The Chair Project: A Case-Study for using Generative Machine Learning as Automatism

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Abstract

We present a case study for the use of generative adversarial neural networks as automatisms to stimulate (or augment) the imagination of human designers. We generate evocative visual prompts for chair designs that become the basis for a design process in which we create sketches, 3D models, and physical prototypes.

1 Introduction

Images produced by generative adversarial neural networks (GANs) are frequently similar in their visceral evocative qualities, surreal creatures and objects. Thus, they sometimes remind of the paintings and drawings of Surrealist artists like Max Ernst. The Surrealists, believing that "the creativity that came from deep within a person's subconscious could be more powerful and authentic than any product of conscious thought," [1] used so-called automatisms: generative art-making techniques to stimulate the imagination.

The authors are not suggesting that GANs adhere to the Surrealist movement, but rather its techniques. We have previously argued that GANs are capable of producing evocative visual prompts similar to frottage — to name just one automatism. What if we employed this means of making images neither as practical debugging nor as art in itself but rather as a tool for mind bending—like Surrealist automatisms: one that caters to the subconscious, the associative, the imaginary rather than the rational? [2]

Taking the chair, the archetype of a designed object, as an example, we present *The Chair Project*.¹ a case study for the use of GANs to augment human imagination.

2 Design Process

2.1 Generative Models

We trained a DCGAN [3] using an original dataset consisting of 600 images of iconic 20th-century chairs. The resulting model was used to generate new images of chairs. It was not our goal to generate a functional piece of furniture, but to generate engaging, semi-abstract 'visual prompts' for a human designer who used them as a starting point for actual chair design concepts. This stands in contrast to other procedural design approaches like Dreamsketch [4] which optimizes designs for functional requirements, e.g. maximum stability at lowest weight.

Our neural network generated hundreds of chairs: Some are barely recognizable as furniture and many others are not exactly functional, lacking a seat or missing a leg. There are concrete ones that

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¹More information available at https://philippschmitt.com/work/chair.



Figure 1: Steps from generated image to sketch to physical model

remind of specific iconic designs and others that seemingly fit into a style, an era or a manufacturing process.

2.2 Physical Models

We turned a selection of generated chairs into sketches and, ultimately, concepts for real chairs (Fig. 1). The idea was to neither simply trace the generated images, nor to transform it into traditional pieces of furniture. Rather, we brought out the chairs we saw in the blurry images to help viewers see what we imagined. 'Seeing the chair' in an image is an imaginative and associative process. It pushes designers away from usual threads of thinking towards unusual ideas that they might not have had otherwise. Methods like sketching and 3D modeling introduce limitations and challenges that the AI didn't face (e.g. perspective) and create opportunities for imaginative thinking.

Based on the sketches, we crafted miniature prototypes of four designs. The physical world introduces yet another layer of constraints (e.g. material properties and laws of physics) and consequently new challenges: How to create this joint? Will it stand? Which tools do I need? How should previously occluded parts look like?

2.3 Conclusion

Before the 19th century a craftsman-designer, often a trained furniture maker, designed and built a unique chair themselves. In the industrial revolution design became separated from the production process. Then, the industrial designer designed a chair using a creative process and a producer took specifications to mass-produce thousands of identical chairs. In the late 20th century computer-aided design (CAD) became an important tool to design machine-supported and optimized for machine production. Today, materials and production methods have further diversified, yet the human is still the creative agent whereas the machine is responsible for production.

Our work turns around the product design and production process, using machine learning not for optimization or mass production but as an early step in the design process, to stimulate the imagination. We use machine learning to generate surprising, evocative prompts — something alien a human might never come up with: as augmented imagination.

References

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