

Generative AI for Medical Device Design

Kristi Bartlett, PhD

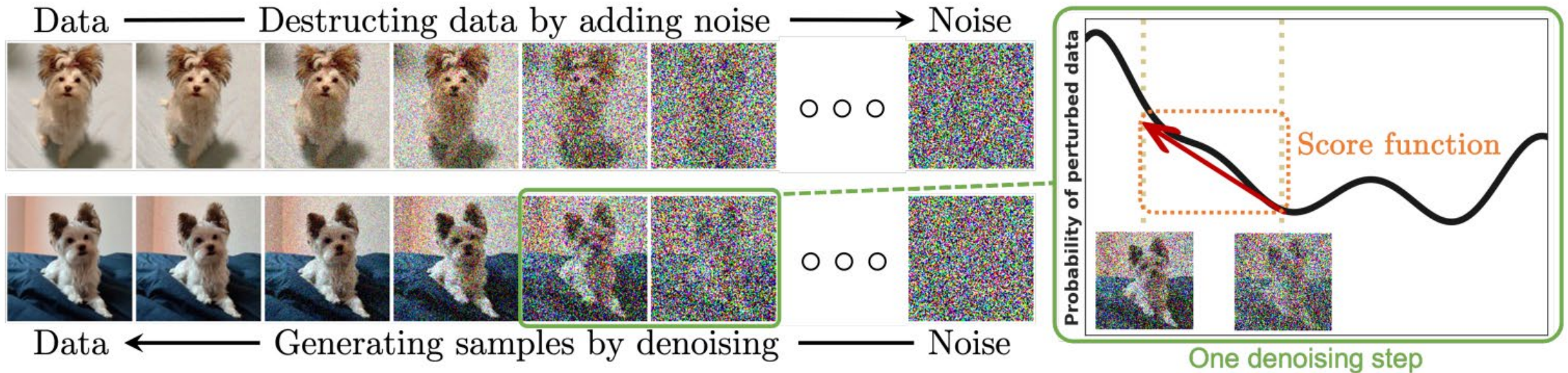
Assistant Professor of Product Design

College of Design

University of Kentucky



How does image generative AI work?



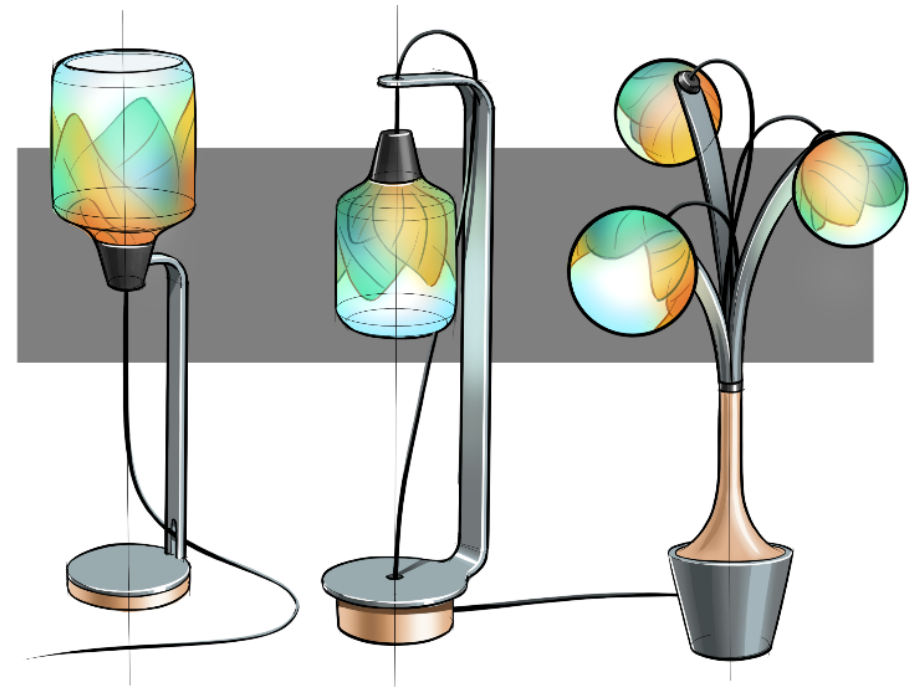
“Diffusion models smoothly perturb data by adding noise, then reverse this process to generate new data from noise. Each denoising step in the reverse process typically requires estimating the score function...which is a gradient pointing to the directions of data with higher likelihood and less noise.”

How can AI be used in product design?

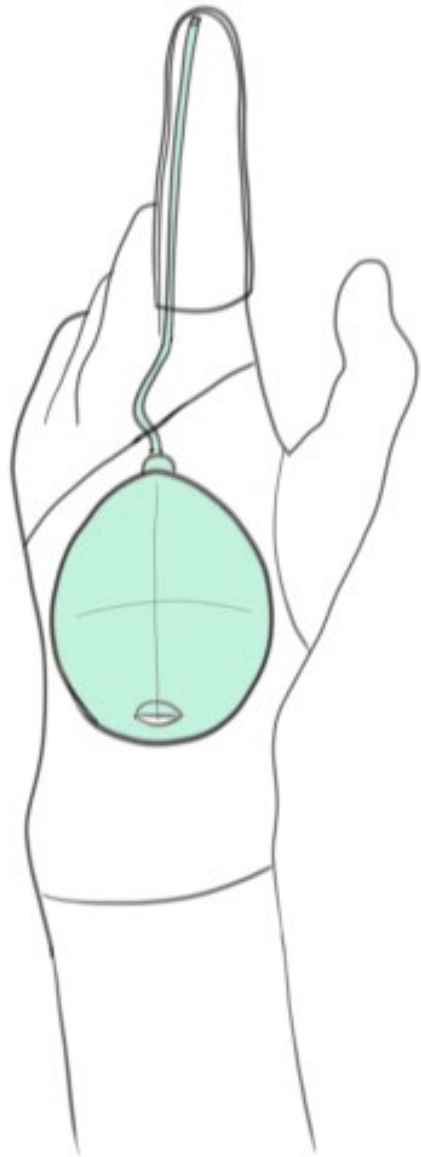
Midjourney V3 Output for Inspiration



Product Designer's Illustration



Images courtesy of Caterina Rizzoni of Kaleidoscope



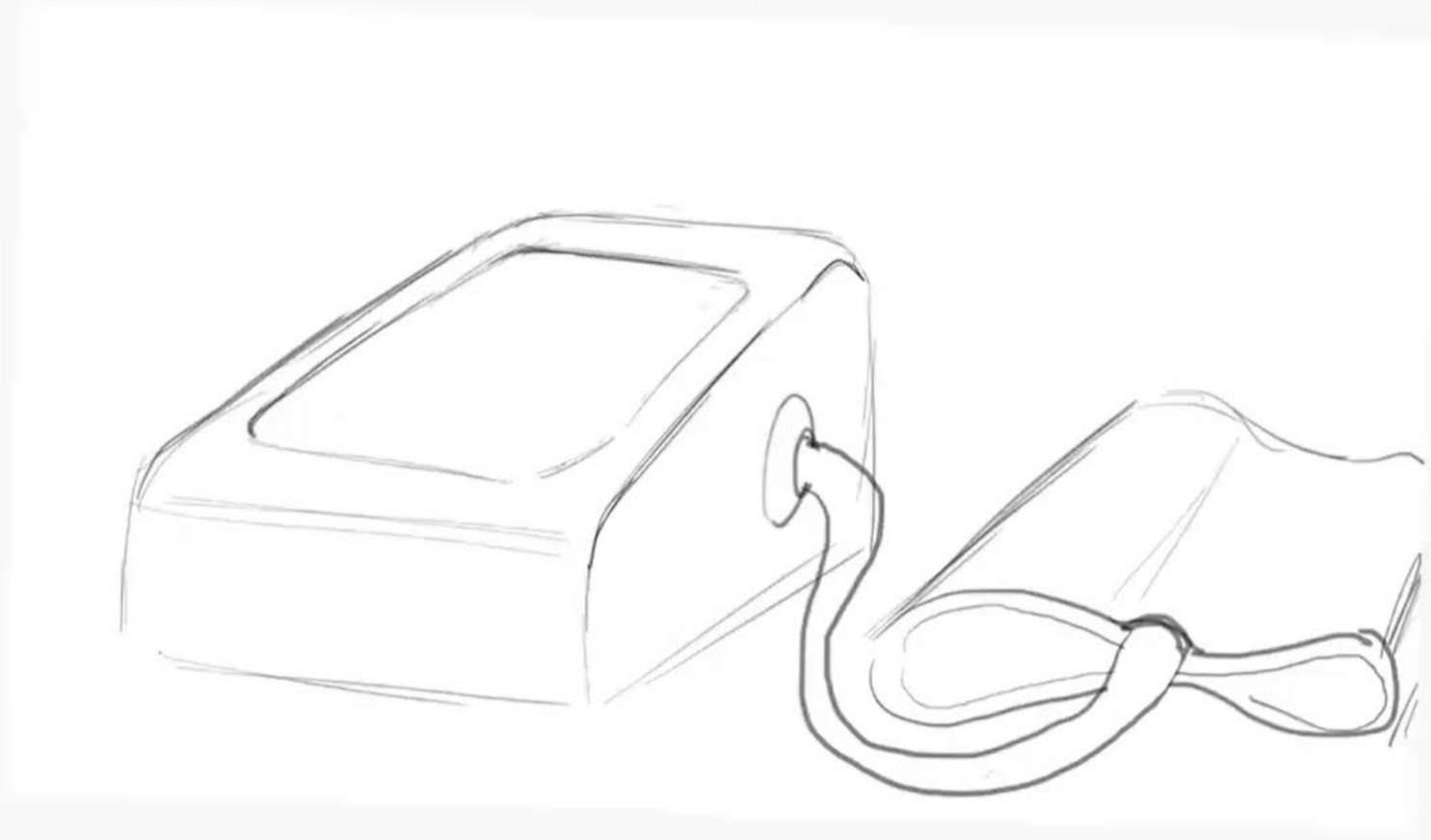
My drawing



Vizcom output
(vizcom.ai)

What is Vizcom?

- AI tool created specifically for product designers
- Allows drawing-based inputs
- Vizcom donated 10 free Pro licenses for this study
- Free version also available



Create ✕

AI-driven visualization tool for quick product variations, sketches, and renderings.

Prompt

blood pressure monitore medical device |

Mode

Render For rendering sketches and line drawings

Refine For refining or iterating on rendered images

Render style ⓘ

Vizcom General ▾

Drawing influence 100%

Number of images

1 4

Generate



Create ✕

AI-driven visualization tool for quick product variations, sketches, and renderings.

Prompt

blood pressure monitore medical device

Mode

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Render style ⓘ

Vizcom General ▾

Drawing influence 65%

—————●—————

Number of images

1 4

Generate





Layers

- Layer 5 N 100%
- blood pressure m... N 100%
- Untitled - 2023-0... N 100%
- Layer 1 N 100%
- Background N 100%



👁️ ↻ 📄 Cancel **Confirm**

Create ✕  

AI-driven visualization tool for quick product variations, sketches, and renderings.

Prompt

blood pressure monitore medical device,
blue fabric cuff

Mode

Render For rendering sketches and line drawings



Refine For refining or iterating on rendered images

Drawing influence 50%



—————●—————

Number of images

1 4

Generate  



Create ✕  

AI-driven visualization tool for quick product variations, sketches, and renderings.

Prompt

blood pressure monitore medical device,
blue fabric cuff

Mode

Render
For rendering sketches and line drawings



Refine
For refining or iterating on rendered images

Drawing influence 35%

—————●—————

Number of images

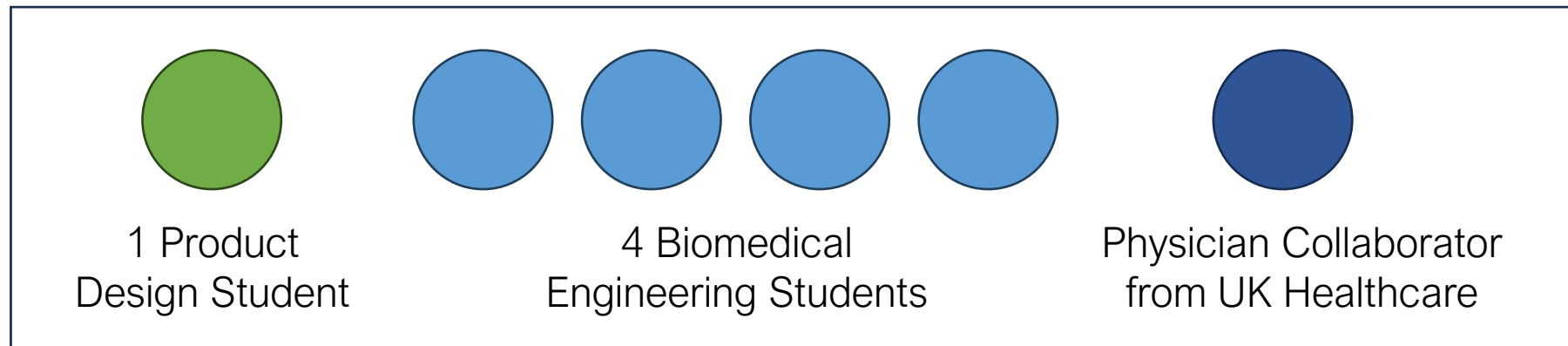
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Generate  

Educational Context

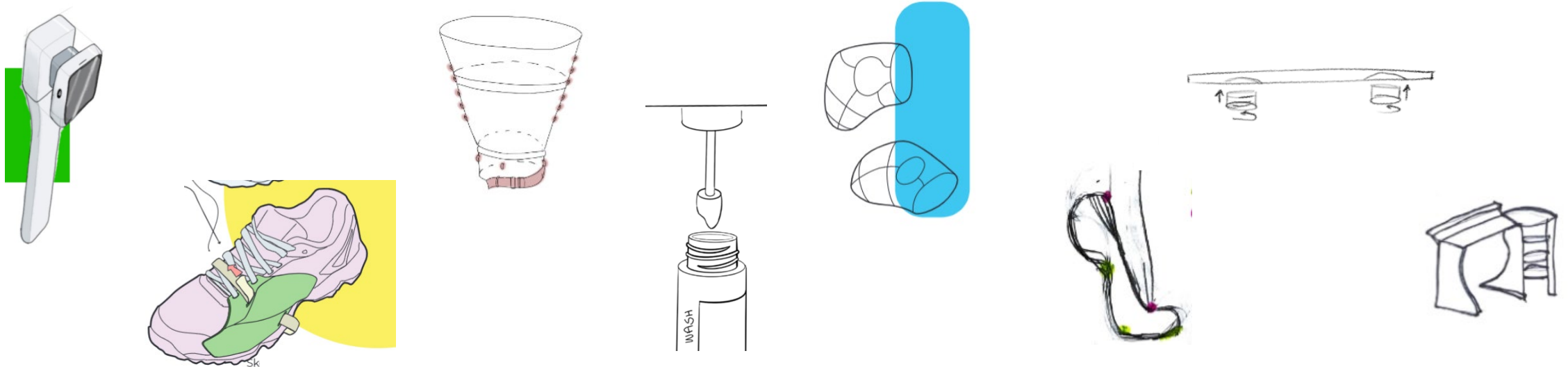
- Collaborative course:
 - Capstone course for biomedical engineering students (BME 420 taught by Dr. Davis Ferriell)
 - 3rd year studio course for product design students
- Student teams identify unmet clinical needs and design solutions

9 Teams



How we are using Vizcom in the course

- Brainstorming and concept generation phase
- Design students will brainstorm many ideas through sketching and low-fidelity prototyping
- Sketching is a way to work out details and communicate design ideas to others



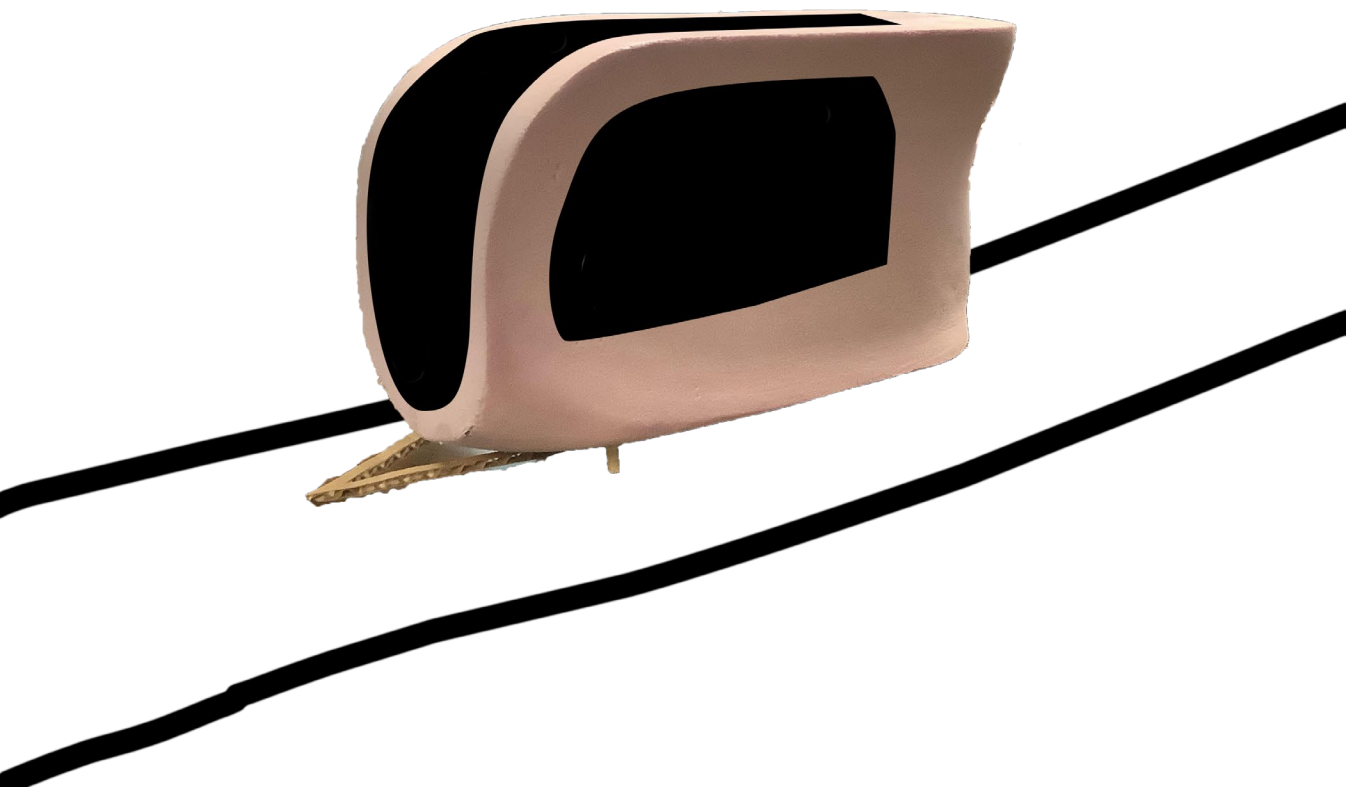
Research Questions

- Does Vizcom help the students develop concepts more quickly?
- Does Vizcom help the product design students communicate their ideas more clearly to their engineering teammates and clinical stakeholders?

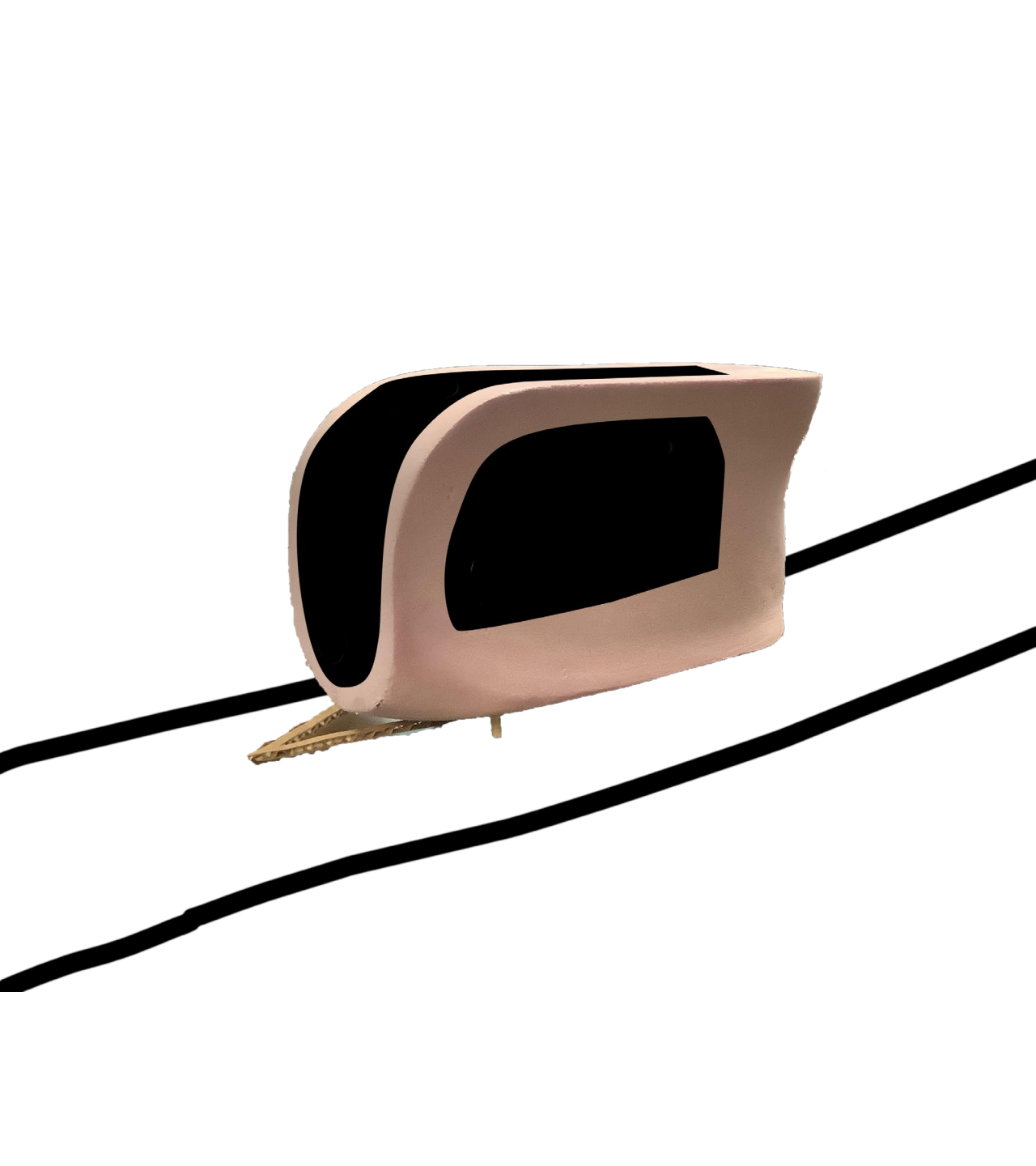


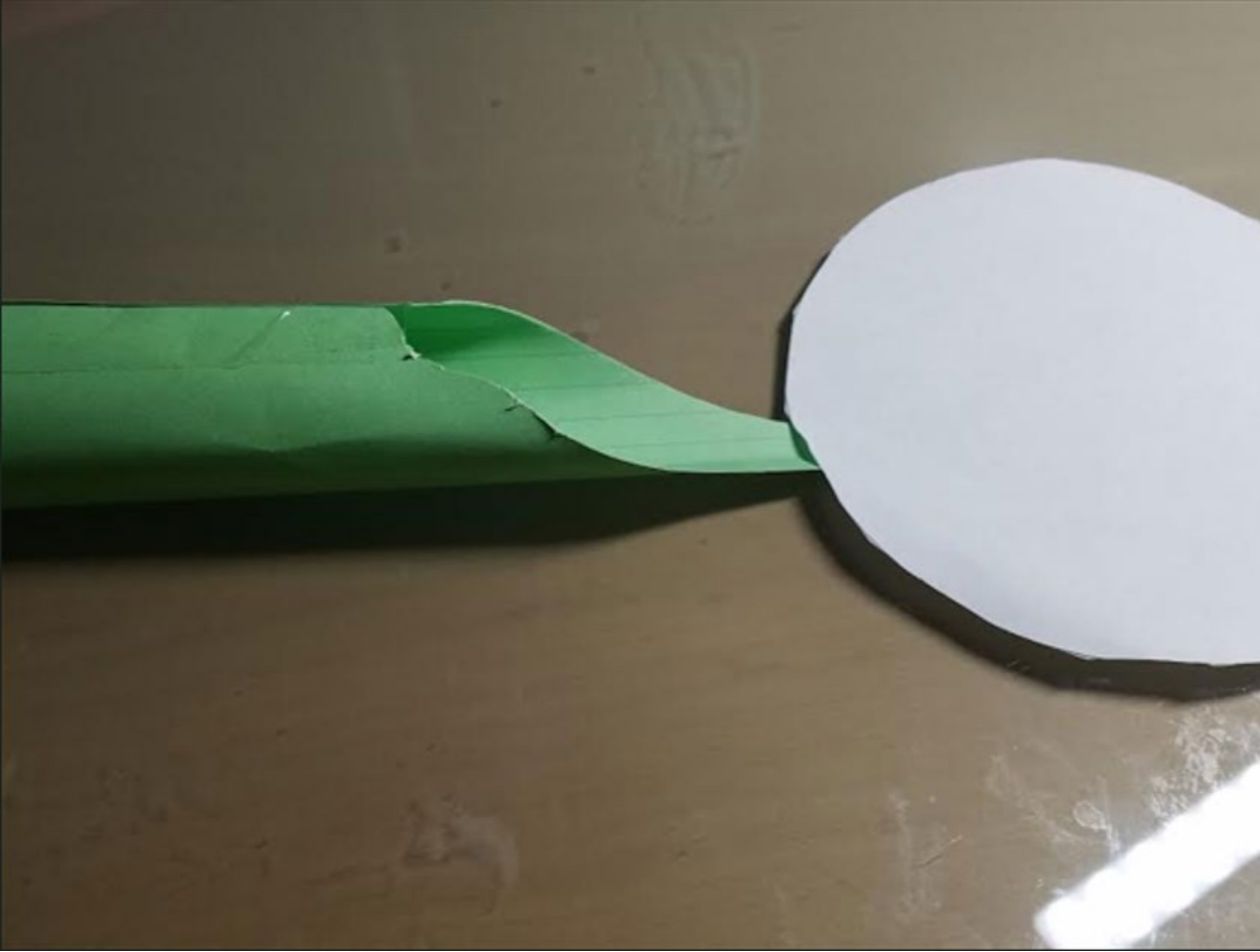
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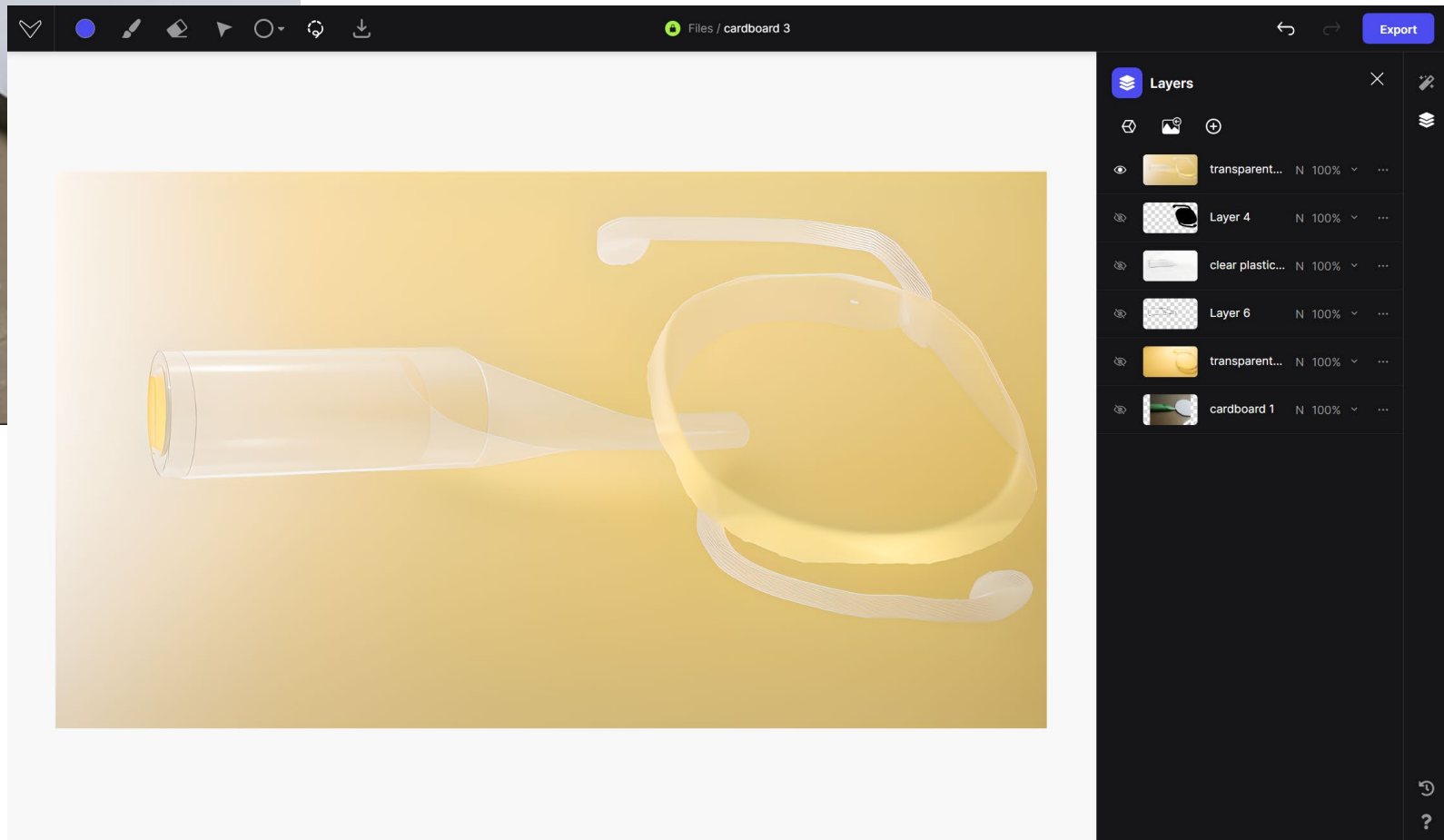


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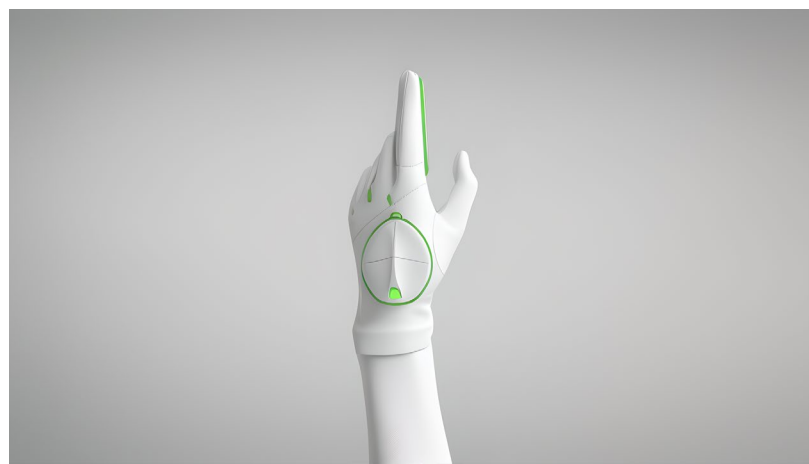


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Research Questions Continued

- Does Vizcom help the students broaden their thinking and come up with ideas they would not have thought of otherwise?
- Does Vizcom play any sort of negative role, for example, causing students to rush ahead without thinking through alternatives and miss out on a better design direction?



Data Collection Methods

Each product design student must create illustrations of 5 – 10 medical device concepts based on their team's identified need statements.

- How many of the illustrations can be successfully enhanced by incorporating Vizcom?
- How many of the concepts illustrated with Vizcom will be further iterated on? (vs. missing out on alternatives)
- Compare student work that uses Vizcom vs. students' baseline sketching level without it

Ethical Concerns

- Theft from artists and photographers whose work is used in training datasets without permission or compensation
- Poor wages and working conditions for annotators
- Outputs can be biased and reproduce stereotypes when depicting humans
- AI itself can be copying

Example of AI Copying



Image generated by
Stable Diffusion



Image found in LAION-
Aesthetics v2 6+ dataset

Concluding Questions

How can AI facilitate better collaboration among interdisciplinary design teams for the purposes of innovation?

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