some stories about STEAM

by some students at Brown University in Providence, RI

STEAM is a student-led effort to ignite communications between disparate fields in academia, business, and thought. Our focus is broad but our starting point is uniting the Arts with STEM (Science, Technology, Engineering, Mathematics).

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What's in a Name?

Ethan M. c/o 2019

The old saw is that if you can't explain something to your grandma, or to a five-year-old, then you don't really understand it.

That once you really know something, you can boil it down to its core features and describe it as easily as retelling a story. That understanding comes first, and that words come second.

I think that's only half true.

Words are powerful. Stories are powerful. Sure, they come from understanding, but they're also how we understand things in the first place: by "putting things in our own words," by turning some book's abstract nonsense or a teacher's dry lecture into something that that we can relate to and see in our normal lives. They are how we discover and rediscover passion.

When I first joined STEAM, I loved it. And what wasn't to love? STEAM was STEM + Art, plain and simple. I did strange science things, I did strange art things, sign me up. And the more I got into it, the more wonderful STEAM became. STEAM was biomimicry and design and human computer interaction.

what was STEAM to me?

It was about making cool things with cool people and it was everything to me until it wasn't. Until I stopped having the time to do cool projects. Until I just spent more and more time in the lab. Until I stopped writing.

It's hard to believe in something you don't do anymore.

Last year, I went into our end of year post mortem with the words "I'm done" rattling around in my skull. After all, I was the president, and some president I would be if I couldn't practice what I preached. At Brown, our post-mortems usually entail what we did that year and any issues we had with logistics or events. We talk about what we want to do next year and start planning our overall goals. This year, since we did a lot of reorganization around what we wanted STEAM to be, we asked everyone to define what STEAM meant to them. The first time the question came around to me I just said what I've said before: "STEAM is about making cool interdisciplinary projects." It was the first one that came to mind. It was the one I'd been taught, the one we told everyone else. It was the only one we had. And I hated it. I hated how trite it was. I hated it because it kept me from something I knew I loved. I hated it because if STEAM were just making, then STEAM shouldn't have been a part of my life (but it was), shouldn't have been something that I thought about every day (but it was), shouldn't have been something I felt in my bones as something that made me me (but it WAS).

it's a way of thinking, a way of seeing the world

So I thought about it.

And thought, and thought ...

What was STEAM to me?

To me STEAM is learning that dancing has its own notation system that some people use to teach robots how to move. It is listening to people talk about how much gesture-based UIs can learn from ASL. It is watching the way sharks and jellyfish move, and thinking about how different characters move through the air in Melee. It is realizing despite how vast the universe is, that you can never truly get lost—that you'll always have something to hang your hat on. It is seeing things I know in things I don't—*putting the world in my own words.*

After those realizations, I came out of our post-mortem more excited for another round of STEAM than I had been since freshman year. Because STEAM isn't just about making, isn't something I have to take time out of my day to do, it's a way of thinking, a way of seeing the world. It's something that anyone can do by just looking around or talking to a friend. STEAM is a way of learning that embraces how interconnected everything is, and how much more interesting that makes the world we live in.

I think I finally understand STEAM—Grandma, do you?

STEAM means putting the world in your own words.

That's a pretty general definition! Is it too broad?

We got to this definition after a lot of back-and-forth discussion. This one felt the best out of all of the sentences we came up with, and it resonated with all of us.

And who knows - maybe in a few years, another group of STEAM kids will find something better.

Well, STEAM itself is so nebulous and so all-emcompassing - how could you sum it up in one sentence?

But until then, this one makes sense for us. We hope it makes sense to you too.

Subtle Bodies: Transcending the Physical Plane Through Virtual Reality

Mariel R. c/o 2020

When I awoke, I was met with an infinite expanse of emptiness. I could not feel my body, and, for a few seemingly fleeting moments, even forgot I inhabited one.

I was naked, suspended in 30cm of densely salinated and unnervingly viscous water contained within an egg-shaped clamshell bath. My foetal capsule was without light, and I was swathed in total silence.

For the past hour, I had been lying, mostly asleep, in a sensory deprivation tank in a tiny home tucked away in the middle of Beijing. It was the summer of 2017. One week prior to this float, I happened to experience virtual reality for the first time: deeply meditative, trance-like, and psychedelic audio-visual experiences.

The rest of my summer followed a similarly serendipitous and uncanny pattern of stumbling upon novel, perspective-shifting experiences... and so began my unexpected free-dive into

radical shift in perspective.

questions of embodiment, sensory perception, consciousness, reality and emptiness.

Fast-forward six months, and I am sitting in a meeting with my STEAM friends, discussing ideas for new projects: any ideas that married computer science and the arts were fair game. I happened to mention my VR and float experiences over the summer, and how exciting it would be to mimic those experiences and share them with friends. That conversation spurred the creation of a STEAM project titled “Subtle Bodies”, a name suggestive of the ephemerality and emptiness of our physical selves.

I wanted to use VR, a powerful and exciting technology, to give others a taste of the transformative experiences I had last summer.

The goal of this project is to create two experiences that present users with a radical shift in perspective, leaving them questioning embodiment, consciousness and their senses. How does my sensory perception shape my views, emotions, and the world I inhabit? How does removing my visual field from my body affect how I see myself, my place in the world, and others? How is my experience of this reality limited, or enhanced, by my senses?

out of body

fully immersive

audio visual

multi sensory

We want people to, very simply, see themselves and their bodies in new ways.

In our first experience, we use screens paired to another person’s camera to switch users’ perspectives, mimicking out-of-body experiences and quite literally letting users “walk in each other’s shoes”. (Watch the video below to see our inspiration for this experience).

Our second experience, still in its ideation phase, will ideally be a fully immersive, visually abstract, generative, multi-sensory VR experience. We are playing with ideas of audio-visual coupling, but also exploring tactile sensation and debating the use of hundreds of tiny vibration motors that envelop the user and control minute fluctuations across the body in tandem with the user’s heartbeat, or perhaps their breath.

We aim to “exhibit” both experiences as installations in a multimedia gallery in the fall, intentionally and carefully carving out slices of space and time in which to share this with others.

We have just begun this project and will begin generating prototypes in the coming days and weeks. We are so passionate and excited about this opportunity to facilitate transformative experiences for our peers. Stay tuned for updates on our progress.

Students, sundials, and school: Inter-disciplinary barriers within the university

David S. c/o 2020

The Timepiece Sculpture is the first student-designed permanent sculpture on Brown's campus, scheduled for installation in Spring 2019 on the Engineering Research Center green. Timepiece is a noon-mark sundial in the shape of a large Mobius strip.

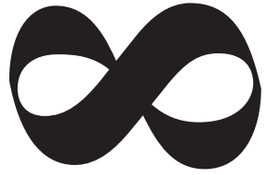
Two years ago, an alumnus of Brown Engineering approached the University about donating a sculpture. However, rather than selecting an existing piece from an established artist (think Untitled (Lamp/Bear) by Urs Fischer), he wanted this sculpture to be different: he wanted it to be designed by students. He only asked that the sculpture tell time in some way and last as long as the building it would sit in front of.

As soon as STEAM caught wind of the project, we knew we wanted to be the group to make it happen. The sculpture's need for durability and accurate timekeeping combined with the aesthetic requirements of a piece of public art makes it quite interdisciplinary by nature, and STEAM specializes in convening interdisciplinary groups of people from around campus.

The donor and administration agreed, and thus the STEAM Timepiece Project was born.

For some reason, the STEAM leaders asked two freshmen, me and Elizabeth Austin (now a STEAM co-president), to guide a volunteer team of engineering, art, computer science, and architecture students through a design process to produce a final Timepiece concept. Though we were nervous at first, we leapt at the opportunity to help make a permanent mark on Brown's campus. And besides, all we had to do was design the thing!

Or so we thought.



After navigating through an iterative process of idea generation, prototyping, and public feedback showcases, we settled on a final design: the Mobius-strip sundial. At this point, we thought our job was over—but it turns out going from a concept to actual, dimensioned SolidWorks drawings requires a lot of work. Most notably, it took a huge amount of idea-bouncing between us, the School of Engineering, and the Brown Public Arts Committee (PAC), which oversees the acquisition and installation of all new campus art (yes, including the aforementioned Lamp/Bear).

This is where we started to see tensions emerge: as we refined our design, the engineering administration became more concerned with budgeting and material and structural feasibility, while the Public Arts Committee pushed us to explore different aesthetic and narrative-based interpretations of our original.

but why was it so difficult for these groups to collaborate?

While these were both important aspects of the project that we could not ignore, deciding which design decisions should be prioritized caused clashes between the engineers and artists. Each thought their own approach had more merit, and that the other contingent had fewer qualifications to make the best decisions.

The engineers thought the artists didn't understand enough about physical constraints, fabrication techniques, and design feasibility, while the artists thought the engineers didn't have enough of an aesthetic eye to be designing a permanent piece of public art.

In reality, both sides were probably partially right. But why was it so difficult for these groups to collaborate? Elizabeth and I had never run a project of this scale before, and we didn't know how to handle the situation, especially because the similarly-diverse student design team experienced no such tensions. Perhaps the students were a self-selecting group, or the administrators and PAC were dealing with tighter constraints, but I believe the issue runs deeper than that. **These tensions and resistance to cross-disciplinary collaboration are a pattern stemming from the structure of the university itself, both at Brown and elsewhere.**

admins

experts

students

Here's the problem we've noticed: at Brown in particular, the upper-level administrators (including the president, corporation board, etc.) have an incredible interest in interdisciplinary practices; it's reflected in the "spirit of free inquiry" in the University's mission statement and in the Open Curriculum itself. That interdisciplinary spirit is also embodied by the students who choose to study here, who are more than ready to soak up these principles. However, there's a disconnect between the interdisciplinary efforts of the top (administration) and bottom (students), and it comes at the level of academic departments.

It's this group within the modern university—between the administration and the students—who need the extra push into interdisciplinary thinking and cross-departmental collaboration. The faculty who make up each and every department are focused experts, we have the utmost respect and appreciation for that. However, they often conduct much of their research in specialized fields, sometimes during decades less friendly to cross-disciplinary collaborations. With Timepiece, these cross-departmental tensions stalled the entire project for months.

But there is a solution.

What finally allowed Timepiece to keep moving was transitioning the Engineering-Arts dialogue away from ten people in a room to smaller, more personal conversations. It was in these one-on-one, two-on-two meetings where members of Engineering and Public Arts could listen to each others' perspectives and realize what they had to gain by accepting elements of a different approach.

It's these conversations that we have to facilitate as a university, and in all universities, in order to have the type of collaborations and the depth of interdisciplinary research and studies that we want—and need.

STEAM is here to do our part in getting people to talk about these issues. So let's sit down together, listen, and learn from those who might have something to teach us.

Launching Art through Human-Robot Collaboration

Erin C. c/o 2019

Just a couple weeks ago, a painting sold at auction for $432,000. Nothing out of the ordinary there. Except one thing... It was created by an AI.

The painting, called *Edmond de Belamy*, from *La Famille de Belamy*, was the first AI-generated painting sold at auction, and it's been making waves in the art world. We've been using machines like the camera and Photoshop to make and alter our art for ages, but what does it mean when a machine becomes the artist? This very question might have been the key to Edmond's shocking success; though initially valued at less than $10k, the novelty of machine-as-painter sparked curiosity in several auction-goers, making it a coveted piece despite the fact that many consider it a peculiar, if not bad, painting.

What happens now? Should we add "artist" to the list of jobs taken over by machines? Probably not, but, nevertheless, the role of technology in art-making does seem to be getting more complicated.

should we add “artist” to the list of jobs taken over by machines?

To better understand our relationship with technology when it comes to creating art, it might be helpful to think of these art-machines as existing on a spectrum. On one end, we have tools that are entirely controlled by human input—with a camera, a human sets up the frame and pushes a button, and, with editing software, a human decides what changes to apply to their images. On the other end of the spectrum, we have autonomous robots that, though influenced by their creators' designs, create without human input—such as the AI from Obvious Art that just became several thousand dollars richer.

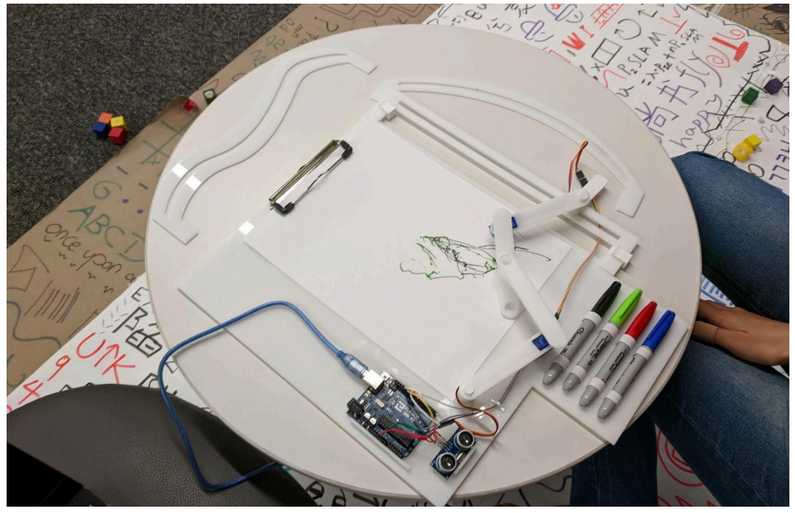
Tools on the “human-controlled” end of the spectrum are more-or-less available to the average person. These once-novel innovations have become a entry point into art for many people by changing how we approach the art-making process. Now, taking a photo is as easy as whipping out a smartphone. You can make a digital painting without buying brushes, canvases, chemicals, or a studio. Through these simplified processes, countless individuals have found a passion for photography and have pushed themselves to make more art.

encourage people to make art without stress

Conversely, AIs that generate original works aren't so easy to come by, and their contribution to art isn't experienced as widely.

As our world becomes increasingly more tech-savvy and interested in the role of AI in our everyday lives, it's interesting to consider how we can incorporate this new tech into our artistic processes. Here, we'll focus on tools that fall in the middle of our spectrum–robots and AIs that augment rather than replace our existing art-making processes–since they have a greater potential to be accessible to a wider variety of people.

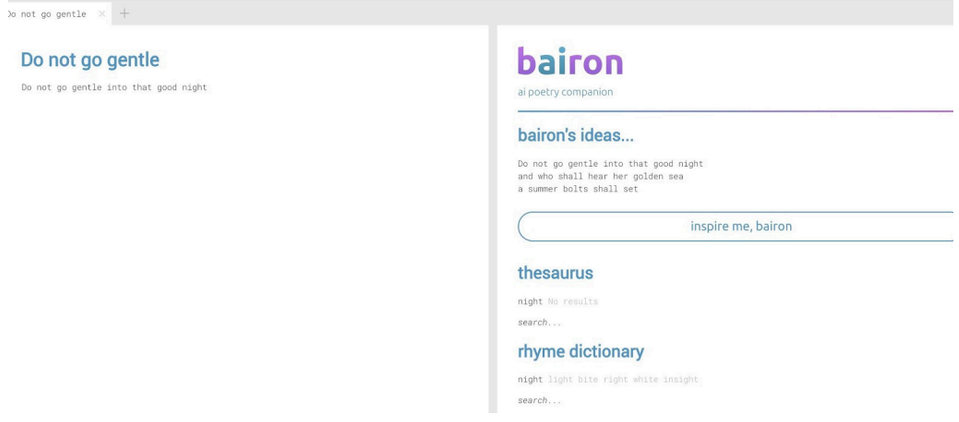
What might such a tool look like? This past year, I've been thinking a lot about this question. I've always loved art and cranked out drawings ever since I could hold a crayon, but for many of my friends the thought of even starting a drawing brings nothing but stress or disappointment that their product isn't “good” or doesn't look like what's in their heads. So, I started thinking about how to encourage people to make art without this stress, similar to how a phone camera takes the stress out of photography and gives artistic agency to a vast number of people.



I began thinking about using technology as a tool in a way that would use robots to augment creativity in drawing. Thus, Melvin was born! Melvin is a Robot Aided Drawing device, or RAD for short. I designed Melvin as an attempt to take some of the onus of making "good" art off the user while making the actual mark-making process a bit more fun and experimental so people who wouldn't consider themselves visual artists might have a reason to get excited about drawing. Here's how it works: the human moves their hand towards and away from an ultrasonic sensor, which causes servo motors to rotate and move the drawing arms across the page. To make the process more interactive, the human can also move the anchor point of one of the drawing

While it's nearly impossible to make coherent images with Melvin, I noticed people had an immediate interest in playing with it. My friends, who generally shy away from artmaking, suddenly wanted to see what they could make with Melvin! This demonstrates that even simple robots can help people jump into new fields of art and have fun in the process.arms.

There are other tools out there with similar a goal: to enhance, or encourage, our ability to create through robot-human collaboration. For instance, two other students at Brown University, Matt Cooper and Martha Edwards ('18), have been working on Bairon, a poetry AI that offers suggestions for how the human poet might add to their poem based on what they've already written. Martha and Matt felt that pure AI poetry is novel, but notoriously bad; however, a collaboration between robots and humans could combine the strengths of both parties: the AI's ability to generate new and unexpected phrases could inspire the human poet, who would take the AI's suggestions and mold them into a meaningful piece.



humans can get inspiration, explore new fields, and grow as artists by working with machines

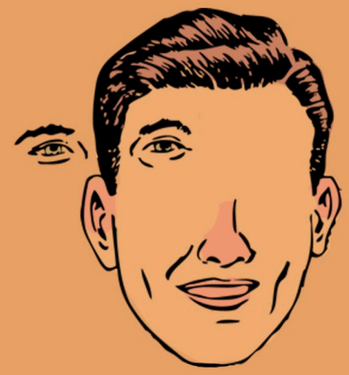
Similarly, Google Magenta's Piano Genie project extrapolates input from only 8 buttons to notes on an entire 88 key piano. They state that the Piano Genie is a way to make music-making and composition more accessible to novice musicians by simplifying the prior knowledge required—instead of needing to use the full octave range of a piano, the user can establish general relationships between their 8 buttons, which the AI translates into more complex musical structures. This provides the user with a way to improvise new music rather than only learning pre-existing pieces.

Projects like these are exciting and hold great promise for getting people involved in artforms they might not be familiar with. They demonstrate the ways humans can get inspiration, explore new fields, and grow as artists by working with machines. Additionally, they ensure that the artist's tastes and understanding of social and personal context aren't lost for the sake of technological novelty.

That said, these sorts of mid-spectrum machines are still few and far between. Fortunately, there's currently a DIY element to many of these projects; there's a lot of documentation online for building your own versions of these tools. But even this open-source framework presents barriers to accessibility. First of all, you have to know that such documentation exists. From there, you need access to the right software for the code or the right materials to construct the project. However, the more we explore these partly intelligent, partly collaborative projects, the more insights we'll have, and the more commonplace they'll become. Who knows! One day we might all be drawing with the help of our very own Melvin, or writing with Bairon, or jamming out with Piano Genie.

Remembering I have feet

Mara J. c/o 2021



The seat of the soul. The vestige of a dorsal third eye. The valve that regulates animal spirit, that opens and closes the cerebral aqueduct.

You guessed it: it's the pineal gland!

From a time when philosophy comfortably coincided with physiology and astronomy, all the way through their separation in the second millennium, and into their happy reunion in the third, there have been thinkers concerned with this organ and its function. In particular, they believed that the pineal gland was where consciousness—or spirit, or res cogitans, or the divine soul—could be found. Their theories are part of a centuries-long search for the location and boundaries of the human Self, a quest that hopes to give us a profound and definite understanding of who we are and how we relate to the world.

Galen Nemesius of Emesa Qusta ibn Luca

Descartes

Today, we're fairly sure that the pineal gland is mostly just responsible for secreting melatonin, a hormone best known for its role in regulating sleep patterns. The roles assigned to it in the days before peer review, however, were much more exciting.

Galen (ca. 130-ca. 210 CE), a Greek medical doctor and philosopher, wrote extensively about a view that was present around his time, which saw the pineal gland's regulation of 'psychic pneuma', or animal spirit, which was then thought to be a basis for consciousness. Nemesius of Emesa (ca. 400 CE) saw it as a mediator between the organs of reason and memory. Qusta ibn Luqa (864–923 CE) expanded by noticing that when one wants to remember, they look up, raising the pineal gland and opening up the passage of memory, while when they want to think, they look down, closing the passage, and protecting the organ of reason from being disturbed by memory.w

Then Descartes found out about it.

> *"The part of the body in which the soul directly exercises its functions is not the heart at all, or the whole of the brain.*

It is rather the innermost part of the brain, which is a certain very small gland situated in the middle of the brain's substance and suspended above the passage through which the spirits in the brain's anterior cavities communicate with those in its posterior cavities.

> *The slightest movements on the part of this gland may alter very greatly the course of these spirits, and conversely any change, however slight, taking place in the course of the spirits may do much to change the movements of the gland."*

For Descartes, the Self is entirely immaterial: independent from, but still anchored in, the physical body. However, in order to explain the interaction between the material and immaterial, Descartes had to introduce a middleman. Thus the pineal gland scored its most remarkable distinction yet and became the center of Cartesian dualism, one of the most famous and widely influential models of how the Self relates to the body and its surroundings.

Fast-forward to today. Most of these pineal gland theories didn't exactly catch on among doctors and psychologists. Their remains are now mostly confined to magazines on psychic expansion of consciousness. Still, the wider tradition to which they belong—one that considers the Self to be separate from the body, but somehow 'seated' somewhere in the head—still enjoys fairly wide acceptance.

I am an immaterial soul *I am a material brain* *I am a body* *I am what I affect* *I am everything* *'I' does not exist*

why does it feel natural to assume that, if there's a me, it's likely located and contained within my head?

Lately, I've found it fun to think about the reasons behind this acceptance. Why does it feel natural to assume that, if there's a me, it's likely located and contained within my head? Why can it feel disorienting to remember that there's more stuff attached to that head? And finally, are there ways to step out of the condition that makes the assumption feel natural?

The obvious first possibility is the position of the brain. It should be instinctive, after all, to feel that the highest concentration of me coincides with where I process all of my surroundings and decide all my actions. However, the more I thought about it, the more it seemed that the character of my experiences wasn't tied to the location of my brain but to the position of my sensory organs. If my eyes and ears and mouth and nose stayed where they are, but my brain was in, say, my left thigh, I wouldn't notice the difference! The point from which I perceived the world, from which I constructed predictions and reconstructed memories—my point of view—would still be where it was: eye-level, in the middle of my head. My sense of self, then, seems to be entirely independent of where my brain (or, for that matter, the pineal gland) is located, but I do seem to identify very strongly with where my point of view happens to be.

The idea that our sense of self depends on the arrangement of our sensory organs might seem obvious, but it certainly makes a large chunk of our search for the Self seem hilariously misled. What makes the whole thing even funnier is that the reason sensory organs are so densely packed has to do with nothing but reducing the amount of effort needed to transfer sensory information from its sources to the processing center.

Our long and impressive history of illustrating the Self as residing in the neck-up region is, as it turns out, a consequence of our bodies trying to save energy.

If neural energy efficiency hadn't been an evolutionary benefit, our sensory organs could have ended up in many other strange places.

Would Descartes' idea of himself have been as clearly bounded and densely unified if his ears were on his shoulders and his eyes were on his knees?

But things are as they are. My eyes and ears are where they are. And as a result, despite knowing about the possibility of shoulder-ears and knee-eyes, my point of view, and with it my sense of self, still seems densely packed into my head and incredibly distant from everything else. It still feels slightly dizzying to remember that I have feet, or that I have a location relative to outside things, or that there are points of view from which I'm peripheral, or even absent. Or, most disorienting of all, to see myself on a supermarket security camera feed.

This is where Subtle Bodies comes in.

Subtle Bodies is a STEAM project in which we use virtual reality to remove the participant's physical point of view from their body. Through the project, we're able to take our eyes out of our head and put them on our knees, on a wall, or into the head of somebody else. VR is essential to the project because it allows us to immerse ourselves fully into another point of view, but as part of Subtle Bodies in particular, it lets us experience our body and presence from the outside in a way certainly more powerful and disorienting than seeing ourselves on security camera feeds.

It still feels slightly dizzying to remember that I have feet.

Wriggling out of our heads and being immersed in alternative viewpoints is surely entertaining and pleasantly disorienting, but it's also deeply therapeutic. Uprooting our physical point of view, holding it in our hands, having the ability to place it elsewhere, and becoming the object of our own gaze for the first time, complicates the boundaries we're most familiar with, and could profoundly affect the way we relate to others, our surroundings, and to ourselves.

Thanks for reading.

COLOPHON

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