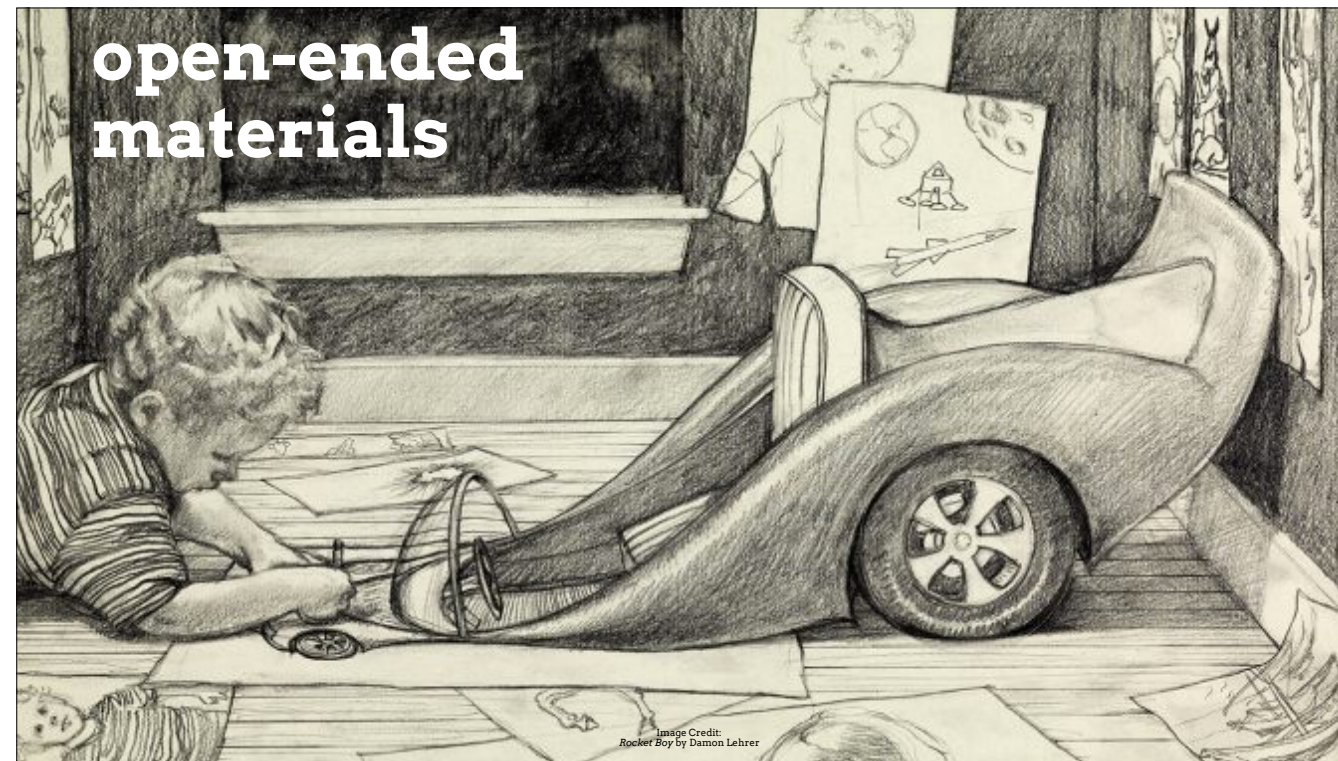


Exploring Ideas & Building Expertise
through
Machine Learning

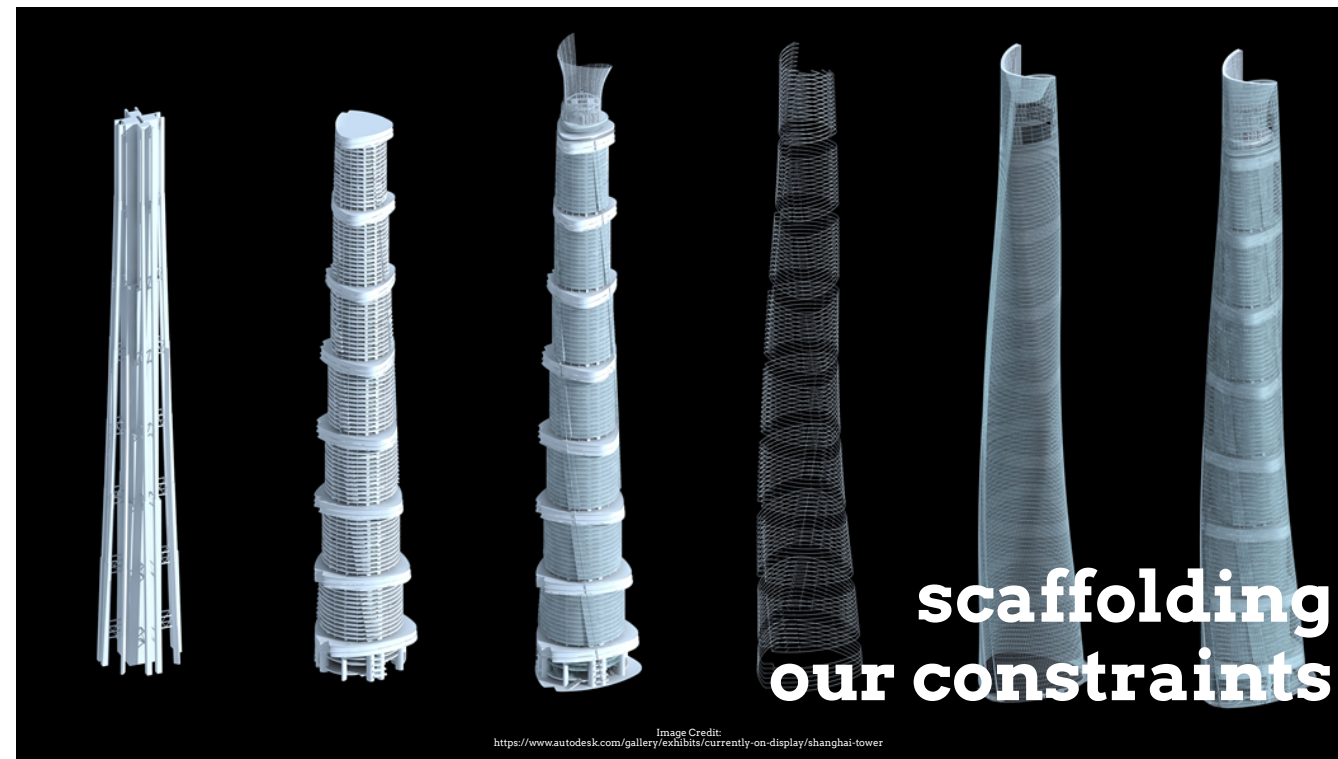
Patrick Hebron



The concept of open-ended materials...
what does it mean for a material to be “open-ended?”

Paper is the ultimate open-ended material.
It allows us to produce any output.
It brings almost no constraint.
This is a blessing and a curse.

In any case,
We didn’t become any freer when we went to computer-based design.



To the contrary, computers help us to think bigger because they enable us to scaffold our constraints.

CAD tools allow us to model physical and material properties that help us to test whether an idea will work in the real world.

Through this, we can probe and scaffold our way towards the building of things that are too complex to model in our heads.

the tyranny of conventional wisdom



But, herein lies the problem...

Since we cannot easily reason or speculate about what might work in such complex domains, we can only probe new possibilities through a kind of guess-and-check interaction with the modeling software.

Naturally, these probes must originate from something we understand and can imagine: the conventional wisdom handed down through the ages.

If we could see outside this lineage and explore the full possibility space made accessible to us by modeling tools, we might find incredibly elegant or optimal new solutions to countless problems.

Unfortunately, it is virtually impossible for us to see outside of the historical lineage in anything other than an iterative (and therefore historical) manner.



Then suddenly, machine learning comes along...

Now we not only have machines that can simulate the world, we also have machines that can speculate about it and search the possibility space in a completely unemotional way - with no regard for how others have solved problems in the past and guided only by a quest for the optimal solution.



To understand the impact of this, let's look at the recent accomplishments of a board game playing artificial intelligence.

People have been developing strategies for the game of Go for almost 3000 years.

The Google subsidiary DeepMind built a Go-playing machine learning system and challenged the best human player.

The conventional wisdom around Go strategy contrasts value of moves in the 3rd or 4th lines.

AlphaGo played a bold move along the 5th line. Commentators thought it might be a mistake. Sedol took a break to regroup. It was a historic move. But its value wasn't self-evident for 3000 years of Go history and it wasn't immediately clear at the moment it was played.

Since the match, professional human players have been revising their understanding of the game, some looking more at moves along the 5th line.

Meanwhile, DeepMind created a new version of AlphaGo that was not trained on any human played games. This version shut out the previous version in 100 games.

The takeaway: conventional wisdom isn't always optimal.

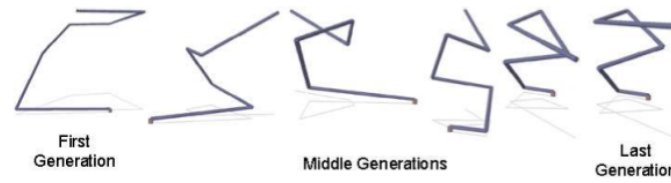
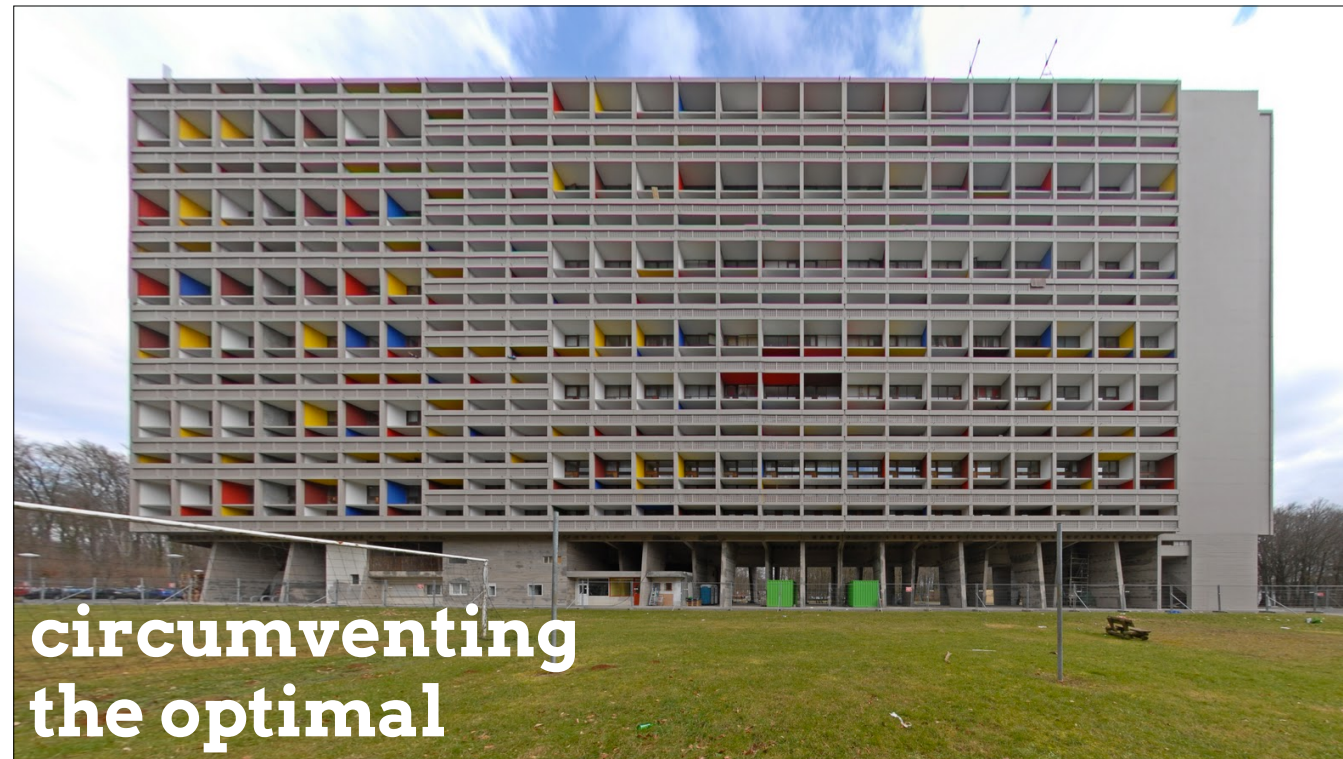


Fig. 10. Sequence of evolved antennas leading up to antenna ST5-33.142.7.

Image Credit:
<http://bit.ly/2E6tYuQ>

NASA evolved antenna geometry.

Domain that involves objective truth that can be modeled.



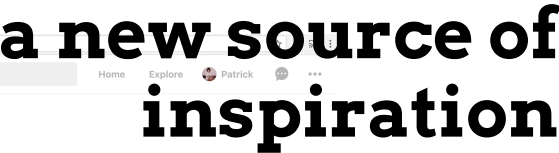
This kind of ahistorical capacity is a very powerful thing.

But, in many realms it cannot stand on its own.

As Minimalist and Brutalist architecture suggest, a designer's effort to optimize a system is not always well-aligned with the true needs of the user, who must often circumvent the system's design in order to perform their duties within it.

In domains like architecture and design, machine learning can provide a powerful mechanism for seeing beyond of conventional wisdom.

But we still need human architects and designers to mediate, curate and synthesize the machine's ahistorical insights into creations that will be useful to and understood by humans.



But it's not a magic bullet. We have to grow too.

So, we can't just look to an algorithm for inspiration.
We also need to look to our clients.

And with that, I give you Michael...

Thanks!

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