



SPATIALHERO

Making instruction-tuned LLMs spatially aware

Team



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“Create CAD for a chair using **cadquery**”

GPT4:

```
import cadquery as cq

# Define basic dimensions
seat_width = 40.0 # in cm
seat_depth = 40.0 # in cm
seat_height = 2.0 # in cm
leg_height = 45.0 # in cm
leg_width = 3.0 # in cm
backrest_height = 40.0 # in cm
backrest_width = 4.0 # in cm

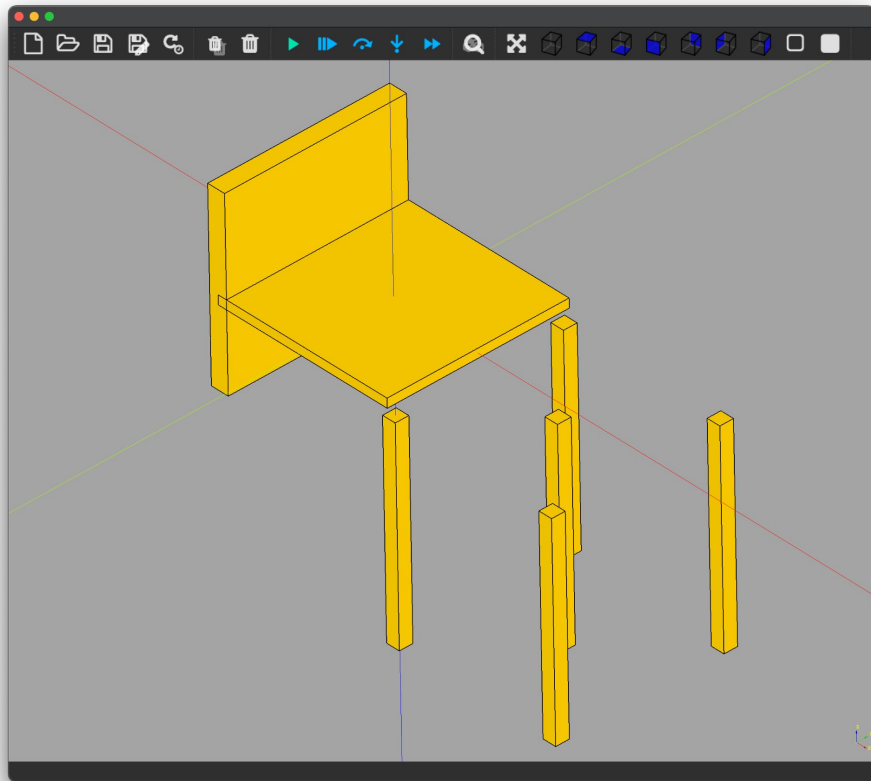
# Create the seat
seat = cq.Workplane("XY").box(seat_width, seat_depth, seat_height)

# Create one leg
leg = cq.Workplane("XY", origin=(seat_width/2 - leg_width/2, seat_depth/2 - leg_width/2, -leg_height))\
    .box(leg_width, leg_width, leg_height)

# Create four legs and position them at each corner of the seat
legs = leg
for x in [-1, 1]:
    for y in [-1, 1]:
        legs = legs.union(
            leg.translate((x * (seat_width/2 - leg_width/2), y * (seat_depth/2 - leg_width/2), 0))
        )

# Create backrest
backrest = cq.Workplane("XY", origin=(-seat_width/2, 0, seat_height))\
    .box(backrest_width, seat_depth, backrest_height)

# Combine all parts
chair = seat.union(legs).union(backrest)
```



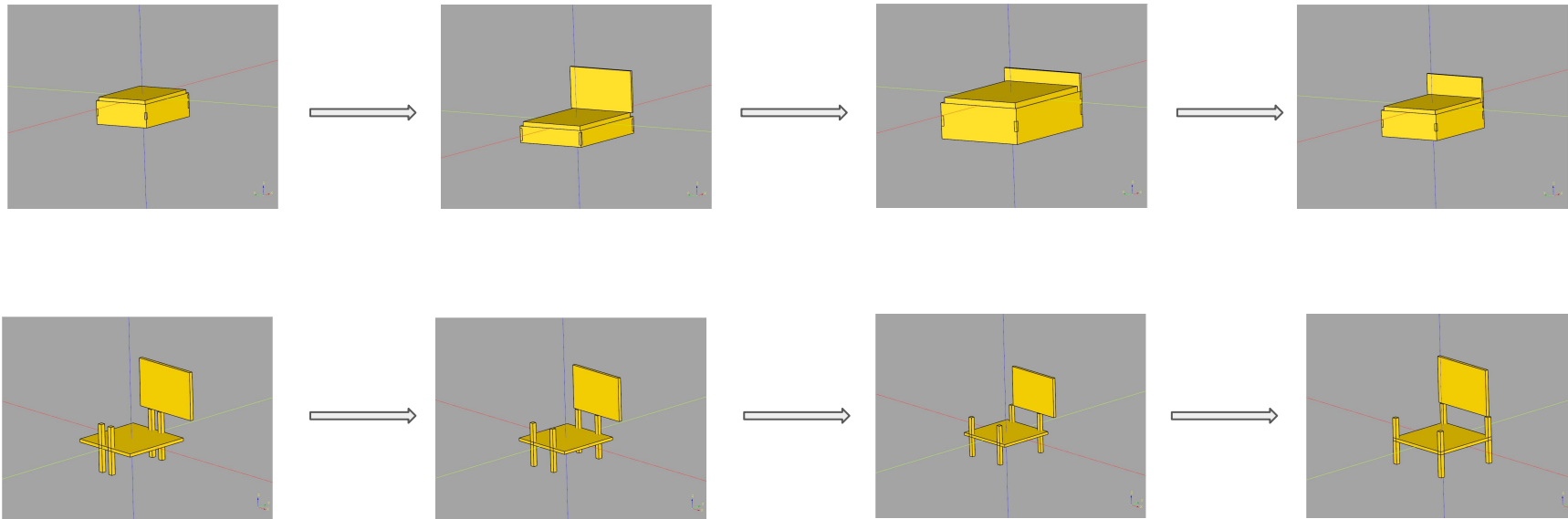
Not bad, but instruction-tuned LLMs lack spatial context to ramp this up in complexity

1. To build real-world spatial geometries/compositions for CAD
2. To be of use in downstream tasks in complex 3D environments
3. To build spatially-grounded co-pilots/assistants for AR/VR (Siri on steroids)



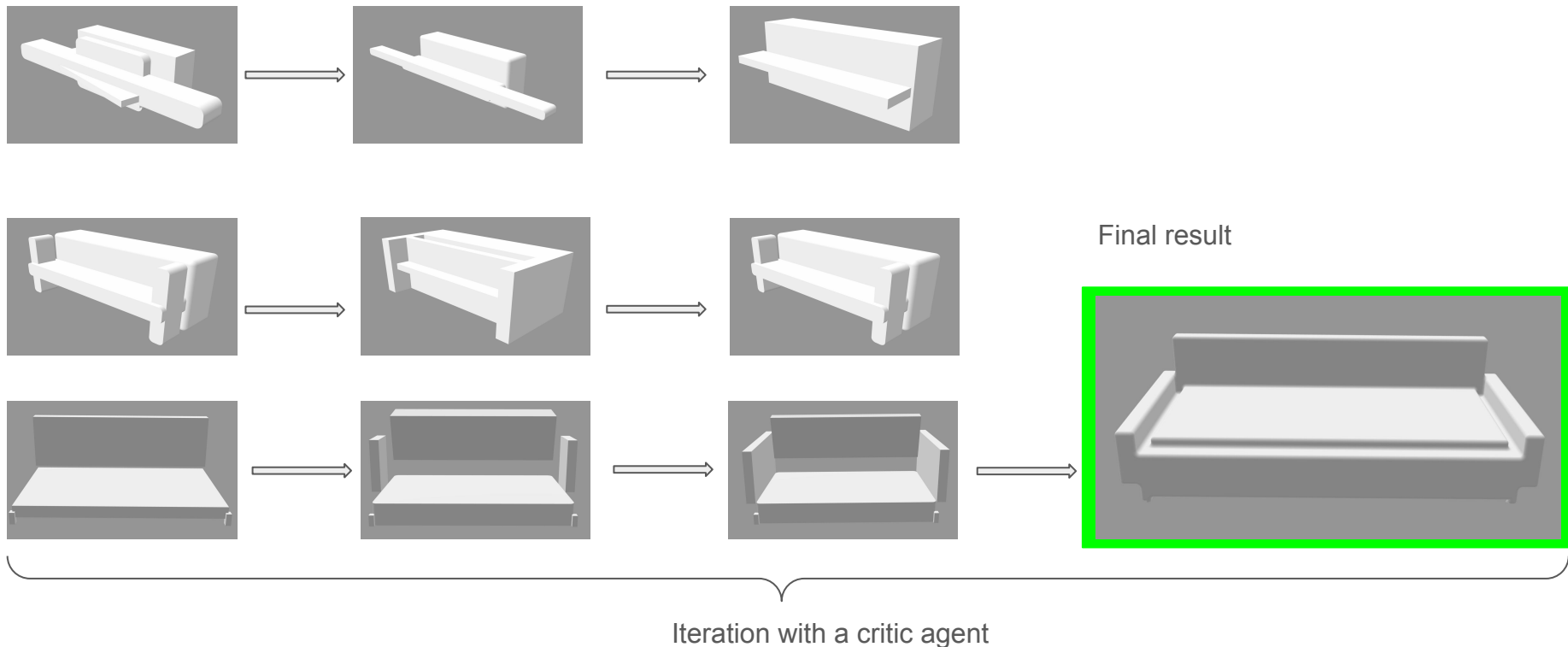
spatialhero: fine-tuning LLMs to be spatially aware

We're training LLMs to generate better instructions for 3D



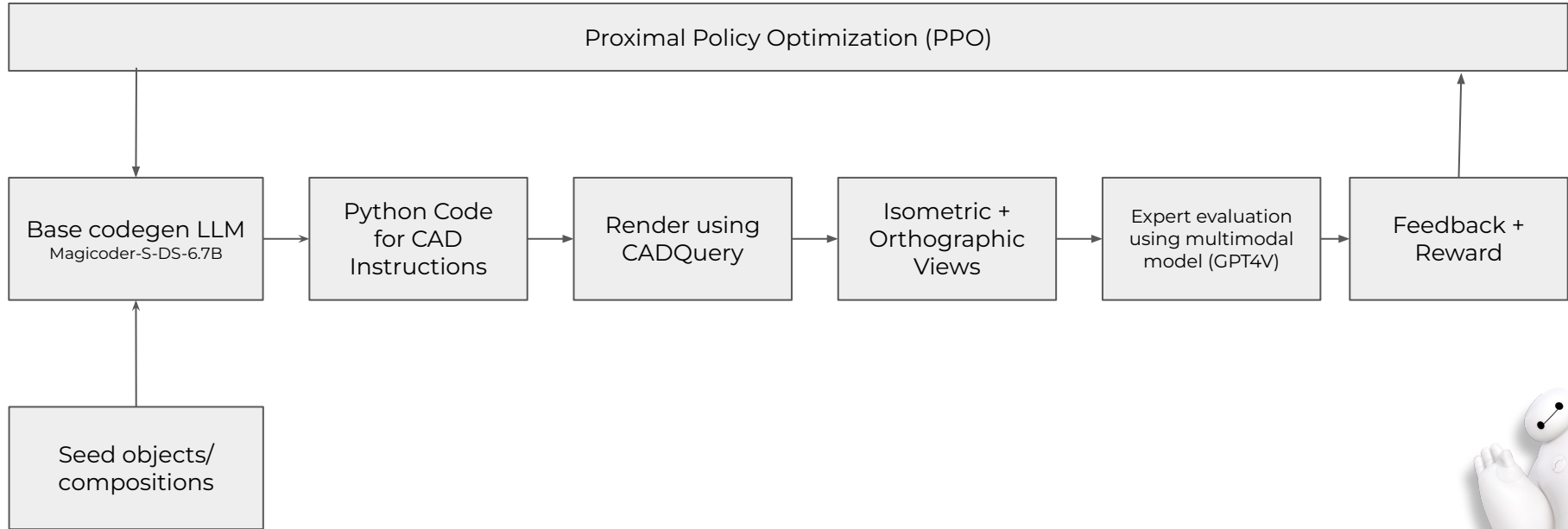
Original hypothesis: 2 LLM agents - actor/critic

Original code

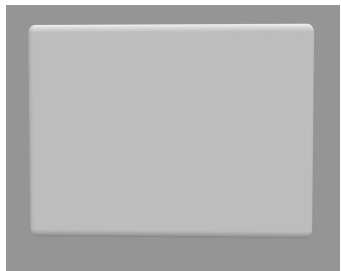


How can we get there in one shot?

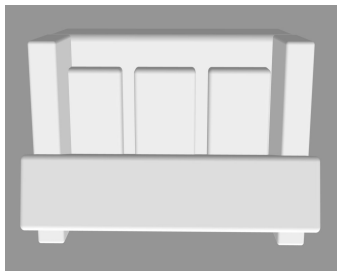
Refined approach: Weak supervision and PPO



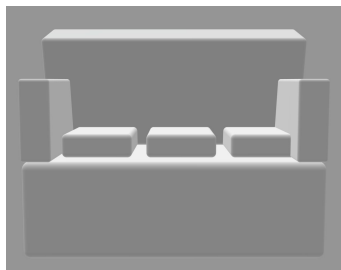
Refined approach: Weak supervision and PPO



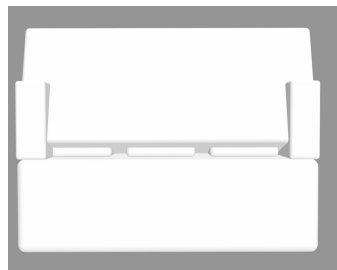
Under View



Top View

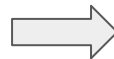


Front View

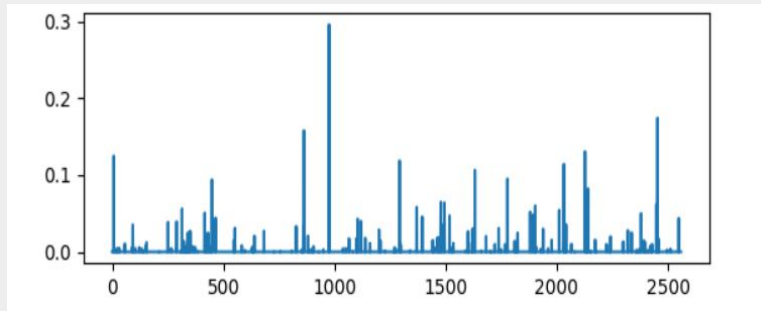


Back View

Expert evaluation
using multimodal
model (GPT4V)



0...1



Reward over time

Use Cases - Example use cases for 3D Modelling across different industries

Automotive

Urban Planning

Transportation

Energy

Military and
Defense

Robotics

Civil
Engineering

Environmental
Science

Meteorology

Oceanography

Public Safety

Entertainment
and Data

Retail

Telecommunic
ations

Geology



spatialhero: API-as-a-service

Our Go-To-Market strategy

- Build presence with open source community
- Enterprise focused solution
- Technical marketing to build presence
- User Retention: knowledge flywheel on company-specific design process



Low-hanging fruit: copilot for CAD

The 3D design software market is highly fragmented - with hundreds of tools for different functions and industries - and dominated by legacy players

- [Autodesk](#) (US, \$56bn market cap), maker of AutoCAD, one of the oldest and most used CAD (computer-aided design) software for 2D / 3D drafting & design
- [Dassault](#) (France, \$60bn market cap), maker of Solidworks, one of the most popular CAD softwares, used heavily in the mechanical engineering and design industries
- [Ansys](#) (US, \$35bn market cap), engineering simulation and 3D design software delivers product modeling solutions with unmatched scalability and a comprehensive multiphysics
- [Speckle](#), open source digital infrastructure for anything designed in 3D. They handle interoperability between software silos, real time collaboration, data management, versioning and automation
- [Onshape](#), qualified CAD users can start their next project using Onshape Professional – a widely used cloud-native CAD and PDM solution



Next-steps: spatially aware assistance

3D design is huge. If we look around - every physical asset has been prototyped in 3D before. And SpatialHero can power 3D design across any vertical.

- Architecture, design and construction (**\$11tn**) - [\\$3.57bn](#) software market
- Industrial, mechanical and electrical design (**\$3.5tn**) - [\\$33bn](#) software market
- Product design (electronics, furniture) is a (**\$1tn**) - [\\$9.4bn](#) software market
- Industrial plant design and ship building (**\$650bn**) - [\\$4.6bn](#) software market
- Infrastructure design (railways, roads) industry (**\$300bn**) - [\\$239bn](#) software market
- Gaming and entertaining is (**\$168bn**) - [\\$127bn](#) software market

TAM on software market that deals with 3D = **\$416bn**

