

AI for Product Concept Design

A Tour of the World of AI-Based Art Generators



Figure 1: Rendering of a Hi-Fi amplifier created with Midjourney by the author.

By Edwin van den Oetelaar (The Netherlands)

Over the past year, AI for image creation has taken a huge leap, making this technology accessible to everyone. Does this give electronics hobbyists and creators a powerful new tool? A few sketches and a well-formulated text prompt are all it takes to get a photorealistic representation of our ideas. But is it really that simple? And what use is it, in practice?

Since the advent of AI, I have always been truly interested in its creative capabilities, and immediately wanted to try the new tools made available on the Web, such as Midjourney, Stable Diffusion, Freepik Sketch, and Dall-E 3.0. In this article, I would like to give you an opinion on them, although this list is not exhaustive and at the time of publication may be already out of date. In my experiments, I tried to create a design concept for an audio amplifier that might look beautiful. Using a combination of sketches, photos of existing devices and directed prompts, I tried to bring my vision to life using Midjourney and other tools. Along the way, I'll explain jargon terms such as *prompt-engineering*, *inpainting*, and *style-transfer*.

Moving at Lightning Speed

If I were to start from an initial observation, I would have to say that developments in Gen-AI image generation are moving at

lightning speed. New online services and models appear every week. Image quality is improving by leaps and bounds. There now seems to be a product for everything.

Convenience serves man — if you can't come up with a prompt yourself or aren't creative, there is a paid service that will help you with sample prompts, styles and specific templates for every challenge, such as logo design, color palettes, app designs and fashion design. Everyone seems to be jumping on this train, and commercial parties are integrating AI into their existing services. In addition to these online services, more and better offline models and tools are becoming available, such as Flux-1-Schnell and Stable Diffusion mentioned above.

Many photorealistic portraits created with these generators are barely distinguishable from real photographs, even to practiced eyes. Effects that were difficult to realize just a few weeks ago — such as text in images — are now no longer a problem. Distorted limbs became rare.

AI offers a new source of inspiration. With simple textual input, AI can generate different variations of a design, which can lead to unexpected ideas. Tools such as Midjourney and Stable Diffusion XL allow users to create multiple mockups from a sketch or prompt, which helps discover design options that might otherwise be overlooked.

Figure 1 shows a rendering of a Hi-Fi amplifier created with Midjourney. (Refer to text box **Get Started with Midjourney**.)

Get Started with Midjourney

How to get started with *Midjourney*: a one-click roadmap!

- › Go to Midjourney's official website [1].
- › Click "Sign In" to log in with your Discord account or Google account.
- › That's all.

Prompt Engineering

Prompt engineering is the targeted formulation of text commands to guide Gen-AI, such as Midjourney and Stable Diffusion, in creating images. In the context of product design, this means using precise words and descriptions to direct the AI to generate exactly the desired shapes, styles and details. It's all about precision in your task, so that the Gen-AI creates images that match your vision. This can be tricky, since the same prompt always yields different variants, as shown in the four examples on **Figure 2**. This is because AI uses a random number, called *seed*, which you can also fix with Stable Diffusion.

A common use of *ChatGPT* (also a Gen-AI) is to generate prompts. You can ask ChatGPT how best to set up a prompt, such as for Midjourney. You will then get an explanation of how such a prompt is constructed, weighting factors, flags, etc., with which you can further experiment and iterate.

The Ease of Editing and Refining

A major advantage of Gen-AI is that modifying or deleting existing ideas is much easier than starting from scratch. This iterative process allows designers to quickly explore different options. This fits well with the *modus operandi* of many young hobbyists: try something out first, then tweak it, where the quick result is a thrill. Selectively removing elements from a generated image and then having it re-generated is called *selective inpainting*. **Figure 3** shows an example of this technique.

Limitations of Fun Graphics

Whether it is Gen-AI, 3D printing or laser cutting, there are often countless iterations without regard to cost. It's fun and fast, but without a clear vision of the design, and without the right dimensions and materials to match the function, you'll get nowhere. Thinking through what you want in advance, thinking through the use cases and planning, is essential to working efficiently and purposefully. You can't give engineering parameters without design-rules, materials, dimensions, without respecting any criteria or logic.

The Addiction Factor, Keep Varying!

When you see what people generate with Midjourney, it seems like it's more of a game than a tool. People keep endlessly creating new variations, hoping that a masterpiece will spontaneously emerge. You can spend an entire evening trying out styles of photographers and artists like this. For hobbyists without time constraints, such as those in their attic, the endless generation of iterations and

variations can be addictive, just like other online activities. Each time you view a new variation, you get a dopamine kick, similar to what you experience when gaming or gambling.

Limitations, Mediocrity

Gen-AI such as Midjourney and Stable Diffusion work from a large data set of existing images. AI combines elements from this data to create a kind of "average" view. This can make it feel that truly new images are difficult to create, since Gen-AI always falls back on what it has "seen" before.



Figure 2: The same prompt produced four different variants of amplifier.

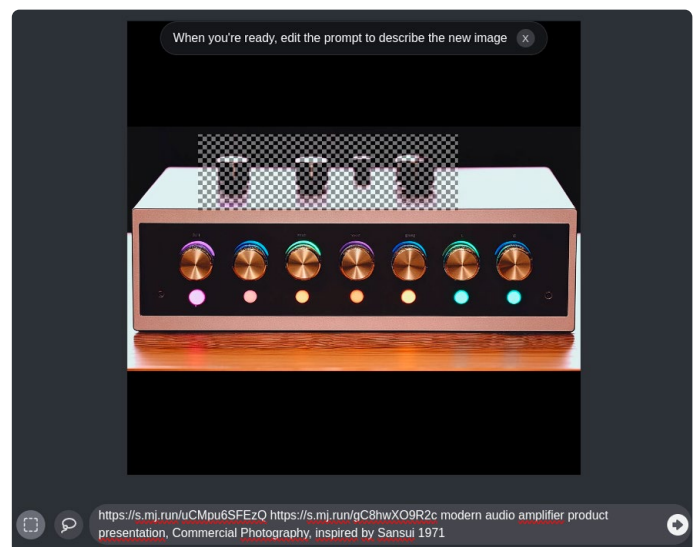
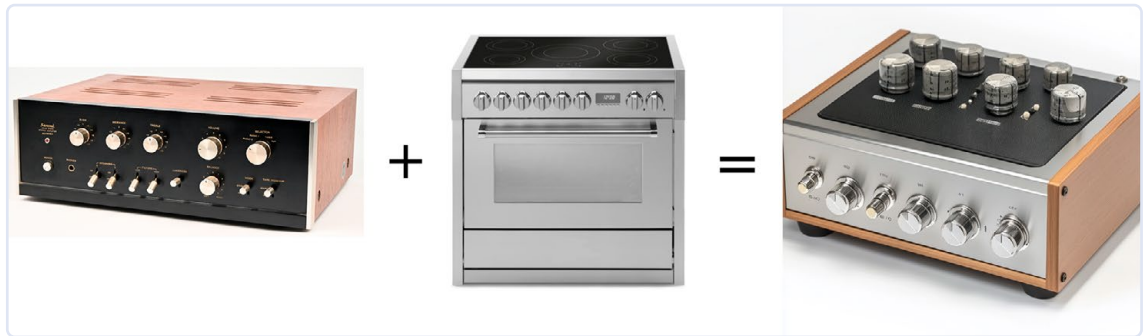


Figure 3: Application of the selective inpainting technique, to remove an unwanted part from the generated image.

Figure 4: Example of AI-generated image that comes from the blending and the interpretation of the two source images.



Smart prompt engineering allows users to force unique and surprising combinations. The power of AI lies precisely in combining elements in unexpected ways, creating images that feel original and different, even when based on existing data. While AI cannot create entirely new things from scratch, it can produce results that are perceived as unique because of the way it reinterprets familiar elements.

Using Your Own Images

Incorporating your own photos and images into the AI design process can significantly improve results. By uploading images of existing designs or inspiring objects, the Gen-AI can generate more specific and relevant designs. In Midjourney, you can upload and merge multiple images via the `/blend` function and also combine them with a prompt, as shown on **Figure 4**, that illustrates the merge of two images into a final one.

Use of Weighting Factors and Style References in Prompts

Weighting factors in prompts can be used to emphasize certain elements of the design. This provides more control over the result and helps create designs that more accurately reflect the intended vision. You can use `::` and numeric values for this purpose.

One example in Midjourney: If you want the AI to emphasize a device in the foreground and not in the background, you can do this with a prompt such as:

```
/imagine a high-tech speaker on a table in a modern living room, clean design, minimalist ::2 background blurred ::0.5
```

Here `minimalist` has a weighting factor of 2 compared to the other elements and `background blurred` just a weighting factor of 0.5.

Style references refer to another image to adopt a specific style. You do this by using `--sref` followed by the URL of the reference image.

In Midjourney, if you want to adopt a specific style of an image, use, for example:

```
/imagine futuristic device with blue accents --sref https://example.com/image.jpg
```

Cost and Accessibility

Traditional product design can be time-consuming and expensive, especially for hobbyists working with limited resources. Gen-AI tools significantly lower this barrier by making it possible to generate designs quickly and inexpensively. Instead of spending hours sketching and modeling, designers can now create dozens of images within minutes.

The availability of affordable or free Gen-AI makes this technology accessible to a wide audience. Tools like OpenAI's DALL-E (via ChatGPT website) and Flux or Stable Diffusion (via *poe.com*) offer even free access to basic functions, allowing hobbyists to get started in no time.

For makers, it may not be worth learning all the ins and outs of GenAI tools. These tools change quickly and become obsolete at the same pace. In addition, creating graphics is often not up the alley of electronics engineers, who are more focused on function than form. Look around you for people whose hobby is GenAI-prompting, just as you have your own hobby. Collaborating with them can be not only enjoyable, but also mutually instructive.

Overview of Online AI Art Generators

Bing Image Creator

- AI art model: DALL-E 3.
- Platform: Web.
- Cost: Free of charge.

Bing Image Creator is the result of the collaboration between Microsoft and OpenAI. It uses the latest DALL-E model, DALL-E 3, and is currently available for free.

DALL-E 3 (via ChatGPT)

- Platform: Web (via ChatGPT).
- Cost: \$20/month as part of ChatGPT Plus.

DALL-E 3 is a substantial upgrade over DALL-E 2, especially if you have a ChatGPT Plus subscription. The results are significantly better, and you have more control by combining it with ChatGPT.

Canva

- AI art model: Stable Diffusion.

- › Platform: Web, iOS, Android.
- › Cost: Free; from \$12.99/month for Pro with more AI features.

Canva recently added a text-to-image art generator. This feature integrates seamlessly with the rest of the template-based design app, allowing you to add AI-generated art to everything from social media posts to birthday cards.

NightCafe

- › AI art models: Stable Diffusion, DALL-E 2, CLIP-Guided Diffusion, VQGAN-CLIP.
- › Platform: Web.
- › Cost: From \$6/month for 100 credits (good for about 1,240 images per month).

NightCafe offers additional features such as styles for DALL-E 2 and Stable Diffusion, and allows you to use older generative art models.

OpenArt

- › AI art models: Stable Diffusion, DALL-E 2, and other open-source models.
- › Platform: Web.
- › Cost: Free for 50 trial credits; from \$10/month for 5,000 credits.

Like NightCafe, OpenArt offers additional features for Stable Diffusion and DALL-E 2, plus access to additional open-source models. You have more control over the specific details of the images you generate. OpenArt also offers options such as sketch-to-image and a stock art transformer that adapts stock images to your needs.

Adobe FireflyFl

- › Platform: Web, Adobe Express, Adobe Photoshop, and other Adobe tools.

- › Cost: Free for 25 credits per month; from \$5/month for 100 credits per month (and included with various Adobe subscriptions).

Although you can use it online, it is now integrated directly into Adobe products such as Express and Photoshop.

One of Firefly's best features is the ability to create custom text effects with a written prompt.

Quora Poe

A platform, Quora Poe, an application or service created by Quora, is available on the Web. This platform allows users to interact with various AI models, including ChatGPT and other AI-based chatbots. On it you can find, among others, FLUX-schnell at [2] and Stable Diffusion at [3]. There will probably be a limited number of credits, but you can try them out.

Other Online Services

In my overall tinkering, I've also experimented with FreePik [4]. This tool offers an interesting feature: in addition to entering prompts — like Midjourney or Stable Diffusion — you can sketch in real time. As you draw, the image adapts to your sketch.

What is noticeable, however, is that the image is constantly changing, making it difficult to control accurately. Sizing and technical precision are lacking in all ImageGen-AI. **Figure 5** shows an example of rendering: the rendered image on the right is derived directly from the (very) rough sketch made by hand on the left.

FreePik is free for a limited number of actions per day, but if you really want to get started, a subscription is required. In addition to FreePik, there are numerous new online services now available.

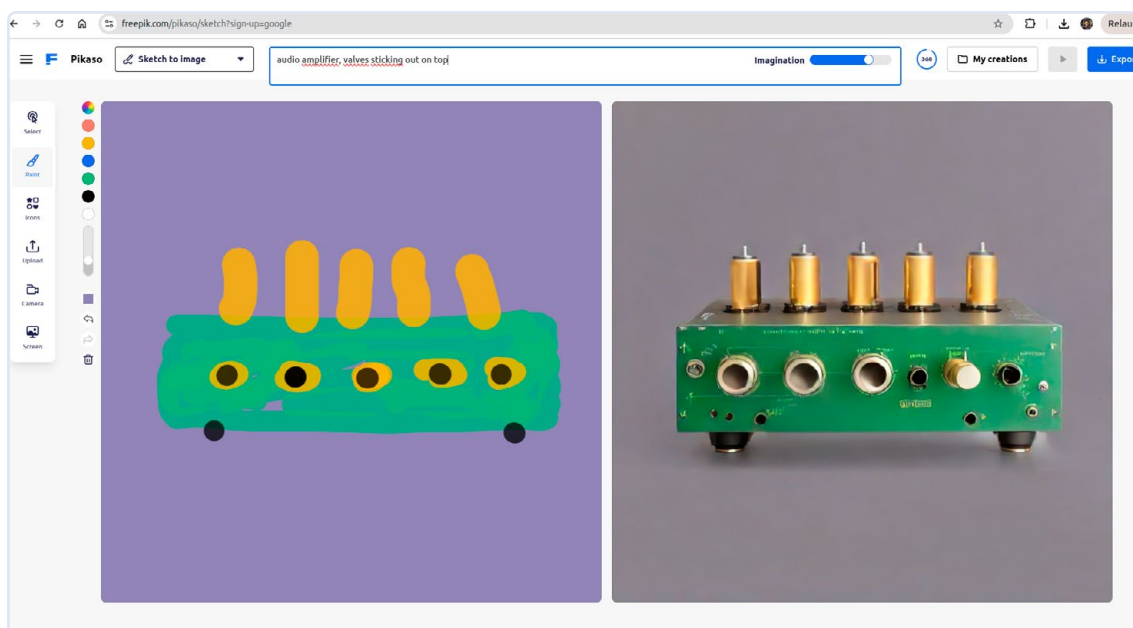


Figure 5: AI helps! The rendered image on the right has been created by Freepik starting from the (very) draft, hand-made sketch on the left.



Of course, there are many others on the web: just type: "AI art generators" in your search bar, and you'll discover a world that you probably weren't aware of!

Offline Alternatives

Flux.1-Schnell (I recommend this one): A fast and efficient implementation of Stable Diffusion, designed to run on consumer hardware.

- PROs: Fast, efficient, and can run on less powerful hardware.
- CONs: Possibly less customizable than the full Stable Diffusion implementation.

To test Flux.1 online or run it at home, visit [5]. Keep in mind that you will need a powerful video card if you want to install yourself, preferably an Nvidia with at least 12 GB VRAM and many CUDA cores. The more powerful the card, the less latency you will experience.

Stable Diffusion web UI: if you would like to get started with this one on your own PC, you may take a look at [6]. Again, a powerful video card is essential for a smooth operation.

Technical Limitations of Gen-AI in Design

Technical constraints on form and function make the engineer's job both interesting and indispensable. An engineer must consider a wide range of requirements—from functional performance to manufacturability, maintainability and recyclability, also known as *Design for X* (DFx). Gen-AI tools are currently not (yet) able to provide for this process; while they can quickly generate pretty pictures, the real value of good design lies in the practical application of engineering knowledge and experience.

Future of Gen-AI in Design

New tools are becoming available daily; it feels like an adventure, new discoveries every day. However, the role of the engineer remains crucial in creating functional and manufacturable designs. Gen-AI can currently serve primarily as a tool for quickly visualizing ideas, but the actual design process requires deep collaboration between the engineer, designer and industrial designer to meet all the complex requirements. Today's AI tools do not yet sufficiently help in this regard, but they can contribute to the creative process by quickly generating visually appealing concepts. So for now, their usefulness is limited to this aspect of the design process. ◀

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About the Author

Ing. Edwin van den Oetelaar is an expert and tech coach at Fontys ICT. He works with students on cool projects like building robots, self-driving cars, and other electronics. Edwin loves teaching by doing, helping students learn real skills through hands-on projects. Whether it's designing circuits or creating new tech, he enjoys exploring the latest technologies and sharing his knowledge. In his leisure time, he likes experimenting with electronics and keeping up with industry trends. For him, learning and creating should be fun, and he loves helping the next generation of engineers to experience that too.

Questions or Comments?

Do you have technical questions or comments about this article? You may write to the editorial team of Elektor at editor@elektor.com.

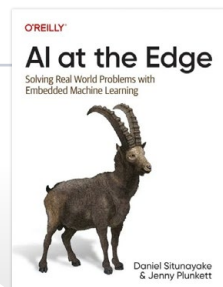
Author's Note

Those interested in learning more about AI may read the book *Living and Learning With AI*, written (in Dutch) by my ICT faculty colleagues [7].



Related Products

- **D. Situnayake, Jenny Plunkett, AI at the Edge (O'Reilly, 2023)**
www.elektor.com/20465



WEB LINKS

- [1] Midjourney's official website: <https://www.midjourney.com/>
- [2] FLUX-schnell at Quora Poe website: <https://poe.com/FLUX-schnell>
- [3] Stable Diffusion XL at Quora Poe website: <https://poe.com/StableDiffusionXL>
- [4] Pikaso's website: <https://www.freepik.com/pikaso>
- [5] Website for Flux.1 testing: <https://huggingface.co/black-forest-labs/FLUX.1-schnell>
- [6] Stable Diffusion on GitHub: <https://github.com/AUTOMATIC1111/stable-diffusion-webui>
- [7] R. Huijts, K. Suilen, D. Bloks, E. Saçan "Leven en Leren met AI" (Noordhoff Business): <https://tinyurl.com/hdej6mpm>