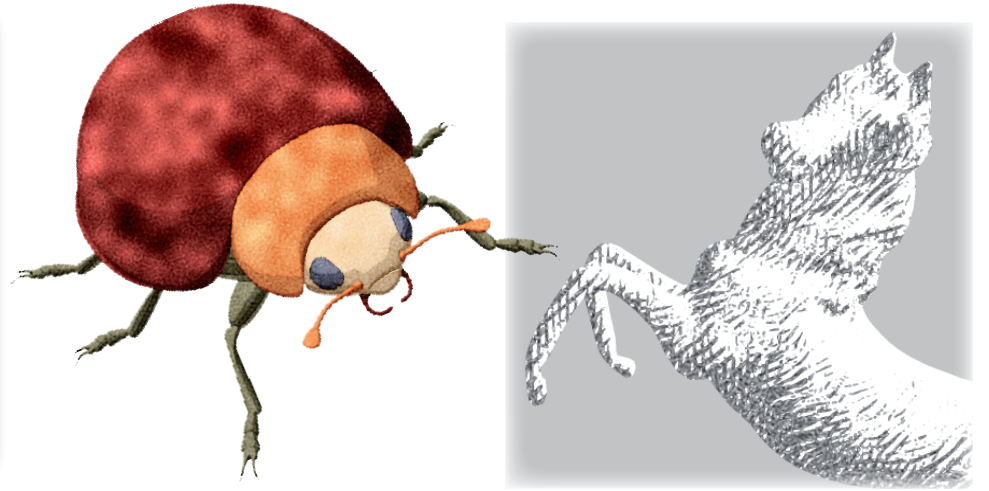


## Goals

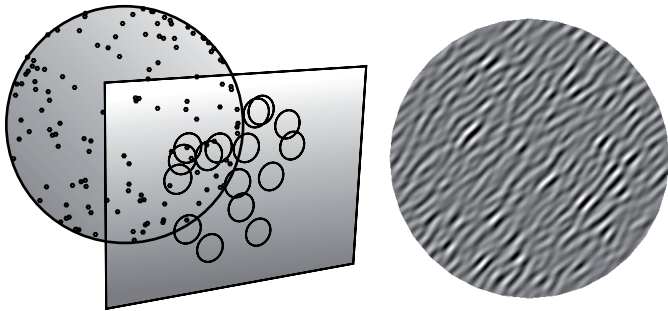
To achieve successful **temporal coherent stylization** of 3D animations in NPR, three constraints must be fulfilled:

- **Flatness:** 2D impression of the style,
- **Coherent motion:** high correlation between the 3D motion field and the motion of the pattern,
- **Temporal continuity:** minimal changes from frame to frame.

These goals are conflicting: temporal coherence may only be achieved through a **compromise**.



## noise generation scheme



## NPR Gabor Noise

Generalizing [KC05,BKTS07], our key insight is that blending a **large number of primitives** reduces popping and creates a continuous texture similar to **sparse convolution noises**. We extend Gabor noise [LLDD09] to obtain a noise satisfying our constraints:

- the noise and its parameters are defined and evaluated in screen space,
- the noise kernels are attached to a distribution of points defined on the surface,
- a **LOD mechanism** ensures continuous and constant density of points in 2D.

Our blending scheme preserves the **statistical properties** of the noise and guarantees a **smooth behavior** throughout time.

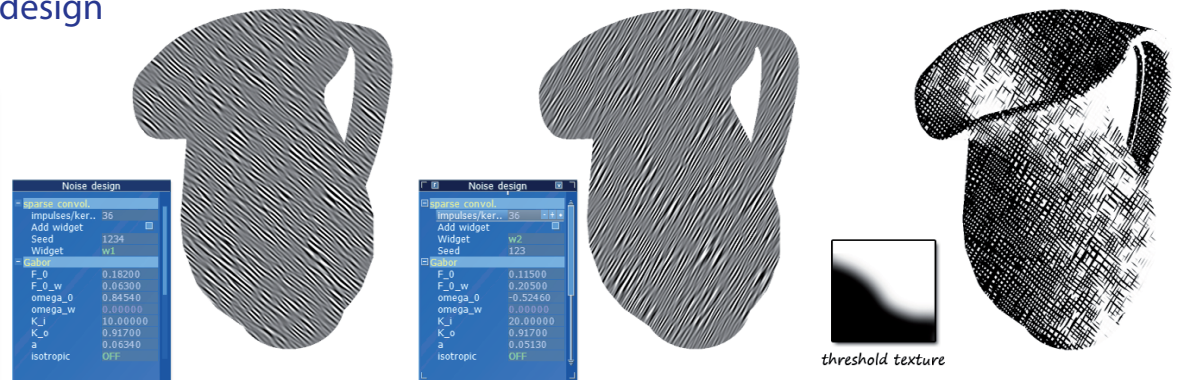
## Styles Design

We use standard techniques from procedural texturing and modeling to create a wide range of styles:

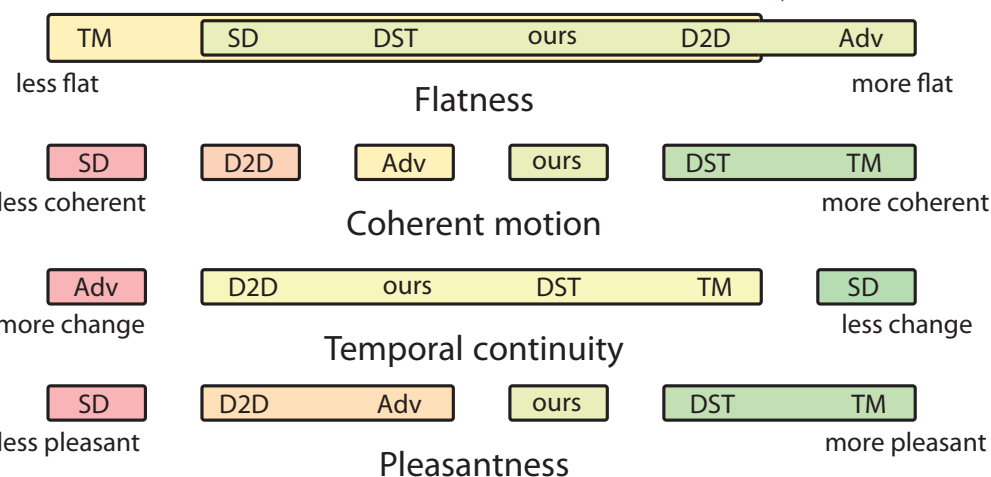
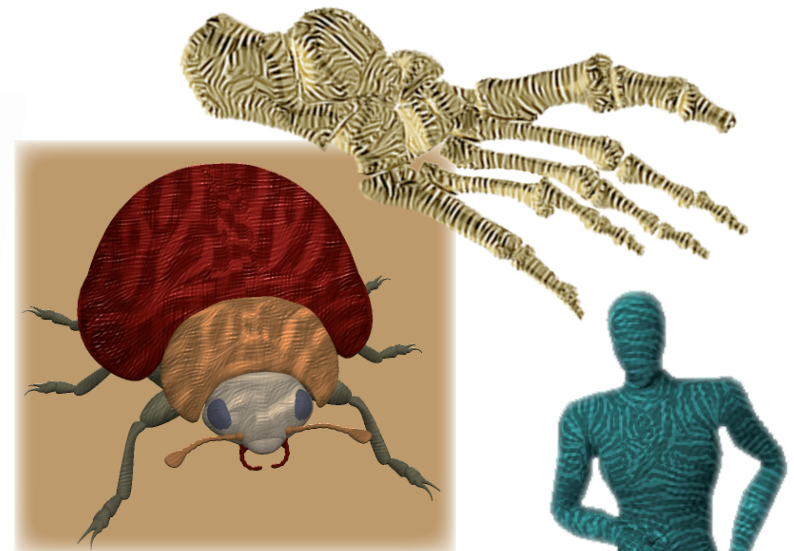
- **Thresholding** to obtain binary styles,
- **Compositing** of noise layers with the scene color,
- **Local control:**
  - curvature can guide the noise orientation,
  - shading can modify the noise frequency.

Our GPU splatting implementation provides the user with **interactive feedback**.

## cross-hatching design



← complex stimuli  
associated results



## User Study

We **perceptually evaluate** the success of six approaches with the following setup:

- **Ranking tasks** for each criteria,
- 2 test scenes: a simple and a complex one,
- 15 naïve subjects.

The results show that **motion coherence** is the most important quality to preserve in the overall compromise, and that our new solution provides a satisfactory trade-off.

## References:

- [BKTS07] Bousseau A., Kaplan M., Thollot J., Sillion F.: *Interactive watercolor rendering with temporal coherence and abstraction*. In NPR (2006)  
 [KC05] Kaplan M., Cohen E.: *A generative model for dynamic canvas motion*. In CAe (2005)  
 [LLDD09] Lagae A., Lefebvre S., Drettakis G., Dutré P.: *Procedural noise using sparse Gabor convolution*. ACM Trans. Graphics 28, 3 (2009)