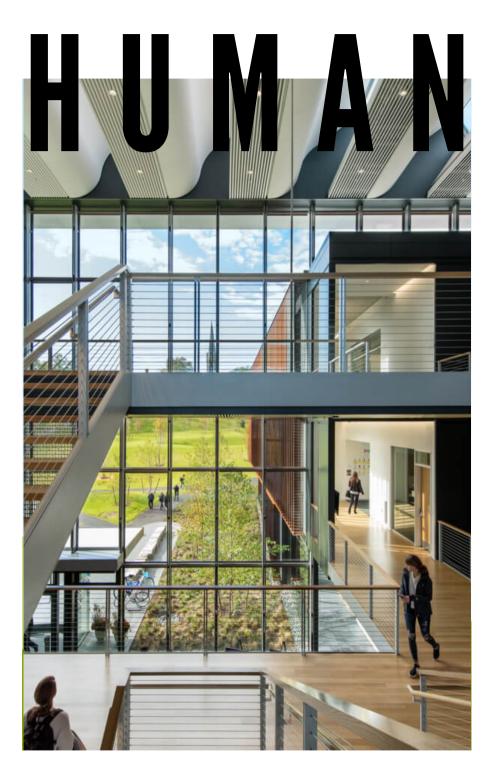


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#### BEING HUMAN IN STEM

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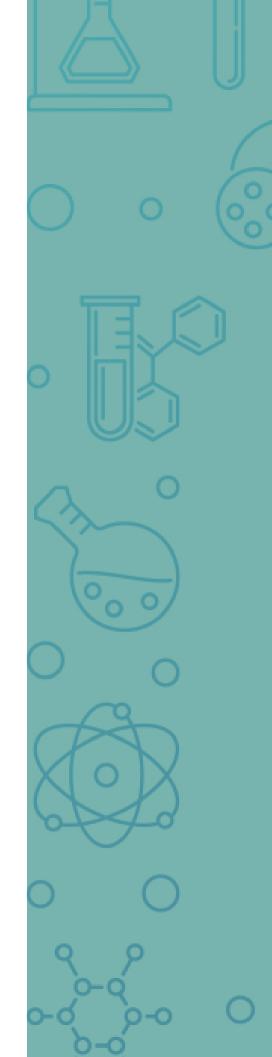
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PAGE 01 / VOLUME 2.0

# C O N T E N T S

- **0 2** MEET THE AUTHORS
- **0 4** WHAT IS HSTEM AND AMHERST UPRISING?
- **0 5** THE HSTEM VLOG: OFFICE HOURS BY KARINA THANAWALA
- **06** WHAT'S GOING ON WITH THE OFF SEMESTER? BY SABRINA TROMBETTA
- **09** SHOWER THOUGHTS ON SCIENCE BY PETER BAIRD
- **12** AMHERST PRE-MED SURVIVAL GUIDE BY ANTONIA TAMMARO
- **13** BEING HUMAN IN HEALTHCARE BY DANNY JEONG & NICOLE CASE
- 14 LET'S TALK ABOUT UNCOMFORTABLE CONVERSATIONS BY ADELE TEO
- **15** THE VILLAIN IMPERSONATOR BY ARTEM PUSTOVID
- 17 AN ENTRY FROM MY HSTEM JOURNAL BY AVA TILLMAN

Special thanks to Dr. Sheila Jaswal, Prof. Leah Schmalzbauer, Aidan Park, and Megan Lyster



## MEET THE AUTHORS

HUMAN MAGAZINE

PAGE 02 / VOLUME 2.0

## ADELE TEO '23: COMPUTER SCIENCE & ECONOMICS

2020 saw a lot of important conversations being had - sometimes they were emotional, sometimes uncomfortable, and sometimes even divisive. I was inspired by Loretta Ross and Jane Goodall's approaches to conflict resolution, so I created a guide with some of their key takeaways in the hope of having even more meaningful and productive conversations in 2021.

## DANNY JEONG '23: CHEMISTRY & NICOLE CASE '22: BIOLOGY

Nicole and Danny created an infographic to spread awareness of the importance of being open-minded as an EMT when interacting with patients of different gender, race, sexuality, backgrounds etc. We are both on ACEMS and believe that this information is critical for proper and effective patient care where both the patient and the EMT feel comfortable and safe.

## **AVA TILLMAN '23: MATHEMATICS & COMPUTER SCIENCE**

My inspiration for this project came mainly from resources on Indigenous Knowledge, LGBTQ+ experiences, and my classmate's and my own experience in STEM. I noticed that for many individuals, especially those who utilize indigenous practices, American education tends to be too rigid and unwelcoming of failure, curiosity, or diversity of opinion in its approach to STEM. In hoping to find a more holistic and objective way of teaching and understanding STEM, I chose to reflect upon my own experiences.

## SABRINA TROMBETTA '21: SOCIOLOGY

My project is inspired by my small, "off-semester" introductory Chemistry courses at Amherst. I put the perspectives of my former professors in conversation with reflections from my own experiences in those classes. I conclude by presenting a preliminary proposal to research the implications of class size on persistence and feelings of belonging in STEM at Amherst.

## KARINA THANAWALA '21: PHYSICS, MATHEMATICS, & ASTRONOMY

HSTEM has given me a chance to reflect on my four years at Amherst. Looking back, I know that I had to struggle in ways that my peers didn't, but I also know that I hold privileges that others don't. I credit my grit to my ability to persevere through struggles, particularly in STEM, but I know I would have benefitted from a clearer path through my education. My project is based on the biggest piece of advice I would like to give to my former self: you deserve the best education possible.

## ANTONIA TAMMARO '21: SOCIOLOGY

I am a senior transfer student from Boston, Mass. I'm a member of the women's soccer team at Amherst and am also interested in a potential career in medicine. I decided to take this class because I wanted to bridge the gap between what I was learning in my pre-med classes and my Sociology classes. I am hoping to take what I learn and use these ideas and ways of thinking about the world to my future career

## ARTEM PUSTOVID '24: UNDECIDED

HUMAN MAGAZINE

PAGE 03 / VOLUME 2.0

I am a first-year student from Russia with a love for biology and philosophy. This is a paper about empathy. I argue that to solve social troubles, we need to be able to exercise empathy even towards people we consider evil.HSTEM means to me: HSTEM is a way to find human souls behind equations and graphs.

S ZENC C

## PETER BAIRD '22: BIOLOGY

Peter is interested in studying genetics and biochemistry, and works in Professor Goutte's research lab, studying the gamma secretase protein complex in C. elegans. He is also a member of the Amherst Swim and Dive team.

PAGE 04 / VOLUME 2.0

## WHAT ARE CON HSTEM AND CAMHERST ?

HSTEM feels safe, warm, and welcoming. It means helping each other grow both intellectually and emotionally.

A way to gain new insight, awareness, and tools for my future in STEM Always ask questions. Challenge yourself to challenge the system.

"On Thursday, November 12th, three students organized a sit-in in Frost library in solidarity with students of color at the University of Missouri, Yale and similar institutions. The event was initially scheduled to last an hour; however, it turned into weekend-long occupation of the library, during which students of color and other students whose experiences are marginalized on our campus gave testimony about their experiences of struggle at Amherst. Over the course of the weekend, students, staff, faculty and administrators alike came together to witness these testimonies—and to begin to think critically about how to make the college a safer, more inclusive place for those who feel the least supported on campus."

#### -Amherst Uprising Information & Sources

"The "Being Human in STEM" initiative aims to empower students, staff and faculty to reshape their classrooms, laboratories and departments to create an inclusive and equitable STEM community that enables humans of all identities to thrive and flourish."

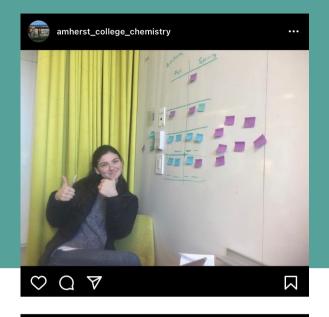
Taking HSTEM over the January term gave me a unique opportunity to reflect on my experiences with STEM and to connect with a number of students before my last semester at Amherst.

#### - beinghumaninstem.com

Being human in STEM means being cognizant that STEM was developed both for and by humans, and therefore contains within in it both the beautiful and ugly ways in which humans perceive the world. We cannot pretend STEM is exempt from human characteristics such as bias and emotion.

HUMAN MAGAZINE PAGE 05 / VOLUME 2.0 "Use Amherst for every single dime of that endowment. Take every advantage. Whether that means going abroad, going to therapy, going to a summer internship that you would never have thought. Like, do it. This place has transformative powers in real ways because it allows you to become a better you in ways that you never thought possible." -Anthony Jack '07 Learn how to navigate the Amherst College education experience, particularly Office Hours, with Karina Thanawala '21. This video is intended for new students and Amherst, and is inspired by the 'Being Human in STEM' course and the book 'The Privileged Poor' by Anthony Jack '07. Watch at https://youtu.be/Ef88IOTQuOA THE HSTEM VLOG: OFFICE HOURS KARINA THANAWALA BY

PAGE 06 / VOLUME 2.0



#### amherst\_college\_chemistry Chem major planning! #maybe View all 2 comments sabrina\_trombetta # patent pending sticky note method March 26, 2019

## MY LIVED EXPERIENCES AND FACULTY PERSPECTIVES

I stumbled across STEM in the Spring of my first year after hearing about my friends' positive experiences in introductory chemistry classes that fall. To my surprise, I ended up enjoying offsemester CHEM 151 enough to want to take another course the following semester. Looking back, those off-semester chemistry classes were places where I developed close friendships with my classmates, strong relationships with my professors, and where I was able to grow significantly as a student.

The HSTEM curriculum introduces several student-centered and inclusive diversity initiatives (David Asai 2020, Diversity Matters) that institutions may take to foster persistence in STEM, particularly among underrepresented minorities (URM). Asai emphasizes the importance of introductory courses as he

## WHAT'S GOING ON WITH THE OFF SEMESTER?

BY SABRINA TROMBETTA

encourages "re-center[ing] the science learning experience on inclusion." At Amherst, low enrollment in off-semester courses – CHEM 151 in the spring and CHEM 161 in the fall – provides an ideal environment to achieve those pedagogical goals.

Students who delay their introductory chemistry courses learn in much smaller environments than those who begin one semester before; for the class of 2021, on-semester CHEM 161 in the spring semester had 105 students, while the offsemester course in the fall had 23. Smaller classes establish a sense of community quickly and organically, creating a strong foundation for professors To convey concepts and for students to master content. Spending 7 class hours together each week in lecture, discussion, and lab sections lets students and professors get to know one another, their strengths, and their scientific approaches in different contexts. This camaraderie makes students more comfortable in the classroom, resulting in more participation in class and regular attendance during office hours.

After feeling engaged and invested in my off-semester classes, I was inclined to continue

#### PAGE 07 / VOLUME 2.0

studying chemistry. I hoped to take one more course in Spring 2019 to help me decide whether the major might be a good fit for me. Despite Dr. J's "patent pending sticky note method" for planning classes, there were no chemistry courses I could take as a student in the offsemester sequence. I would have been able to complete the major requirements in my last two years at Amherst, but this would mean declaring after having taken only two introductory courses.

The off-semester Chemistry sequence has the opportunity to call-in students who might not have expected to study STEM as well as those who intentionally delay the class given their math background. Regardless of their reasoning for delaying the semester, the small class environment fosters a sense of belonging that may encourage persistence in STEM. Before this spring, delaying introductory courses by just one semester created challenges for students with a "late" start to the major considered how to fit academic and extracurricular interests into their remaining time at Amherst.

New course offering this semester (Spring 2021) will Introduce more flexibility for students in the off-semester sequence. Organic Chemistry 1 (CHEM 221) will be offered, disrupting the previous system of having to take Organic 1 and 2 sequentially in one academic year. A new elective (CHEM 380) will be offered without organic as a requirement, allowing students to engage in higher-level topics early. Students will now have more pathways to complete the chemistry major should they have started the "late." I hope that these initiatives will prove to encourage more persistence in STEM, particularly among URM and those who may discover an unexpected interest in, in this case, chemistry.

## A PROPOSAL FOR FURTHER RESEARCH

To build an HSTEM practice and to continue to consider this topic in an interdisciplinary fashion, I am interested in exploring the case of the offsemester in more detail for my upcoming Social Research course. Required of all sociology majors, SOCI 316 allows students to design and execute an original research project. Conducting a study grounded in data and student experiences could illuminate meaningful patterns as STEM departments at Amherst consider more strategies to foster inclusive learning environments when structuring course sequences.

Persistence in STEM has been studied extensively by sociologists of education. Class size has proven to be correlated with academic achievement (Glass 1982, Sobel et al. 2016). A comprehensive literature review may reveal more current research on the effects of class size on persistence in STEM, as well as the impact of class composition on persistence in STEM (a topic of interest as we consider what happens when students with different academic backgrounds come together in larger STEM classes, such as the "on-semester" organic chemistry sequence).

Metrics of interest would include the breakdown of how chemistry majors structured their introductory coursework; on-vs off semester? CHEM 151 vs 155 (placement being based on secondary school math and science preparation). Likewise, how does introductory coursework timing and placement affect grades in future courses?

#### PAGE 08 / VOLUME 2.0

Surveying, interviewing, or conducting focus groups with students from the off-semester sequence may reveal further patterns. My questions to my peers would be, what made you delay CHEM 151? How did this affect your sense of belonging in STEM? Did it influence your persistence in STEM? How did you experience the adjustment to larger courses? I would be equally interested in learning how race, gender, and class play into persistence in the Chemistry major in particular.

This research can open a broader conversation about the place for exploration in the Amherst STEM curriculum. While many students come to Amherst with broad ideas of their interests, are course offerings set up to allow students to follow through with any interests they may discover "late?" Looking back at the experiences of students who did not have the upcoming Spring 2021 options may emphasize the importance of continuing to offer flexible courses in the future, especially with the goal of fostering persistence in STEM.

## A C K N O W L E D G E M E N T S

A special thanks to Professor Burkett and Professor Cartier for their dedication to teaching that made these off-semester experiences so special, and for re-connecting with me to share their perspectives on class size for this piece.

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PAGE 09 / VOLUME 2.0

## SHOWER THOUGHTS ON SCIENCE

BY PETER BAIRD

My inspiration to study molecular and cellular biology began with genetics. The concept that all life on earth was blueprinted by the same molecule fascinated me, leading me to develop wild fantasies. What if I could make vegetables taste like chocolate, or plants which were so hardy they could withstand transport halfway across the world and maintain freshness? Lentered Amherst believing I would immediately learn how these dreams could be accomplished, but by fall of sophomore year I felt I was getting nowhere. I took matters into my own hands by becoming a research assistant in a biology lab on campus. I was jubilant after receiving my first assignment to read some literature reviews on the protein studied in this lab. Finally, I was taking the first step toward gaining the lab experience necessary to conduct my own experiments on DNA. My initial ego bubble was quickly burst once I began to read the aforementioned papers. They were dense, long, and full of sentences with more jargon and acronyms than real words I could pronounce. After I struggled with these first few papers, and to perfect seemingly basic lab techniques, I had thought I made a mistake in my choice of a career goal. Would my life be reading these papers that took five rereads to understand? Eventually, I grew used to the language of these papers, and the longer I work in this lab, the more I enjoy the research. But why did I end up staying? Why did I even continue to study this field after the discouragement of my first year? What would other students have done if they felt the same way? This article is an account of my thoughts as I try to answer these questions.

In her book Braiding Sweetgrass (2013), Robin Kimmerer argues for a fusion between indigenous ways of knowing and scientific knowledge. Kimmerer could be the perfect advocate of this kind of fusion, as a STEM Professor who reconnected with her indigenous roots after receiving her PhD in Botany. I was initially skeptical of allowing the subjectivity that comes with indigenous thought systems into the realm of science, but one story of Kimmerer tells of her first meeting with her undergraduate adviser caught my attention, challenging my acceptance of the supremacy of objectivity. In this meeting, Kimmerer described why she wanted to major in botany, citing her desire to find out "why asters and goldenrods looked so beautiful together" (39). The unfortunate response by her adviser was "I must tell you that that is not science" (40). The adviser was correct. Kimmerer describes her education as "reductionist, mechanistic, and strictly objective"(42). Science was memorization of Latin names and plant chemical concentrations. Accepting that this was the way science must be done, Kimmerer soaked up this knowledge and maintained her fascination with plants, despite struggling in her introductory classes. Kimmerer did not resume asking subjective questions like why the purple asters and yellow goldenrods paired so well together until many years later.



Figure 1: Asters and Goldernrods

#### PAGE 10 / VOLUME 2.0

I immediately realized the parallels between my experience and Kimmerer's. I was inspired to study biology after becoming fascinated with the almost alien world that exists on the cellular level. I held lofty goals about investigating these cellular processes for the betterment of humanity. Instead, I had to repeatedly practice stoichiometry and read dense papers in which proteins and genes are given names which seem like an arbitrary compilation of letters and numbers. Sometimes, I actually enjoyed this process, and like Kimmerer, I did not question that this was how science should be learned. Kimmerer's love of science was also energized by professors conducting "heart-driven science, whether they could admit it or not"(42). My own passion for molecular genetics is similarly energized; I remained in my lab because I had seen the excitement the lab professor had for the research I initially thought dull. I am also inspired when I step back from decoding acronyms or completing problem sets to see the broad developments being made in biology. The technology involved in the new COVID-19 vaccines, for example, is particularly exciting.

Currently, I enjoy my research in the lab, but what if I had struggled more in my introductory classes, and never bothered to join a lab? I had a strong background of introductory biology and chemistry from high school, which prepared me well for these courses in college, but many students do not have this strong foundation. Kimmerer's passion for plants pulled her through those times she thought about quitting. What if this passion hadn't been quite as strong? The reductionist nature of science lacks the human passions, connections, and aspirations which draw us to science. The fundamental way science is taught becomes the source of at least some of its inaccessibility, especially to those who may not have the same background of resources I have had or had a chance to develop the kind of intense passion Kimmerer expresses.

To better realize how this lack of humanness may produce inaccessibility, I conducted a short survey asking my classmates why they chose to study STEM (or not), and what aspects of STEM they struggled with. Although I received a wide range of answers, most revealed some common themes. Most students described their motivations broadly, like one physics major who enjoyed "looking for the fundamentals of the universe." The struggles my classmates experienced were much more specific, but shared a common issue with the impersonality of their courses. Some students complained about being taught from the textbook, or being "talked at" in lectures. Many felt trepidation toward office hours. My classmates want to study science out of a general interest or the impact they can have on the world. They are weighed down by tasks like teaching themselves from an impersonal book or memorizing information for difficult exams, and struggle to form connections with their mentors.

"I must tell you that is not science" -Braiding Sweetgrass by Robin Kimmerer

I think it is clear from my classmates reponses and my own experience that we should strive for Kimmerer's goal of incorporating the holistic, more human and more subjective ways of knowing indigenous knowledge systems provide into science. As someone who has always been a proponent of objectivity, it surprises me to say this. But thinking subjectively and from our own inspiration is a valid starting point for scientific thinking. Returning to her original question, Kimmerer learns that bees are also attracted to the contrast of asters and goldenrod. This attraction means the two plants are more frequently pollinated when they are together than when they are separate, a scientific conclusion stemming from a subjective thought.

#### PAGE 11 / VOLUME 2.0

Completely overhauling how we think about science will take a long time, perhaps multiple generations of students and teachers. However, we have to start somewhere, so to prepare ourselves for this transition, I have a few points of advice which I had originally prepared for myself, but I am now convinced apply to many other students currently studying STEM, and even to the mentors of those students.



*Figure 2: "*The Amherst Biology Departments annual BioBlitz is a great example of simply observing. You can read more about it here: https://www.amherst.edu/news/news\_ releases/2018/5-2018/bioblitz" **For Myself (and Other Students)**: Remember your original inspiration, whether it be a desire to help discover the origins of the universe, heal those around you, or just understand nature more fully.

**To Mentors:** make these inspirations visible in classes. Tie abstract concepts to real world examples. Discuss and express your enthusiasm for your own research.

For Myself (and Other Students): Learn actively. One of the best questions in science is "I don't understand." By actively searching for the answers to your questions, you discover a way of understanding things which is especially tailored to you, and you further develop the ability to conduct your own investigations.

**To Mentors:** be a guide for this active learning, rather than simply a source of information. Promote office hours, and use textbooks as reference material rather than a teaching plan.

**Most Importantly:** Observe and only observe. We must take the time to simply observe phenomena and conduct experiments for fun once in a while with no hypothesis or experimental design. As Kimmerer states, we must not only ask of plants, "How does it work?" but also "What can you tell us?" (42).



## AMHERST PRE-MED SURVIVAL GUIDE

#### PAGE 12 / VOLUME 2.0

#### BY ANTONIA TAMMARO

#### I Wish I Knew This Earlier

- Office hours are IMPORTANT, build organic relationships with professors early. These relationships can be super meaningful and also serve as a resource for future recommendations and research opportunities
- The Q center is a great source for help with challenging pre-med courses. Schedule an appointment at amherst.edu > academics >academic advising and support > moss quantitative center > for students > individual appointments with Q center staff. You can go as often as you pood!
- often as you need!
  Purple book- applying to med school requires one to create a narrative of their work, activities, and experience Every time you do something significant I suggest writing it down in a notebook and reflecting on that experience, so you already start forming a solid narrative.
- There is no one right path to medical school, everyone has their own journey. Take pride in that journey and do things that genuinely interest you along the way

#### <u>Loeb Center</u>

- Sign up for the Houston Internship Program as early as possible. There are a few requirements, so look into this early. Accessed at amherst.edu > student life > Loeb Career Center > Charles Hamilton Houston Internship Program > For students
- Email a pre-health advisor and ask to be placed on the prehealth e-mail list. The list provides you with many updates. on potential opportunities
- Make an initial appointment with a pre-health advisor your first semester to get your feet off the ground.
- Start crafting your resume/CV. Instructions to do so can be accessed at amherst.edu > student life > Loeb Center for career exploration and planning > how to guides > Resume Howto-Guide. (Our Peer Career Advisors or PCA's are great resources for you to get help with editing and formatting)



## A Mammoth Introduction to Pre-Med

Created by students for students

#### <u>Clubs + Volunteering</u>

- Globe Med
- Charles Drew Pre-Health Society (mentorship program!)
- Amherst College
   Emergency Medical
   Service (ACEMS)
- AC Public Health Collaborative
- Project SALUD
- The Association for Women in Science, AWIS (support + mentorship group)

All club descriptions and contact names found at <u>the hubamherst.edu.</u>

Please Note: These are suggestions for STEM related clubs and orgs, you are encouraged to branch out and get involved in things that interest you. Do not just check boxes!

#### <u>Classes</u>

- Pages 9-15 of the pre-health guide outline necessary courses and sample schedules. Do note: everyone's journey looks different, this is just a guide. Talk with pre-health advisors about nontraditional scheduling
- Choose classes of genuine interest and major in something that excites you! You do <u>not</u> have to major in a STEM related discipline, medical schools encourage students to major in what most interests them.
- Five College certificates (Culture, Health, and Science and Reproductive Health Rights and Justice)
   For more information go to <u>fivecolleges.edu</u> under the academics tab.

#### Pre-Health Guide

Check out this extensive prehealth guide courtesy of the Loeb Center!

How to access: <u>amherst.edu</u>, student life >Loeb Center for Career Exploration and Planning > Graduate School and Pre-Professional Programs > Health Professions >Amherst College Guide for Premedical Students

#### Interesting + Helpful <u>Resources</u>

- www.Briannachristophers.com > premed/grad resources
- Themedicalschooldirectory.com
   > timeline (this is general, everyone's timeline is different!)

## BEING HUMAN IN HEALTHCARE

BY DANNY IFONG & NICOLF CASE

PAGE 13 / VOLUME 2.0



PAGE 14 / VOLUME 2.0

## LET'S TALK ABOUT UNCOMFORTABLE CONVERSATIONS

BY ADELE TEO

## ABOUT UNCOMFORTABLE CONVERSATIONS



#### Listening

Practice active listening. Some tips to help you listen actively include: giving your full attention to your conversation partner, withholding judgment, and letting them finish speaking without interruption. Active listening is not easy but, with practice, we can avoid miscommunication, misunderstanding, and conflict.

#### Sharing

Respectfully voice your agreement or disagreement. While it may be tempting to call a person out, try calling them in first. A call in is a call out done with love. Calling in as a practice recognizes the human in each of us, and in doing so, recognizes the human potential for mistakes. It is possible to call out behaviour but call in the person.



#### Understanding

People are more likely to engage in productive conversation if they can understand where their partner's beliefs are coming from. It is helpful to apply empathy, compassion, and context. Ask yourself why your partner might hold that opinion, and, if you don't fully understand it, repeat it back to them and ask clarifying questions.

## For more information, visit Amherst College's new Center for Restorative Practice!

## THE VILLAIN IMPERSONATOR

PAGE 15 / VOLUME 2.0

BY ARTEM PUSTOVID

"The devil is born from an angel spitting in rage." People and systems crumble to dust, but the spirit of hate, bred by the champions of good, is immortal and thus evil on Earth knows no end."

In recent years we have been observing a sharp decline in the ability of people to speak with their opponents. In opposition to the rise of populist movements, the call-out culture grows. This applies both to international and interpersonal relationships. bifurcation point: the actions of the X government. It Contemporary thinkers, such as Loretta Ross and Natalie Wynn, aka Contrapoints, have pointed out that this may be caused by the vicious circle of mutual decrease in the ability to feel empathy towards your opponents.

To illustrate how these circles work, I would like to give an example of a relationship of two countries, X and Y. I purposely do not name any particular example to avoid being criticized by both sides. However, I am certain that each of us can see their countries in this example. Let us say that countries X and Y are initially on the same level of development and in a good and mutually beneficial relationship. However, as time goes on, due to some unstraightforward factors, country X becomes a little bit richer, while the level of life in the Y country decreases to a certain percent. This observed inequality may cause social unrest in the Y country. It may resolve in the needed reforms and economic growth, but it also can lead to the appearance of a populist government.

#### -Grigory Pomerants

Instead of organizing social development, it will resort to pointing fingers and accusing the X country of all the problems of Y, while also causing a further decline of its nation. Now we have arrived to the next may soon realize the true reasons behind the change of Y's rhetoric, and try to help its citizens in order to return to the mutually beneficial existence. Or it can get to a defensive and harsh position towards the Y government, forming the vicious circle of mutual hatred and accusations. Thus, we can see how the coincidence of only two unfortunate factors: the election of a populist government in one country, and the inability to understand the need for the help of the other, may lead to the destruction of the peace and mutual impoverishment.

The same happens on the interpersonal level. As an outsider, I see the cause of the growing polarization in the US in the same vicious circle. I by no means assert that there are no actual problems, and wholeheartedly condemn racism, sexism, white supremacy, and other forms of xenophobia. However, what I see is that the existing practices of the discourse lead to no solution to the aforementioned problems. People cannot, and most of the time do not want to, put themselves in the place of their opponents.

#### PAGE 16 / VOLUME 2.0

The labels, with which each group marks each other, become more and more polarized and degenerating. At the first glance, an outsider might think that the whole society is divided into the far, far right, and even further left. But, as science tells us, there are much more centrists in each group, than there are marginals. In my opinion, this situation arises from the loss of the ability to see similarities in each other, and in the decrease of empathy. This loss of the ability to solidarize with the people holding different identities leads to the inability to solve complex social, economic, and environmental problems.

One factor that is both the result and the cause of the rising polarization is the formation of social bubbles and echo chambers, dominated by people with excessive opinions. The inhabitants of such chambers may easily be tricked into viewing the outsiders as the "other", or even the "enemy". And what discussion can be held with the enemy? So even if some more center-leaning people might want to reach out to their opponents, the "enemy" of the group, they will immediately be depicted as "traitors" and ostracized. Therefore, the formation of such bubbles leads to further division and separates people from each other.

To try to diminish the polarization, we need to be able to break free from the vicious circles of mutual hatred. To increase your ability to feel empathy towards your opponents is a crucial necessity that may lead to this escape. Out there are lots of different methods to raise your empathy, but I would like to propose one more way, which had helped personally me.

I call this method "The Villain Impersonator". The idea behind it was that practically no one in the world thinks of him or herself as an evil person. Sometimes people are just ordinary; sometimes they believe that they are struggling for a higher cause. People from different groups have their ideals, their reasons to act in such ways. The method I propose is pretty simple: try to look at the world through the eyes of your opponents, try to find the arguments in favor of their position, try to understand, where they are coming from. For this method to be useful, you need to genuinely try to be as fair with yourself as you can possibly be. Try to avoid argument as "they just want to oppress us", or "they want our society to collapse". Those will only reinforce the vicious circle and push you further from finding the solution.

Being often exercised, this method will help you raise your empathy, and the next time you meet your opposition, you will be able to engage with them in a more thorough dialogue. Even if you do not change your point of view the tiniest bit, you will be able to make more thought-through arguments, which might eventually turn your opposition into your allies. Another benefit of this method is that it allows us to see the evil inside of us, behind our own deeds. This is an extremely important ability to be able to break the immortal "spirit of hate", the one that Grigory Pomerants wrote about.

Instead of the conclusion, I would like to make a call for action! Each and every one of us should nourish our own empathy, each day, every time. This is the only solution to overcoming the vicious circle of hatred!

## AN ENTRY FROM MY HSTEM JOURNAL

PAGE 17 / VOLUME 2.0

Journal Entry #7

#### BY AVA TILLMAN

January 20th, 2021

Today in class, we talked about the "objectivity" of STEM. "Science as Social Knowledge" by Helen Longino and "Rethinking Standpoint Epistemology" by Sandra Harding provided a basis for discussing how STEM can be biased and what can be done to change that.

Longino explains how historical context plays a role in the scientific method: because individual scientists live in a world shaped by their experiences, surroundings, and institutions, the questions they choose to ask, the methods they use, and the ways they interpret their data are inherently subjective. Although the scientific method attempts to standardize scientific research, and the understanding of science as a societal practice subject to criticism and peer review can (in theory) counteract individual biases, inequalities within STEM cause individual subjectivity to be inadequately counteracted.

Sandra Harding builds on this idea with feminist standpoint theory (the belief that by studying science from the perspective of marginalized groups, we can increase objectivity in STEM). Feminist standpoint theory acknowledges the role that historical context and social inequality play in science, which enhances our understanding of the world by accounting for the limitations/blind spots of the dominant group.

Both readings were complex and very theoretical, making it hard to recall precise examples of subjectivity in STEM. Thankfully, we have read accounts from individuals that show STEM from an alternative perspective. These resources helped me visualize concepts from Longino and Harding with examples from my own STEM experience.

#### PAGE 18 / VOLUME 2.0

January 20th, 2021

For example, Indigenous approaches use emotion AND the mind to understand nature both as its own entity and as something that we form a relationship with. Alternative ways of thinking are suppressed by institutions that hold the power to decide what is "official science". An excerpt from Braiding Sweetgrass demonstrates this bias:

But my advisor said, 'It's not science,' not what botany was about...'Not science,' he said, and he ought to know, sitting in his laboratory, a learned professor of botany...He told me that science was not about beauty, not about the embrace between plants and humans.

Those who hold power create exclusive environments for women, BIPOC, and many others, which limits the perspectives from which we see things and leaves many assumptions unchecked. It is overwhelming to think about the potential for these perspectives to create lasting and meaningful change. How many voices don't have a chance to be heard? How many students drop STEM because of its narrow-minded and exclusionary culture?

In "Does STEM Stand Out?," research shows that Black and Latinx students were more likely to switch majors or leave college without a degree in STEM than white students. This pattern did not exist for non-STEM majors. Though black and latinx students aren't explicitly peing excluded from STEM, the environment, not a lack of preparation, drives them out of the field. According to Harding, these are the students that we need to be hearing from the most.

#### PAGE 19 / VOLUME 2.0

January 20th, 2021

This is a massive problem, but the solutions are not simple or universal. Through hearing my classmate's experiences and recalling my own, I have realized that greater transparency and discussion about these problems is the first step to reaching solutions. It's not that everyone should have to take HSTEM to understand why it is essential to bring our whole selves into our work and encourage others to do the same. This dilemma comes with any attempt to create social change: without certain programs and rules in place, inequalities will persist, but as soon as something becomes mandatory, it loses some of its original purpose and can turn into "just another box to check". Despite this, something still needs to be

done.

Math has always felt simple to me because you can pick apart the most complex problem into smaller, simpler tasks. However, things aren't always that easy. If something exists one way in isolation, this is irrelevant if it has been separated from its natural environment. This applies to the study of STEM itself--when we assume that we, the scientists, are not an influential part of the science, we may learn a lot, but our knowledge is not holistic or realistic because it ignores the reality of human subjectivity.

PAGE 20 / VOLUME 2.0

## January 20th, 2021

These readings made me realize that I actually have seen efforts to create a more objective and welcoming STEM environment. While brainstorming possible solutions, I recalled programs and people who had already attempted to bridge the gap between humanity and STEM. But these were not enough to change the way I approached my courses. Without the context of HSTEM, I still wouldn't fully understand the importance of these actions. Why didn't these attempts work on me, and what can be done to change that?

STEM doesn't leave room for talking about much beyond assigned problems or course material. In other classes, discussions allow students to bring their own experiences into the classroom, creating a community. Wouldn't it be great to have time for students and professors to get together and talk about more? Could this help students feel less isolated or intimidated? I realized, feeling shameful of my ignorance, that the email I receive every couple weeks advertising Math/Stat tableis that exact program. But I have never once been to the Math/Stat table, which is an open opportunity for students and professors in the math department to eat lunch together. I usually send the email straight to my trash, and I didn't understand its intentions until now.

In high school, I had a teacher who encouraged the entire class to come in during lunch and debate math problems. She said that this was the best way to learn. I remember not wanting to sacrifice the 40 minutes of break we got to talk about MORE math. I was the type of person who liked to figure things out on my own instead of getting confused by someone else's methods. After reading Braiding Sweetgrass, I realized that my teacher's advice was actually an attempt to help us build community and become better students by seeing different pathways to one solution.

PAGE 21 / VOLUME 2.0

January 20th, 2021

Maybe I have just been lucky enough to have teachers that encouraged me to challenge everything. However, I was so used to thinking "objectively" that their words seemed to contradict my educational experiences. The few voices that encouraged me to think differently were drowned out by years of "learning" (and succeeding) by precisely following instruction. After years of science "experiments" with preconstructed results, staying up past midnight to finish homework, and the understanding that grades get you into college, and college gets you a job, and jobs make you money, college professors that stood at the front of the room and told me to "question everything" almost seemed comical.

My aversion to these experiences was caused by the nature of high school education, not the idea of learning for the process instead of as a means to an end. I don't mean any disrespect to these teachers. They were the ones who touched me the most, and they truly wanted students to think and feel like they had the opportunity to bring their passion and perspective into the classroom. However, these small acts were not enough.

For HSTEM to really work, it needs to be stressed over and over again from when we are young, and it needs to be reiterated into adolescence and adulthood. Community, curiosity, and emotion need to be embedded into the daily practice of STEM; encouragement of these qualities can't be contradictions to the reality of our education. Lastly, humanity in STEM shouldn't be a privilege for students who are fortunate enough to go to schools with the most resources or the best teachers. Every student should know their humanity is valued, especially those whose perspectives and identities deviate from "Western" knowledge.