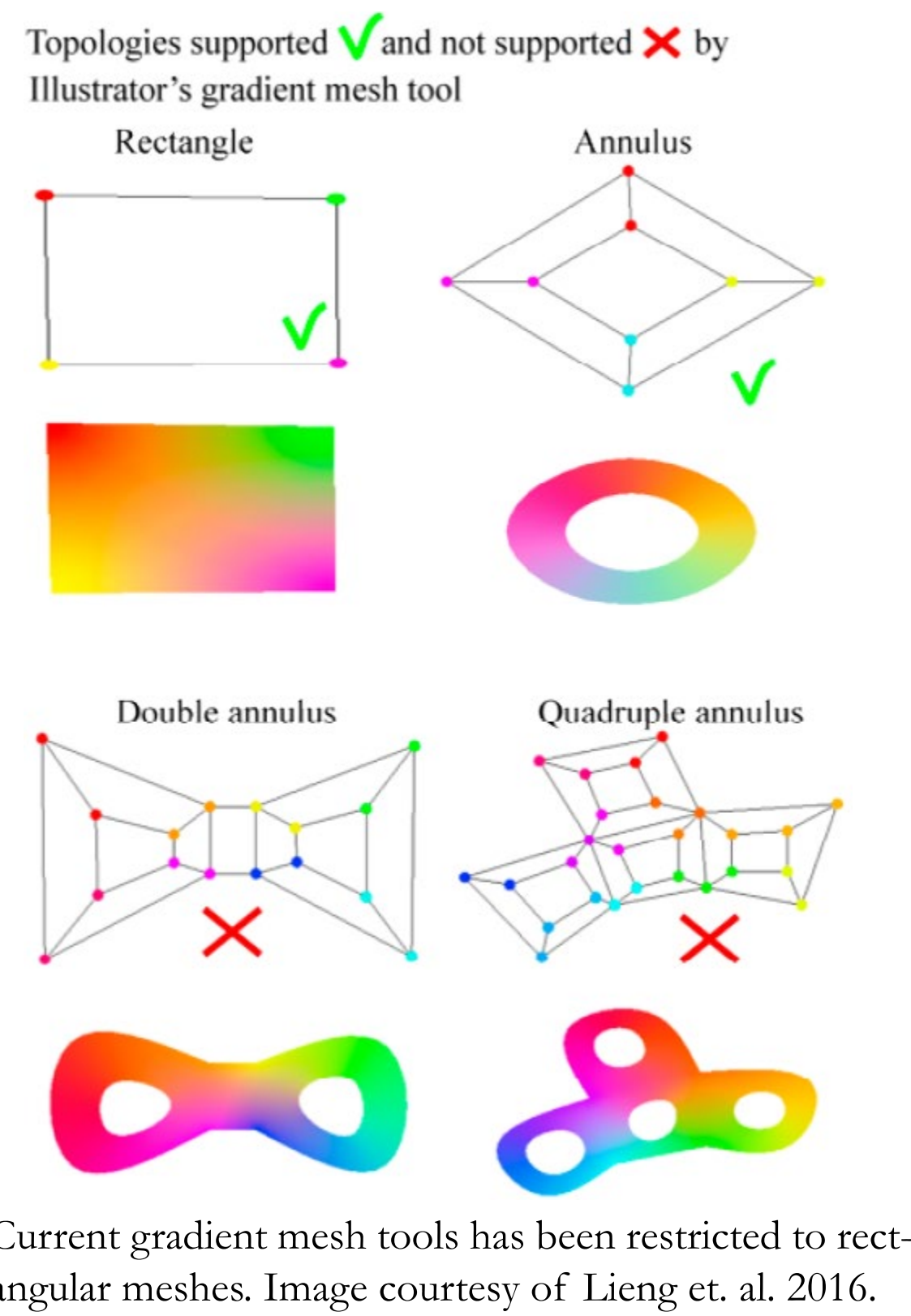


# A Gradient Mesh Tool for Non-Rectangular Gradient Meshes

John Kasper Svergja, Henrik Lieng



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## Problem description

In vector graphics design, the restrictions of the linear gradient tool is one reason designers turn to pixel-based tools when the design turns complicated. This issue has been acknowledged and a wide range of different approaches have been proposed to make design of colour gradients more effortless [Orzan et. al. 2008; Shao et. al. 2012; Vergne et. al. 2012; Lopez-Moreno et. al. 2013].

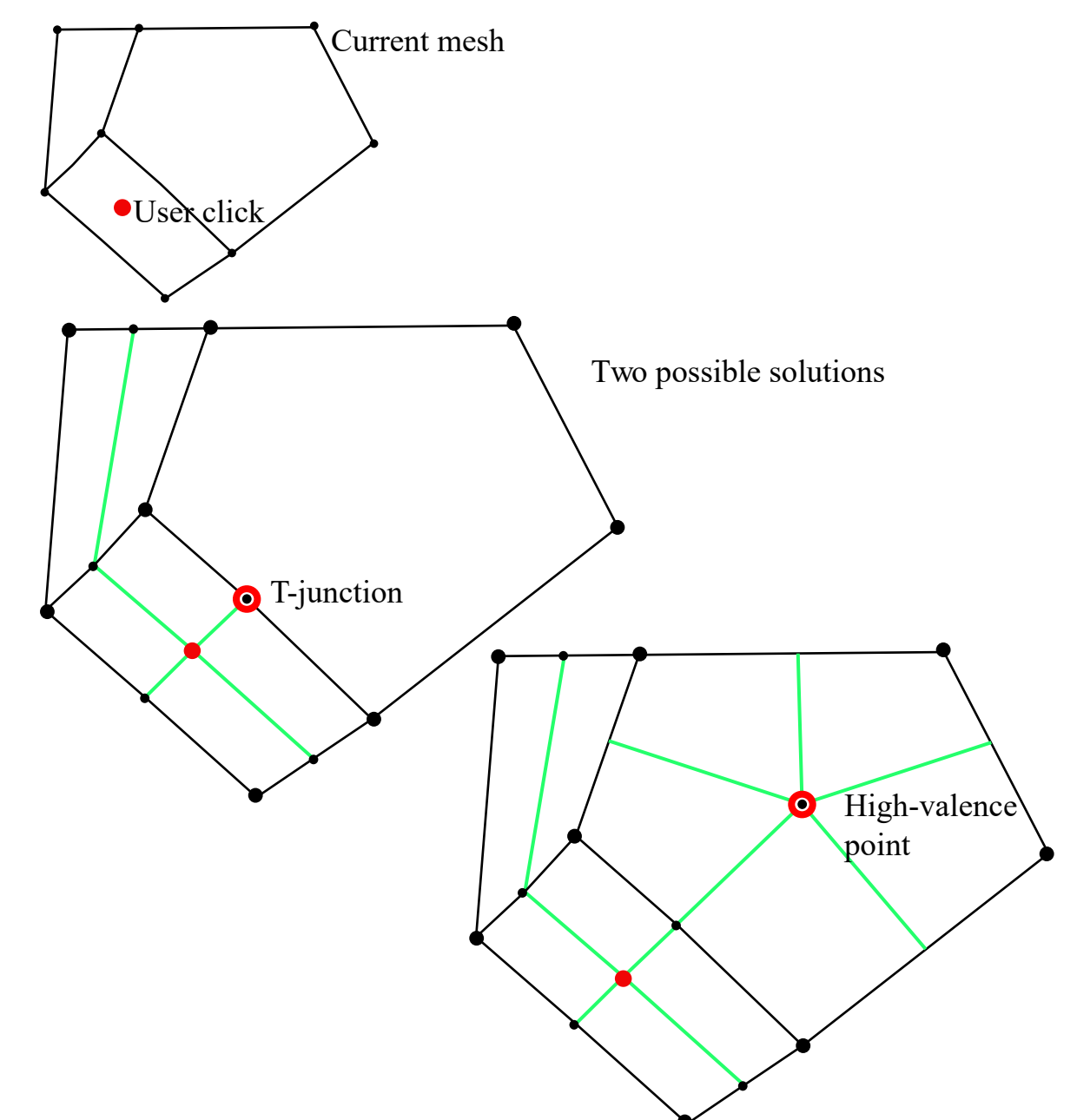
The gradient mesh tool, found in graphics packages like Adobe Illustrator and Corel CorelDRAW, is useful in scenarios where the linear gradient tool does not suffice. However, the mesh which the user interacts with must be of rectangular topology. Our problem is creating a interaction tool with support for arbitrary topology.

In previous gradient mesh tools, there are two approaches to mesh creation. The first option creates a gradient mesh with a given number of rows and columns, restricting the representation to a grid-based structure.

The second is a point-and-click interface where the user clicks on a location inside the shape and a new control point is created at this location. The interaction produces a global alteration: when a control point is added, a new row and column is added to the entire mesh. It is therefore challenging to achieve local gradient edits.

The figure (right) illustrates a point-and-click interaction inside a polygon adjacent to a pentagon. The effect of such an interaction is ambiguous and any solution would be ad-hoc.

In this poster, we present a new gradient mesh tool that supports non-rectangular gradient meshes, with native support for a wide range of different shapes. Our approach takes advantage of a recent gradient mesh interpolation technique that supports arbitrary mesh topology [Lieng et al. 2016].



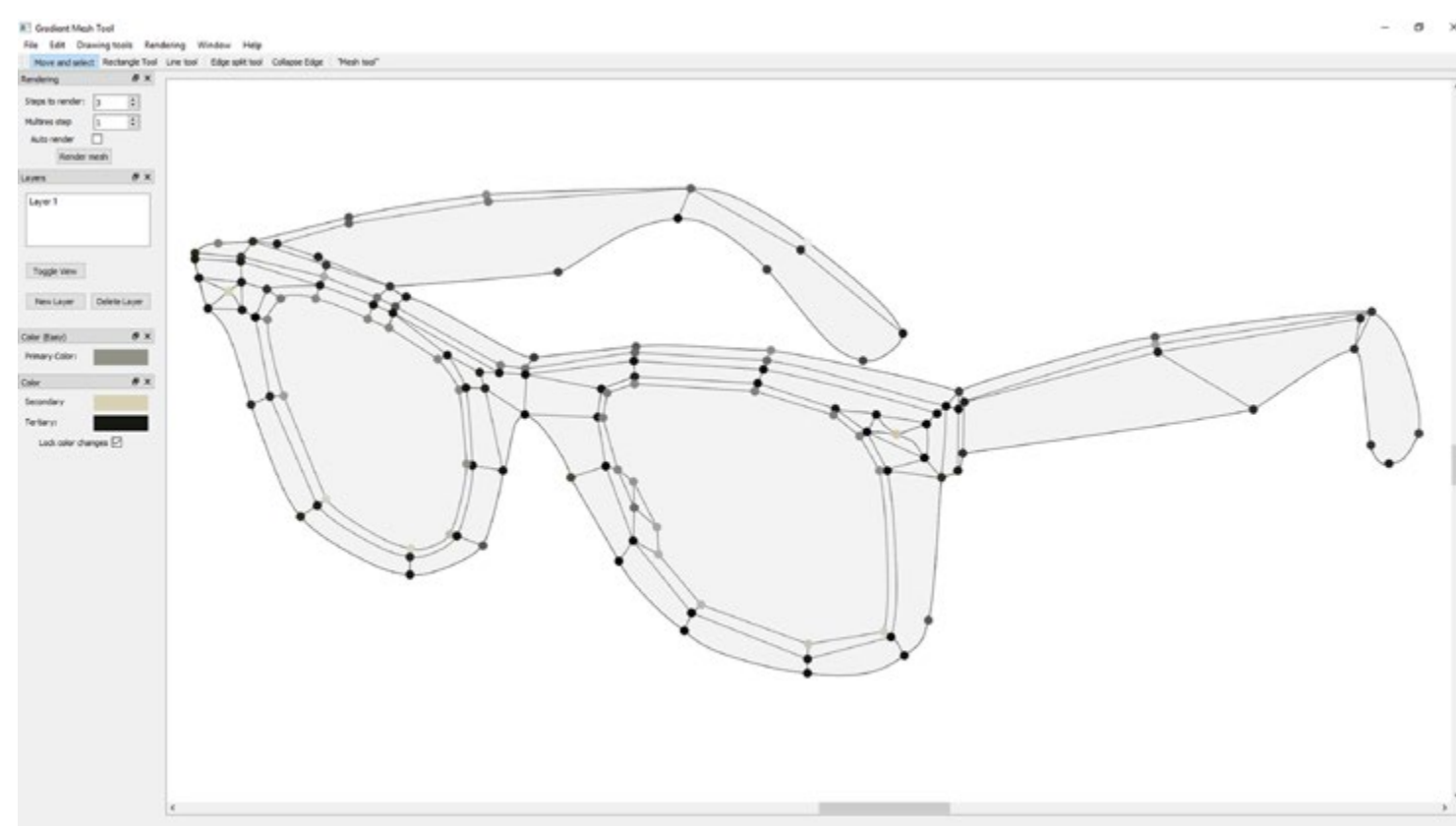
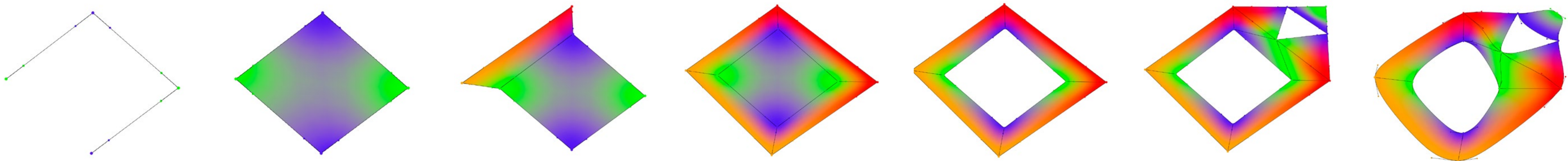
A new control point is inserted at the location of the user click (red point). New edges are inserted from this point (green edges). Two possible solutions are shown; both options give rise to mesh of poor quality.

## A new gradient mesh tool

Our approach takes inspiration from the pen tool found in SketchUp. To add a face, the user selects an existing control point and places new ones on the canvas. The face is closed by clicking on an existing control point. The mesh is expanded by iteratively adding faces to it.

Our tool provides several operations, such as edge split and face deletion. Faces of arbitrary topology is supported. Adjacent edges can be collapsed for mesh simplification and faces can be removed to introduce holes.

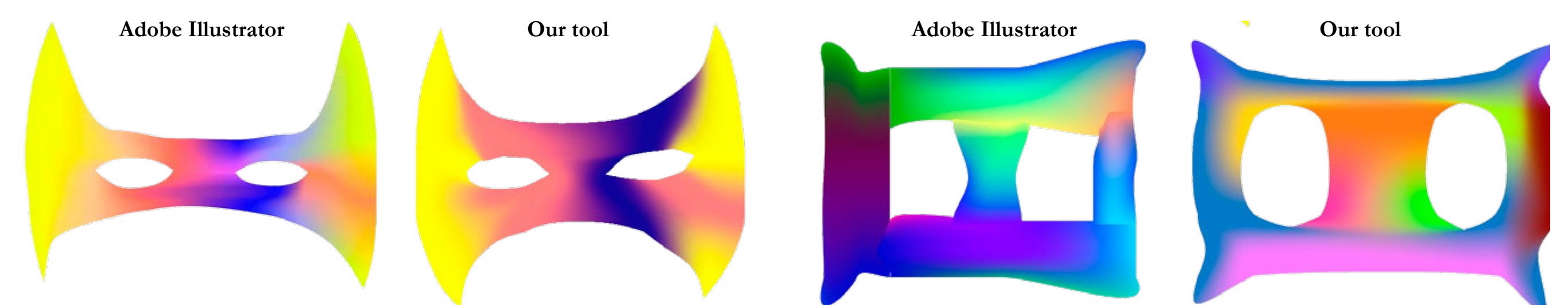
Sequence of edits



## User study

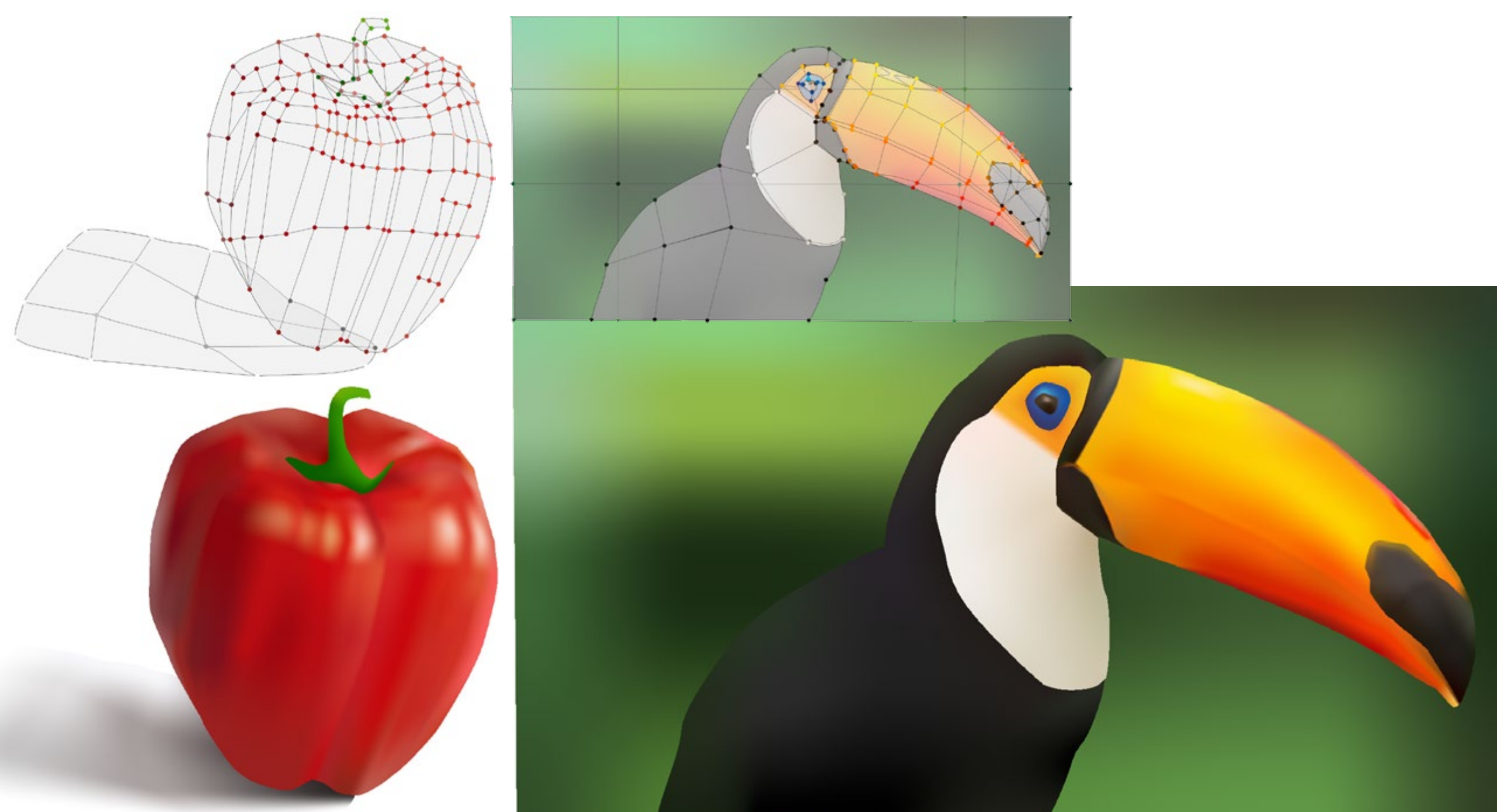
We performed an informal user study where five subjects were tested: two professional designers and three art students. The subjects were given two task, each completed with our tool and with Adobe Illustrator's gradient mesh tool.

For the non-regular mesh, users preferred our tool over Illustrator's. The subjects praised our tool for enabling face-specific manipulation capabilities such as face deletion.



Subject 3. Time consumption in Adobe Illustrator was approx. 20 minutes, against 8 minutes in our application.

Subject 4. The subject gave up for Illustrator due to problems with color selection across multiple layers.



## Future work

Though our gradient mesh tool offers opportunities to work with non-rectangular gradient meshes, it is not a full experience graphical design software application. In the future, we aim to rewrite our tool as a plug-in for Adobe Illustrator. This presents several issues, as the underlying mesh representation in Illustrator differs from ours. One approach can be to incorporate Pixar's OpenSubdiv library with Illustrator's SDK.

## References

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Code available at: <https://github.com/johnksv/GradientMeshImproved>  
Additional data from the user study can also be found in the repository.