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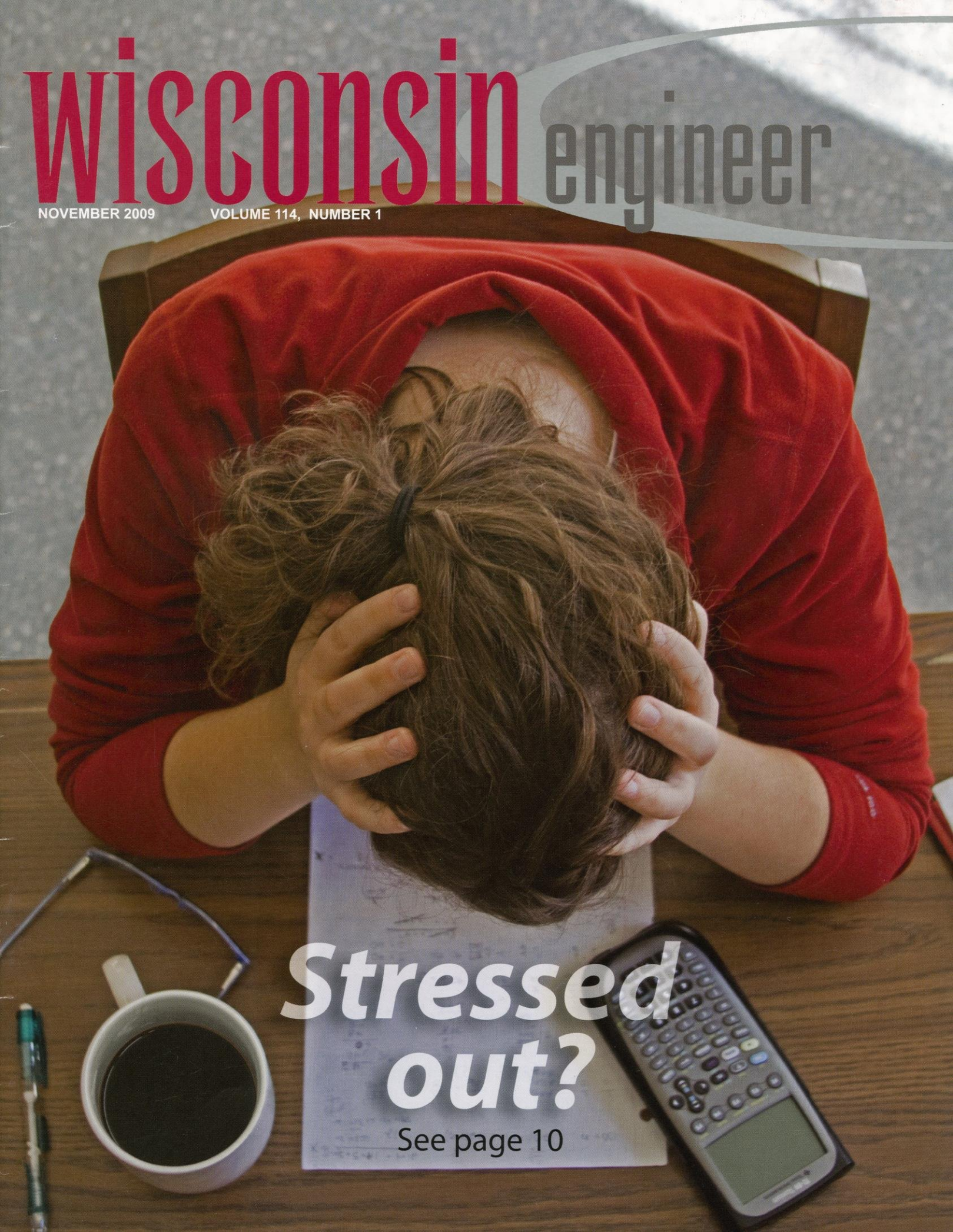

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See page 10

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Feature

General

Cover photo by Kristen June, Steven Shutt and Ross Tillman

Commentary

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Jumping out of the comfort zone

By Carrie Boecher

Laugh if you must, but I got a little teary-eyed watching the last Minnesota Twins game on television last season. And it wasn't because our World Series hopes were dashed for another year, or even because we got crushed by that New York Yankees powerhouse in a series of three pathetic games. No, it was because the Twins were playing their last-ever game in the Metrodome, their home field of the past 27 years.

Now, if you know anything about the Metrodome, you're probably wondering how anyone could miss that ugly dump of a stadium. The seating was terrible, the hallways consisted of dismally lit concrete and that white inflatable roof blocked out any semblance of sunshine on even the most beautiful summer day.

So why did I cry?

My memories, of course. I spent the better part of my life watching baseball in that stadium, observing the intricacies of the game, bonding with my dad and learning the facts of life from the drunken college kids who sat behind us in the left field bleachers. Dreadful as it was, the Metrodome was our stadium, and above all we felt comfortable there.

Of course I'm being ridiculous. Saying goodbye to the Metrodome is not a tragedy. In fact, as I write, the Metrodome's replacement, Target Field, is sitting proudly in downtown Minneapolis, receiving its final construction touches and awaiting a sea of Twins fans. There are wood-backed seats, a heated open-air concourse and—get this—real grass! It's something many Minnesotans, myself included, have dreamed of for years. Still, I don't know if I will ever feel as comfortable there as I did in the Metrodome.

Oh, comfort. That warm, wonderful feeling that influences more of our decisions than we'd like to admit. Refusing to get out of a toasty bed on a snowy day, standing outside a banquet hall full of unknown faces, staying in the hometown we know rather than seeing what else the world has to offer—we've all chosen comfort over challenge at some point. But what are we missing out on when we take the comfortable route?

It seems that we're missing out on a lot: opportunity, adventure and above all, that old UW-Madison ideal, progress. That "continual sifting and winnowing" for which our forerunners called isn't going to happen if we're content with the way things are. To push us forward, to see what else could be, we have to jump out of bed, stride into that banquet hall, hop on a plane and even give a new ballpark a chance.

In this issue, we explore the stories of several groups whose discontent with comfort led them to innovation. Whether they are designing sustainable fishing lures, changing the way we store energy with something as basic as salt or revolutionizing online learning, these people show us the importance of shaking off the status quo and asking, "How else could we do this?"

Caroline Bacchus

COLLEGE OF ENGINEERING
UNIVERSITY OF WISCONSIN-MADISON

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Photo by Steven Shutt

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-Idiom

1. An outstanding or exemplary team member within a specified field.
2. Highly sought after.

Photo by Stephan Jedlicka

Engineering Professional Development professor Laura Grossenbacher combines her love for teaching and traveling by leading study abroad programs in France and China.

By Ben Weight

One of the keys to having a superior college football team is recruiting. Coaches spend hours upon hours scouting and watching video of blue chip recruits trying to find that special piece to fit into the complex puzzle of a team. It turns out that UW-Madison's football program is not the only group on campus recruiting; the college of engineering found a blue chip recruit of their own down in the heart of football country- Austin, Texas.

"I had been teaching technical communication classes at the University of Texas when UW-Madison recognized my work and asked me to apply," Laura Grossenbacher says. After teaching and obtaining her PhD in English, both at the University of Texas, Grossenbacher headed for the tundra of Madison, Wisconsin. "I wasn't sure if we would stay here, but once we had been here a year or two, I realized how much I liked the students and enjoyed working with my colleagues," " Grossenbacher says.

Grossenbacher began her tenure as a lecturer at UW-Madison with a full slate. She taught several classes including basic communication courses, technical communication courses, technical editing and technical team courses. Furthermore, Grossenbacher designed and taught a class called Social and Ethical Impacts of Technology.

"I felt the program should emphasize the critical thinking necessary in engineering education. For example, we need to ensure our students understand how engineers are connected to the society around them," she says. "What I've tried to do is foster and develop teaching methods with and beyond core courses that will support the development of the humanistic side of engineering."

In addition to lecturing, Grossenbacher has been the director of the Technical Communication Certificate (TCC) Program in the college of engineering since the fall of 2003.

"One of the greatest things the program offers is core courses that are cross-disciplinary. The biggest challenge [for engineers] is to work on a technically complex project and be able to talk across disciplines," Grossenbacher says. "What we're trying to do is improve communication across the college."

With the current state of the economy, companies are able to be more demanding of future employees, and one competitive edge available to UW-Madison engineering students is the TCC program, which provides them the tools and experience needed to succeed in the business arena.

Currently, Grossenbacher is working on new projects with funding from the college of engineering's 2010 initiative. "We did a survey of faculty to see what they thought students needed to do better with involving communication," Grossenbacher says. "Many of the key areas that kept coming up had to do with organization, integrating graphics into talks and papers, and designing slides effectively for presentations."

Through the analysis of these surveys, Grossenbacher and her colleagues have developed a system of online modules that will address these issues involving communication. "The plan is to roll out these modules next fall in the Engineering Professional Development 397 (EPD 397) classes," Grossenbacher says. The modules contain quizzes that allow students to solidify the information they absorbed in the modules. "What's great about the quizzes we're developing is that they require the student to do so much work, the student learns as they're taking the quiz."

Along with the work Grossenbacher does on campus, she also loves foreign cultures and languages. With this passion, Grossenbacher and her husband have taught overseas in past summers. "We team taught EPD 397 in Toulouse, France a few summers ago, and two summers ago we did the same in Hangzhou, China," Grossenbacher says. "We love to travel and take the kids, and we like languages a lot, so it's a perfect fit."

Away from the classroom and bustle of the campus, Grossenbacher enjoys hiking and cross-country skiing. "I sometimes joke with my students that I can't wait for it to snow; sometimes I feel like I want to ski to class," Grossenbacher says. She will also soon be competing in her first triathlon.

As football recruits must prove their will and determination on the gridiron every Saturday, Grossenbacher has proven her blue chip reputation everyday in the classroom since arriving in Madison.

Grossenbacher's passion and pride for teaching shines through in her conversation. "I love my teaching; it is the most important thing to me. If my teaching doesn't go well, nothing is going well." WE

Author bio: Ben is a junior majoring in electrical engineering. This is his second semester with the magazine.

SALT

From French Fries to Nuclear Fission

By Timothy Busse

The ultimate conundrum in energy production: how to transfer heat with maximum efficiency? The answer may be right in your kitchen, and it's salt.

In addition to sodium chloride, or table salt, which melts at 800 C, there are other salts that melt at low temperatures, resist thermal decomposition at temperatures above 1000 C and possess incredible thermal properties. These unique physical properties make molten salts superior heat transfer fluids that can store the sun's energy, cool nuclear reactors by transferring their heat directly to hydrogen production and other chemical plants, dissolve nuclear waste and coax petroleum out of oil shale.

"The Holy Grail in a salt is to have very low melting points and very high decomposition and boiling points," Mark Anderson, senior scientist of UW-Madison's engineering physics department says.

The goal is to have a high enough temperature difference by pushing the temperature limit as high as possible. This increases the efficiency at which you can generate mechanical work.

Because of the useful applications of the molten salt, a team of UW-Madison researchers is currently working to maximize its potential. The team, consisting of distinguished research professor Kumar Sridharah and Michael Corradini, as well as other UW-Madison faculty, graduate students and undergraduate students, conduct innovative research investigating several high impact molten salt applications.

Molten salts encompass a wide variety of ionic compounds, each with unique physical properties such as melting point, high thermal conductivity, specific heat and density that make each salt ideal for heat transfer applications.

In addition to advantageous thermal properties, most of these salts are resistant to thermal decomposition far beyond the limits of conventional heat transfer fluids such as oil, which allows engineers to employ these salts in applications that require extreme temperature environments for extended periods of time.

One of the most important facets of molten salt research concerns the design of heat transfer systems that can transfer process heat from next-generation, high-temperature nuclear reactors to hydrogen production plants or chemical industries. This could have a significant impact on the economics of nuclear reactor systems.

Photo by Kevin Lee

This custom-fabricated valve regulates the freezing point of molten salts by purging or adding water as the system temperature fluctuates during heat transfer.

Because of the heat transfer capabilities, another concept under development is the use of molten salts as a coolant in nuclear reactors, where they would transfer heat from nuclear fission to steam or gas turbine generators. Additionally, the heat generated by fission may also be used to directly power other chemical processing satellite facilities, conserving energy by cutting out the need to generate electricity or burn fossil fuels.

In the newest aspect of research, spent nuclear fuel is dissolved in molten salt to facilitate electrochemical separation of nuclear waste claddings from the unspent fuel. Though the technology dates back a few decades to studies at Argonne and Idaho National Laboratories, the field is still rife with opportunity because it is an important step towards fuel recycling, and it minimizes the need for nuclear waste storage.

"In the Department of Energy community this has become a big issue. Now that the Yucca [Mountain] is on hold, we can't say we are going to send everything there," Sridharan says. "So waste separation—taking the fuel and trying to separate the good and the bad—has become a big issue."

The salts are also applicable in a variety of solar thermal energy systems. "They are a good heat storage medium, kind of like a battery," Anderson says. "It is relatively easy to store a large amount of energy in a big pool of liquid salt."

Researchers are developing salt mixtures with low freezing temperatures for implementation in two main types of solar thermal systems: power towers and parabolic troughs. In a power tower, a field of mirrors focuses light onto a single tower, which is filled with a heat transfer fluid. In contrast, a parabolic trough system is composed of crescent-shaped mirrors that focus light on tubes pumping this heat transfer fluid. The fluid in either system can directly power facilities, eliminating energy loss that normally occurs when solar energy is converted to electricity.

Power tower systems are easier to engineer because the tower holding the molten salt can be drained at night to prevent freezing.

Photo by Kevin Lee

The immense potential of molten salts drives this research team to investigate the potentials in heat transfer, fuel recycling, and solar thermal systems.

Conversely, salt's applicability in parabolic troughs is limited because the salt is dispersed throughout the field of troughs, increasing the risk that it might freeze at night then rupture the pipes when the salt melts and expands in the heat of the next day.

However, conventional parabolic trough systems could be modified to accommodate this issue. The addition of a water evaporation system, for instance, could dilute the molten salt to prevent freezing as the system cools, then evaporate off to allow full temperature operation. This modified system would have a much lower freezing point while retaining all the beneficial physical properties of pure molten salt at high temperatures.

Researchers have fabricated such a modified flow system to study the effects of adding water to molten salts. Anderson describes the complete startup and shutdown of a flow loop integrating the molten salt and water system as one of the most exciting moments in his recent lab work with the salts.

During the experiment, water is quickly boiled out of solution as the system approaches its operational temperature of approximately 500 C, producing a pure molten liquid salt. During shutdown, the water is reintroduced as the system to prevent freezing as the system cools.

Much to the surprise of Anderson and others, the water did not flash vaporize or have any other negative reactions when injected at 200 C, proving that this approach can be utilized to safely reduce the freezing point of larger molten salt systems. There are, however, still issues with the system that need to be developed and researched.

Though each of the different applications of molten salt is important in its own right, a crucial area of research pertinent in all applications concerns, not the salt itself, but rather the materials that contain it. Sridharan leads the team in materials corrosion research, which studies how conventional alloys, ceramics and coatings hold up under extreme chemical environments.

"One of the thrusts of the program is to look at materials that can withstand corrosion in high temperature salts to understand how corrosion occurs in static and flowing salt environments, and which materials and coatings can be applied to mitigate the effects of corrosion," Sridharan says. Nanomaterial coatings present a highly applicable area of research for enhancing corrosion resistance. "I can see nanomaterial coating becoming an area of fundamental research coming up in the next year or so."

With a solid foundation in proven technologies and a dedicated team brimming with new ideas and expertise, molten salt research at UW-Madison could move in many directions. "We are looking now at coupling super critical CO_2 cycles with liquid salt heat transfer and storage technologies," Sridharan says.

Whether the application is in solar, biomass or nuclear applications, molten salts as a thermal storage medium can play a vital role in increasing the efficiency of our current energy infrastructure and economizing sustainable forms of energy.

So the next time there is a heated discussion concerning nuclear or renewable energy, remember that the secret ingredient is just pinch of salt. WE

Author bio: Tim Busse is a senior majoring in chemical engineering with a certificate in technical communication. This is his first time writing for the magazine. He warns: one that smiles when things go wrong has thought of someone to blame it on.

International Internships

with International Association for the Exchange of Students for Technical Experience

By John Keehn

In today's world most products are made overseas. Even the majority of parts found in a Chevrolet—an American icon—are made in Canada, Mexico and China. This expanding marketplace doesn't just apply to products. The job market, too, is now more international than ever before. As our country becomes more international and technology shrinks the globe, it becomes even harder for graduates to find jobs after college. These graduates are not just competing with people from the United States anymore, but with people from all across the world.

This competition has driven students to become more internationally savvy by learning languages and experiencing other cultures. When UW-Madison students want to gain experience overseas, they can turn to the International Association for the Exchange of Students for Technical Experience, more commonly known as IAESTE.

IAESTE is an international internship exchange program for university students. The program provides UW-Madison students, and students across the globe, the opportunity to gain experience in internships through industry and universities in a foreign country. IAESTE is very much an exchange system, with students from across the world essentially swapping jobs for a while.

So how do students find these jobs? The local UW-Madison IAESTE chapter works to create jobs here in Madison, while other chapters do the same in their own cities. Chapters from the United States then report the jobs they find to the national IAESTE headquarters, whose members then go to an international meeting with the 80 or more other IAESTE chapters. After this exchange, the national committee places IAESTE members from the UW-Madison chapter and chapters around the United States with jobs that meet their requirements. Once members are placed in a job, final screening is completed by the new employer, and the member prepares to go overseas.

Jon Jaeger, president of the UW-Madison chapter, says not only do IAESTE chapters set up internships but the chapters also "take care of [the exchange students] in a way, setting up [their] housing and showing them the lay of the land" in their new job and country.

Students who participate in the IAESTE internships must be juniors or older, but sophomores are strongly encouraged to apply for the program for following summer. This way, they have time to start looking for jobs so they may have one to exchange. "Getting an internship overseas depends heavily on the individual, as we ask them to do a large part of the job raising, and it is vital to getting opportunities for our members," Jaeger says. A new requirement from the national IAESTE headquarters is that all students participating in the program must raise a job to be traded at the international meeting.

The job a student receives through IAESTE depends much on his or her set of technical skills. Specific engineer-oriented skills, such as experience in laboratories, collecting data or computer programming, can highly influence the type of job that an IAESTE member will obtain. Having an internship in the United States before taking one internationally with IAESTE is certainly an advantage. Honing one's technical skills in the United States can help members enjoy their experiences more, and make their time abroad much easier.

Members of IAESTE welcome all students to join the organization, and their number one priority is to find an internship for anyone who would like one. Through IAESTE, members are given the opportunity to experience a new country and take on challenges unique to an international internship. Whether it's trying to perform computer programming with a German keyboard or tackling engineering problems unique to the region of the world, engineers abroad get a fresh perspective on the traditional internship experience. These challenges can broaden their critical thinking skills and make them better problem solvers.

The IAESTE experience can help form the well-rounded individual employers in the United States and around the world are looking for: someone who can succeed outside of his or her comfort zone, solve complex problems and understand international issues. IAESTE can put you miles ahead of other new graduates. WE

Author bio: John is a freshman in mechanical engineering. This is his first semester with the magazine.

Photo by Greg Bartels

UW-Madison student Greg Bartels (far left) and fellow interns explore the Czech Republic while interning abroad.

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Studying abroad in China

The College of Engineering (CoE) offers undergraduates the opportunity to spend six weeks in China during the summer while taking ME 306 Mechanics of Materials or EPD275 Technical Presentations . In addition to CoE courses, students can take lessons in Mandarin and learn more about Chinese culture while living in the city of Hangzhou. If you're interested in taking a ride on the Grand Canal, visiting the Chinese National Tea Museum, or watching the local Greentown soccer team play in the Yellow Dragon stadium, an abroad experience in Hangzhou, China may be for you.

Photo by Steven Zwickel

Students Craig Bolyard, Ben Pfeilstifter, Stephanie Schmidt, and Jim Trauba cheer for the Hangzhou Greentown soccer team with their Chinese friends. Hangzhou beat Shanghai 2-0 that day.

Photo by Steven Zwickel

Student Alex Wehrmann, pictured sporting his Red Sox, t-shirt was a big hit in Hangzhou.

Stress 101

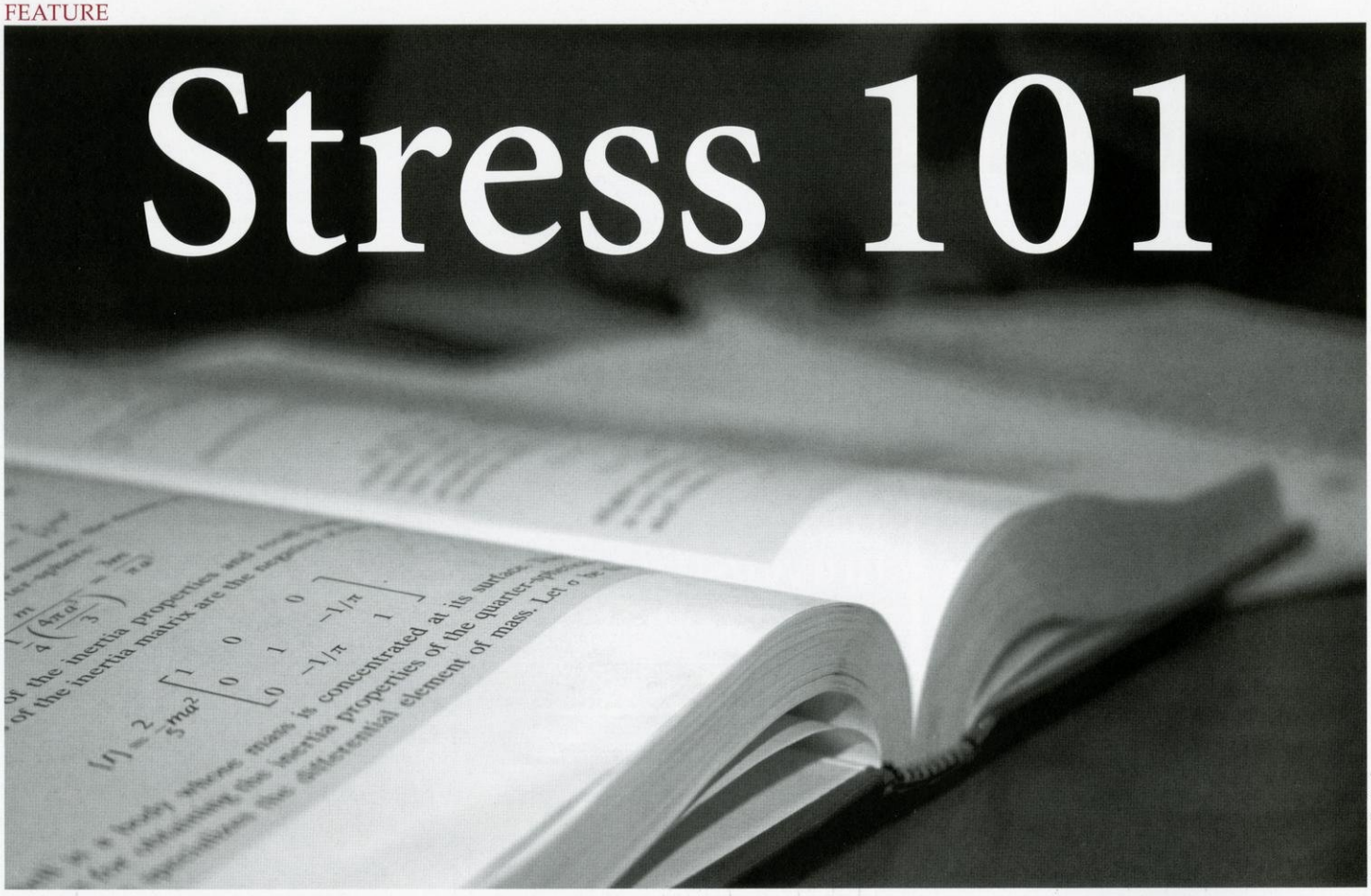


Photo by Emily Sorensen

By Marcus Hawkins and Lauren Kern

It's 2 a.m., Wednesday morning. You sit in a deserted computer lab with only the night custodians to keep you company. Mountains of red bull cans , coffee cups and Doritos bags surround you, occasionally serving as pillows . Your eyes burn, your back aches and all you want is to go home and go to bed. But there is no time for sleep tonight. Homework is due at 8:50 a.m., and those notes for your exam aren't going to study themselves. The worst part is that when, or if, you do got to bed, you'll have to arise in just a few hours, to do it all over again.

Students from every corner of campus are all-too familiar with this scenario. For most, the school week means five days of nonstop classes, meetings, work and studying.

The typical college student doesn't acknowledge the effects of stress beyond a sense of panic and anxiety, but in reality, stress has distinct effects on the brain. It can be caused by one's environment, one's body and even one's thoughts. However, stress can be managed and greatly reduced with the use of simple tips and techniques.

While many of us wish there were six extra hours in our day, it is unfortunately out of the question. One of the hardest things about being a college student is managing countless hours of studying, class, projects and jobs. Factor in the typical Saturday of tailgating and football, and the result is an equation for maximum stress. For a college student, stress is just one more book on an already daunting stack of homework. This is why it is important to manage stress and keep it from adding to the chaos.

"I feel very overwhelmed, exhausted, like I can't fit everything into the day."

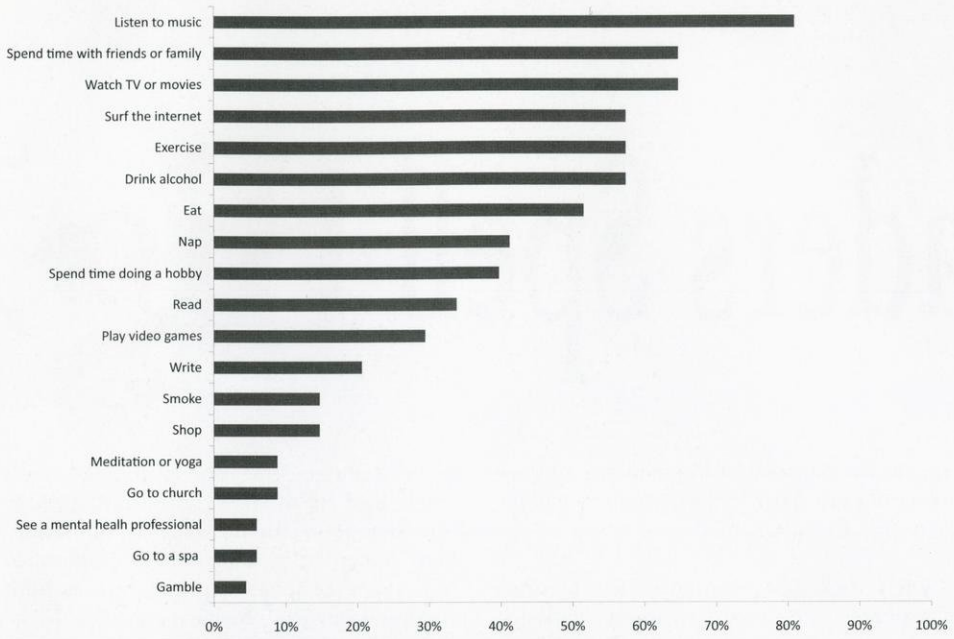
-Caitlin DeVos

Stress has many causes and it affects each person differently. However, there is no denying that it spreads to every corner of campus, from the freshmen in the dorms experiencing life on their own for the first time, to the graduate students performing breakthrough research. Whatever the case, college students must deal with many unique conditions that seem to promote stressful situations.

"I feel very overwhelmed, exhausted, like I can't fit everything into the day," Caitlin DeVos, a freshman at UW-Madison who is dealing with the stress of being new to an enormous college campus, says. DeVos explains that the stress of being a freshman includes things like "coming to a new place, living with people you don't know and trying to get along with them."

DeVos is not alone. Freshmen year is a stressful time for most students, as they adapt to an unfamiliar environment while forming new relationships away from home. According to a study done in College Student Journal, "College students, especially freshmen, are a group particularly prone to stress." A study done by the College Chronic Life Stress Survey found that "in regard to chronic stress, first-year students scored higher than other students."

Being in a new environment is not the only thing that freshmen have to deal with. In addition to new surroundings and a roommate she has never met, DeVos and other freshmen must deal with strenuous coursework. "My classes are very stressful; I am taking 15 credits including chemistry, which is not very fun," DeVos says. It's no secret that adapting to new types of classes, which are often filled with 300 students, is an added stress for freshmen. In fact, research has shown that freshmen and sophomores in college react more to stress than juniors and seniors.



A poll conducted by the magazine of 100 students about how they manage stress. Students were asked to check all those that apply. Listening to music, spending time with friends and family, and watching tv or movies ranked among the top choices.

So that means all juniors and seniors in college are completely stress-free, right? "I try not to let [stress] affect me too much, but because I'm so concerned with grades it obviously does," Brandon Deaner, a junior majoring in Engineering Mechanics with plenty on his to-do list every week, says.

Deaner has been managing a jam-packed schedule since he began college. Since his first semester, Deaner has been involved in time-consuming extra-curricular activities creating obligations in addition to courses work. He participates in student organizations related to his major, the running club and works a part-time job. It goes without saying that this is all in addition to a demanding course-load. Last semester he clocked how much time he spent studying and found that he was spending a daunting thirty-seven hours a week on homework alone.

The desire to achieve academic success and maintain a busy schedule to bolster a resume is one thing that drives college students. This also causes a great deal of pressure and anxiety. Many people can relate to cramming at the library until the early morning hours, depriving their bodies of sleep and sanity, just to excel in a particular class. Filling the days with activity after activity leaves little time for the body to relax and decompress. Many may feel it is necessary to get the most out of the day and to not waste any time, but students must remember that it is important to slow down and relax every once in awhile. It is best to give the brain a break to let it recuperate.

Not all stress can be blamed on new environments and heavy coursework; most students actually perpetuate stress with a little thing called procrastination. According to Piers Steel, of the University of Calgary, students will "delay tasks they are not confident about," especially if "the task is [less] urgent, less appealing, or daunting." In the end, the postponement of tasks will only cause more stress, making procrastination a double threat. This phenomenon is all too familiar to Bill Neave, a junior at UW-Madison. When asked why he procrastinates, Neave says "I know that once I start to do the work, the reality of all the work I have to do will hit me." As expected, procrastination is hard to avoid, even though Neave acknowledges the importance of managing stress "because quality of work or health can suffer."

While many people think stress is just an inevitable part of life, there is much more to it. The stresses felt throughout the day have effects on the brain, but not all of them are adverse. Naturally, one might think that the body's physical and emotional reactions to stress cause reactions in the brain, but it is actually the other way around. Chemicals released in the brain are compounded by stress, and these reactions then trigger the physical and emotional response. Often times these physical and emotional responses are not managed by the person feeling them, or are ignored altogether.

It is clear that college life is stressful, but the real question is, do students know how to relieve and cope with it? "I stay up late to get things done," DeVos, the college freshman, says. She also responds to stress by relaxing and socializing, and does her best to "take naps and have fun to relieve stress from the week." Despite his overloaded schedule, Deane is able to manage stress by staying active. "A half-hour run can do a world of good for me," Deane says. And Neave, the student who admits to procrastinating occasionally, confronts his stress by "planning, exercising and doing fun things."

According to Rob Sepich, a stress management counselor at University Health Services, relieving stress can be as simple as adjusting "the perspective you take about it, more than the external stresses ... Taking lots of brief breaks helps a lot, not just the weekend, or at end of the semester," Sepich says. He also advises students to "find places on campus where you're not studying, just to relax." He notes that it's important for students to associate campus and surrounding areas with more than just the stresses of academics.

"An anxious mind can't exist in a relaxed body," Sepich says, highlighting the undeniable link between mental and physical stress. "Posture is important; having relaxed shoulders and slow breathing will have mental effects." Speich also suggests that students exercise for a half an hour each day.

When it comes to the stress of being new to a college campus, Sepich has plenty of helpful strategies. "Maintaining contacts and support from home is important," Sepich says. "Those old relationships are not over, they're just different." He also suggests getting involved in an organization that is similar to something you had been involved with previously, as well as getting involved with something new that interests you. This will help make the transition easier, all while making the college experience "your own." Last, but not least, "acknowledge that change is hard and that many are feeling the exact same way," Sepich says.

By following these simple tips one can manage and learn to cope with stress, minimize hair pulling and maximize productivity. With these tips, Monday may not seem as agonizing and the temptation to slap the snooze alarm may subside. With a little luck, one might even be able to add a few extra hours to the day. WE

Author bios: Marcus is a junior majoring in nuclear engineering. This is his first semester with the magazine, and 5th semester being stressed out. Lauren is a sophomore majoring in industrial engineering. This is also her first, and most stressful, semester with the magazine.

Tiny Invaders Spell Big Trouble for Wisconsin Walleye

By Jack Johnson

It is a part of growing up for much of Wisconsin's youth—you feel a tug on the line, you set the hook, Dad grabs the net, all followed by big smiles captured in a Polaroid for the scrapbook. The caption: "My first walleye!" It's a cherished experience, but one that is facing a serious threat in the depths of many Wisconsin lakes.

The threat is *Osmerus mordax*, commonly known as the rainbow smelt. This species of fish is native to the Atlantic coast from New Jersey to southern Canada, and it has taken a liking to inland Wisconsin lakes.

"Smelt are a death sentence...If they get into a lake the walleye are gone in ten or fifteen years"

-Dr. Stephen Carpenter

The rainbow smelt's journey from the ocean to our lakes was a long one. Rainbow smelt were once exclusive to salt water, entering fresh water only in the early spring to spawn. The species was introduced into the freshwater lakes of Michigan in 1912 to serve as food for commercially stocked populations of Atlantic salmon. The smelt thrived in their new freshwater habitat, and the population quickly spread to Lake Michigan. In 1928, the first *O. mordax* were detected in Wisconsin waters at Little Sturgeon Bay in Door County. Through the efforts of individual fishermen, smelt were transported to the inland lakes of Wisconsin.

Although its physical appearance is less than menacing, the species brings on terrible ecological effects on the native aquatic species. Smelt feed on the juveniles of many different native species, particularly walleye and yellow perch. Smelt also consume zooplankton, the main diet of newly hatched walleye and perch. Additionally, the smelt are rich in enzymes that destroy thiamine, a vitamin necessary for the development of fish embryos and one that can cause harm to the reproduction of the game fish that eat them.

"Smelt are a death sentence," Dr. Stephen Carpenter, an award-winning ecologist and professor of zoology at UW-Madison, says. "If they get into a lake, the walleye are gone in ten or fifteen years." The damage that the nonnative smelt population is causing to Wisconsin ecosystems has been well documented by the Department of Natural Resources, but current measures only prevent the spread of smelt. Considered a 'rough fish,' transportation of live smelt away from the body of water in which it was caught is illegal. However, many anglers are unaware or neglectful of these laws and continue to use the smelt as bait for game fish. Fifteen lakes in Vilas County, Wisconsin are now populated with smelt, and six of those lakes have already lost their reproducing walleye population. Until recently, it was thought impossible to remove the invasive population without further damaging the native species. However, a team of UW-Madison engineers and limnologists led by Dr. Carpenter and Dr. Chin Wu, a professor of civil and environmental engineering, are tackling the smelt infestation with some revolutionary ideas.

"Smelt are highly adapted to cold water that is rich in oxygen. Our goal is to eliminate that kind of water from the lake," Carpenter says. This is certainly not a light undertaking, but the team is confident in its new solution, which is a device known as GELI (Gradual Entrainment Lake Inverter).

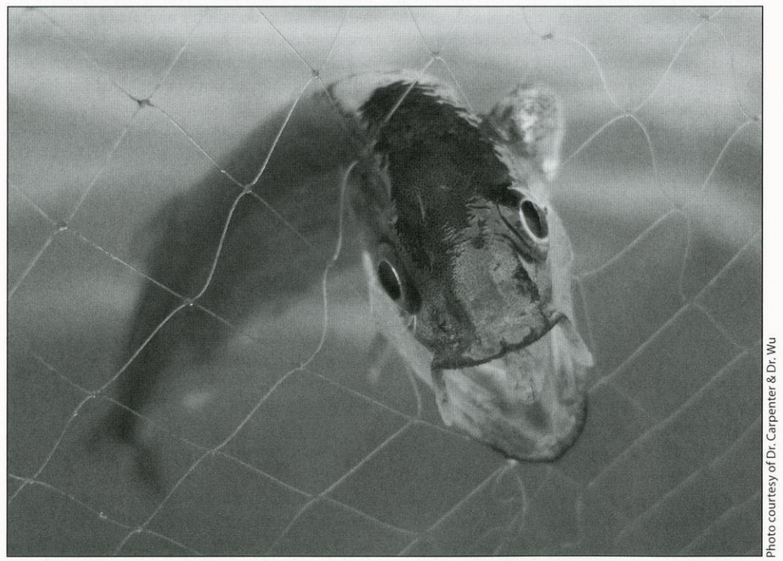


Photo courtesy of Dr. Carpenter & Dr. Wu

The rainbow smelt doesn't appear menacing, but they are a devastating invasive aquatic species responsible for damaging walleye populations across the state.

"[The device] looks like a kiddy swimming pool, but much, much bigger," Carpenter says. "It is four to five meters in radius. A giant disk with a reinforced rim sinks into the lake. You inflate the rim and it rises carrying the cold water. You spill the cold water and pump the air out." This process mixes the warm water at the surface with the colder water in the depths, effectively raising the temperature of the smelt habitat. The increase of temperature will either kill the fish or stress its breeding habits, thus preventing it from reproducing. The native species, such as walleye, live at temperatures much higher than the projected final temperature, after using the GELI.

"We're looking at increasing the temperature to around 20 degrees Centigrade. The native species involved live in lakes around and above 25 degrees, so there is no danger of harming them," Jordan Read, a doctoral candidate in civil and environmental engineering, says.

The GELI is still a work in progress, and several questions need to be answered. "How many GELI do we need? Do we bunch them up in the middle or spread them around? Do we use them as soon as the ice melts or later?" Carpenter says, but he remains confident these questions will be answered. "So far everything looks really good. We're going to test, test and retest. Just like any other large intervention, we're going to be very careful, but there has been no indication we shouldn't be moving forward with this technology."

"This isn't going to be a panacea. You need a cold-water species you want to kill, while none of the other species are sensitive to removal," Carpenter says. The teams plan is to move the project to a large scale, hopefully using it in several smelt-ridden lakes, but Carpenter and his team understand the limits of the GELI.

The team has done preliminary field tests in central and northern Wisconsin lakes, including Crystal Lake in Vilas County, which no longer has a yellow perch population due to the smelt invaders. This 83 acre lake is expected to be one of the first to receive extensive GELI treatment. Additionally, Read sees potential in using this technology in areas suffering oxygen depletion or in drinking water reservoirs. Currently reservoirs are treated by pressurized aeration, but tests have shown that the GELI technology can be up to ten times more efficient.

Photo by Lakshay Gupta

The GELI creates a column of warm water, raising temperatures to levels uninhabitable by invasive smelt.

Read says the team is using this year as a baseline year to gather information about the fish populations, while the GELI is projected to be introduced to lakes in 2011 or 2012. As the team diligently moves forward, the future of Wisconsin's lakes and fisheries look to be in good hands, and the next generations of anglers should have no trouble finding their first walleye. WE

Author bio: Jack Johnson is a freshman in the college of engineering at UW-Madison. This is his first semester with the magazine.

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The Allure of Sustainable Lures

By Anthony Lai

In a simpler time, there was a short list of things that were harmful to humans and our environment: asbestos, lead poisoning, DDT and oil spills among them. Now, that list is much longer, and growing by the day. In fact, it seems like we have to worry about almost everything: cell phones that rot our brains, plastic water bottles that leach carcinogens and fishing. Yes, fishing.

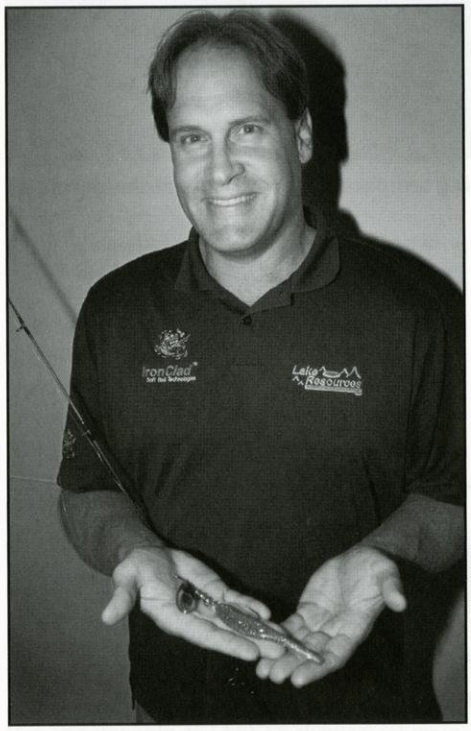


Photo by Danny Marchewka

Ben Hobbins implemented skin grafting principles from his previous experience in the biotechnology industry to create the IronClad plastic soft lure.

At first glance, most people wouldn't consider sport fishing an environmentally harmful activity. Sitting in a boat amidst a forested landscape and floating above a lake teeming with life doesn't exactly seem hazardous. However, fishing may be more dangerous to the ecosystem than one might think, all because of a small, often-overlooked piece of equipment: the fishing lure.

The spectrum of fishing lures available is wide, from jigs to surface lures, spinnerbait to swimbait. These lures are designed primarily with form and function in mind. Plastic lures are especially favored for their ability to mimic the form, texture and movement of aquatic prey. In addition, these lures are easy to produce and affordable. These plastic lures are efficient and economical; however, they are also taking a toll on our rivers and lakes.

To create a typical plastic lure, manufacturers often dope polyvinyl chloride (PVC) with phthalates, which are chemical compounds that serve to enhance the flexibility, transparency and durability of the lure. "Half the weight of these lures is plasticizer, or very-low molecular-weight materials that are called phthalates," Tim Osswald, director of the Polymer Engineering Center at UW-Madison, says.

Unfortunately, these phthalates have been shown to pose significant health risks to humans and wildlife. In fact, they are prohibited for use in many products. Therefore, it is particularly disturbing, according to Ben Hobbins, CEO and president of the Lake Resources Group based in Waunakee, that several thousand tons of soft lures are deposited on the bottom of lakes, rivers and other waterways each year, threatening the surrounding fauna and flora. "If you go into a sporting goods store, every soft-plastic fishing lure on the wall is lost in the environment, and that's a staggering thought," Hobbins says.

How does this happen? As it turns out, these traditional lures have a tendency to detach from the hooks because they lack strain endurance. This means the lures stand a good chance of breaking off while meandering around thickets of local flora, or simply sliding off the hook at other inopportune times. The affordability and accessibility of these lures, coupled with their inclination to be lost, implies that the number of plastic lures stuck in sediment beds will only increase as time goes on.

That's where Hobbins comes in. Looking for an alternative to the traditional lure, Hobbins, who is also an entrepreneur, went to the UW-Madison school of business and college of engineering for assistance. His goal was to develop a soft bait lure that provided the flexible attributes of traditional lures, while increasing strength and decreasing the likelihood of being lost and becoming an environmental risk.

In November 2006, with the help of Osswald, whose research interests include engineering design with plastics and sustainability, Hobbins devised a unique fiber-reinforced soft plastic lure that implemented skin grafting principles from his previous experience in the biotechnology industry. The results and their implications were astounding.

"[The fibers] are placed in such a way that you still have the flexible lure, but you can't rip it," Osswald says. The mechanism behind the strength of the bond of lure and hook is the fab-

rication process that embeds microscopic fibers into the plastic polymer. As a result, the lure is significantly less likely to disengage or break off the hook. "[The lures] are stiffer to the pull if you stretch them, but they're still flexible and deliver the desired performance," Osswald says.

"If you go into a sporting-goods store, every soft-plastic fishing lure on the wall is lost in the environment and that's a staggering thought."

-Ben Hobbins

The advantages of this new lure are quite evident. First, the increased strength of the lure means that anglers will save money in the long run, as the new lure is built to last. As a result, fishers using the lures will enjoy a greater ratio of fish caught per lure. Secondly, there is a much smaller risk to the ecosystem.

"It adds a lot of pleasure to the fishing experience," Hobbins says. "It also stops soft-plastic waste in the environment."

After the lure was developed, Hobbins took his innovation to the UW-Madison school of business. Phil Kim, an assistant professor who teaches entrepreneurship, challenged his students to devise a business model for the lure. "It puts the classroom learning into a bigger context. And also, in the end, in many cases, [the students] have an opportunity to influence the way the business owner is running their business," Kim says.

Kim's students set out to capture and analyze valuable data on the market of plastic soft lures, especially metrics that had not previously been studied. "They came up with some hard numbers that now are applied in market research as viable for the industry," Hobbins says.

Since then, the microfiber-based plastic soft lures, officially marketed as "IronClad Lures," have garnered many accolades and have been featured in several magazines. *Popular Science*, for instance, honored the lure as a top ten invention of 2009. Available at national sporting goods chains, the lure is competitively priced with conventional plastic lures.

The IronClad plastic soft lure is a boon to sport fishermen and a tribute to the environment. How the lure came to market is an excellent example of the entrepreneurial process: a merge of idea, design and business. While Hobbins succeeded with the help of Osswald, Kim and a business class, there is one more thanks he would like to give.

"I owe the Wisconsin system—which strongly supports entrepreneurship and technology invention—much credit for the success of our project," Hobbins says. We

Author bio: Anthony is a senior majoring in computer engineering and political science. This is his second semester with the magazine.

Top ten places to fish in Wisconsin

1. Lake Winnebago
2. Yellow Lake
3. Eagle River
4. Minacqua River
5. Boom Lake
6. Wisconsin River
7. Wolf River
8. Mississippi River
9. Sturgeon Bay
10. Pelican Lake

Photo by Danny Marchewka

The fibers of these IronClad lures are designed for superior strength and flexibility.

Tracing the source of photo-induced seizures

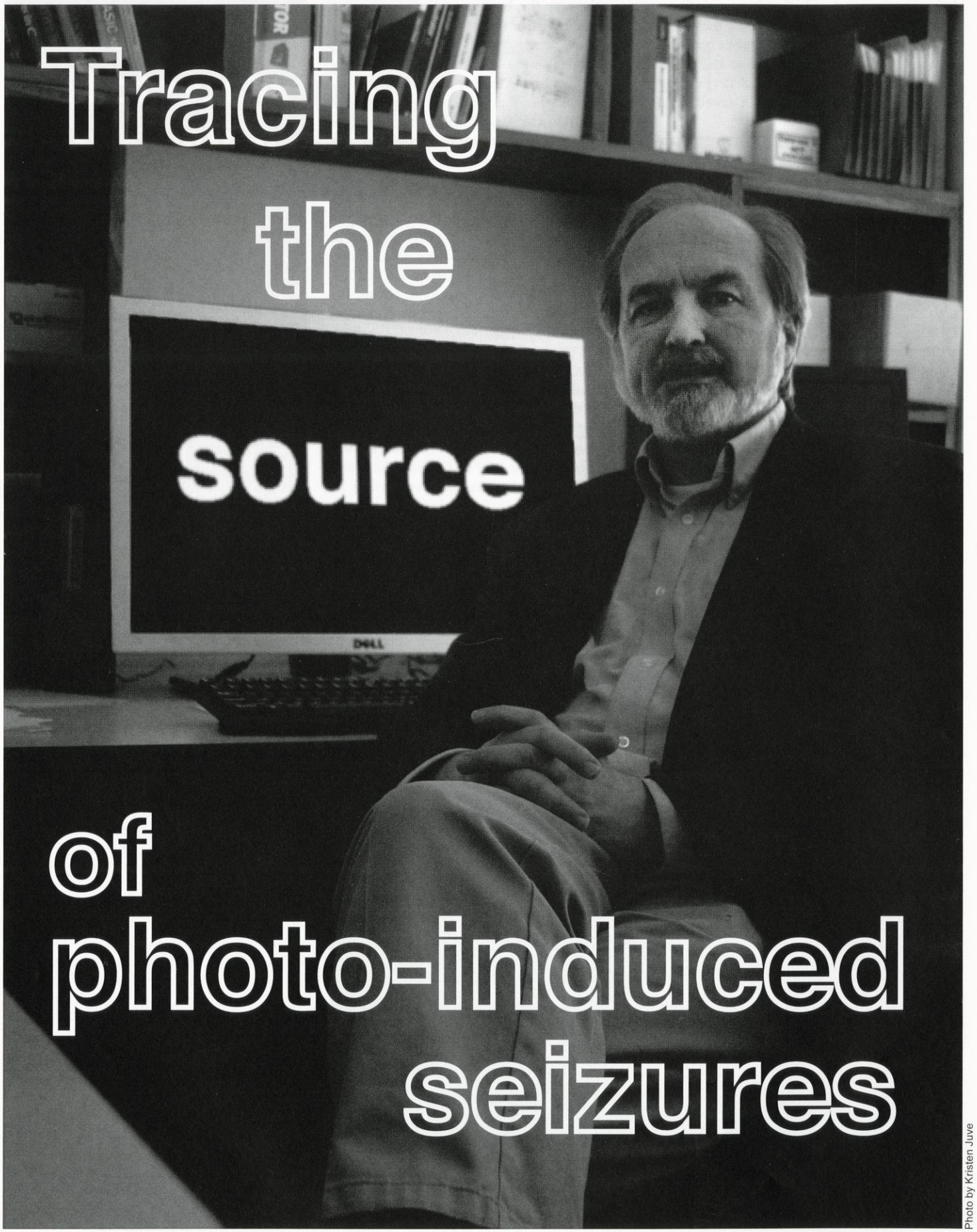


Photo by Kristen Juve

By Melody Pierson

We were all told as children to turn off the television because "it will rot your brain." This statement may have been just a scare tactic at the time; however, after an incident in Japan in 1997, when a sequence of flashing images in a Pokèmon episode triggered photosensitive seizures in almost 700 people, researchers began to take this statement more seriously. One group that became involved in the issue was the Trace Research and Development Center.

The Trace Center, which is part of the UW-Madison college of engineering, has become a world leader in research efforts to address the problem of web- and television-triggered seizures in people with a condition called photosensitive seizure disorder.

Dr. Gregg Vanderheiden founded the Trace Center 38 years ago. Since then, the center has grown to occupy its own set of office suites in the Engineering Centers Building, and it boasts a long list of developments that improve accessibility for the disabled. Many of the projects that the Trace Center has taken on have been the very first ideas of their kind and remain the only product of their type available. Photosensitive epilepsy was an especially unique topic for the Trace Center.

"The problem is, most people don't know they have a seizure disorder until they have a seizure," Vanderheiden says. When the Trace Center first took on the photosensitive seizure project about ten years ago, Vanderheiden went straight to the leading expert in the field, Dr. Graham Harding, of Great Britain's Aston University. During an interview with Vanderheiden, Harding provided a brief description of the condition: "Photosensitive epilepsy is a condition in which people have seizures or attacks or fits when they are presented with a visual stimulus. It's not very common; whereas epilepsy is common, photosensitive epilepsy occurs in approximately 1 in 4,000 of the population."

Harding and his team developed a new tool that allows for television broadcasters to evaluate each program to determine if it has the ability to cause seizures. The only drawback of this tool was its incredible expense, costing about $20,000. Complications arose further when some governments in Europe wanted to try to regulate television and website content through legislation. This was difficult to do without making clear-cut "yes-no" rules, because flashing and bright colors are not dangerous to individuals with photosensitive seizure disorder until they reach a certain level.

"You couldn't have a rule if the only tool cost $20,000 Vanderheiden says. "What we wanted to do was provide good advice to people on what to do and [deliver] a tool that was free that they could use to determine if what they were doing was dangerous."

> ***"The Problem is,*** *most people don't know that they have a seizure disorder until they have a seizure."*
>
> ***-Dr. Gregg Vanderheiden***

Trace developed the first set of web content guidelines that were later picked up by the World Wide Web Consortium (W3C) and refined into what is now the Web Content Accessibility Guidelines (WCAG) 2.0. Vanderheiden is a co-chair of a group of volunteers from the web page development industry who came together to write the W3C Recommendations under the WCAG 2.0.

In developing the current tool used to help people follow these guidelines, the Trace group started with the ideas Harding and his team had already developed. They licensed the underlying algorithms for a sum of money, allowing them to distribute the information free of charge. Some adaptations needed to be made to the original software because it was specific to television programs and did not address internet content. Watching television and looking at a computer screen are very different experiences because the two technologies have different purposes. "When you're looking at a computer screen up front you actually have to look at every little bit of the screen rather than just the whole screen," Vanderheiden says.

When the group released the software, which is called Photosensitive Epilepsy Analysis Tool, or PEAT, there was still a catch. Using the software "required that you buy this other special screen capture card that could cost hundreds of thousands of dollars to capture the image and then you could analyze it using the tool," Vanderheiden says.

The Trace group got to work right away on developing a built-in video capture capability that would eliminate the need for the capture card and make PEAT a much more practical tool for web developers. With the built-in video capture, "you can literally just turn it on and it can capture the screen contents, do the analysis, and then [it will] tell you what it is." Vanderheiden says.

PEAT is the only tool of its kind, and it is a huge step towards making the internet a more accessible place for everyone. A free download of PEAT is available as a link off of the WCAG 2.0.

"When you go into the guidelines, it points to the tool. So mostly, the people who find out about the tool are the people that know about the guidelines." Vanderheiden says, admitting that creating awareness is always a hurdle. "We don't really have any money to fund a major information campaign."

Trace Center researchers continue to look for improvements to their products.

"We would like to create a preventative tool," Vanderheiden says. "So that even if [web developers] don't use the … analysis tool, and they do put dangerous stuff up on the web, someone with seizure disorder could detect there is a problem." WE

Author bio: Melody is a junior majoring in nuclear engineering and also pursuing a certificate in biology in engineering. This is her third semester with the magazine.

MOOOVING FROM eCOW TO eCOW2

The college of engineering makes the official switch to a feature-rich Learning Management Software

By Dylan Liebl

Students and professors in the college of engineering have a powerful new learning tool at their disposal, and with the help of fellow graduate and undergraduate students, they can learn to use this tool to its full potential.

For almost 15 years, college of engineering students and professors have depended on Engineering Courses on the Web (eCOW) to share and view course materials over the Internet. This past summer, eCOW was shut down and the official switch to eCOW2 was made.

The learning management system (LMS) eCOW was a software designed to support learning through technology. It provided a space for professors to upload files and an easy-to-use interface for students to access them.

"Well, eCOW1 was a fantastic product, and actually still is in terms of its simplicity and interface ... but it was also built in the mid- to late-90's by an employee who is no longer here, with a technology that's kind of getting old and we needed to update it." Paul Oliphant, computer-aided engineering (CAE) consultant for the Technology-Enhanced Learning (TEL) project, says. CAE spent years just trying to figure out what to do with eCOW and eventually agreed that maintaining it just wasn't feasible.

Around the same time, UW-Madison purchased the Desire2Learn (D2L) license and used it to craft a campus-wide online LMS known as Learn@UW. Unfortunately, usage of Learn@UW didn't skyrocket in the college of engineering and eCOW retained market share. "What it really boils down to is that we found that the D2L product wasn't really effective for foreign languages. And engineers talk a foreign language. It's called mathematics," Oliphant says. Thus, the search began for a new LMS that could fulfill the special needs of engineers.

Photo by Nattapol Arunrattaramook

Clockwise from π radians: Carrie Boecher, Evan Western, Natnan Miller, Andres Perdomo, Tim Tynan, Annete Spyker, David Simkins were instrumental in identifying the original eCOW's shortcomings and implementing the changes seen in eCOW2.

"[We] found that Moodle is the lead in the open-source area for learning management systems. It's the front-runner all over the world. Lots of people use it," Oliphant says. In fact, as of the writing of this article, over 26 million people from 204 countries are Moodle users. Thus Moodle became the backbone of eCOW2, but the college of engineering still needed a team to support this new technology.

Representatives from CAE, including Oliphant, joined forces with Dr. Sandy Courter, director of the Engineering Learning Center (ELC) , in hiring a team to explore eCOW2, and work with instructors to produce a set of example online course homepages. The typical route would have been to hire instructional designers who also had a focus on technology. Instead, they made the unprecedented decision to hire a team of motivated and computer-savvy graduate and undergraduate students to take on this role.

"I think that this model of the undergraduate TEL consultants working with the graduate students is an awesome way to get undergraduates involved in the process of improving the way we are learning in our college of engineering," Courter says. "The faculty are learning in the process and the undergrads are learning, but they're also helping instructors teach better. I think that has been a missing link for a while, and it's just the begi nning."

Funded through the offices of Aaron Brower, vice provost for teaching and learning, and Steve Cramer, associate dean for academic affairs, this team of students was tasked with integrating eCOW2 into courses in the college of engineering, providing support to faculty in their transition to eCOW2 and producing long-term instructional materials for its use.

Every week throughout the summer, these students held three-hour team meetings with Courter, Oliphant and other CAE consultants to share new things they discovered in Moo-

Photo by Nattapol Arunrattaramook

eCOW2 allows for users to personalize their home page and allows students to communicate instantly with other students or professors.

dle, problems they encountered and to discuss plans for the upcoming week. While the meetings have been cut down due to class schedules, the students continue to flood the meeting room with knowledge of the college of engineering's new LMS. "There's a reason I've been coming to the meetings. It's not just to contribute, it's to learn," Oliphant says.

However, even with a support team at their disposal, many college of engineering professors have yet to integrate eCOW2 into their courses. "The major challenge was helping the faculty to make the change. There weren't any choices. The old eCOW was going away. And we believed, and still believe, that the new system is better, but it is difficult to change," Courter says.

The main advantage of eCOW2 is that it's based on open-source software. "One of the reasons that we went to open-source and not a commercial product is that engineers are not necessarily mainstream. Many of the learning systems that are out there are tailored to the mainstream because that is where the cash flow is, but engineers are a little more special, with the mathematics especially," Oliphant says.

Because Moodle is open-source, CAE developers are able to tweak eCOW2 specifically to engineers by integrating new features like the MathML Editor, which allows professors and students to type complex mathematical expressions into any text box equipped with an HTML editor. The expressions appear just as they would if someone had written them by hand.

The new eCOW2 provides an abundance of features that can reduce the workload for professors and enhance the learning experience for students. The different interactive activities allow professors to provide students with engaging material at a more frequent rate than they could ever achieve in class.

Automatically graded activities like quizzes and lessons free professors from the hours it takes to grade them by hand, while at the same time provides students with instant feedback. In addition, a feature called the "feedback manager" cuts down on the time needed to grade answers to essay questions for large classes.

"The faculty are learning in the process and the undergrads are learning, but they're also helping instructors teach better. I think that has been a missing link for a while, and it's just the beginning."

-Professor Sandy Courter

ECOW2 provides an organized structure for professors to store and display material, and for students to view and interact with that material. As Courter says, "It's a one-stop-shop. It's really handy to have all of your resources in one place." Once all of those resources are on an eCOW2 page, the "label" resource can be used to display text, images and videos directly onto a course's page, giving it a personalized feel.

Perhaps one of the greatest advantages that Moodle has over other LMSs is its emphasis on collaborative "Web 2.0" activities, which help enforce group-based learning. Forums, wikis and chats allow students to work together to solve complex problems or document projects.

One common use of the "chat" activity has been to replace scheduled office hours. Instead, professors can set up a chat room for a specific time where students can ask questions and receive answers from the professor, as well as other students, in real time.

Of course with all these advantages there must be some drawbacks. Since the technology is relatively new, bugs continue to be discovered by the support team, professors and students. So far, CAE developers have been able to squash the bugs or find temporary ways to work around them while a permanent solution is researched.

In addition, eCOW2 is feature-rich, it demands a more complicated interface than eCOW did. This fact has been a turn-off for many professors. Some professors continue to demand the same functionality of eCOW, "[but] can you imagine a Moodle site that is used in the exact same way as the old eCOW? You can, but you don't want to. It's like moving into a modern house and still having an outhouse out in the back and hauling in water every day to your sink," Oliphant says.

The official switch to eCOW2 has been made, and in the process a model for linking undergraduates to professors has been created. There is still work to be done and the TEL support team is hard at work creating long-term instructional materials and supporting professors in their transition.

Only time can tell how eCOW2 will become a foundation of engineering courses at UW-Madison. But if the hundreds of course home pages already created are any indication, eCOW2 is here to stay. WE

Author bio: Dylan is a junior in materials science and engineering. This is his first semester with the magazine.

WANT TO LEARN MORE ABOUT eCOW2?

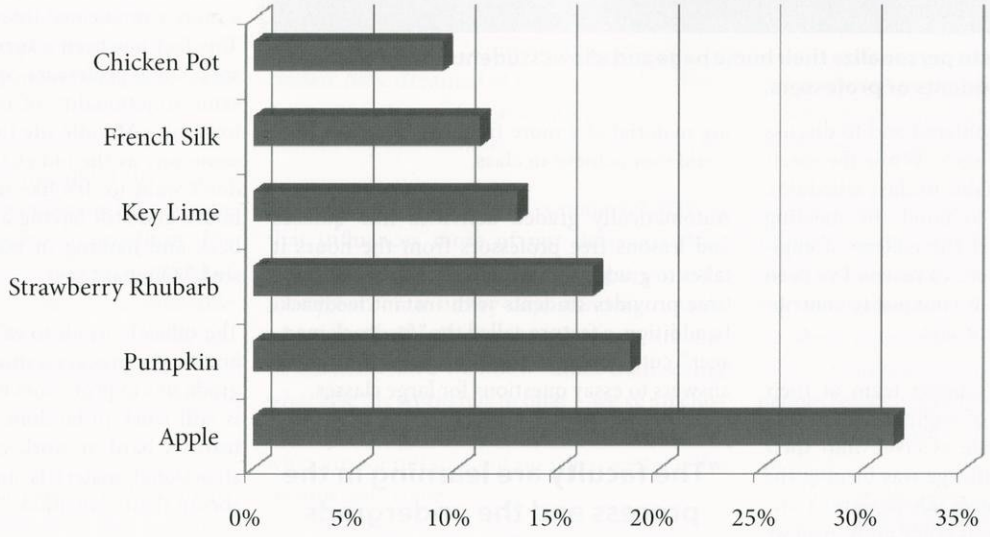
For the latest news, tutorials, and information about eCOW2, visit the eCOW2 homepage at:

http://www.ecow2.engr.wisc.edu

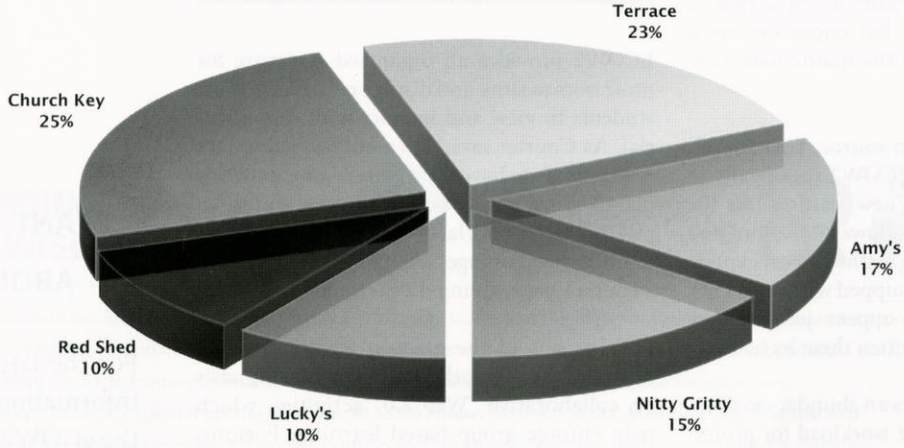
Just one more

The finest in eclectic humor

Bar graph of our favorite pies



Pie chart of our favorite bars



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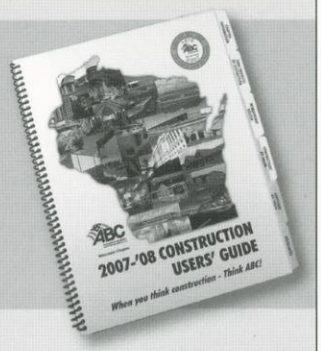

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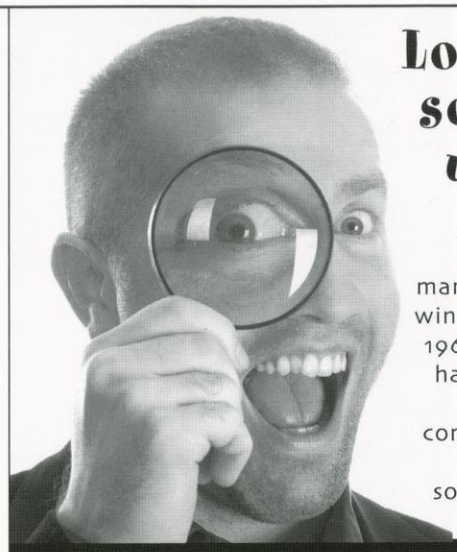

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