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Blast From the Past: Revisiting a "Hot Trail"

WRITTEN BY
KRISTY WENDT

Tasked with investigating the intentions of rival engineers, UW-Madison civil engineering alumnus John Lane (J. L.) Van Ornum set off on a clandestine reconnaissance mission for the chief engineer of a Virginia railroad, posing as a bird hunter. He describes his escapade in a roman à clef titled "A Hot Trail" for the very first issue of Wisconsin Engineer, published in 1896.

After graduating from UW-Madison in 1888, civil engineer J. L. Van Ornum began a two-year foray into railroad engineering[1]. Recounted as fiction in 1896 and told from the relative safety of his new position as a professor of civil engineering at Washington University, Van Ornum describes surveying a rival railroad for the chief engineer of Little Kanawha River Rail and Valley Railroad (shortened in the story to L.K.R. and V.R.R., respectively) under the auspices of bird hunting.

At the time of publication, a notoriously bitter turf rivalry existed between the Baltimore & Ohio (B&O)-backed Valley Railroad (which connected Staunton to Lexington, Virginia) and the Pennsylvania Railroad-backed Shenandoah Valley Railroad[2]. Preserved in spirit and namesake in the popular boardgame *Monopoly,* the corporate owners of Virginia's railroads did not build transportation infrastructure for the overall benefit of the state. Instead, local officials discouraged rail lines from connecting with each other and carrying people directly through the city, as the inefficiency created economic benefits for local businesses[3].

Though Van Ornum preserves the anonymity of the rival railroads at the center of *A Hot Trail* by referring to them only by their acronyms, the Shenandoah Valley Railroad and Valley Railroad do match the geographical descriptions of the railroads he describes. But numerous competing railroads crisscrossed the terrain of Virginia and often serviced the same communities, so Van Ornum's story would nevertheless have applied to many of them. Nineteenth-century maps of American railroad tracks evoke civic disaster: each railroad often built a separate station in the same community, and there were frequently no connections between the tracks of each railroad.

A Hot Trail begins with the Chief Engineer of "L.K.R." and "V.R.R." approaching Van Ornum with an unusual request:

'Before you organize your party for the location survey, I have an investigation I would like you to undertake, concerning the intentions of a rival road in the mining region.' He proceeded to state that the general manager had learned of an apparent intention of the X-R.R. to extend their line into the newly developing fields and so destroy the supremacy of our road in that region. It was reported that a party of X- surveyors was recently at work in the field, and it was the desire of the general manager to learn of their intentions as fully as possible, without disclosing the fact of the investigation to them.

When our plans were perfected, I asked the Chief if he could loan me his shot gun. 'What do you want of that?' said he. 'You are going on serious business, not for pleasure.' I explained that my idea was to pass as a hunter if I found my investigation about to be discovered by the rival engineers, and so cover the real purpose of my presence near their lines.

Armed with a shot gun and dressed as a hunter, Van Ornum arrives in the office of the division engineer at "H-" inquiring about any new developments in the case, as nothing had occurred for two weeks. From the undisclosed city, "A-," Van Ornum describes traveling eastward into uncharted woods, using his training as a civil engineer to recognize the marks of the rival survey: "the distinctive narrow line cut through the brush, the stakes being most obscure in size and height."

"DISCOVERY WAS ONLY THE MATTER OF A MOMENT AND SO I DISCHARGED THE GUN IN THE AIR, AND, SPRINGING UP, GAZED INTO A TREE WITH RAPT ATTENTION."- J. L. VAN ORNUM

Staying overnight in a nearby hotel, and observing "the universal custom of small towns," Van Ornum waits at a local depot for the evening train to come in. To his consternation, Van Ornum recognizes a fellow Badger in the group of rival engineers who would also likely recognize him. The following morning, he quickly pays his hotel bill and resumes reconnaissance, sneaking along the hill line where the rival track approaches his employer's railroad. Here, he is discovered by the chief of the rival party:

He stopped for a moment opposite my hiding place and then started directly toward me. Discovery was only the matter of a moment and so I discharged the gun in the air, and springing up, gazed into a tree with rapt attention. Some muttered exclamation appeared to be followed by a close scrutiny of the unexpected hunter, who continued to appear oblivious to his presence. After a minute or two he remarked on the fruitless shot which was reluctantly admitted. Then, to shift his attention from myself, I asked him the purpose of a slope-board he carried in his hand. 'It's for use in measuring land,' he said, 'you could not understand it if I should explain all-day.'

Van Ornum escapes undetected and continues carefully surveying the rival line, finally determining that "their plan, as disclosed by their work, was to parallel our line to its end and a little beyond, and then construct a switchback around the end, thus enclosing it in a cul de sac." Tellingly, Van Ornum proposes evading the rival by always advancing his employer's tracks ahead of the rival and concludes his story with the assertion that his employer's tracks are "still supreme at the mines."

Long after the publication of *A Hot Trail,* planning and construction of railroads in Virginia continued to progress rapidly and haphazardly, without direction or supervision from the states that granted charters to construct them. Today, all that remains of the Valley Railroad south of Staunton are a few viaducts, weathered embankments, stone arch bridges and bridge abutments: fossils of a mode of transportation not engineered for the common good.

A PORTRAIT OF J. L. VAN ORNUM, TAKEN FROM THE 1888 UW-MADISON PHOTO ALBUM

PHOTOGRAPHY BY
ANNIE KRILLENBERGER

GRAPHIC DESIGN BY
ANGEL SALAS

Source: Page 67 - A Hot Trail / Van Ornum, J. L. - The Wisconsin Engineer Vol. 1, No. 1 June 1896
[1]Year Book. (1914). United States: Banner Publishing Company.
[2]https://www.abandonedrails.com/valley-railroad
[3]http://www.virginiaplaces.org/rail/unionstations.html

THE CHALLENGES OF WOMEN IN STEM AND HOW TO CONFRONT THEM: A PROPELLING WOMEN IN POWER PODCAST REVIEW

THIS PODCAST BY TWO UNDERGRADUATE UW-MADISON STUDENTS HIGHLIGHTS THE EXPERIENCES OF WOMEN PROFESSIONALS IN STEM AND DISCUSSES HOW TO OVERCOME THE OBSTACLES OF A FIELD RIDDLED WITH SEXISM.

WRITTEN BY
MEREDITH BATTAILE

As society progresses, women's impact in science and technology has become more prevalent and accepted. Although there has been progress, the progression of women in STEM has been slow and met by countless roadblocks. Society often sees women as less than men in academics and beyond, which can inhibit women from being able to reach their full potential and lead them to having undeserved self-doubt.

AATRESHA BISWAS - MS STUDENT IN DEPARTMENT OF MECHANICAL ENGINEERING

These roadblocks are the subject of the podcast *Propelling Women in Power.* This podcast is run by two young women studying at the University of Wisconsin-Madison, Michelle Chung and Mary Riker. Chung is a senior, majoring in biology and environmental studies and Riker, a junior, is majoring in civil and environmental engineering. The podcast emphasizes listening to and learning from other successful women's experiences. They focus on combating gender norms and biases women face in their classes and workplaces as STEM professionals.

Through this podcast, the pair hope to teach young women in science how to work toward success. More importantly, they teach how to succeed while faced with obstacles. Riker and Chung stress not only overcoming obstacles but using them as launching points from which to learn and grow.

The pair interview women who work in fields ranging from microbiology to environmental studies. Their guests share their best advice for learning from instances of prejudice. They also tell the stories of becoming successful women in STEM, who are confident in their abilities and work.

Through these interviews, Chung and Riker explore different perspectives of adapting to adversity. One key piece of advice was to make sure that your efforts and ideas are heard. Overcoming the fear instilled by society that the word "woman" is less credible than "man" is crucial to detaching from harmful biases in STEM.

In an episode from July of 2022, titled "Give a Little Bit", the pair interview Great Lakes Bioenergy Research Center Research Coordinator Adrianna Trusiak. They discuss the prevalence of impostor syndrome and how it disproportionately affects women and other underrepresented groups in science. Trusiak explains that

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imposter syndrome is not acquired but an inescapable byproduct of society. To get over impostor syndrome, women must believe in their own success and attribute it to nothing other than themselves and their hard work.

Another episode, titled "Chocolate Cake," features Riker and Chung interviewing Life Sciences Communication Professor Dominique Brossard. They discuss the need to overtly address sexism in STEM. If these issues are publicly recognized, then the issue cannot be suppressed. It forces correct firm response. Perpetrators can realize their biases, intentional or not, and learn from them.

As a woman who has faced adversity throughout my own academic career, it can be hard to recognize these acts of bias, because they can range in severity. The podcast asserts that it is not only important for both women and others to recognize these events. They need to correct themselves if needed and most importantly learn from the experience.

Through interviews with successful women sharing their remarkable experiences, Chung and Riker delve into the importance of women not only respecting and believing in each other, but also themselves. Allowing yourself to learn from your mistakes, making your voice heard, and reminding yourself that you are capable of impactful work is crucial for women to thrive in STEM.

"THROUGH THESE INTERVIEWS WITH SUCCESSFUL WOMEN SHARING THEIR REMARKABLE EXPERIENCES, THE TWO DELVE INTO THE IMPORTANCE OF WOMEN NOT ONLY RESPECTING AND BELIEVING IN EACH OTHER, BUT ALSO THEMSELVES."

If you are interested in learning more about ways to address bias against women, tune in to *Propelling Women in Power*. This podcast delivers insightful and captivating accounts of female STEM professionals, and the years of experience they have navigating their careers.

PHOTOGRAPHY BY
HRIDYESH TEWANI

GRAPHIC DESIGN BY
LUCAS BARTEL

Humans of the Engineering Campus

WRITTEN BY
PAIGE DOLLEVOET

Throughout my time at UW, my engineering friends and I have spent a lot of time parked in Engineering Hall doing homework and finishing projects. We've bonded just as much over the difficulty of finding a table within a 10-mile radius of an outlet as we have over the frustrations of maneuvering our legs around the oddly configured table legs.

While conducting research for this article, I started thinking about a new question: who else studies in the engineering buildings besides engineers? To answer this question, I conducted two random interviews in mid-October on the engineering campus. It happened that neither of the interviewees were engineering majors.

I first interviewed Clara Haeffner, a senior in neurobiology who loves Bon Iver and chai tea. When I approached her, she was sitting near the entrance of E-Hall, engrossed in her studies. I asked what her motivations were to get her through her difficult major as a woman in STEM at UW-Madison. Her reply? "There is no greater motivation than wanting to do well for a dream job."

In the future, Haeffner wants to become involved in academic research associated with neurobiology, and potentially become a professor. Her specific interest is in affected neuroscience, which deals with emotional responses created by the brain. As someone who spends most of my own time poring over transport and thermodynamic textbooks, this was something I had not heard of before. It sounded very interesting.

Haeffner says that some people who have helped her on her path are her parents, who are academically-minded. She also feels that having friends in her major has helped her significantly. Asked if she could give one piece of advice, she suggests: "Be friendly and open to making connections in your major. Friends in your major will help you through hard times in classes."

The second person I interviewed was studying solo on the top floor of the Engineering Centers Building. Eren Wolf is a senior in environmental science and conservation biology. She works as a lab assistant at the Arboretum and enjoys exploring it when she is not busy studying.

Wolf shared that one of her motivations for getting through her degree is connecting with her peers. She finds it important to have people to be able to communicate both successes and struggles with. "Build a community—if you can—of supportive people who can cheer you on," she says.

In the future, Wolf would like to be involved in ecology research. She is interested in working for the Environmental Protection Agency or the Department of Natural Resources, and possibly going to grad school down the road. She loves going to the farmer's market, drinking hot apple cider, and listening to Post Animal.

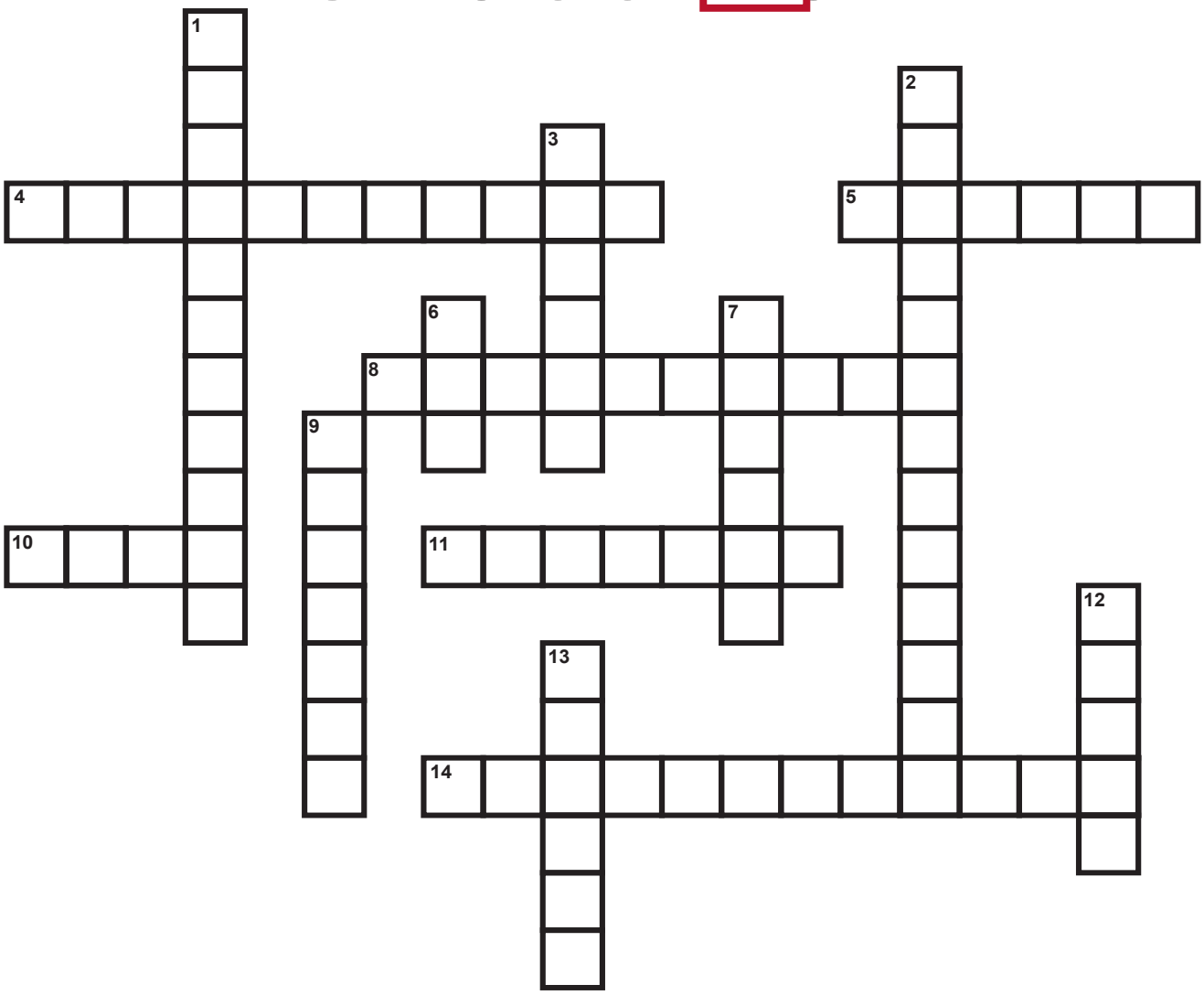
Over the course of my interviews, I found it significant that both students stressed the importance of building a community. In difficult engineering classes, it can be easy to get into a routine of managing the stresses of college life alone. As was emphasized by our peers outside of COE, the importance of building a community and the positive impact it can have cannot be overstated.

After these interviews, I realized that the fondest memories I have of being in E-Hall come not just from the quirks, like the minimal outlets and weirdly-configured tables, but also from having a good community of people to be able to spend time with.

PHOTOGRAPHY BY
ANNIE KRILLENBERGER

GRAPHIC DESIGN BY
ANGEL SALAS

ENGINEER CROSSWORD



Across

4. Can be considered as a flexible ruler.
5. This widely-known tool is used for gripping, bending, and cutting.
8. A hand-held device used in math classes like statistics, calculus, and physics.
10. A device used for holding things tightly in place.
11. When working in a lab, one should always wear _____.
14. Another name for a box cutter.
15. This tool is used to make precise measurements of an object.

Down

1. There are two main types of this tool: flathead and Phillips.
2. A _____ is used mainly by electrical engineers to fix circuits and connect wires.
3. In order to fasten nuts and bolts you should use a _____.
6. The very first _____ manufactured was actually used as a nail file, not for cutting wood.
7. This multi-purpose tool is typically made from a wooden handle and metal head.
9. A carrying case that can be used for all your instruments.
12. When hanging a poster or picture frame, one must use a _____ to make sure the piece is properly hung.
13. There are many different types of this tool, and it is primarily used by woodworkers and carpenters.

WRITTEN BY
JESSICA BECKER

DESIGN BY
LUCAS BARTEL

Answers 1. screwdriver 2. soldering iron 3. wrench 4. tape measure 5. pliers 6. saw 7. hammer 8. calculator 9. toolbox 10. vise 11. goggles 12. level 13. chisel 14. utility knife 15. caliper

THE NATURAL LANGUAGE OF NATURE

AN EXPLORATION OF HOW LINGUISTIC PRACTICES IMPACT SCIENTIFIC DISCOVERY

WRITTEN BY
MICHELLE HARASIMOWICZ

I. THE VAN HISE BUILDING ON CAMPUS, HOME TO UW-MADISON'S LANGUAGE DEPARTMENT

II. SCIENCE HALL ON CAMPUS

Natural language is the inescapable medium in which we learn and relate information. It infuses our daily tasks: we narrate while searching for keys, think and talk on our feet during meetings, and read to ourselves while glancing at an article. Yet, linguistics is often overlooked in science, eclipsed by the rightfully dominant role of mathematics.

Nevertheless, I would like to emphasize practices for scientific discovery, not rooted in mathematics, but instead in natural language.

I'll begin by sharing a time when I was studying calorimetry, or the process of measuring the amount of heat released or absorbed during a chemical reaction. I reflected aloud on alternative ways to measure a food's energy content besides calorimetry, which involves burning the food and measuring the temperature change of a water bath in thermal contact. I mused about different ways that food energy could be described, perhaps by summing up the vast amounts of molecular bond energies, or by applying a voltage across the food and observing how much heat is released by resistance.

I retracted the latter—energy would be added to the system, so capturing the heat from resistance would not be a good indicator of the system's own energy. Besides that, the food's resistivity made me realize the lack of uniformity across many foods. It appeared that burning food was a near perfect approach to characterizing the total energy of a non-uniform organic mass, along with its simplicity and succinct thermodynamic equations to back it up.

Moments like this made me wonder why I thought this way. It wasn't a mathematical line of reasoning—rather, I was attempting to overcome this intellectual puzzle by simply talking myself through it. In writing this article, I set out to identify underlying ideas of what I was experiencing and to learn how to wield natural language tendencies that affect scientific thought.

This led me to interview Dr. Maryellen MacDonald and Dr. Gary Lupyan, both psycholinguists researching language and cognition, and professors of psychology at UW-Madison. Dr. MacDonald studies language production and comprehension, as well as verbal working memory. From Dr. Lupyan's website, questions are posed like "Does language simply allow us to better communicate our thoughts? Or does it fundamentally shape the structure and format of our mental states?"

I approached both professors with the broad question of how linguistic practices and frameworks provide useful perspectives for scientific work. I will focus on three of the practices they shared: naming, metaphor, and talking.

Naming involves identifying an object by its given characteristics. Both

naming and awareness of its impact on cognition can improve science, which is rife with abstract mechanisms and characters. How do you name such abstractions, say an electron, when it is not familiar to us in our everyday macroscopic interactions?

If naming is the ability to define, and defining is the culmination of recognition, to have a deeper connection to the electron's name, then, you must thoroughly engage the characteristics of the electron through experimentation or calculations. The more you understand and can characterize an object, the more you can operate, model, discern novelty, and spot patterns.

Though, this is probably easier said than done.

"There is no requirement that ideas be expressible. It's interesting that so many ideas *are* expressible," says Dr. Lupyan. This sentiment is palpable in science, particularly in fields like quantum physics, where small-scale behavior doesn't always mate with macroscopically-derived language.

In addition to naming, we also considered other ways we relate the objects we shape.

"Language is metaphorical through and through—our thought is metaphorical," says Dr. Lupyan. From the casual to the artistic, metaphors convey a fuller picture of what is being stated. So how can we apply them to science?

Carefully. In the essay "SCIENCE: Magic on the Mind Physicists' Use of Metaphor," American physicist Alan Lightman points out: "Physicists have a most ambivalent relationship with metaphor. We desperately want an intuitive sense of our subject, but we have also been trained not to trust too much in our intuition." A natural language metaphor, then, should be selected as carefully as a mathematical model and should express an idea concisely, while not leading astray to notions of something that is not happening.

Metaphor also has a place in discovery, as metaphorical thought can give a preliminary mental model to test with mathematical rigor and experimentation. A famous example of metaphor aiding in scientific discovery is the story of American theoretical physicist Richard Feynman's wobbling plates. At a Cornell cafeteria, a rowdy student flung a plate. Feynman considered its motions: "I went on to work out equations of wobbles. Then I thought about how electron orbits start to move in relativity. Then there's the Dirac Equation in electrodynamics." Aided by his metaphorical thoughts, Feynman went on to develop equations describing the wobbling plates that later contributed to his Nobel prize-winning breakthroughs in quantum electrodynamics.

Tying these insights together is best done while engaging in the last linguistic practice that I learned about: talking. "Producing [talking] is much harder than comprehending," says Dr. MacDonald. Talking increases fitness, as does writing. Active engagement with the subject matter is key.

It's likely that Feynman, a famed science communicator, would have agreed, having championed that the best way to learn is to teach.

> "THERE IS NO REQUIREMENT THAT IDEAS BE EXPRESSIBLE. IT'S INTERESTING THAT SO MANY IDEAS *ARE* EXPRESSIBLE."
> – DR. GARY LUPYAN

MacDonald explained further that talking trains the verbal working memory, the immediate memory of processing information. Verbal working memory is also enriched by long term memory. Someone looking to apply these ideas to scientific discovery should allow time for establishing long term memory, while introducing challenges that enhance the verbal working memory.

Reflecting back on calorimetry, I saw that I had been engaging in these practices. My thoughts became metaphorical as I wondered about ways that food energy could be described. Talking through my attempts to characterize energy in different ways confronted my understanding of the system at hand, a form of active engagement. And recalling the forms of energy I knew was possible due to my long term memory. This funneled into modeling and solving the problems I set forth, where I eventually conceded to the simple elegance of calorimetry.

PHOTOGRAPHY BY
JAMES BALLARD

GRAPHIC DESIGN BY
JADEN SIM

WiscEng

Flight CBE - 424
Destination: Summer Lab

Date 40CT
Time 01:51

Gate K7
Seat 22E

A LOOK INTO THE DEPARTMENT OF CHEMICAL AND BIOLOGICAL ENGINEERING'S FIVE-WEEK SUMMER LAB PROGRAM IN OVIEDO, SPAIN

WRITTEN BY
ISABELLE EGIZIO

For most students, the idea of taking a summer class can be daunting. However, it's a reality for all students majoring in chemical and biological engineering at UW-Madison. After completing CBE 324, 426, and 430, all chemical engineering seniors are required to take a 5-credit hour summer lab: CBE 424.

This five-week intensive course requires students to work in an industrial lab. During this time, students conduct experiments, write lab reports, and meet company representatives. Despite the rigorous coursework involved in completing this capstone project, chemical engineering majors often recall this class as the culmination of their time at UW-Madison.

Some students take advantage of this required summer class by choosing to complete the program abroad. Through this program, students gain the opportunity to visit local companies like Bayer — the only supplier in the world for acetyl salicylic acid — or meet with representatives from the biofuel company Vertex Bioenergy. With destinations including Spain, China, Hong Kong, and Ireland, engineering students can explore the world.

UW-Madison's College of Engineering organizes these programs in partnership with universities across the world to offer the same rigorous course in an international setting. For engineering students who are unable to complete a study abroad program during the regular academic year, this is an extraordinary opportunity to complete their coursework in a foreign setting! Aside from completing the required coursework, participants are immersed in a new culture and language for the duration of the program—an invaluable experience for any young person.

"THE SUMMER LAB ABROAD PROGRAM GIVES A MORE WELL-ROUNDED EXPERIENCE, CONSIDERING HOW WE ARE NOT ONLY LEARNING ABOUT CHEMICAL ENGINEERING CONCEPTS, BUT WE ARE ALSO GIVEN THE OPPORTUNITY TO SEE REAL-WORLD APPLICATIONS IN INDUSTRIES." – FALCON SOEDARSONO

Falcon Soedarsono, a recent graduate of the class of '22, participated in this program last summer. "My friends and I were always joking about studying abroad but never ended up doing it because it is a bit harder for us [engineering students] to find transferrable credits. The summer lab is a great opportunity to experience studying abroad while keeping yourself on track with graduation," recalls Soedarsono.

This past summer, CBE seniors traveled to Oviedo, Spain for five weeks and studied at the University of Oviedo. Throughout the duration of the course, the students worked in professional and industrial labs. They conducted research, presented their findings, and sought professional applications of chemical engineering by visiting companies like the Industrias Lácteas Asturianas (ILAS).

"The summer lab abroad program gives a more well-rounded experience, considering how we are not only learning about chemical engineering concepts, but we are also given the opportunity to see real-world applications in industries," Soedarsono recounts.

For most chemical engineering students, this opportunity makes the prospect of a summer lab less daunting. With the program restarting after a two-year break, it is the perfect opportunity for seniors in chemical and biological engineering to study abroad!

For underclassmen still years away from completing CBE 424, the idea itself provides motivation to power through organic chemistry, thermodynamics, and physics classes. For those considering this program, Soedarsono remarks that "it is a great opportunity to do the lab and experience a whole different culture all at once. And, if you are scared about how hard it's going to be living in a different country, this is your opportunity to experience that with the help of others!"

GRAPHIC DESIGN BY
LUCAS BARTEL

FORMULA SAE:

THE SPIRIT OF TEAMWORK AND SUCCESS

WRITTEN BY
LUCY STEFFES

NO ENGINEER CAN COMPLETE THEIR BEST WORK ALONE. SEE HOW THIS IDEA IS EXEMPLIFIED IN THE COLLEGE OF ENGINEERING'S LARGEST STUDENT ORGANIZATION.

WISCONSIN RACING PUSHES THEIR CAR TO ITS LIMITS AT THE COLUMBUS 151 SPEEDWAY

What good is an engine, a wheel, a transmission, and a set of brakes, sitting all alone in a workshop? They have no greater purpose without the whole host of parts that make up an expertly built race car. Just as these parts cannot function alone, the members of the Formula SAE Team must work together to reach their goals.

In the largest engineering student organization on the UW-Madison campus, 120 members work together each year to design, build, test, and compete with two Formula One race cars at international competitions. Approximately 60 students work together on one electric car (or E-Car) and one combustion engine car.

Beginning at the start of each school year, abiding by the new year's rules and guidelines, teams set out to redesign their race cars. All rules are geared toward increasing driver safety, focusing on the dimensions of the car, the volume of the engine, the height of the cockpit, and the extent to which drivers' hands and arms are covered. While many purchased components are reused from year to year, particularly for the combustion car, everything else is built from the ground up.

Such a hands-on project, drawn out over an extended period, allows members to participate in real engineering work and teaches them far more than they could learn in the classroom alone. Amir Shukle, the Team Principal, and a fourth-year mechanical engineering student, explains: "When I started school, I thought I was learning a lot. And when I joined this team, I was learning even more." So many concepts from a variety of classes apply to different facets of these two cars, and the team accomplishes

AMIR SHUKLE, WISCONSIN RACING'S TEAM PRINCIPAL, TALKS TO THE WISCONSIN ENGINEER ABOUT THE CARS, THE TEAM, AND THE BENEFITS OF JOINING

REAR DRIVETRAIN OF COMBUSTION CAR

things that even the brightest student could not dream of doing alone.

But the true benefit of joining Formula SAE is the exposure to the breadth of skills of the members, and the sheer number of students who devote their time to accomplish a unified goal. From mechanical engineering students to data science, computer science, and business majors, the skills of these students encompass everything the team could need.

"Anyone can join the team, and put in as much time as they want," emphasizes Shukle. While there is no real time commitment, there are still deadlines to meet and projects to get done. Most students spend as much time as they are able—usually one to three days a week in the lab. "You get out of it what you put into it," Shukle explains, who himself spends nearly every day working on some aspect of the racecars.

All of the hours of work on these cars culminate in May and June as the teams head to the Michigan International Speedway to compete against teams from not just across the country, but across the world. Contests involve design presentations, static and safety tests, and dynamic tests. During static events, every aspect of driver safety is thoroughly inspected to ensure that the design meets all requirements released that year. Even the thickness of the carbon fiber is put to the test.

Then, the teams' drivers take the cars out for an acceleration test time trial, skid tests that involve driving in a sharp figure 8, and a 35-kilometer endurance test. When the dust and exhaust cleared, last year the UW Formula SAE team placed fifth out of 111 teams with their combustion engine race car. They were also the only team to fully customize and build their own electric engine.

"WHEN I STARTED SCHOOL, I THOUGHT I WAS LEARNING A LOT. AND WHEN I JOINED THIS TEAM, I WAS LEARNING EVEN MORE."
– AMIR SHUKLE

Looking to this upcoming year, the team will be replacing their single-cylinder combustion engine with a two-cylinder engine. They will also be working to decide on what will improve their design the most, already aware of what brings them the most success: their spirit of teamwork and impeccable work ethic.

PHOTOGRAPHY BY
AKASH DEEPAK

GRAPHIC DESIGN BY
JADEN SIM

2022 PHOTO CONTEST WINNERS

wisconsin engineer

COVER PHOTO

BUCKET LIST SHOT: TUNGENESET
ANGELINA HUANG

READERS' CHOICE

AHHHH, VENICE
KATIE ZETTEL

LANDSCAPE

MULAFOSSUR WATERFALL, FAROE ISLANDS
ANGELINA HUANG

CITYSCAPE

BEFORE THE STORM
ZHUOER WANG

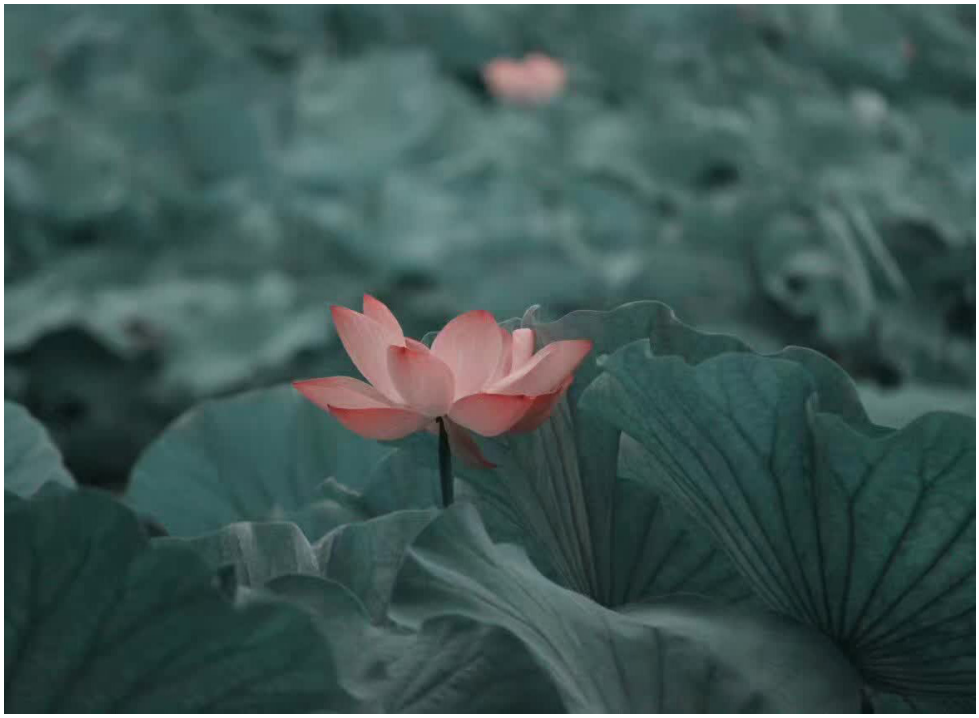
2022 PHOTO CONTEST WINNERS

wisconsin engineer

PORTRAIT

COLORFUL CHILDHOOD
XINLIN JIANG

STILL LIFE



DUSK
KAIRUI WANG

BAJA SAE: BUILDING CONNECTIONS AND CARS WITH AUTOMOTIVE ENGINEERING

WRITTEN BY
SARAH GEROVAC

MEMBERS OF THE WISCONSIN BAJA SAE TEAM WORK ON ONE OF THEIR VEHICLES

Most engineering students at UW-Madison have some grasp of the importance of extracurriculars, especially when it comes to finding real-world experience that will prove beneficial in the job market. In fact, there are over 50 engineering-specific organizations scattered around campus, vying for their next new member. However, while there are several clubs that focus on building cars, only one offers the off-road, hands-on experience of Baja SAE.

Each year, Baja designs and builds a one-seat, all-terrain vehicle meant to get muddy. Competitions are designed to test different aspects of the vehicle's design, and each one is composed of five dynamic events, which test features including tractor sled-pull and acceleration, suspension, traction, and maneuverability. There is also an endurance race, where teams complete as many laps as possible in four hours.

Baja SAE Co-President, Eli Gordon, showed me the team's design posters for their static events, where teams provide presentations and written reports about their vehicles. "We do design presentations for each subsystem, so it's suspension, steering, brakes, chassis, drivetrain, system integration, and ergonomics," he says.

Recently, Baja participated in a competition in Arizona in early October, their first fall competition, and came in 17th overall out of the 48 competing teams. They also placed 8th for design as part of their static event presentations. Additionally, the team competed at Rochester Institute of Technology last June and came in 6th overall out of over 85 teams.

PHOTOGRAPHY BY
JAMES BALLARD

GRAPHIC DESIGN BY
JADEN SIM

Despite the many successes Baja has had in its competitions, members say they have gotten much more out of the experience than just trophies. Colin Hartigan, a sub team lead, explains that before he joined Baja, he hadn't had many opportunities to put his engineering skills to use in the real world.

"I hadn't really had any real-world experience in engineering," he says. "As soon as I started, I was put into a bunch of different projects doing computer-aided design, and I also got to get in the shop and get my hands dirty. That's kind of something I've always loved doing since I was a little kid."

Baja builds their entire car in shop, Hartigan adds. "This last winter break, we all came together for the last week and built the whole frame. Just seeing everything you design slowly come together into a car is something you wouldn't get to experience if you didn't do a club like this," he says. This sentiment is shared by other members as well.

"The reason I joined, and the reason I still enjoy it so much today, is the team is a lot smaller than other racing teams," says Grant Christenson, another sub team lead. "It's a good blend of having stuff to constantly work on and being a serious team. Being a small enough group, it's easy to get very involved with very specific parts of the car."

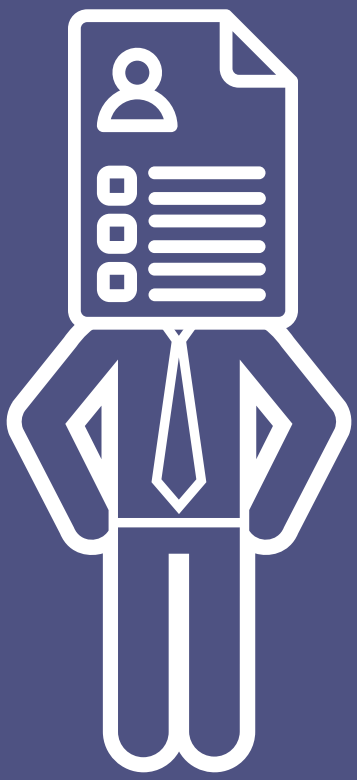
"JUST SEEING EVERYTHING YOU DESIGN SLOWLY COME TOGETHER INTO A CAR IS SOMETHING YOU WOULDN'T GET TO EXPERIENCE IF YOU DIDN'T DO A CLUB LIKE THIS." – COLIN HARTIGAN

Members of Baja SAE all rave about the rewarding experience that comes with participating in such an extensive and hands-on experience, and one of the most important aspects of the club is the connection it builds from school to real-world engineering.

"I've learned a lot that not a lot of classes teach here, and it's a great opportunity to get hands-on knowledge and network with people that teach very niche facets of mechanical engineering," Christenson says. "It's the conglomeration of a lot of interesting knowledge for a career path that not a lot of people talk about how to get into."

Participating in activities like Baja SAE is important in helping students build up the skills needed to land internship and job opportunities, specifically in the automotive industry. As demonstrated by the many College of Engineering extracurriculars at UW-Madison: there's no better way to learn than to do.

THE WISCONSIN BAJA SAE TEAM GATHER AROUND THEIR VEHICLES



EASY DOES IT

WISCONSIN ENGINEER SITS DOWN WITH COMPUTER SCIENCES STUDENT XIAOHAN SHEN TO TALK ABOUT THE SOFTWARE HE DESIGNED FOR EASYJOBS, A ONE-CLICK CHROME EXTENSION THAT AUTOFILLS MULTIPLE JOB APPLICATIONS SIMULTANEOUSLY.

WRITTEN BY
KRISTY WENDT

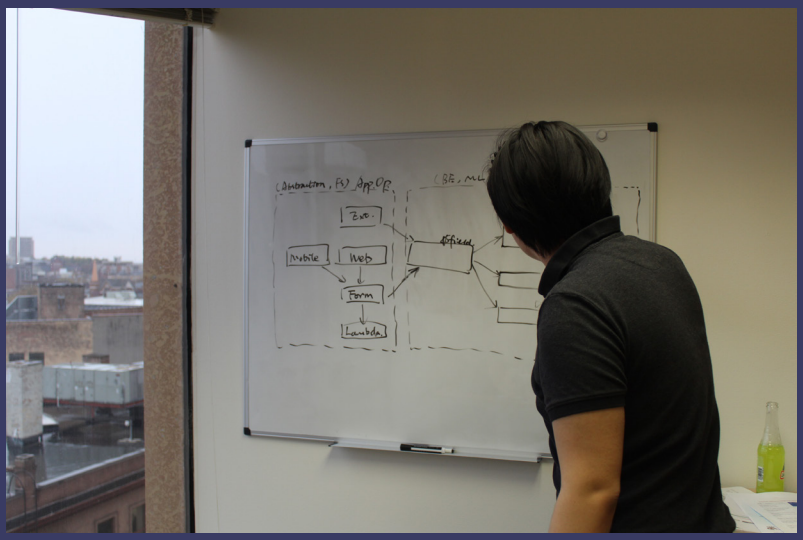
Q: What gave you the idea to create an automatic way for interns to track job applications? Were you starting as an intern yourself?
A: That's exactly how it started. Last year around October, Hankel Bao, cofounder and CTO of the company, and I were both looking for a summer internship for our Junior year. I had completed an internship as a software engineer at Intel my sophomore year. Though I found the internship really rewarding in terms of improving my professional profile, we found that the process of applying for summer internships was getting harder from year to year. When we were just getting started, we were going to big job sites like LinkedIn, Indeed, Handshake, and applying to relevant openings. Once we applied, we were asked to fill out a long application form. Most of the application forms asked the same questions, but every company asks them in different ways. We ended up filling out what was essentially the same application a hundred times. Finding the opportunities was already hard enough, so this additional process was annoying. Instead of doing another internship, I decided to try to change that.

Q: Do you have success stories of EasyJobs users getting the internship they wanted?
A: Yes, a lot of them actually. In the past week, a little over 9,000 job applications were submitted through EasyJobs. One friend of mine submitted over 330 job applications last year with EasyJobs. Eventually, he secured a software engineer internship at Salesforce. He told me that EasyJobs' job collections helped him find many relevant job openings on one page, and the autofill was a life-saver: he used to spend 15 minutes just on filling out every job application, and with EasyJobs, he rarely spent over 2 minutes on every job application. He thanked us for making his job search so much easier, and it made our day!

Q: How did you promote EasyJobs?
A: We promoted the site in multiple ways, with LinkedIn posts probably being the most effective. One of the first things we did was simplify the process for applicants using AI technology to classify jobs from multiple sites into job lists that are targeting a smaller group of people, eliminating the need for the applicant to jump between multiple sites when applying for a particular type of job. For example, we built one for the summer of 2023 for software engineer internships, so there's a list of 300 jobs that are just for software engineer internships in the summer of 2023 for different companies.

Q: I think this is starting to answer a question that I would like you to elaborate more on, in that we're all wondering what leads to an online application being plucked like a needle from a haystack from what may be hundreds received by an employer? Can AI really solve that?
A: Yes. AI can recognize specific features in the job description and the job title so that it can be targeted to the right people—the people who would find that kind of job interesting. At least in part, it's the match between features of applicants and employers that increases the probability of an in-person interview. Not to deter from our main selling point for applicants, which is that we've built a Chrome extension that can autofill job applications in one click, and we are using AI technology to do that. It's smart and accurate, which is why our users love us, because we save them time. What used to take 20 minutes takes one minute now.

Q: Yeah, I think what really appeals to me about your company is that for anyone who has applied to things online sight unseen, there's a strong sense of sending it to an abyss. Your company seemingly puts some power back into the hands of the applicant.
A: Exactly. We know that recruiters use software in the form of application tracking systems (ATS's) that use AI to look at every single application and the resumé of an applicant. Recruiter AI parses the resumé to tell if it is a good match for the job, but AI isn't always very accurate in that process. It makes a lot of mistakes, so it filters out good candidates all the time. AI is filtering about ninety percent of the applications, and only about ten percent of online applications are ever making to the eyes of a recruiter, which is why most of the job applications online nowadays just end up with no response or a rejection email months later. That doesn't really help.



SHEN IN HIS EASYJOBS OFFICE ON CAPITOL SQUARE

Q: I think that really speaks to the incredible value of what you've created. Is this the destination for you, do you think? Has coming up with this permanently altered your career trajectory?
A: It really started as a side project, this dream in mind that we would build a unicorn company. We don't know that it is going to work out, but after trying very hard for half a year, we were able to fund the company in March from two angel investors, one of which is the current co-founder and ex-CTO of ZipRecruiter. He thinks there's great potential in the way we are working out. We share that mission, and we are totally going into this, working on this in the next few years, turning this into an IPO company.

Q: (Laughing) I think the Badgers reading about this are mainly going to be wondering about how to avoid getting their online applications tossed by the robots.
A: That part is really about how you write your online resumé. Make sure your skills and experiences are an obvious match in your descriptions because AI technology is just scraping your words and comparing them to the key words in the description. It tries to compute similarity, so for example if you see "Python" as a desired skill set, but don't put "Python" in your resumé, chances are your resumé won't ever be seen.

Q: Is that part of the process still organic, or can your software help match what is written to what already may pre-exist in a listing somewhere?
A: We are working on that feature, and we have that in mind. Right now, how we solve it is by the numbers. For example, I have a friend who is a very good software engineer. He had two years of experience at ITENSE and he won the SAP Community Coding Challenge Series bronze medal, which makes him a very competitive candidate, and he wrote his resumé very well. Last application season, he sent out a total of 420 job applications. Out of those, only around 50 applications had a response. You can see how sometimes it is not about how you write the resumé. He was an international student, so he requires some kind of visa sponsorship, and a lot of companies don't like that. What we noticed is that regardless of how good you are, it is really a numbers game. If you hand out a thousand job applications, chances are you will get ten interviews. If you are very good, but you fill out ten applications, you are not going to get ten interviews.

PHOTOGRAPHY BY
ANNIE KRILLENBERGER

GRAPHIC DESIGN BY
LUCAS BARTEL

HOW DO INTERNATIONAL STUDENTS GET TO UW-MADISON?

WRITTEN BY
PAULINE STEIN

Moving to the United States for school is like going through the metal detector at an airport. You are certain that nothing will go wrong, but you're also sure everything will. Such is the case for the roughly 6,000 international students who call UW-Madison home.

I myself am an international student from Germany, who moved to the U.S. in 2018 to attend school at the University of South Florida for a degree in biology. Later, I moved to Wisconsin for graduate school.

I recently got the opportunity to speak with Leo Barolo Gargiulo, a chatty, outgoing UW-Madison alum who got his Master's in Life Sciences Communications this year, and Darshigaa Gurumoorthy, a biomedical engineering undergraduate student with a bright smile and love for helping people. Both Leo and Darshigaa are international students—from Brazil and India, respectively.

Leo and I recently discussed our experiences as part of UW-Madison's international student body and realized how different the application process is for international students compared to domestic students. Most students from the U.S. never realized how long, expensive, difficult, and sometimes nerve-wracking the process of coming to the U.S. as an international student can be.

Just like all students in the U.S., we begin our journey of getting to college by researching potential universities to attend, but we experience an added challenge—moving to a different country. There are many reasons why people decide to not study at their home countries' universities.

Gurumoorthy explains that she came to UW-Madison because of the opportunities it offers, and she wants to be part of a "good biomedical engineering department". Furthermore, she tells me that research opportunities were important to her "because at that point in time, I wanted to get into research." Barolo Gargiulo, on the other hand, not only came to UW-Madison for the opportunities it offered him with its well-established zoology department, but he also has a family member relatively close to Madison. I myself came to the U.S. for university because I have personal ties to the U.S., and I also wanted to pursue a degree in English and not German.

However, this is where the similarities end.

Unlike domestic students, international students must submit a bank statement to show the university that we can pay for our education and living expenses. Getting the bank statement is not always easy—in fact, Barolo Gargiulo told me it was rather difficult for him, as applicants cannot just print out a statement from their bank account themselves. Banks need to write and sign a piece of paper as proof that prospective students will be able to pay the estimated yearly expenses of attending UW-Madison. The process of getting a statement depends on your bank: it can take a few days, but sometimes longer than a week depending on your circumstances. Barolo Gargiulo told me that "for us [his family], it was a lot of trouble because the money needed to be all stored in

"YOU'RE NOT HIDING ANYTHING. BUT BECAUSE THERE'S SO MUCH AT STAKE, YOU GET SO WORRIED ABOUT IT, LIKE YOU'RE BOARDING A PLANE."

- LEO BAROLO GARGIULO

one checking account or savings account."

Additionally, we need to have our transcripts translated, and we must take an English language proficiency test. Neither of these come at a small cost. Barolo Gargiulo explained that "I had to translate a lot of documents, every syllabus from every class that I took in university. And I was like, if I take this to an official translator, and they charge per page, and it's going to be super expensive."

Once accepted, the university issues an immigration document that allows students to apply for a visa. The visa application requires a myriad of forms and fees that end up totaling roughly $510—quite a lot of money for a student. Coming to the U.S. is no cheap endeavor.

After having filled out the forms and paid the fees, students are one step closer to coming to the U.S. There is only one step left—the U.S. embassy appointment. Barolo Gargiulo recalls, "You're not hiding anything. But because there's so much at stake, you get so worried about it, like you're boarding a plane." At the embassy appointment in your home country, you are only allowed to bring your passport and visa application materials. Because of that, I had my parents hold onto my things while I anxiously waited in the embassy for my appointment.

The embassy appointment consists of an interview inquiring why each student is seeking a visa and why they should be granted one. I remember being sick to my stomach leading up to my appointment. I was so scared that during my interview, I would say something wrong, and my visa request would be denied. I would be left with nothing to show for all the work I put in up until that point. Luckily, I wasn't.

After successfully completing the interview, applicants can look forward to receiving their passports in the mail—now, they contain a pretty neat-looking visa stamp.

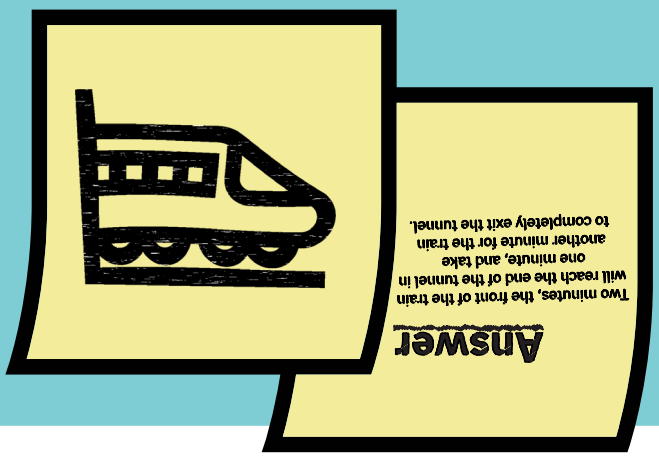
The F1 visa process is long, expensive, and includes quite the nerve-wracking interview, but it is worth it. Gurumoorthy is thrilled with how the College of Engineering has supported her through this experience and how well she did for herself. Barolo Gargiulo has also enjoyed being part of UW-Madison. Getting here was one of the most difficult things I have done in my life so far. Next time you talk to an international student, please remember how much time and effort it took for us to be able to be here and talk with you.

PHOTOGRAPHY BY
SHUFAN SUN

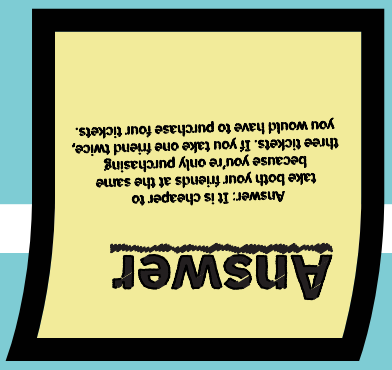
GRAPHIC DESIGN BY
ANGEL SALAS

BRAIN TEASERS

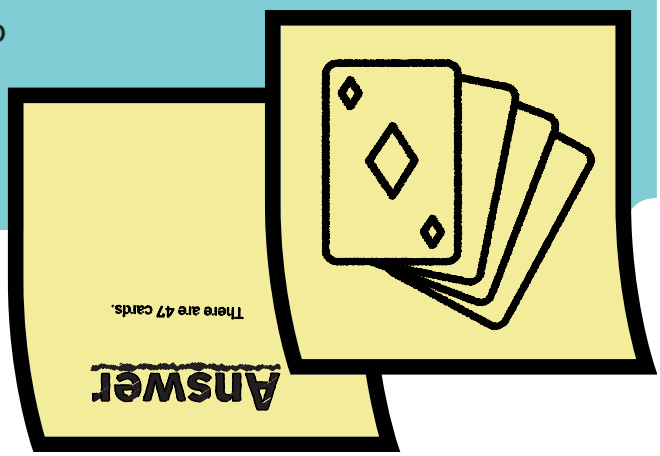
A 500 ft. train is traveling at a speed of 500 ft. per minute and has to travel through a tunnel that is 500 ft. long. How long will it take for the train to travel through the tunnel completely?



If you go ice skating and you're the one paying, is it cheaper to take both your friends to the rink at the same time, or take one friend twice?



A certain number of cards have been lost from a complete deck. If I take this same deck of cards and deal it amongst five people, two cards are left over. If I deal amongst four people, three cards remain. If I deal amongst three people, two cards remain. How many cards are there in the deck?



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