

# DaVinci MindScribe: An Adaptive AI Concept Sketch Machine Essay

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## Technical Field

Artificial intelligence, natural language processing, robotics and embedded systems, human–computer interaction, digital fabrication, and applied psychology and learning science.

## Background Information

Ideas die because the creator cannot verbalize the concept, or draw it faithfully, or access the right tools. Current text-to-image systems are limited by how they were trained. The user accepts what the model returns and lets go of their original vision. Reviewers and teachers still demand crisp visuals. The result may survive a cursory glance, yet it falls short of what the creator knows to be possible.

MindScribe closes that gap with a two-way process. The system learns how the user thinks, builds a baseline profile, and asks targeted questions to fill in missing details. When intent is clear, it generates a concept image. After approval, it converts that image to machine paths and plots a clean physical sketch. Output favors blueprint-style line work with a Da Vinci flavor. Each session feeds the profile. Over time, results come faster and land closer to the user's style.

## Prototype Image

```

PS C:\Users\MadTi\OneDrive\Desktop> python profile_questionnaire.py

=== MindScribe • Baseline Profile (Psych Questionnaire) ===
Artist name (for file label): De La Paz

Which shape best matches how you picture ideas?
1. Square
2. Circle
3. Obelisk
Select 1-3: 3

Your default mode while designing?
1. Mechanical/analytical
2. Visual/story-driven
3. Kinetic/motion-first
Select 1-3: 1

Preferred detail level in early sketches?
1. Minimal outline
2. Moderate with notes
3. Dense crosshatching/annotations
Select 1-3: 3

Line style that feels right?
1. Crisp technical
2. Loose organic
3. Hand-tremor antique
Select 1-3: |

```

FIGURE I SAMPLE PROFILE QUESTIONS

```

PS C:\Users\MadTi\OneDrive\Desktop> python twenty_questions.py

=== MindScribe • 20 Questions (Per-Sketch Brief) ===
Path to baseline profile.json (or Enter to skip):

Answer the following to generate a precision sketch brief:

Name this concept (short): Drone
One sentence: what job does it do? check submarine hulls

Primary motion?
1. Linear
2. Rotary
3. Oscillating
4. Compound
Select 1-4: 4

How many axes?
1. 1
2. 2
3. 3
Select 1-3: 3
Scale (handheld, desktop, room, etc.): |

```

FIGURE II SAMPLE Q&A FROM 20 QUESTIONS

## Prior Art (Research): Annotated Bibliography

### Vizcom, Render Mode

Description: A Tool that starts from a user sketch plus text cues to produce refined renderings. Assumes a competent starting sketch.

Difference: MindScribe does not require an initial sketch. A user model and adaptive Q&A produce a structured concept description, then the system generates blueprint-style line work designed for vectorization and plotting.

Citation: Vizcom. (n.d.). *Render Mode*. <https://docs.vizcom.ai/render-mode>

### Adobe Firefly Prompt Builders

Description: Guided prompt tools for general text-to-image generation. Not invention-specific. Does not output machine-ready vectors or toolpaths.

Difference: MindScribe focuses on invention capture. The user profile steers generation toward line-first imagery, the system converts to SVG with centerline tracing and plot-safe simplification, and vectors go directly to a plotter.

Citation: Adobe. (n.d.). *Adobe Firefly: AI generative prompt builder*.

<https://www.adobe.com/products/firefly.html>

## AxiDraw and DIY Plotter Bots

Description: Pen plotters that draw vector paths. AxiDraw commonly uses an EiBotBoard controller with an Inkscape extension. Many DIY machines use GRBL. Strong motion control with no upstream AI or profiling.

Difference: MindScribe supplies the upstream layers. The system builds the concept description, generates plot-ready vectors with stroke simplification, corner rounding, and hatch spacing, then exports EBB for AxiDraw or GRBL-compatible G-code for DIY and CNC-class devices.

Citation: Evil Mad Scientist Laboratories. (n.d.). *AxiDraw writing and drawing machines*. <https://axidraw.com>

## Project Description

MindScribe is an adaptive pipeline that turns an idea into a physical, blueprint-style concept sketch while learning about the user and improving over time.

- Baseline profile: quick signals on domain, visual style, level of abstraction, novelty tolerance, and preferred materials or mechanisms.
- Adaptive interview: about 12 to 20 branching questions guided by natural language processing, covering purpose, power source, scale hints, constraints, and three to five key components.
- Image generation: monochrome, line-first concept aligned to the concept description and tuned for legibility.
- Vectorization: centerline tracing with plot-friendly simplification, corner rounding, and hatch spacing set for technical pens.

- Robotic plotting: SVG to EBB for AxiDraw or SVG to GRBL G-code for DIY and CNC plotters.
- Learning loop: approvals, quick ratings, and minor edits update the profile, so future sessions ask fewer questions and produce closer matches.

*(Scope note (SIP311): This submission demonstrates the adaptive AI intake only (baseline profile + 20Q). Vectorization and robotic plotting are deferred to later courses.)*

Default output targets a single-pen line drawing for early reviews and patent previsualization. Typical deliverables include SVG at Letter or A4, hatch spacing around 1.2 to 1.6 mm, minimum feature around 0.35 mm for a 0.3 to 0.5 mm technical pen, and GRBL feed rates in the 1500 to 2000 mm per minute range with 0.2 mm lift moves. AxiDraw devices receive equivalent EBB commands.

#### Evaluation Criteria (SIP311)

- NLP builds an initial creative profile from first answers.
- Follow-up questions are generated from that profile (not a fixed script).
- Later questions adapt based on earlier answers.
- Profile is saved to structured JSON/parameters.
- Profile → on-screen blueprint/line-art preview (no manual tracing).
- Sketches are original (not copies of da Vinci).
- Multiple sketch variations from one profile.
- User can tweak at least one setting (line width/detail/scale) before finish.
- Simple, intuitive GUI for non-technical users.
- New user reaches a first sketch in  $\leq 60$  minutes (target drops over time).
- Guided end-to-end flow with no dead ends.
- Full demo runs without freezing/crashing.

Process Overview (text): Intake builds a profile → adaptive Q&A fills gaps → generate line-art preview → (future work) vectorize/plot → approvals feed the next session.

## Goals & Tasks (SIP311)

Goal 1 — Profile from NLP intake

Tasks: choose NLP stack; prototype profile extraction; persist profile JSON.

Goal 2 — Adaptive, guided Q&A

Tasks: branching logic from profile; test with sample personas; integrate into GUI.

Goal 3 — Line-art preview generation

Tasks: research line-art generation approaches; wire profile → preview; validate originality.

Goal 4 — Usable GUI

Tasks: mockups (sliders/buttons/preview); working GUI prototype; connect GUI ↔ Q&A ↔

Preview; quick usability passes.

Goal 5 — Working demo in  $\leq 60$  minutes

Tasks: dry-runs + timing logs; write a step-by-step demo script; fix bottlenecks.

## Innovation Claim

MindScribe combines psychology-informed intake, an adaptive interview, a structured concept description, vector-first image generation, and robotic plotting in one flow. A personal user model guides each session and improves with use. The result is a repeatable path from rough idea to precise, physical sketch that reflects the user's voice and gets better over time.

## Usage Scenario

- Individual creator: the first session builds the baseline profile and a concept description, then plots a clean concept page. Later sessions get shorter because style and priorities are already known. After a few rounds, only a handful of prompts are needed to produce a plot that feels right to the creator.
- Education: each student's profile follows the work, so concept sketches improve across a

term. Teachers get consistent plots and structured concept pages that speed feedback

- Patent figure prep: an independent inventor captures the concept, generates blueprint-style line drawings, exports plot-ready vectors (SVG plus EBB/GRBL), and receives a plotted review page and an editable vector/PDF set for a patent professional to finalize.