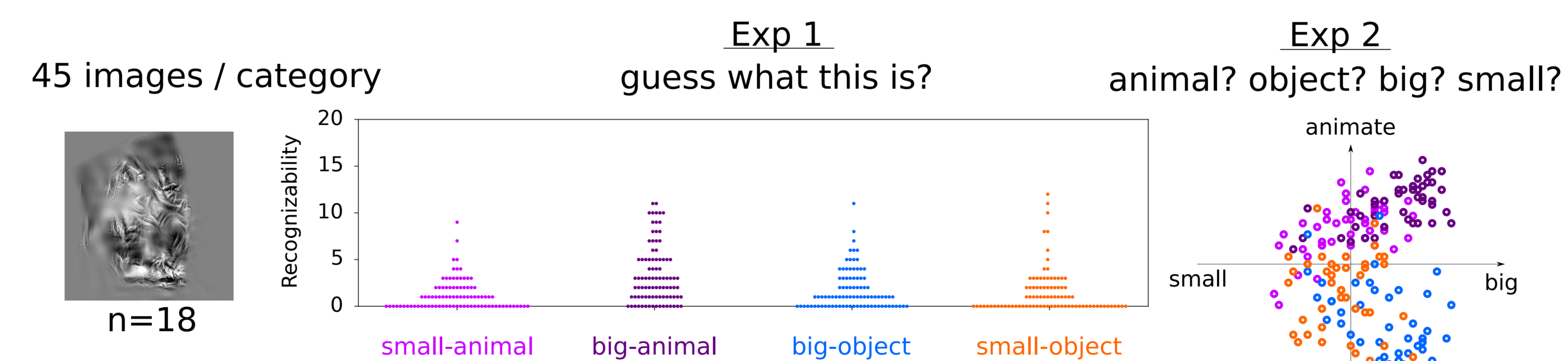
Accelerating Texforms

Original Method:

24 hours, 164x164 px

Freeman & Simoncelli (2011)

New Method:

20 minutes, 640x640 px

New method renders faster + higher resolution!

Behavioural Testing

45 images / category

n=18

<u>Exp 1</u>
guess what this is?

<u>Exp 2</u>
animal? object? big? small?

small-animal   big-animal   big-object   small-object

animate / inanimate   small / big

Unrecognizable, but with some animacy/size information preserved

Variations

Point of Fixation

center   side   outer periphery

Scaling factor

s=0.3   s=0.5   s=0.7
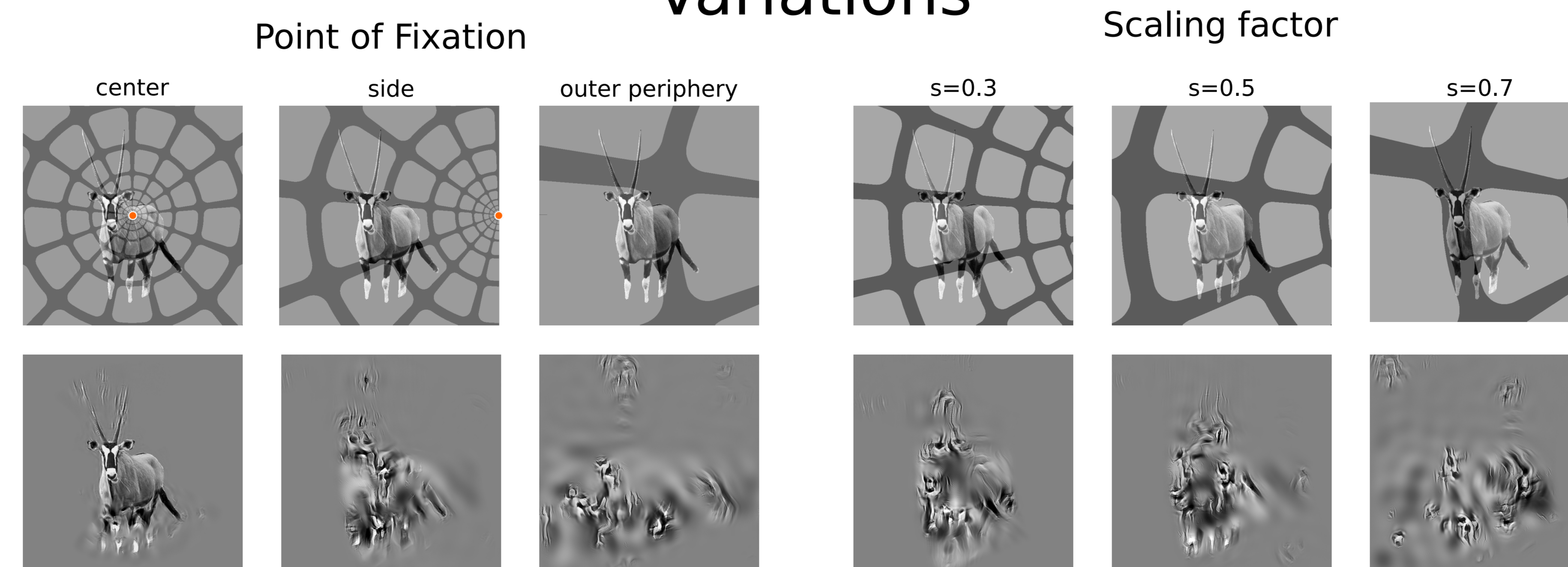
Potential for parameterizing texforms

Distortlets

Method:

Image   Noise   VGG-Net Encoder   Peripheral Architecture $\mathbf{C}_i$ $1-\alpha$ Meta VGG-Net Decoder   Metamer

$\mathcal{S}(\mathbf{N}_i) \uparrow \alpha$ $\mathbf{T}_i$ $\mathbf{N}_i$ AdaIN   For every i-th Pooling Region

Deza et al. (2019)

1 second, 640x640 px
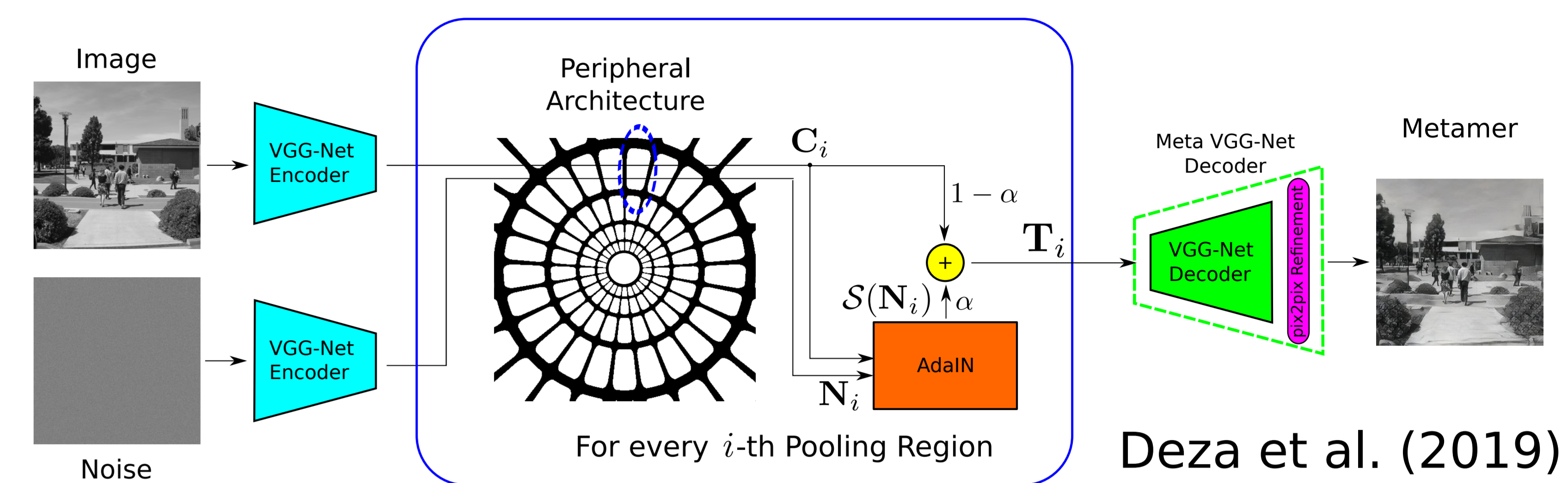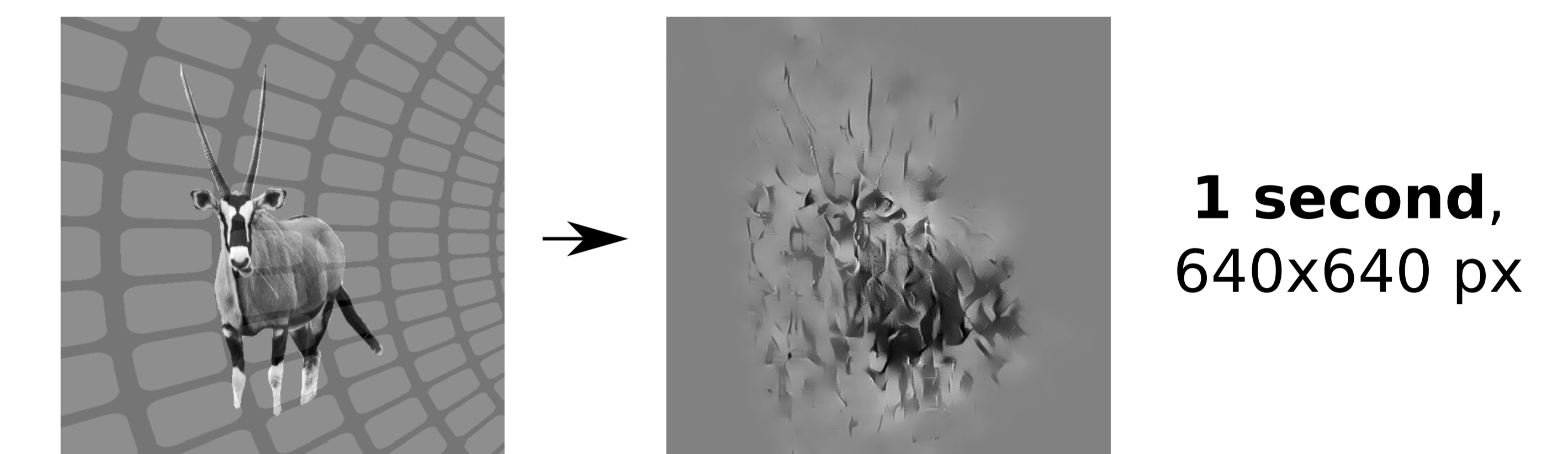
Distort image through foveated style transfer

Examples:

Behavioural Testing

small-animal   big-animal   big-object   small-object
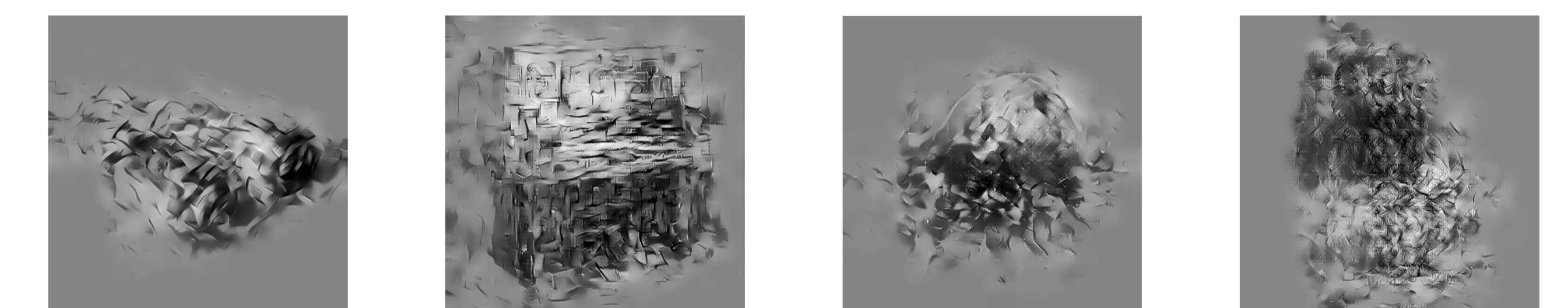
animate / inanimate   small / big
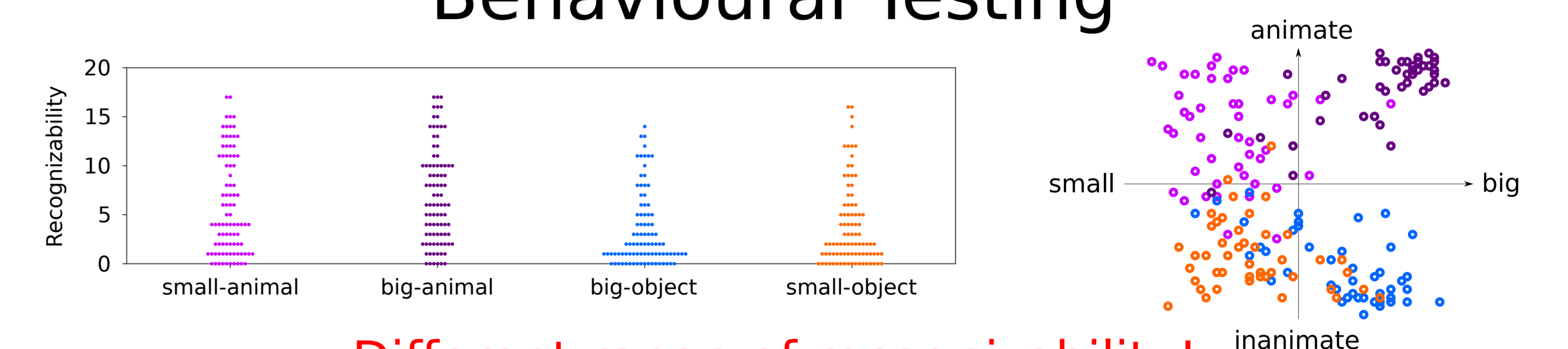
Different range of recognizability!

Conclusions

Fast Texforms: We present an accelerated and equivalent model of texform generation that increases resolution and decreases rendering time
Code: https://github.com/ArturoDeza/Fast-Texforms

Distortlets: We present an alternative way to distort images in the direction of their texture representation and call these images Distortlets
Code: https://github.com/ArturoDeza/NeuroFovea