



# An Interactive Showcase of RCSketch: Sketch, Build, and Control Your Dream Vehicles

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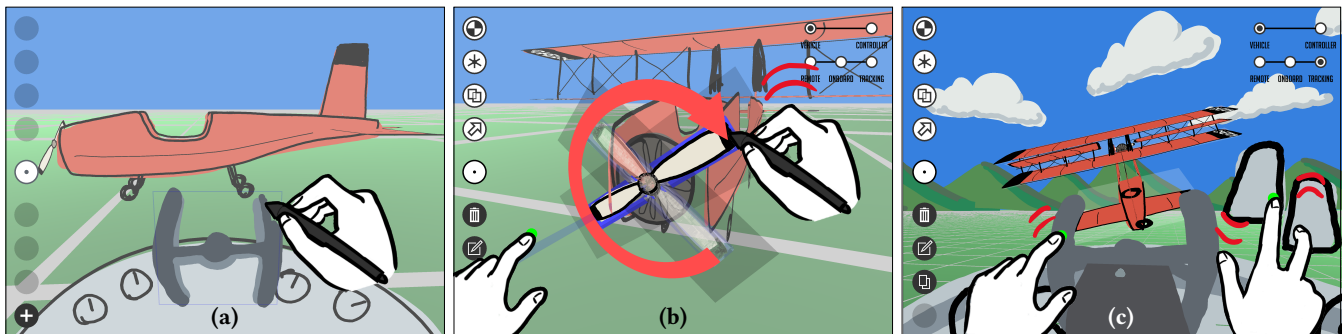


Figure 1: RCSketch is a system that enables children to design their own vehicles and controllers with which they can operate the vehicles. For example, children can (a) *sketch*: create a 3D airplane and a controller by drawing and grouping sketch cards; (b) *build*: define each group's movement, such as rotation of the propeller; and (c) *control*: use multi-touch to manipulate the controller and fly the airplane as if operating a remote control (RC) toy.

## ABSTRACT

We present RCSketch, the award-winning interactive system that lets anyone sketch their dream vehicles in 3D, build moving structures of those vehicles, and control them from multiple viewpoints. Visitors to this interactive showcase are able to use our system and design vehicles of their own and perform a wide variety of realistic movements across the vast digital landscape onboard their vehicles.

## KEYWORDS

Vehicle; 3D sketching; motion sketching; multi-touch

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## 1 INTRODUCTION

Science museums and art galleries have many installations in which children's drawings come to life in 3D, with vehicles being a popular subject [Creative 2018; teamLab 2014, 2018]. However, these installations often limit children's imagination because they have to draw on top of given templates of 3D models and can only observe predetermined movements. Our study aims to unleash children's imagination by allowing them to express the 3D shapes of vehicles and control the vehicles as they wish.

To design a system for representing a vehicle's form in 3D quickly and easily, we studied previous research on casual 3D sketching. Dorsey et al. proposed a system in which users arrange planar sketches in 3D space to create 3D concepts [Dorsey et al. 2007]. Bae et al. showed that such a 3D authoring technique can be suitable for students [Bae et al. 2009]. In our system, users create complex 3D forms by combining multiple sketch cards in 3D space.

To design a system for intuitively rigging and controlling vehicles, we referred to previous studies on motion sketching. Lee et al. introduced a novel widget for rigging 3D sketch parts using multi-touch gestures [Lee et al. 2022]. Kazi et al. proposed a system in which users establish causal relations between motions in 2D sketches [Kazi et al. 2014]. In our system, users define 3D motions using sketch card planes and an axes widget, and remotely control vehicles through synchronized motions of sketch cards.

## 2 RCSKETCH

Integrating the above techniques, we propose RCSketch, a pen- and multi-touch-based system to enable users to create their dream vehicles quickly and easily, and manipulate them with custom controllers. To do so, the user follows three stages: *sketch*, *build*, and *control*. (Please watch the accompanying video for detailed interactions.)

### 2.1 Sketch

In the sketch stage, the user creates the 3D forms and structures of a vehicle, and a controller used to move the vehicle (Figure 1a).

*Drawing sketch cards.* The user draws a part of a vehicle or a controller on a digital tablet with a pen. Then, a sketch card, which is either standing up or lying down on the floor, depending on where the camera looks at, is generated from the drawing.

*Arranging sketch cards.* The user copies, resizes, and places sketch cards into a complex 3D arrangement.

*Grouping sketch cards.* The user binds the arranged sketch cards into a group so that they move together as a whole.

### 2.2 Build

In the build stage, the user defines how they can move the vehicle using the controller (Figure 1b).

*Defining a linear motion.* The user selects a card belonging to a group and draws a linear arrow on the card plane.

*Defining a circular motion.* The user selects a card belonging to a group and draws a circular arrow around a selected axis.

*Connecting motions.* The user draws a line connecting the motion arrows to establish a causal relation between the group's motions.

### 2.3 Control

In the control stage, the user selects one of three viewpoints from which to manipulate the vehicle (Figure 1c).

*Remote viewpoint.* The user controls the vehicle from an unlinked viewpoint, as if playing with a remote control toy.

*Onboard viewpoint.* The user controls the vehicle from a viewpoint that is fixed to it, as if driving the vehicle from the inside.

*Tracking viewpoint.* The user controls the vehicle from a loosely coupled viewpoint, as if being a wingman.

## 3 INTERACTIVE SHOWCASE

This interactive showcase presents the award-winning RCSketch system, the recipient of the People's Choice Best Poster Award on November 2, 2022, at ACM UIST 2022 [Kim et al. 2022], to be experienced by the attendees of ACM SIGGRAPH 2023. Visitors will be able to create their own vehicles, such as an airplane (Figure 1), a car, an excavator, a rocket, and a spacecraft (Figure 2), and explore the vast digital landscape onboard their vehicles.

The RCSketch system, written with Unity 3D and runs on top of Wacom Cintiq Pro 24 Touch tablet, can be easily learned through a step-by-step tutorial. Through sketching, building, and controlling impressive 3D vehicles through intuitive pen and multi-touch gestures without any prior knowledge of 3D modeling and programming, the SIGGRAPH community will receive a firsthand glimpse of the latest content authoring technology and the joy of creation that the RCSketch system brings to children and adults alike.

## ACKNOWLEDGMENTS

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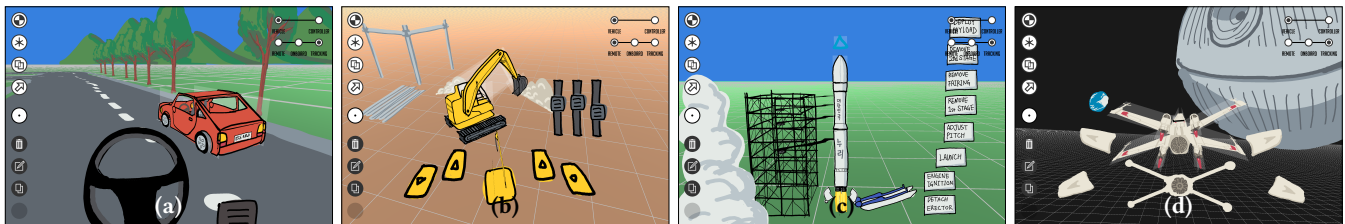


Figure 2: To explore what is possible with RCSketch, we designed (a) *Car*: the user can race the car by pushing the pedal and turning the steering wheel; (b) *Excavator*: the user operates the excavator to dig in the ground by driving each of the two caterpillars independently, spinning the cockpit, and actuating the joints of the boom; (c) *Rocket*: the user can simulate the stages of a rocket launch, such as engine ignition, stage separation, and satellite deployment; and (d) *Spacecraft*: the user can maneuver a spacecraft around a big space station by unfolding the wings and adjusting the thrust of the four engines separately.