Look In, Look Out, Look Around

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Colleagues, students, parents and members of the Juniata community; since I'm a faculty member of the Physics Department, and the advisor of the Society of Physics Students, who organize the annual *Physics Phun Night* event, I imagine that many are expecting some sort of physics demonstration. I don't want to disappoint. But since this is the annual Awards Convocation, I thought this particular demonstration should be memorable for the students. Then I realized the perfect one to present.

We all recall an icy day back in March, on which students were widely blaming the administration for what they perceived as its failure to close the College on that day. To satiate the students, I thought I'd have a high ranking member of the administration lie on the infamous bed of nails while I break a cinderblock on their chest. But President Kepple was out as a victim – he's already joined this elite club, lying on the bed of nails several years ago during a *Physics Phun Night* show. The next option was Provost Jim Lakso. When I pitched this idea to him, he was so terrified at the proposal that he quickly left the country. Next in the chain of command would be the man standing in for Provost Lakso today, Assistant Provost Jim Tuten. I would have asked Jim to represent the administration in this matter, but he and his wife Belle have recently been blessed with a lovely new addition to their family,

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and it's too soon in life for a newborn to lose his father in this way. I also feared that it might cause little Oscar to develop a lifelong aversion to physics, and there's already enough of that in the world.

For these reasons, we'll have to try something else. It is well documented that only 78.3% of physics demonstrations performed in front of a class or an audience actually work, so I'll skew the odds in my favor and resort to an old standby – a simple demonstration of gravity. *(Speaker pulls out and drops an elastic ball.)* I chose this one because it *usually* works, at least more than 78.3% of the time, and it will serve to provide a framework for the thrust of my talk.

Sure, this is an easy demonstration, but in this quaint experiment lies a metaphorical lesson regarding looking in, looking out, and looking around.

Prior to 1500, in pre-Copernican days, the demonstration you just saw was explained by assuming that the Earth was the center of everything. Philosophers used this model to explain why objects on earth fell to the ground when released, and why objects in the heavens seemed, to them, to circle the earth in a cosmic symphony – the music of the spheres. This supported their worldview; the earth was at the center of the universe, so everything *should* revolve around us. These people looked in for a rationale to support what they were observing.

In 1514, Copernicus published a smallish book called the *"Little Commentary"*[1] in which he laid out his idea that the earth was *not* the center of the universe – in fact, Copernicus was remarkably prescient in arguing that there was *no* center to the universe.

In 1689, Isaac Newton made a wondrous advance in humanity's vision of nature when he considered an object, reputedly an apple, falling to earth. Seeing the same phenomenon as our pre-Copernican friends, Newton looked out and had a revolutionary realization. His triumph was *not* in discovering gravity, as is commonly held (the first caveman who was hit by a thrown rock knew about gravity in some sense), but rather in achieving the unification of celestial mechanics, the motion of planets and galaxies, and terrestrial mechanics, the motion of balls and apples and everyday objects. He realized that the law of nature that governs the fall of an apple on earth is the same as that which describes the motion of the moon about the earth, and the motion of stars and galaxies – of

everything in the universe. Newton looked out and developed a universal law based on this powerful conceptual insight that was so successful, it held sway for over 200 years. Remember this story; we'll return to it in a few minutes.

Usually the address that I'm giving now would be delivered to the incoming freshmen, but since I was abroad in India with my family during the Fall 2003 semester, working to develop and promote a study abroad program in south India for the Brethren Colleges Abroad organization, it was shifted to today's Awards Convocation.

In my education I did not have the benefit of a strong liberal arts background as all of you have the good fortune to enjoy. My coursework was primarily in Physics and Mathematics, although my interests led me to take a number of classes related to peace studies as an undergraduate, and philosophy of science as a graduate student. In my education I generally looked in, within a discipline.

In coming to Juniata College, I was given the freedom and support to look out. I've greatly grown and profited from the experiences of team teaching with other faculty, including Bob Wagoner in Philosophy, Belle Tuten in History, and Andy Murray in Peace and Conflict Studies. The smaller campus here (my graduate and post-graduate studies were conducted at a Penn State-sized institution) facilitated discussions with, and insights from, not only my colleagues in Physics and other sciences, but across the academic spectrum. I owe a huge pedagogical debt to so many faculty members seated with you today with whom I've enjoyed conversations that spawned new ideas.

When the opportunity to go to India for seven months arose, I have to be honest with you, I was simultaneously excited as hell and scared to death. As someone who, as a rule, really doesn't like to go out and take great risks, but is aware of this shortcoming, I felt an out-of-body experience as I watched myself quickly agreeing to this undertaking. Many later told me that this was not an "out-of-body" experience, but a "you're-out-of-your-mind" experience. For I am diabetic and dependent upon an insulin pump for my health, my wife is deaf, and we were bringing our three and five-year-old sons with us who would be joining the Indian school system. Many times members of the administration confided, "You know, you don't *have* to go – you can still back out." But these

encounters, while heightening our trepidation, only strengthened our resolve – we were going, dammit!

How did it turn out? It was at the same time the most difficult and the most enriching and rewarding experience of our lives. We made a conscious effort to immerse ourselves in Indian society, and not only learn about another culture, but share a more accurate sense of our own culture and values to those there – a critical aspect that I think is often bypassed in the exchange equation.

As it turned out, our kids integrated extremely well into the Indian school system and they were adopted by a local fishing crew. We learned to take meals on banana leaves, eating with our hands while sitting cross-legged on the ground – for the kids this was natural. We spent a day staring at the most beautiful and romantic piece of architecture the world has to offer. Before we left the United States, our older son Aiden had but one concern – he would miss his favorite holiday. So, my wife brought a new tradition to our neighborhood in India – Halloween. This evening turned out to be one of the best experiences we had; all the kids loved it, and my wife was able to convince the Indian men present, normally a very reserved social group in this type of setting, to engage in party games.

One of the most touching moments of our visit came when our younger son, Soren, wanted some scrambled eggs and the woman of the house, a strict vegetarian, was unable to prepare them. An adopted uncle went into the kitchen and cooked eggs, for the first time in his life I think, as his nephew looked on stunned and in absolute disbelief. But above all, what we will cherish most from this experience are the friendships we all forged during our time there.

This experience of looking around taught us not only about another culture, but gave us valuable insights into ourselves and our own culture that we never would have had if we had stayed in the comfortable bubble of the Juniata College campus. Was it difficult and uncomfortable at times? Absolutely. Would we do it again? Without hesitation.

To end, let's return to our story with gravity. What does all this have to do with apples falling from trees anyways? Newton's explanation of a universal law of gravitation, with gravity explained as masses attracting each other against a static backdrop of absolute time and absolute space held, as we noted, for 200 years. But in

1915, a young former Swiss patent clerk named Albert Einstein came along with his Theory of General Relativity and viewed gravity and a number of other seemingly unrelated phenomena as manifestations as of an underlying reality, and envisioned a completely different explanation. He saw gravity as the result of a distortion of the very fabric of space and time. Imagine space and time as being represented by a pliable rubber membrane. Masses placed on this sheet will curve, or dimple, the very fabric of space and time around them, and move in the curvature caused by other masses. It's simply a matter of geometry and topology. His ideas were verified in 1919, and today are necessary to consider for the proper functioning of any number of modern devices, including cellular phones and GPS receivers.

So, I guess my message to you is this. You are among the brightest and best trained college students our country has to offer. As you go out and cultivate your own image of the world, don't be content to accept the established dogma or paradigms of your field or the worldview that is fed to you daily by media messiahs and pop-culture prophets[2] on television. This is a recipe for both social and scientific stagnation.

In discussing a recent report about the educational dangers facing America that he co-authored, former education secretary Dr. Richard Riley noted that "Our country simply cannot afford to remain ignorant of the rest of the world. The stakes are simply too high. We have a serious deficit in global understanding … a stubborn mono-lingualism and unawareness of the world."[3] At all costs, you should make it a priority in your life to gain a real understanding of another culture by living, not just residing, in another country, to see more of the people and the places that surround you now. This is the time to do it – for life will only get more frenetic as you grow older.

In his 1964 acceptance speech for the Nobel Peace Prize, Dr. Martin Luther King, Jr. noted that we live in an age where "We have guided missiles and unguided men."[4] I believe the same can be said of our world today, 40 years later. Even if you are unable to experience another ethnic culture, strive to be aware of all the facts and assumptions in your own disciplinary culture, and don't be afraid to view the pieces of the puzzle in a new light, and seek new connections in your chosen field.

In closing, I wish you the best of luck in your finals and beyond. And in whatever endeavors you choose, be sure to not only look in, and look out, but also to look around.

NOTES

[1] E Rosen, Copernicus' Hispalensis, *Organon* 11 (1975), 137-149. (The *Little Commentary* (1514) was a handwritten document, not printed, published as a prelude to his major work *De revolutionibus* which Copernicus began writing in the following year.)

[2] Neil Peart, "Totem Ple," *Test for Echo*, Atlantic/Anthem Records (1996).

[3] Richard Riley, *Securing America's Future: Global Education for a Global Age*, A Policy Forum marking the release of the report of the NAFSA Strategic Task Force on Education Abroad, NAFSA: Association of International Educators, November 18, 2003.

[4] Martin Luther King, *The Quest for Peace and Justice*, Nobel Lecture, December 11, 1964.