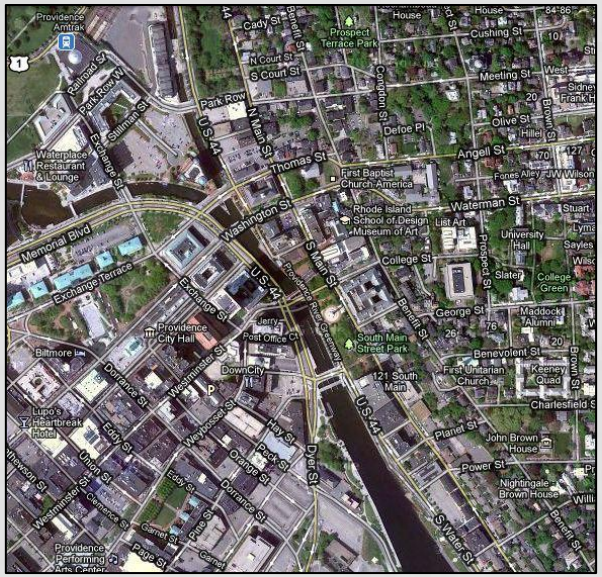
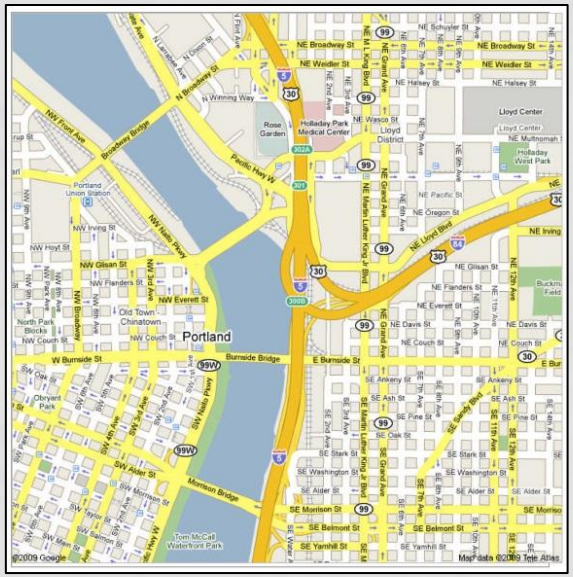
# ICE:
# INFINITE CANVAS ENGINE

# BACKGROUND

- Two common representations in computer graphics include **images** (pixels) and **SVG** (Structured Vector Graphics)



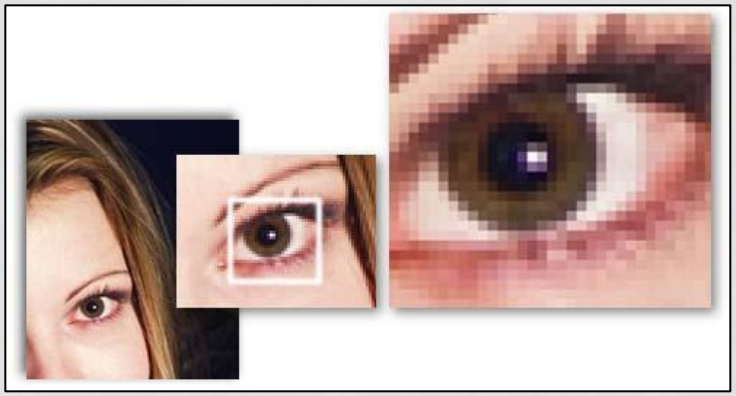

**Image**



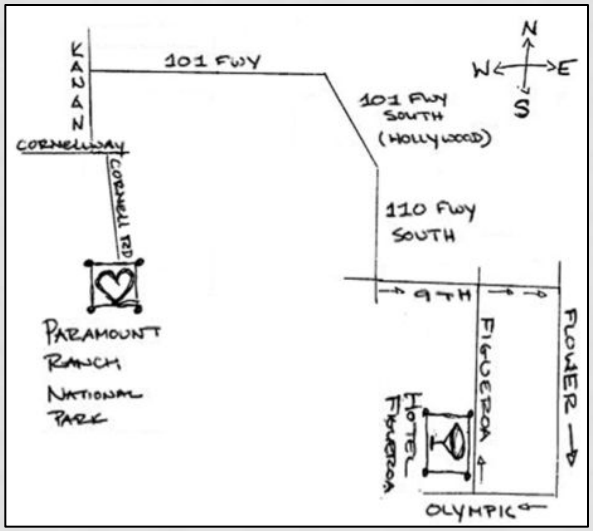

**SVG**

# BACKGROUND

- Images provide rich texture and detail but don't scale without pixelation artifacts and require considerable space



- They also provide no level of abstraction which can help when trying to convey various forms of information or when trying to edit a particular element




**Abstraction yields clarity**

# BACKGROUND

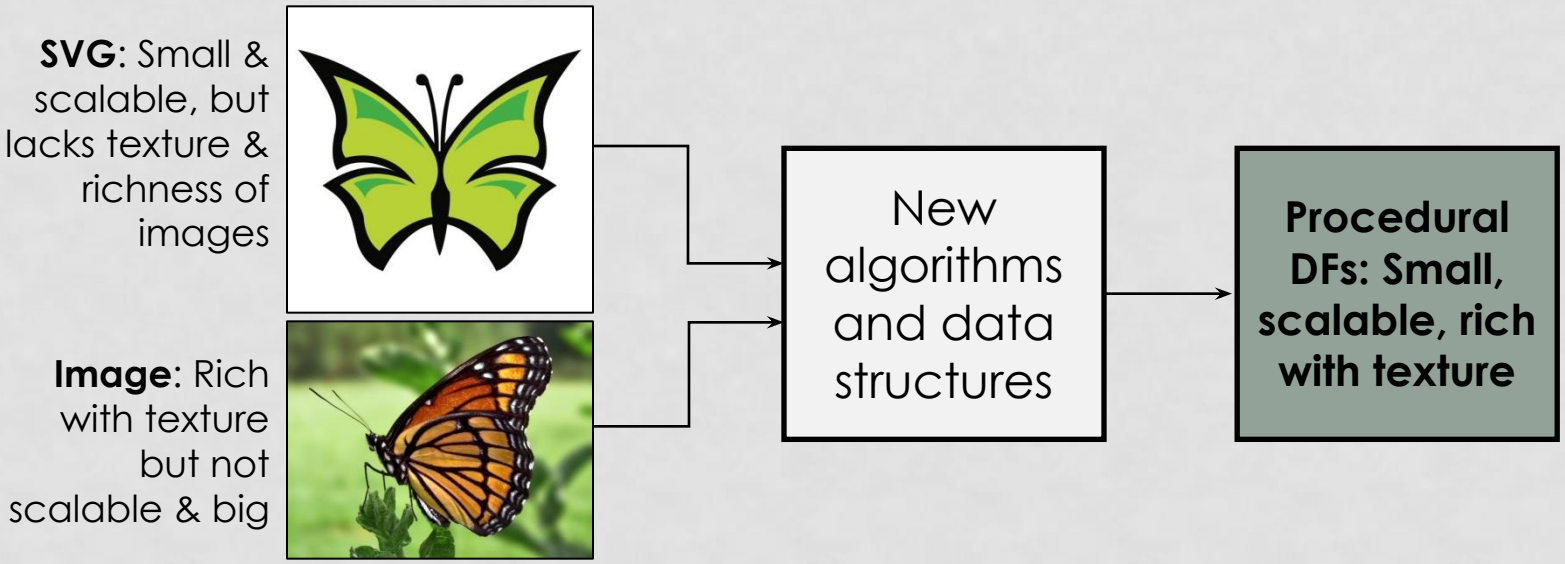
- SVG is compact and can be scaled to any size without loss of quality but lacks the texture and richness of images

**SVG**: Small & scalable, but lacks texture & richness of images

**Image**: Rich with texture but not scalable and big

# THE NEXT FRONTIER

- What's needed is a representation that provides the richness of pixels with the scalability and size of SVG
- A new form of **procedural distance fields** (DFs) provide such a representation

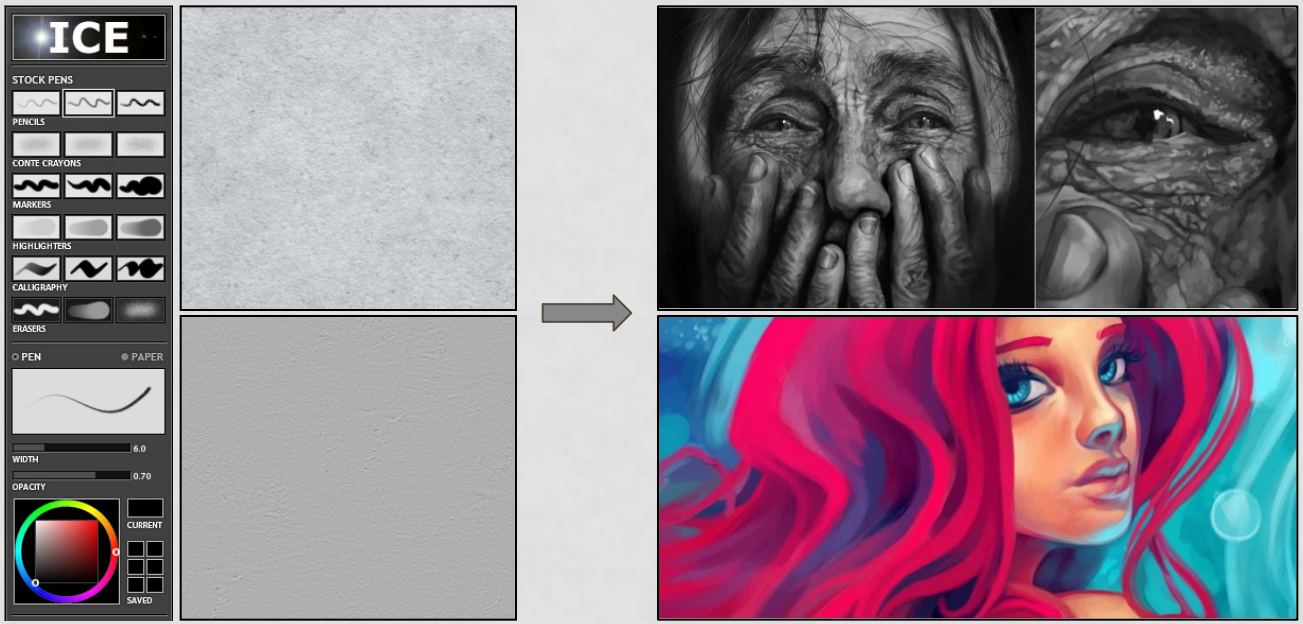


# PROCEDURAL DFS

- Procedural detail directed distance fields are used to represent geometry such as variable width strokes and solid regions
- The distance fields are either explicitly represented in a data structure or defined implicitly and generated on demand when required
- The distance fields are supplied as input, along with other parameters, to a procedural component which adds texture and color and modulates geometry
- The procedural component provides rich texture and detail with **infinite scalability**

# PROCEDURAL DFS

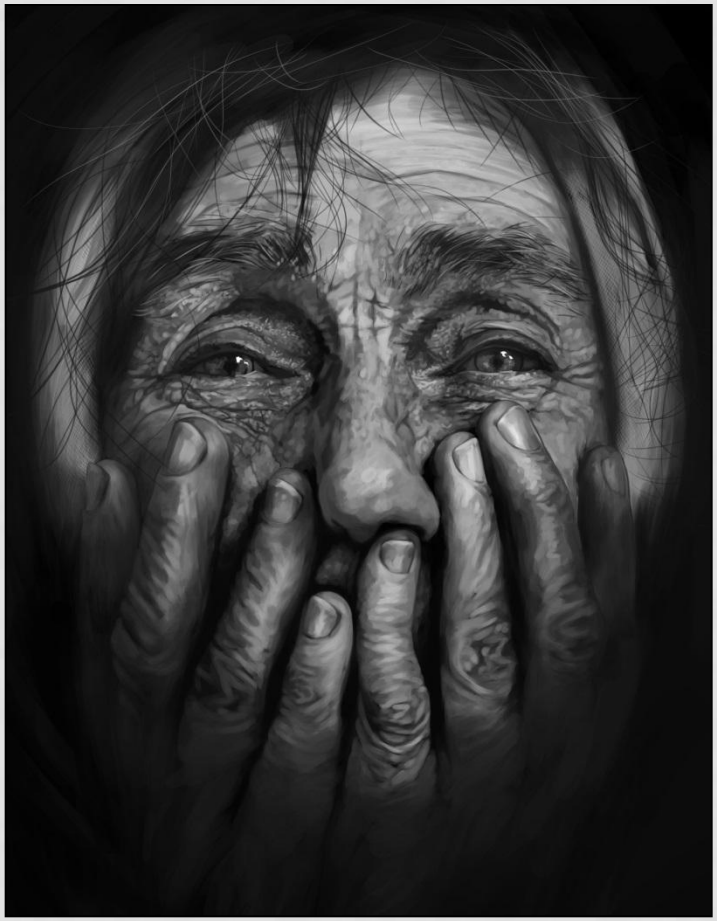
- A small set of primitive procedural DFs (i.e., a set of basis functions) can be combined to produce a very broad range of appearance styles




Primitive Procedural DFs

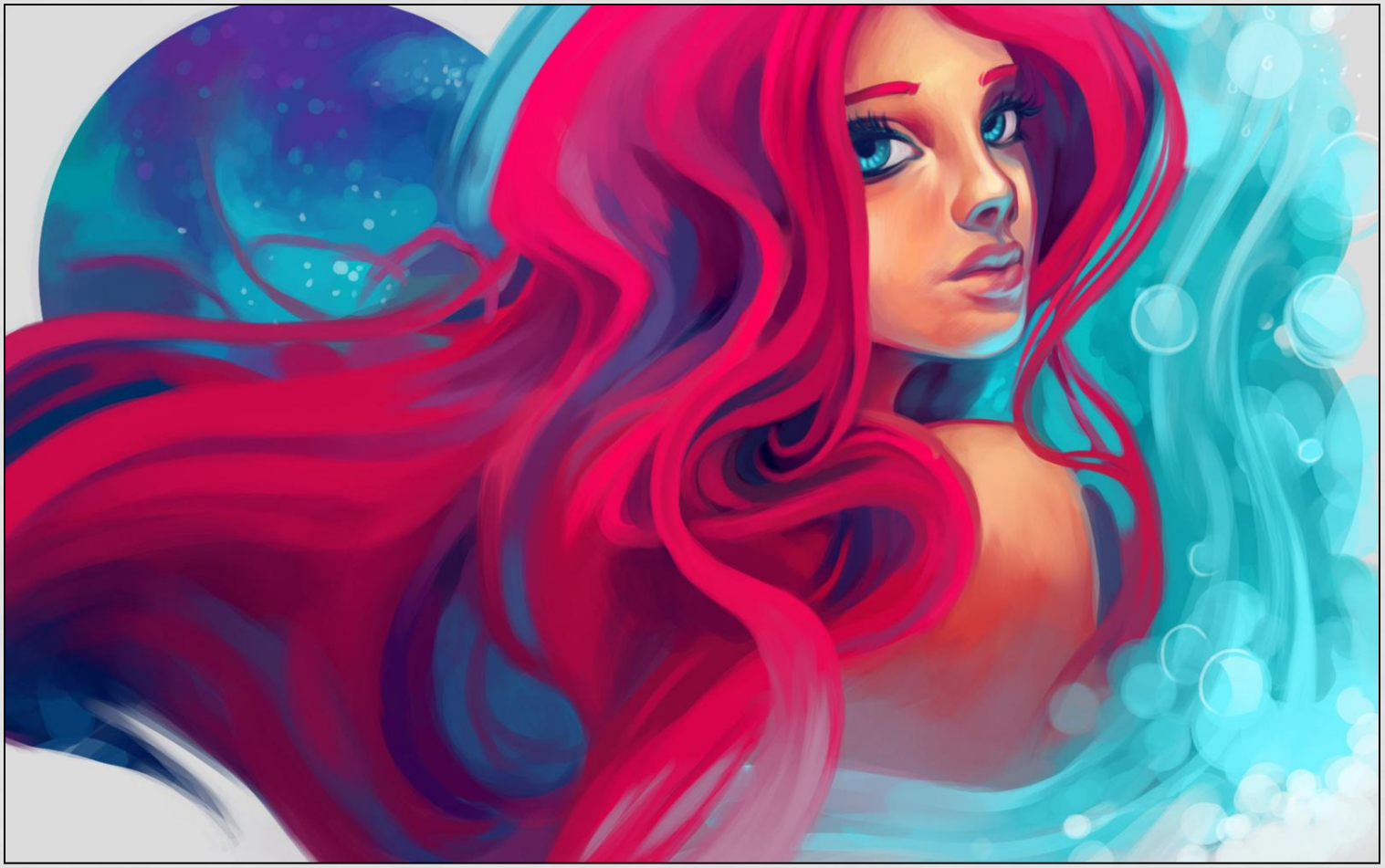
Broad Range of Styles

# PROCEDURAL DFS: EXAMPLES



Procedural DFs: Small, scalable, rich textures, broad range of styles

# PROCEDURAL DFS: EXAMPLES



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# PROCEDURAL DFS: EXAMPLES

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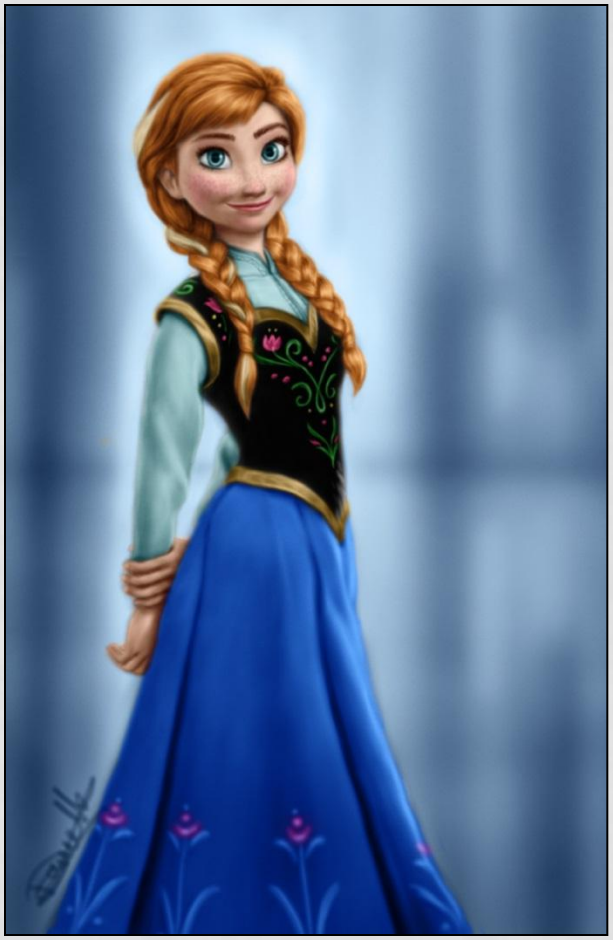

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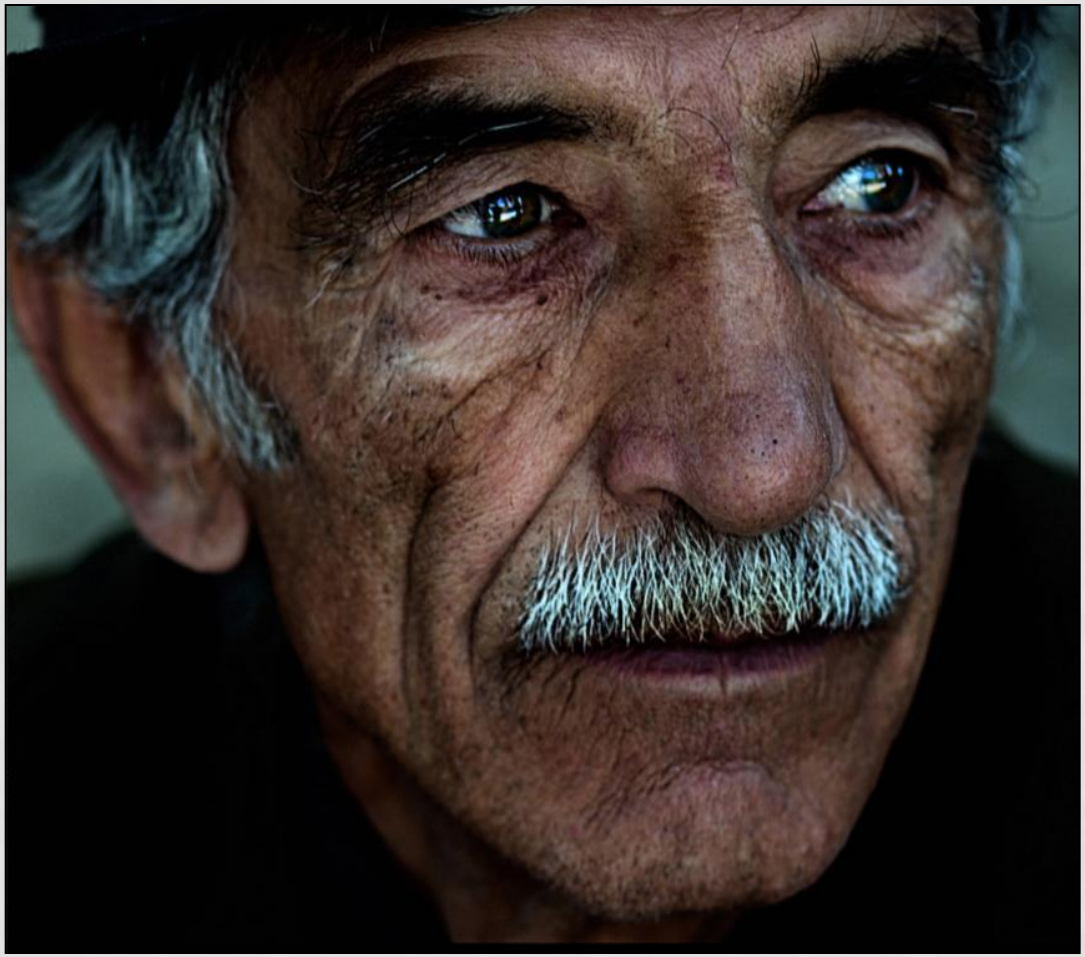
# PROCEDURAL DFS: EXAMPLES


Procedural DFs: Small, scalable, rich textures, broad range of styles

# PROCEDURAL DFS: EXAMPLES



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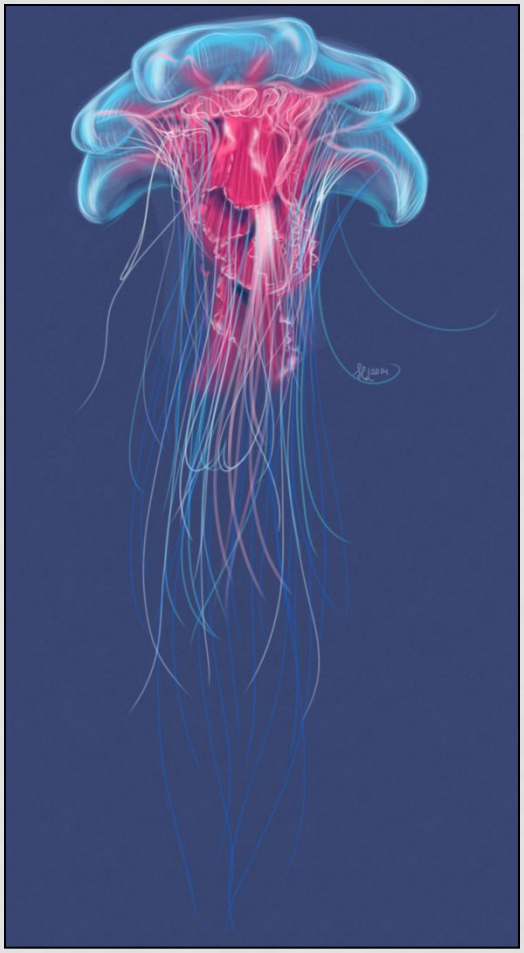
# PROCEDURAL DFS: EXAMPLES



Procedural DFs: Small, scalable, rich textures, broad range of styles

# PROCEDURAL DFS: EXAMPLES

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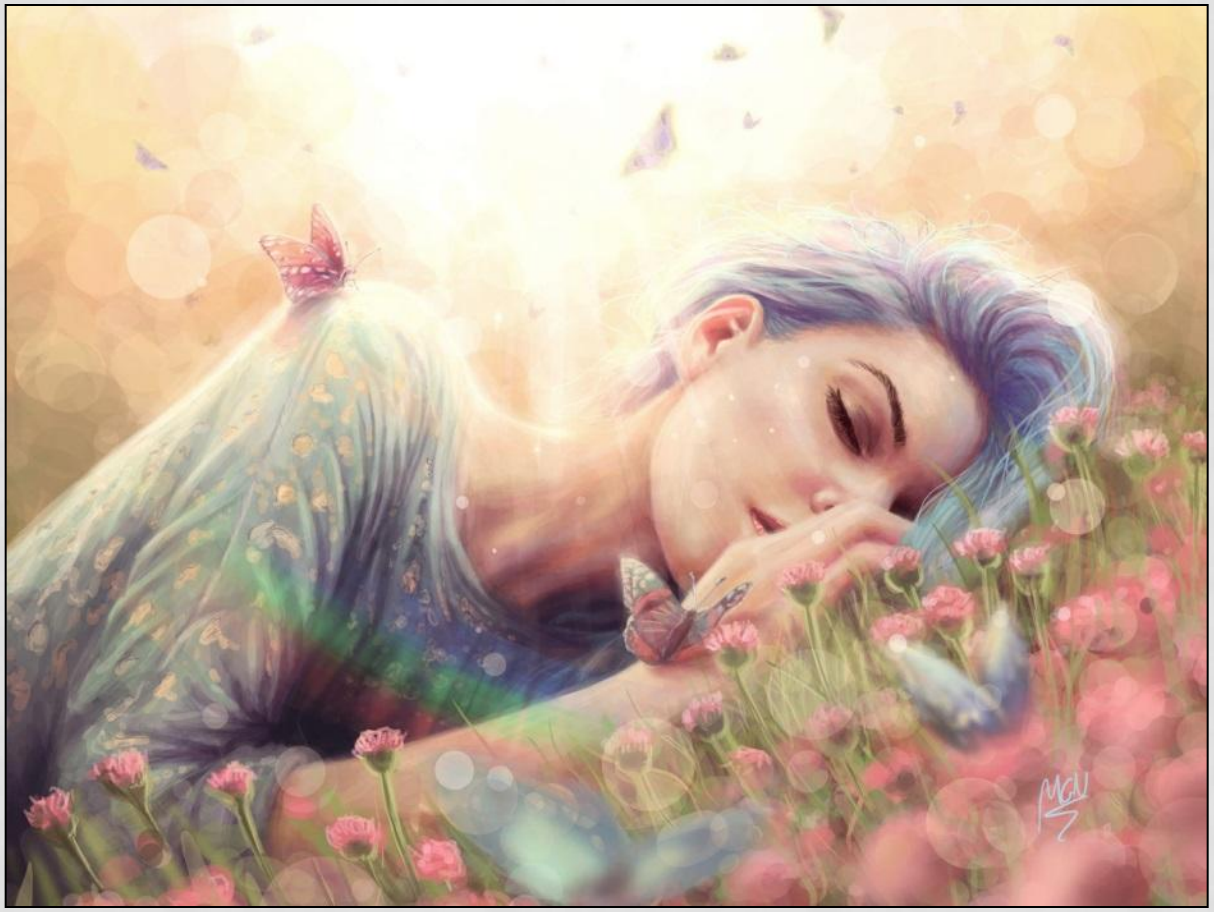

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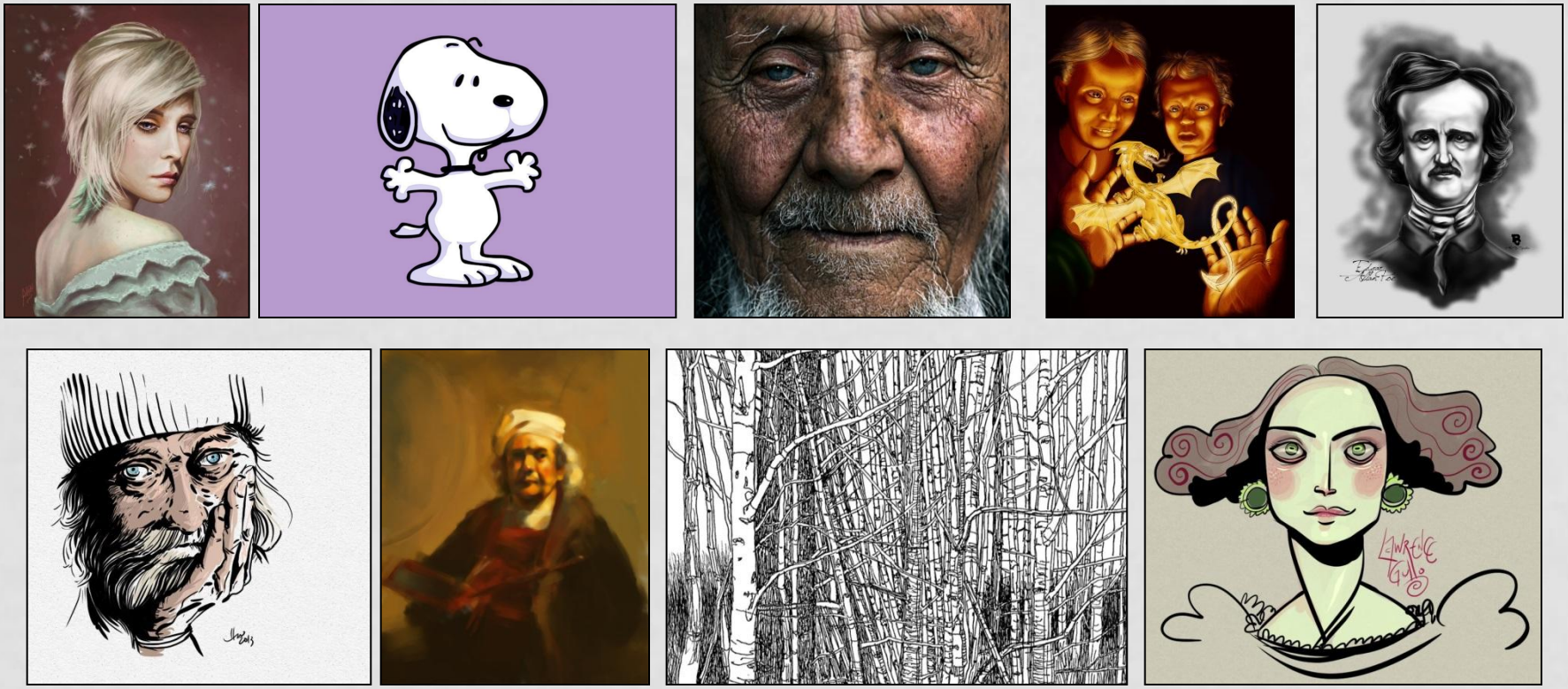
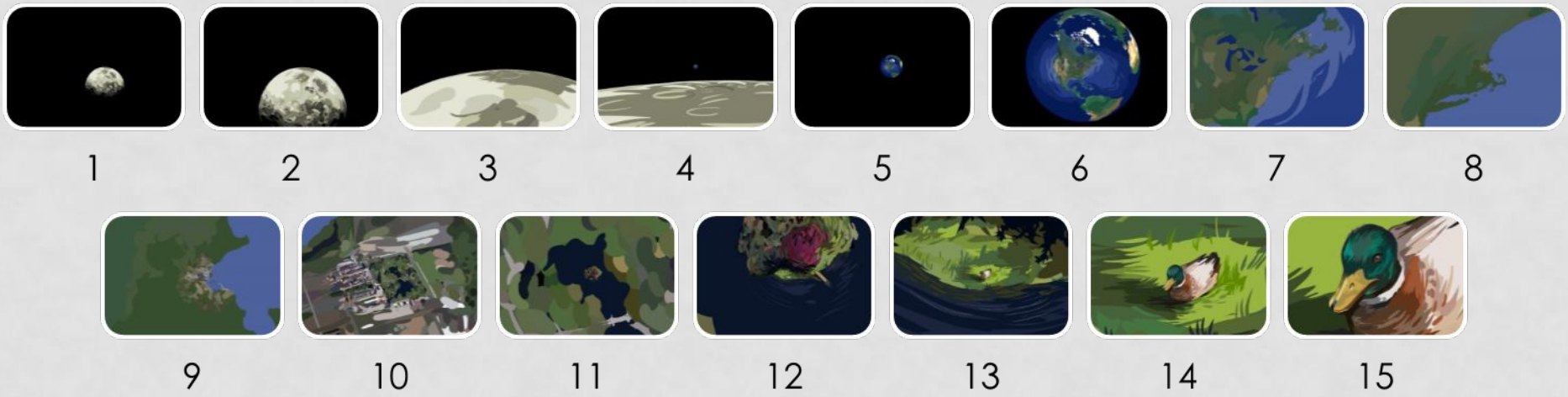


Procedural DFs: Small, scalable, rich textures, broad range of styles

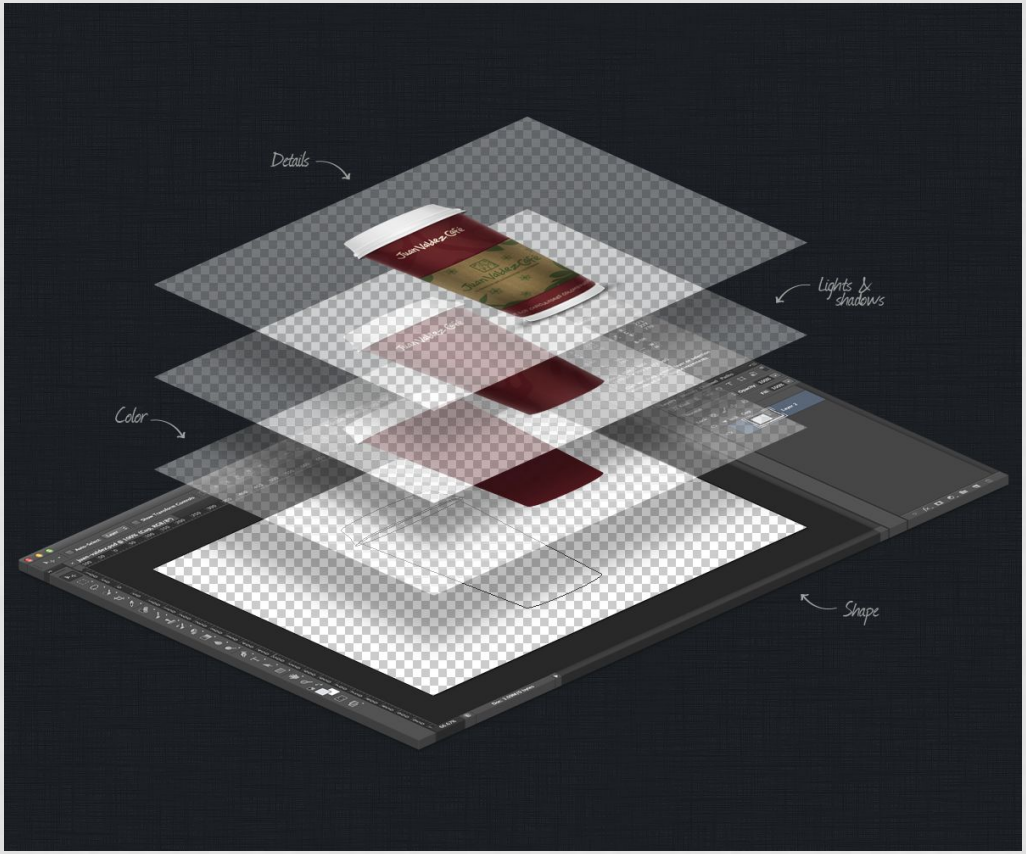
# SEAMLESS INFINITE ZOOM

- Procedural DFs enable a 50 trillion to 1 dynamic zoom range
- Scaling is artifact free and seamless with no fades and other video tricks used to avoid popping



# LAYERS

- Procedural DFs support layering, an essential tool for deconstructing a target image into its parts
- All forms of image creation benefit from this technique



# SUMMARY OF ADVANTAGES

- Richness of pixels with the scalability and size of SVG
- Seamless infinite zoom
- Easily supports layers
- Fast by exploiting the massive parallelism inherent in GPUs
- Proven high quality rendering
- Amenable to stylization for different looks and levels of abstraction