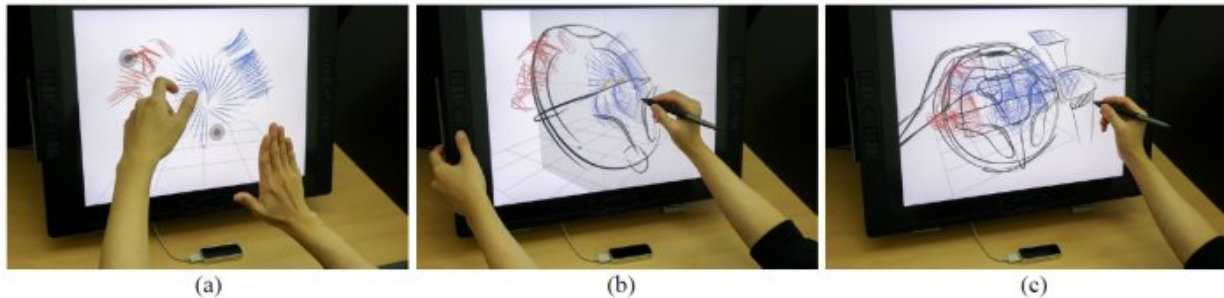


3-D sketching with air scaffolding

July 26 2018



In the agile 3D sketching workflow with air scaffolding, the user (a) makes unconstrained hand movements in the air to quickly generate rough shapes to be used as scaffolds, (b) uses the scaffolds as references and draws finer details with them, (c) produces a high-fidelity 3D concept sketch of a steering wheel in an iterative and progressive manner. Credit: KAIST

People often use their hands when describing an object, while pens are great tools for describing objects in detail. Taking this idea, a KAIST team introduced a new 3-D sketching workflow, combining the strengths of hand and pen input. This technique will ease the way for ideation in three dimensions, leading to efficient product design in terms of time and cost.

For a [designer](#)'s drawing to become a product in reality, it has to be transformed from a designer's 2-D drawing into a 3-D shape; however, it is difficult to infer accurate 3-D shapes that match the original intention from an inaccurate 2-D drawing made by hand. When creating a 3-D

shape from a planar 2-D drawing, unobtainable information is required. On the other hand, loss of depth information occurs when a 3-D shape is expressed as a 2-D drawing using perspective drawing techniques.

To fill in these missing links during the conversion, 3-D sketching techniques are under development. They would help designers naturally provide missing 3-D shape information in a 2-D drawing. For example, if a designer draws two symmetric curves from a single point of view or draws the same curves from different points of view, the geometric clues that are left in this process are collected and mathematically interpreted to define the proper 3-D curve. As a result, designers can use 3-D sketching to directly draw a 3-D shape as if using pen and paper.

Among 3-D sketching tools, sketching with [hand motions](#) in VR environments has drawn attention because it is easy and quick. But the biggest limitation is the design cannot be articulated solely via rough hand motions, and are thus difficult to apply to product designs. Moreover, users may feel tired after raising their hands in the air during the entire drawing process.

Professor Seok-Hyung Bae and his team from the Department of Industrial Design integrated hand motions and pen-based sketching, allocating roles according to their strengths. This new technique is called Agile 3-D Sketching with Air Scaffolding. Designers use their hand motions in the air to create rough 3-D shapes which will be used as scaffolds, and then they can add details with pen-based 3-D sketching on a tablet.

The team came up with an algorithm to identify descriptive hand motions from transitory hand motions and extract only the intended shapes from unconstrained hand motions based on air scaffolds from the identified motions. Through user tests, the team determined that this technique is easy to learn and use, and demonstrates good applicability.

Most importantly, the users can reduce time, yet enhance the accuracy of defining the proportion and scale of products.

Eventually, this tool will be applicable in various fields, including the automobile industry, appliance manufacturing, the film industry and robotics. It also can be linked to smart production technology such as 3-D printing to make manufacturing process faster and more flexible.

Ph.D. candidate Yongkwan Kim, who led the research project, said, "I believe the system will enhance product quality and work efficiency because designers can express their 3-D ideas quickly yet accurately without using complex 3-D CAD modeling software. I will make it into product that every designer wants to use in various fields."

"There have been many attempts to encourage creative activities in various fields by using advanced computer technology. Based on in-depth understanding of designers, we will take the lead in innovating the design process by applying cutting-edge technology," Professor Bae added.

Professor Bae and his team from the Department of Industrial Design has been developing better 3-D sketching tools. They started with a 3-D curve sketching system for professional designers called ILoveSketch and moved on to SketchingWithHands for designing a handheld product with first-person hand gestures captured by a hand-tracking sensor. They then took their project to the next level and introduced Agile 3-D Sketching with Air Scaffolding, a new 3-D sketching workflow combining [hand motion](#) and pen drawing, which was chosen as one of the CHI (Conference on Human Factors in Computing Systems) 2018 Best Papers by the Association for Computing Machinery.

More information: Yongkwan Kim et al, Agile 3D Sketching with Air Scaffolding, *Proceedings of the 2018 CHI Conference on Human Factors*

in Computing Systems - CHI '18 (2018). [DOI: 10.1145/3173574.3173812](https://doi.org/10.1145/3173574.3173812)

Provided by The Korea Advanced Institute of Science and Technology
(KAIST)

Citation: 3-D sketching with air scaffolding (2018, July 26) retrieved 24 April 2024 from
<https://phys.org/news/2018-07-d-air-scaffolding.html>

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.