A love letter to engineering, and embedded systems Watch this talk on YouTube

<u>V. Hunter Adams</u> November 13, 2023

- Why should you do engineering projects?
- What makes embedded systems projects special?
- How can you get started on projects of your own?

What are some projects that students have recently completed, or are presently working on?

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This needs to be a **conversation**, because I'm going to try to articulate thoughts that I haven't yet figured out the best way to communicate. It's hard to explain why you love something, just like it's hard to explain why you love someone.

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There are **practical** answers to this question, and there are Hunter's personal answers to this question. I'm going to address both but dwell on the latter, because I expect that the practical reasons are largely obvious to a group like this.





evidence for your competence as an engineer is a project portfolio.

Building things is engineering. If you want to be hired as an engineer, the most important

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 - Gives you credibility. (This is also true in research settings.)

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• The engineering curriculum here will teach you how to solve problems with engineering. And it should! This is what you'll be paid to do, and this is the engineer's obligation to society and

I'm going to tell you my personal reasons for loving engineering and engineering projects. I'm not trying to convince you that you should share these feelings. But it's a good exercise to try to understand why people love things which we ourselves may not love.

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(Also, I just enjoy having conversations like this with colleagues and students)

V. Hunter Adams

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• Once we learn to read, we use reading as a **mechanism** for gaining information about **other** things. In the process, we also improve our reading skills! So it goes for engineering. We use it as a mechanism for learning about other things, and become better engineers in the

- process. We can use engineering projects to learn about things like . . .
 - Birdsongs
 - Synchronization in nature
 - Flocking behavior
 - The behavior of fluids
 - History (Enigma & Bombe, Archaeology)
 - Algorithms/Math (FFT, Mandelbrot, Lorenz, cellular automata)
 - Art (Picasso & Fourier)
 - Animal science
 - Space exploration

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- speciality, it makes you a better engineer! Here's one example of this fact . . .

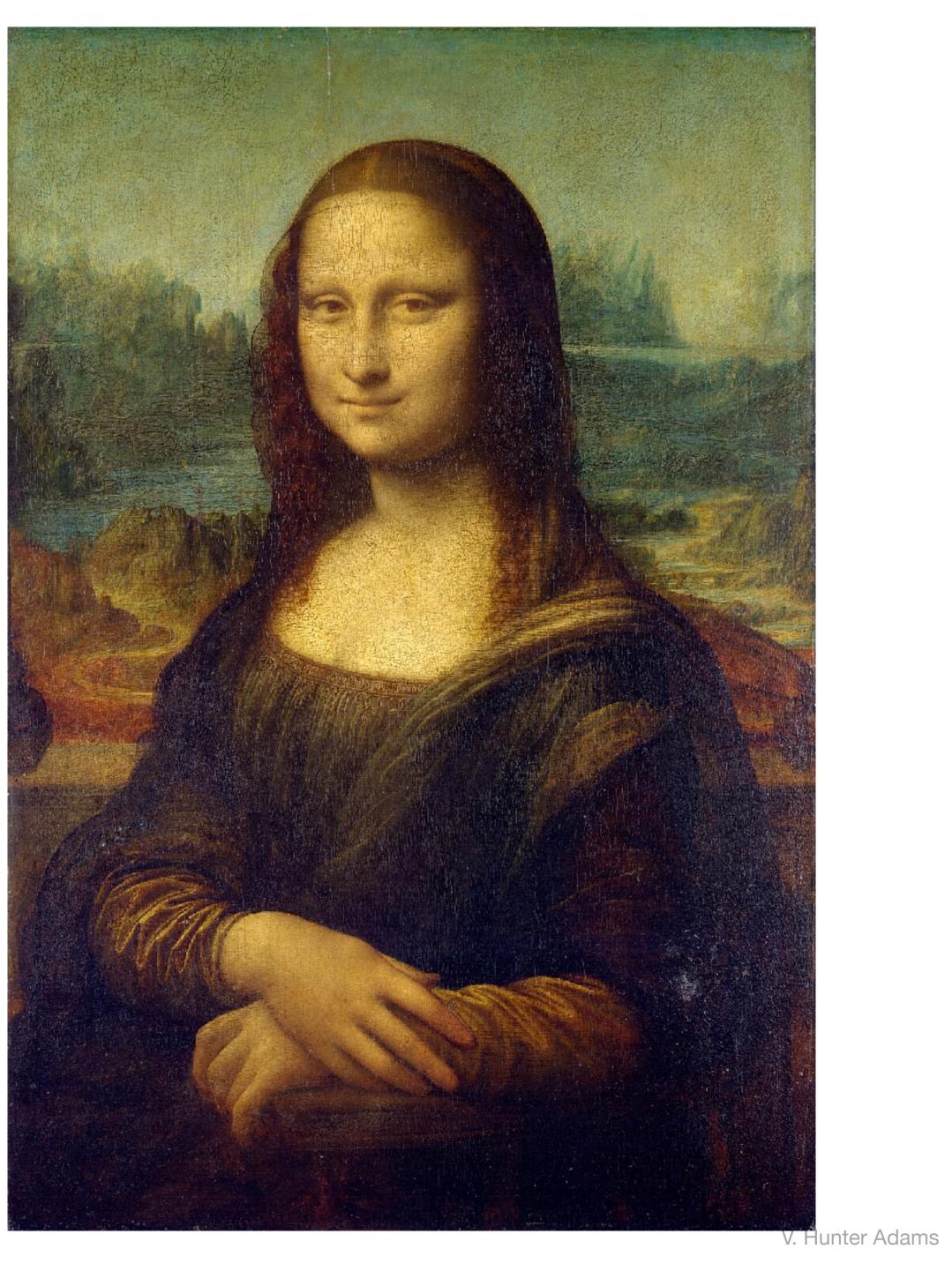
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Exploring a diversity of interests doesn't indicate a lack of commitment to your area of

"And what about the scholars and critics over the years who despaired that Leonardo squandered too much time immersed in studying optics, and anatomy, and the patterns of the cosmos? The Mona Lisa answers them with a smile."

- Walter Isaacson, Leonardo da Vinci



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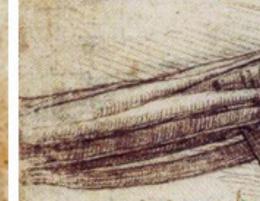
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Only a person with this many interests could generate the Mona Lisa.

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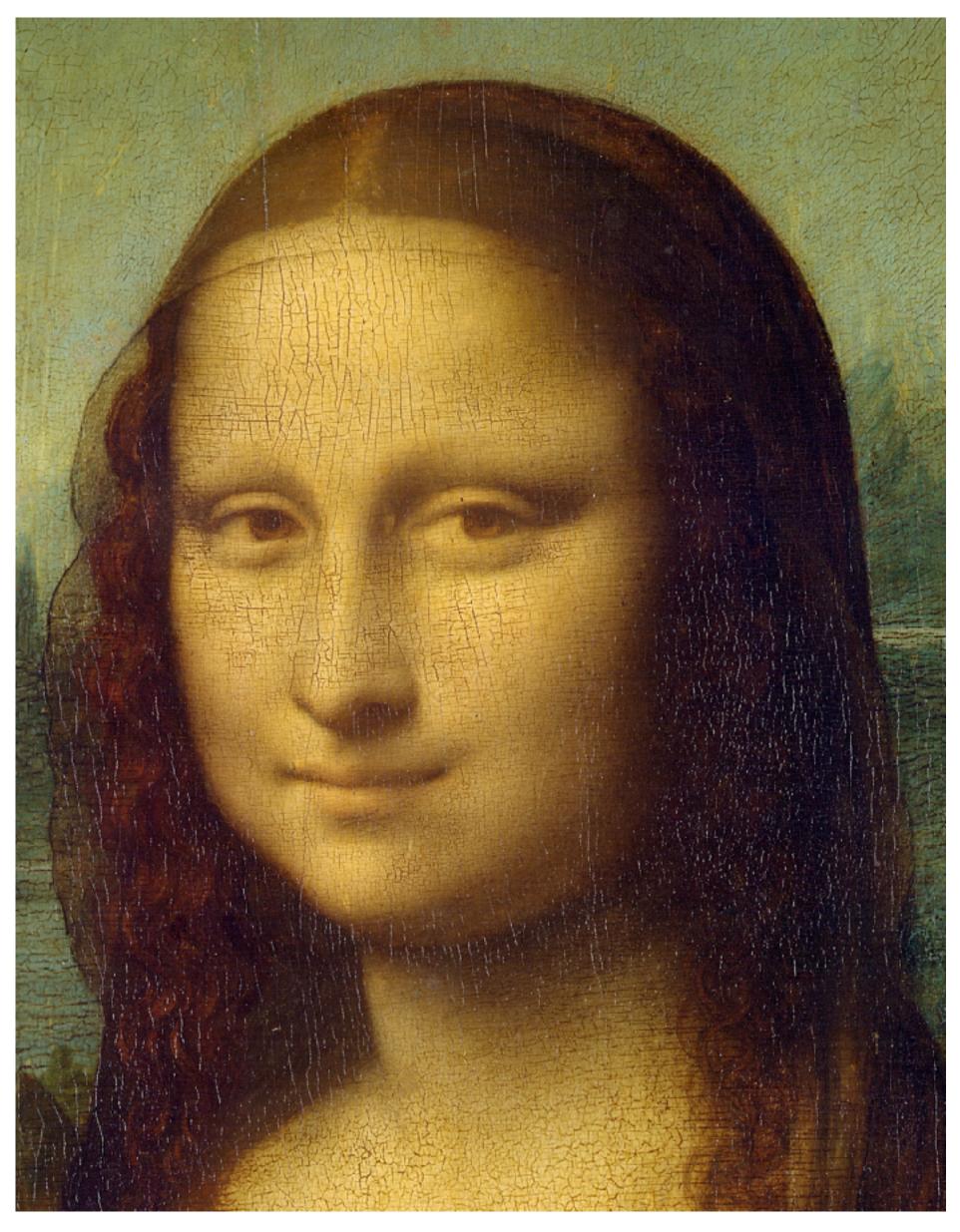
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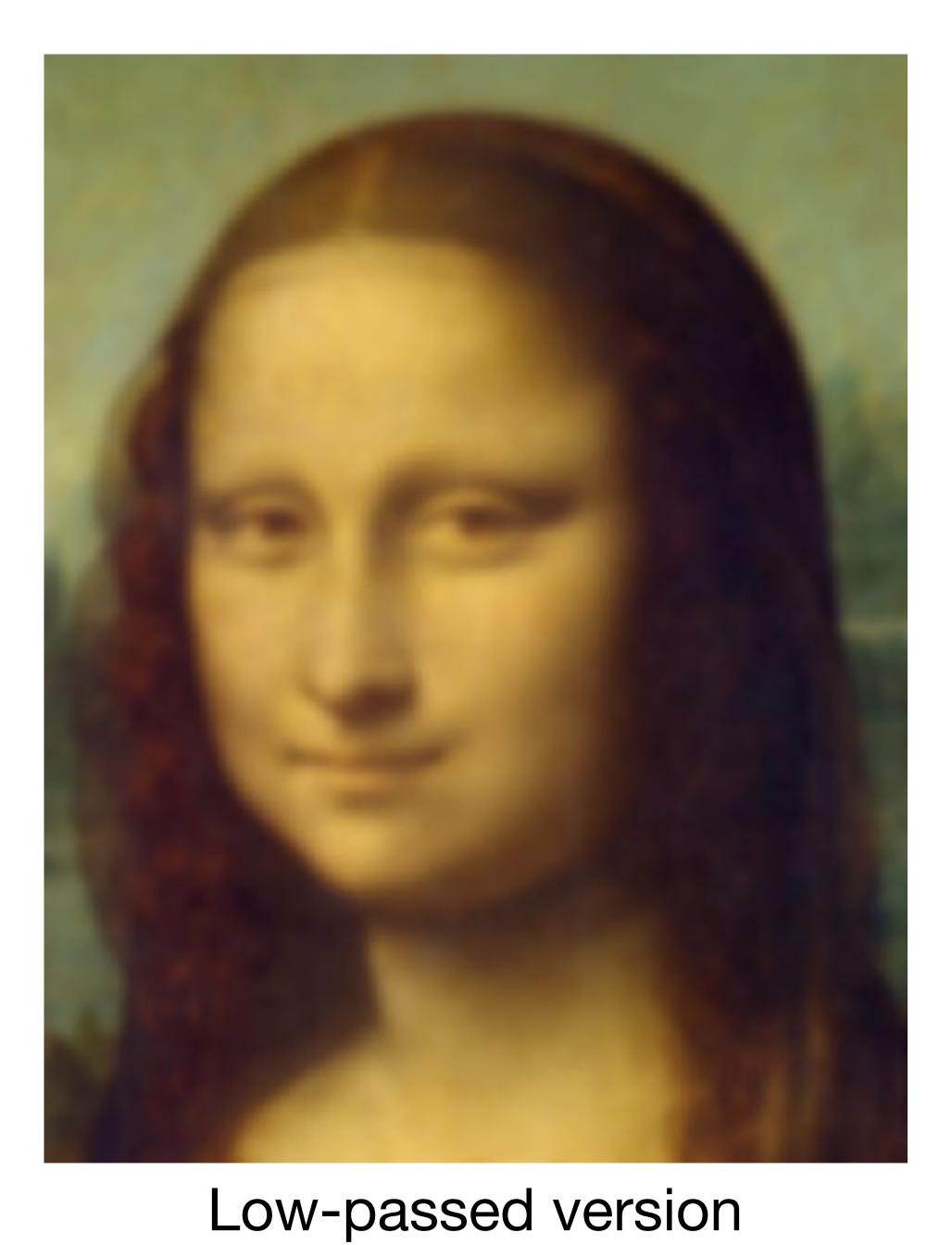
These weren't distractions, they made da Vinci a better painter. And engineer. And scientist. And architect.

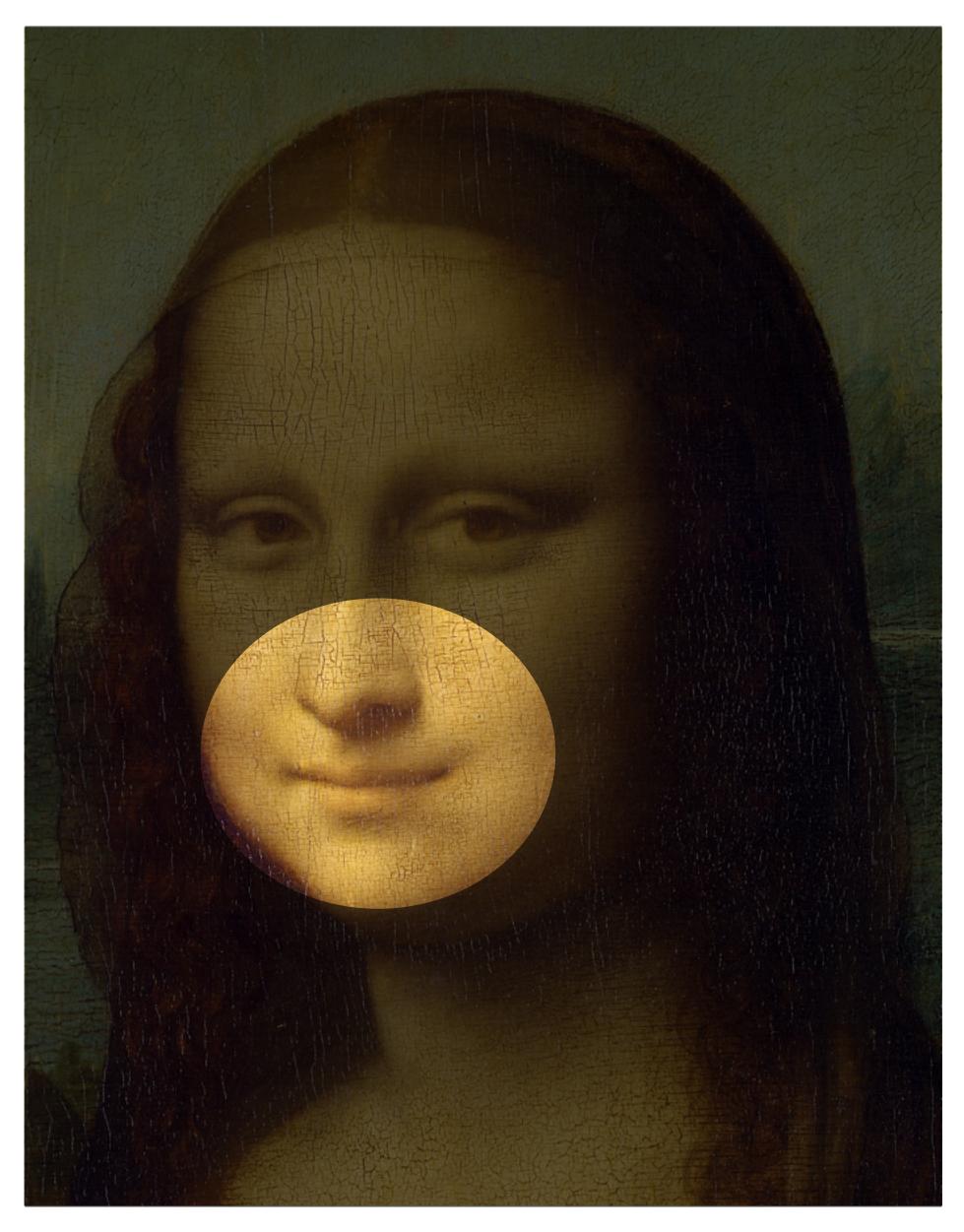
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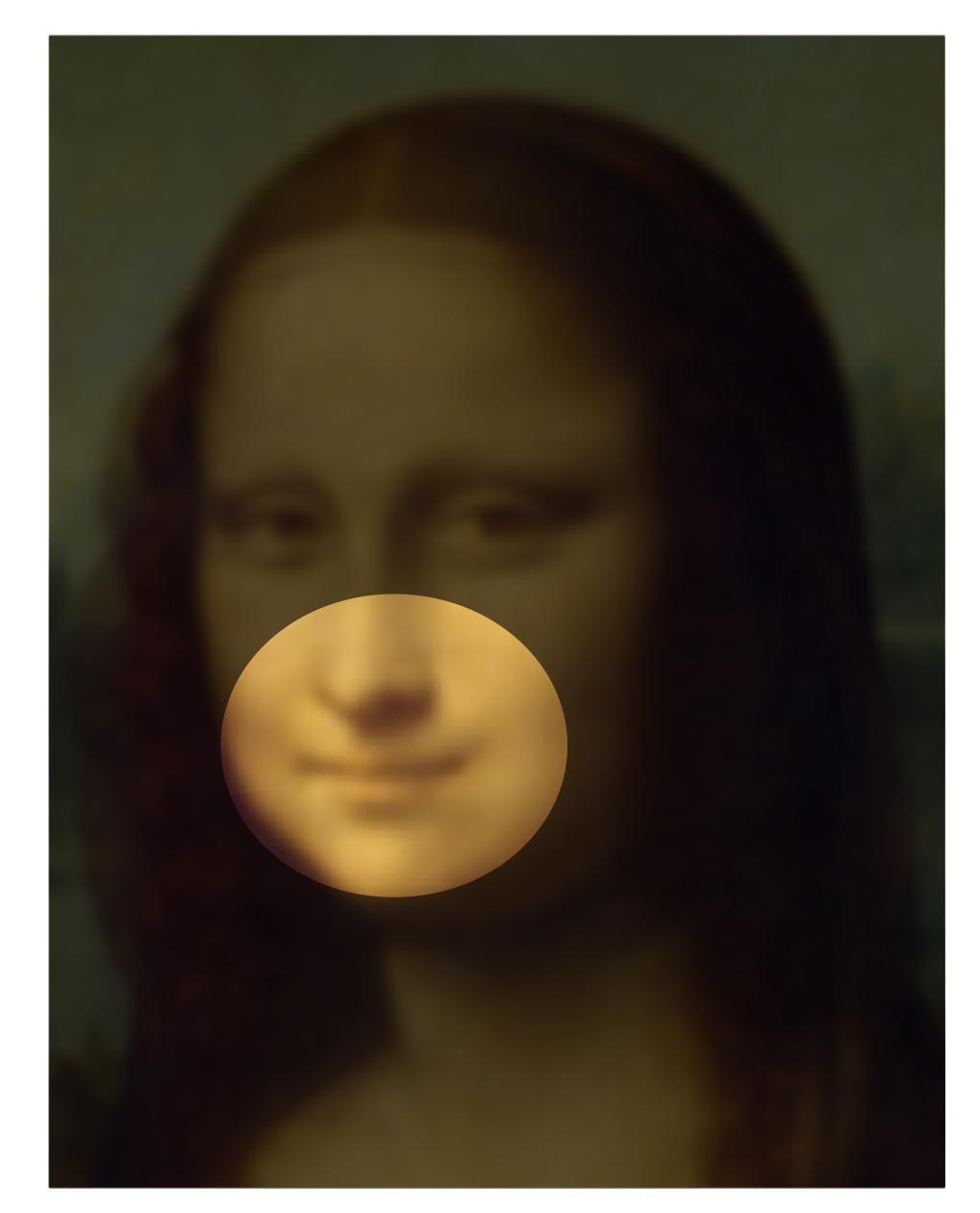


As Leonardo painted her





Her smile is more apparent in the lower frequencies!



"Wish away the dilettante who spent the bulk of his later life on chess, machines, and juggling, and you'd also wish away the curious genius who invented information; **it came, all of it, from the same place**."

- Jimmy Soni and Rob Goodman A Mind at Play: How Claude Shannon Invented the Information Age



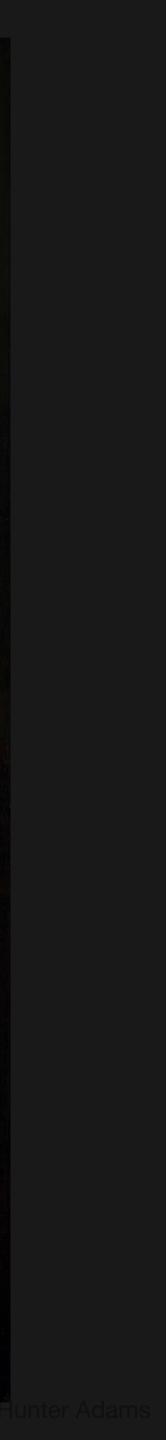
Photo: © Stanley Rowin

Engineering projects are *filter removers*. They cause for you to notice and appreciate the natural and constructed worlds in new ways. You suddenly notice things that have always been there, but that have been filtered away from your conscious mind. Birdsongs, algorithmic - Walter Isaacson behavior in insects, etc.



Like in a good piece of music, there's an interplay between order and chaos in the natural world. Engineering projects let you *hear the music*.

- Walter Isaacson, Leonardo da Vinci



- Why should you do engineering projects?
- What makes embedded systems projects special?
- How can you get started on projects of your own?

Everything I've said thus far applies to all sorts of engineering. What's so special about embedded systems in particular (to me)?

What are some projects that students have recently completed, or are presently working on?

- They are **vehicles** to other fields and disciplines.
 - explore that interest using, say, nuclear engineering!

• We can explore an interest in birdsongs using embedded systems. It would be a lot harder to

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- They offer constraints!
 - same is true for embedded systems.

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 - burned fingertips. Make a mistake in a high-power system . . .

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- (and beautiful) views of each.
 - programs must know about the hardware on which they are running.
 - hardware, or is it a consequence of physics?)

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• Make a mistake in an embedded systems project, and you'll be out a few dollars and nursing some

• They sit on the boundary between the **natural world and the computational world**, and offer unique

• One acquires a computational view of nature, and a deep understanding of computers. Our

• Debugging places you in conversation with **nature** and with **physics**. (Is the bug in software, or

- Why do engineering projects?
- What makes embedded systems projects special?
- What are some projects that students have recently completed, or are presently working on? How can you get started on projects of your own?

What are students working on?

- ECE 4760/5730
- ECE 5760
- ECE 6930

How can you get started on projects?

- that are building cool things for fun.
- Come knock on my door! I'd be happy to brainstorm some projects that allow for you to

• Join the Maker Club! No previous experience is required, come join a community of students

improve your engineering abilities, while also exploring your other interests and curiosities.