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Interdisciplinarity and Pedagogy: Disciplining Collaboration in Academia. An Interview with Carl Mitcham.

William Davis

This interview between Carl Mitcham and William Davis took place by phone on Wednesday, September 14th, 2011. Carl Mithcam, Ph.D. in Philosophy from Fordham University, directs the Hennebach Programme for the Humanities at the Colorado School of Mines, and has held posts at numerous US and European universities. He has published regularly since the 1970s, including *Thinking through Technology: The Path between Engineering and Philosophy* (1994) and *Research in Philosophy and Technology: Social and Philosophical Constructions of Technology* (1995). More recently, he co-edited the *Oxford Handbook on Interdisciplinarity* (2010), and this book serves as the stimulus for much of the interview.

The interviewer, William Davis, is a PhD student at Virginia Tech studying Science and Technology Studies (STS). His interests include pedagogy of STS, philosophy of science and philosophy of technology. Though this interview primarily concerns the general topic of interdisciplinarity, some of the questions deal directly with STS, as an example of an interdiscipline, and how instruction in such programmes can, does and should occur.

Keywords: Epistemology, Interdisciplinarity, Pedagogy, Philosophy, Philosophy of Science, Philosophy of Technology, STS, Transdisciplinarity

William Davis (WD): Can you tell me why you wanted to work on the *Oxford Handbook on Interdisciplinarity* (*OHI*)? Why you think the book is important, or what you would like to see as a result of it?

Carl Mitcham (CM): I have been working with Bob Frodeman and Julie Thompson Klein for a number of years on various interdisciplinary projects. They were always specific interdisciplinary projects, and it seemed appropriate and the right time to thematise interdisciplinarity in general. Julie and Bob and I have had a number of conversations. Julie is really the leader in the scholarly field, but she is more a historian, a participant, a creator of self-conscious reflection on interdisciplinarity from the inside. Bob and I have been coming at it more from a philosophical perspective and a little bit maybe from the outside, and so we thought we could have value added by collaborating with somebody who has been a long-time promoter of interdisciplinarity for a couple of new kids on the block. We wanted to raise the concept of interdisciplinarity for greater thematisation, for conscious reflection in ways that are not that much different from what would have been done before. I would say it is more of a marginal advance. At Penn State, before coming to Colorado School of Mines, I had been involved with Joe Kockelmans who Julie considers one of the founders of the interdisciplinarity. Julie had studied with Joe Kockelmans back in the 1980s before I ever thought about

interdisciplinarity. I learned about Julie from Joe. Joe had created a programme at Penn State, the individualised doctoral programme in interdisciplinarity. And when Joe retired from that, I was asked to take it on, so I became the director of that programme at Penn State. So I had involvement there at the graduate level trying to promote interdisciplinary graduate education, but then I realized by reading Julie's work, before I ever met her, that what I had really been doing was interdisciplinarity. I had not called it that, but that is what I had been doing since I was an undergraduate. The idea of trying to do the *OHI* was something that was a natural outgrowth of long trajectory of work and then I finally beginning to think about my work as fitting within the interdisciplinary rubric.

WD: Do you see Philosophy of Technology, which is a field you work in specifically, as almost inherently interdisciplinary? Have you always thought of it that way?

CM: Yes, I would say that is true. I think I was always doing it, but I did not know that that is what that was. It is a little bit like the first time I took a trip outside of the country and realised that I was an American. You have to leave, and then you take a perspective where you realise, oh, that is who I am. Hemingway made a comment one time that it was strange that he had to go to Paris to realize he was an American. So, it is a little bit of that. Because for me philosophy is about trying to figure out what it means to live in the world that we are living in, I became convinced even in high school that, or certainly as an undergraduate, that technology was a primary influence on the world I was growing up in. In the philosophy field, there was no respect for the Philosophy of Technology. It was dismissed as, well, look, the real problems are in Philosophy of Science. But what I discovered was that, even as an undergraduate, engineers were willing to talk about those kinds of questions, but philosophers weren't. So even though I have a Bachelor's degree in Philosophy, I took a double Bachelor's in General Studies because I wound up going outside the philosophical discipline in order to find people who would talk to me about the kinds of questions that seemed to me important. So even from my undergraduate degree I found that narrow discipline of professionalized philosophy was not adequate to try to reflect on the issues that seemed to me most important, and I found myself talking to engineers. Then I discovered STS in the 1980s, so I began to think of Philosophy of Technology as one of the three major fields that contributes to STS, sociology and history being the other two. In fact, for one of my first publications, the *Bibliography of the Philosophy of Technology*, there was no philosophy publishing house that would publish it. It was the Society for the History of Technology that published it. So there again, I realized I was crossing boundaries. And then when I discovered Joe Kockelmans and Julie Thompson Klein's work, where they thematised interdisciplinarity, I realised, look, STS is just a kind of interdisciplinarity, too. So it was just sort of climbing up the ladder. Getting a better perspective on what I was doing all along enabled me to, I hope, do it better.

WD: Is interdisciplinarity a broad approach to education? Should it affect entire disciplines or curriculums? Or is this just what specific programs like STS are about, and interdisciplinarity is not going to affect the entire university curriculum?

CM: I think it should affect university curriculums. This sort of relates to a conflict in the STS community. For ten years I was at Penn State and I directed for six years the STS programme there. We took the position that STS should not become a discipline; should not become a department; should not be professionalised in a disciplinary way. There is a tendency when a new interdisciplinary field is created for it to devolve into a discipline, like bio-physics was originally going to be a kind of synthesis that included biology and physics. But it became very quickly just a new specialised discipline. Bio-chemistry, the same thing. Geo-physics, the same thing. And so from my initial involvement in STS, I wanted to try to keep STS from becoming just another specialisation. So at Penn State we consciously rejected the idea of having our own faculty. There were no faculty tenured within the STS program. We did not want the program to become a department. We did not want to create a major. We wanted STS to become a part of all majors, rather than STS should become a major. We lost that battle. The work that people did at Cornell and other institutions, to some extent there at Virginia Tech [institution of the interviewer], to promote STS as a discipline, as a major, as a department, won out, over the attempt to preserve it as an interdiscipline. I think that is a mistake. It is a loss to what education could be, what STS education could be. At Penn State we tried, and did not succeed, to make it a requirement for all undergraduate majors that they have to take a minimum of one STS course. The best we were able to do was, among a suite of general education courses, students have to take one of them. We were put together with environmental studies, women's studies, African and African-American studies, at Penn State. So these were four interdisciplinary fields that students had to take [one] course [from] as an undergraduate. But then what we tried to do was make common cause. Like with women's studies: can we create an STS women's studies course? Can we create an STS African and African-American studies course? Can we create an STS environmental studies course? That would bridge these interdisciplinary divides. We simply weren't successful. I am disappointed in that. To me, there has been a real loss. There was a great promise in STS as an interdisciplinary field that insisted on remaining interdisciplinary, but it has become, well, the name of the field has changed. It is no longer Science and Technology in Society. It is now Science and Technology Studies. To me that is a loss.

WD: You are echoing what Frodeman mentioned in the intro to the Handbook. He thinks of STS as fundamentally anti-disciplinary as opposed to interdisciplinary. He thinks that is a very good thing. It sounds like you agree with him.

CM: Yes, Frodeman and I, [we agree so much that] sometimes we think there might not need to be two of us on the planet.

WD: Is it too late for STS to be anti-disciplinary? Is there a potential for a shift, or this is what it is now, and we just have to figure out what to do from here?

CM: I guess I think that is a little bit the case. There are people like me, and I try to encourage my students [as well]. I teach a graduate course, an Intro to [what I call]

Science and Technology in Society Studies, trying to bridge the gap between Science and Technology Studies and Science and Technology in Society. Steve Cutcliffe and I agree on that, too. Our book, *Visions of STS*, is subtitled, *Counterpoints in Science, Technology in Society Studies*. So the graduate students I teach, I make this pitch to them. There is no doctoral programme (I teach this at U Colorado, Boulder) . . . there is no STS programme there, but this course is part of the environmental studies curriculum, and it is required for the Master's in Science and Technology Policy. So, this is a place where I try to infuse STS as a useful interdisciplinary perspective within another programme. I am not sure I know anyone who does this except Frodeman, Steve Cutcliffe and I. There are a few other people around. Langdon Winner is someone who adopts this perspective. To some extent Deborah Johnson at the University of Virginia. The programme at Arizona State University (ASU) is a little more along this line. It's called Human Dimensions of Science and Technology. Originally, before even the STS moniker got created, there was a diversity [among the programmes]. At Lehigh University it was Humanities Perspectives on Science and Technology. At Stanford it was Science and Human Values. At SUNY Stoneybrook it was Science and Technology Literacy Program. That all happened in the late '60s and early '70s, and by the end of the '70s, things had sort of standardized into Science and Technology in Society programs. Then in the '80s, that [title] was replaced by Science and Technology Studies. There has been a little bit of devolution back into diversity of names. I think that is a good thing. There is some contingent about that within 4S (Society for Social Studies of Science). 4S tends to be more wanting to promote science and technology studies as a discipline rather than an as interdiscipline, but there is always a little bit of fluidity in the academic world. I think we can move forward with some kind of effort to preserve the rich interdisciplinary character of STS, particularly within these groups that are promoting interdisciplinarity itself. For example, Frodeman right now is at a meeting in Switzerland, TDNET, Trans-discipline Network. People in Europe and the TD community, I think, are more sympathetic to this.

WD: Would you help me with terminology: transdisciplinarity, interdisciplinarity, are we talking about something similar? Are these not the same thing?

CM: Interdisciplinarity has a broad meaning and a narrow meaning. It is an umbrella term that includes multi, anti, cross, trans, inter, intra, etc. I tend to use the term that way, primarily. That is what we mean in the *Handbook*. There are different kinds of interdisciplinarity. There is, on the one hand, interdisciplinarity in different fields. Like, chemists working with chemical engineers, working with sociologists, working with philosophers, etc. There tends to be what we call narrow interdisciplinarity where you have disciplines in engineering collaborating, or disciplines in the sciences collaborating, or disciplines in science and engineering collaborating. That all is pretty narrow. You have the same thing happening within the humanities. That primarily tends to be what I call multi or cross-disciplinary work, like where I am involved in a programme here at Colorado School of Mines, called Smart Geo. [This programme brings] computer and geo-scientists and geo-engineers together to design and implement instrumentation in dams and bridges and buildings so that, particularly, dams and earth structures have

sensors in them that monitor things like water flow or fracturing of dams, so that you do not have to have them inspected. The dams talk to you. It is really important to have some computer scientists and computer engineers who are really good specialists in their field working alongside geological engineers and geologists and geo-physicists to collaborate. That's multi-disciplinarity. Cross-disciplinarity is when you have somebody actually moving. We have some people in the smart-geo program who are trained as civil engineers, but now have become as much computer scientists as anything else. This is crossing disciplinary boundaries. That is a kind of interdisciplinarity. But trans-disciplinarity is really when you are going outside the disciplines to appreciate the social context in which you are working. That can be done from a single discipline. Or it can be done from the base of multi-disciplinary collaborations. But trans-disciplinarity usually means going vertical. Going outside the academy to communicate with and collaborate with economists, business people, corporations, government agencies, the public.

WD: What do you think are the benefits of an interdisciplinary culture in the university? Does it have limits? Or should, for example, science education—you mention chemistry, or even biology—should they become more interdisciplinary? And if so, what would that look like? Is it just putting STS into every discipline?

CM: I think this fits well with the increasing emphasis in the world that we live in on accountability and responsibility in research. One of the things that has happened to the sciences is, it is used to be the case that both the scientific community and the larger non-scientific community were content to have funds given to the scientists. They did their work without paying much attention to where the money came from or what the needs were of the larger society in which they lived. They just sort of, they didn't try to articulate it in a way that would have been most useful. But, increasingly, society is saying, governments and states are saying, look, if we are going to supply lots of money, which we do, then we want you not just to remain isolated in your laboratory, but to think about in your lab how you can be most useful to society. Well, that is what STS and inter-disciplinarity and trans-disciplinarity can help scientists and engineers do. I think this is truer of science than engineering. I think engineering has always been more collaborative with society. We say that engineers are "on tap not on top." Scientists have often had a culture of thinking they need to be autonomous, independent, left alone to do their own thing. And there is a place for that in some science. I am not denying that there is some place for that, but there is also a place for scientists trying to be proactive and not just reactive to the social context in which they live and work, in which they are citizens. So I think of STS and interdisciplinary and trans-disciplinary, as helping scientists be better scientists in the sense of being more sensitive to the social context in which they work. And also be better citizens, not isolate themselves from society. Bring their work as scientists to the larger non-scientific community and help us all become more intelligent. In this I am follower of John Dewey. What we should really be doing is trying to increase public intelligence. Science has a big role to play in that. Science does offer some perspectives. Yes there is some social construction involved, but it is a social construction that has given us an insight into reality that is superior to some other

insights. And the scientists don't need to be apologetic about that, but it is going to be hard to get non-scientists to appreciate that. It is our responsibility to do that. I see interdisciplinarity and STS as helping scientists be more engaged scientists in the non-scientific world, and that will do some moderate chiropracting on the way science is done. To take our smart-geo programme as an example, there is a lot of resistance initially. This is an IGERT (Integrative Graduate Education and Research Traineeship). Now, students are becoming comfortable with it. All dissertations have to have a chapter on social and policy implications of the project that the dissertation is reporting on. And the students have discovered, that it is really neat, it helps me understand why this problem should even have cropped up, and how my research might benefit my fellow citizens.

WD: If interdisciplinarity is vital and important in academia, how do we promote it? By "we" I mean as a student, as a professor, perhaps as an administrator. How should each promote that? Is there anyone else that should be involved?

CM: One of the best examples of really effective promotion is at Arizona State University. When Mike Crow became president, something in like 2002, he had been provost at Columbia before that and trying to promote interdisciplinarity there. But when he came to ASU he said, look, I am not going to punish anybody who doesn't do interdisciplinarity, but the rewards are going to go to the people who do interdisciplinarity. If any unit or individuals on campus can come to me with proposals for bridging disciplines and trans-disciplinary engagement with the community, particularly in Arizona, then I will find ways to get you funds to do different kinds of things. One great example was the anthropology department and the sociology department got together and said, there are so many synergies between sociology and anthropology, especially cultural anthropology and sociology. They created, or proposed, a new department: The Department of Human Evolution and Social Change. So the social change part was sociology, and the human evolution was the anthropology department, and they created a new PhD program in human evolution and social change. Mike Crow said that's great, and came up with two million dollars of extra funding for this combined unit. Leadership from the top can really be very effective. But you have to have imaginative leaders like Mike Crow. He is a really exceptional guy. I was on sabbatical at ASU in 2006, and ASU is the largest single campus in the U.S. I think there are 52,000 students at the Tempe campus. Mike Crow teaches a class. He is the president of a university that is, I think, one of the most dynamic universities in the country and he teaches a class. And he really teaches. He doesn't just come and do war stories. I saw the syllabus for the year before I took the class with him. And I saw it the year I took it. It was a different syllabus. We would meet on Wednesday mornings. He said, look: my days get away from me, so we are going to start class at 7am. We go until 10am. There are times when we did not even take a break. At the beginning of class he gave out his personal email to all the students and he said: please, do not share this with anybody else. At the end of the semester, forget it, otherwise I just have to get a new one. But I will be available for you. I can't make any appointments during the day, but if you would like to

talk with me individually, I will be here at 6am. At least half of the time, when I showed up at 7am, he was there already, having individual discussions with students. He is just an amazing guy. This was a class, science and technology and human affairs. We read work in philosophy, history, sociology and management, and it was a fantastic class. He only missed one class during the semester. Leadership like that is just worth gold. I was so impressed with Mike Crow. He didn't dominate. He wrote a paper during the semester, shared it with the class, and people criticized it. There was no ego involved in it. Then, the paper was published in *Issues in Science and Technology* the next semester. He said: I use this as an opportunity to think. Why can't we have more imaginative leadership at the top? If Mike Crow can do it, no president in the U.S. has the excuse not to teach a class every year. It just is a matter of putting your priorities where they need to be. So I tried to, here at Colorado School of Mines, when I came back, I went to my president and tried to argue with him to teach a class. The most I could get him was to come in, one class, and tell war stories, which was a real disappointment to me. But I am excited by that kind of leadership. I try, in my own much more mundane way, to do the same thing. The normal teaching load here is two and two, but because I have administrative responsibilities, I could get a course released. I refuse because I think it really important to teach a full load. In fact, I teach an overload a lot of the time. I am teaching three [courses] this semester instead of two. I make a point of it that I do not [always] teach in my discipline. I teach a sophomore required course for all students, and I teach an ethics class as well, which is my philosophy discipline, but I think it is really important to teach outside one's discipline, and to team-teach. The course I teach at the sophomore level is an interdisciplinary course and we have historians, political scientists, me, anthropologists, all teaching in it. We have to meet regularly and try to agree on a syllabus, and how it works. I think there is a role for administrators, a role for faculty, and I think there is a role for students, too. It took me nine years to get my bachelor's degree. That was nine years very well spent. I think it is a crime that we force students, that we judge ourselves on 'through-put'. That we say, a certain percentage of students have to graduate in four or five years. That is a crime. That is not what education is about. It is not about "through-put." It is about learning who you are, the complexities of the world. Students need to have more courage and push back and say, look, I am not here to just quickly get a degree in four years, with a minimum amount of time. But it is hard to get students to do that. I have four kids that, two of them, it took longer than me to get their bachelor's degree, but I am convinced that was time well spent. I have a grandson at university right now, just starting, and I told him, you don't have to finish in four years. It is going to be more costly, but you can work; you can pay for this. String it out. Don't string it out to play, but string it out to learn. Take a gap year. I feel like I am a success when I can convince my students to drop out for a while. I am convinced that 25% of my first-year students would be better off outside the university doing something else for a while. At Penn State I got my wrist slapped by the president for talking like that.

WD: What are the values that interdisciplinary programs promote? Are they promoting autonomy? Or is it something else? Why are those values important to us, in either academia, or the world itself?

CM: I'd say the basic good of interdisciplinarity is leading a richer and more rewarding life. Human flourishing. It is really a kind of return to what philosophy was for Socrates, the examined life. For Socrates, the unexamined life is not worth living. Interdisciplinarity is leading an examined life. Flourishing, human wellbeing raised to a level beyond just material wellbeing. Thinking about what we are doing. Trying to live responsibly. Recognising the challenges of social justice. Recognising that we are not alone, we are not just isolated individuals. We are part of a human community. We are part of a biosphere. We live on a pretty unique planet and galaxy, from all we can tell. It is becoming more self-aware and therefore being a different kind of entity, a better kind of entity. That is what life is about, not making money.

WD: In terms of scholarship, what does an interdisciplinary approach mean? Does it mean greater collaboration in terms of research, in terms of writing? I am guessing you don't think interdisciplinary scholarship should look like one thing and one thing only, but what might it look like to you? What would you want it to be?

CM: The only way I can answer that is at the level of cliché, and I am loath to do that. But, in scholarship, take more than one thing into account. One of the things I have argued in the ethics of technology is that the fundamental principle is to take more into account. This seems to me not just avoiding conflicts of interests or honesty in research, but our larger moral responsibility is to take more into account. To try to consider different perspectives, longer-term implications, to be reflexive, as the STS community likes to talk. I think that is a good way to put it, too. Be aware of how we fit into a particular context, social, economic, political. This should find some kind of echo in scholarship. Maybe in part in the kinds of things we do as much as the way we do them. I like to distinguish between two kinds of problem. One is doing things right and the other is doing the right kinds of things. I teach a course, Introduction to Research Ethics, at the graduate level. I tell the students at the beginning that the emphasis in responsible conduct of research tends to be on just making sure we do things right, but I think we also have to go beyond that and ask questions about what's the right thing to do. And the final assignment in my class is always to write an ethics code for yourself. Sure, the professional society in which you work is going to have some kind of guidelines, and you take that into account. But, write an ethics code for yourself that you could put on your wall and help remind you that, after due consideration, these are the ways you want to lead your life, and these are the kinds of things you want to do. Then, put it on your wall so you look at it now and then and revise it every year or five years because none of this stuff should be set in stone. It provides a helpful framework because we all get bogged down and trapped in the details, in the quicksand of academic life. But, we all need to work to rise above the quicksand and the trees to be able to see and appreciate the forest. I would say that is what interdisciplinarity should help us do. To return again and again to

thinking about what we are really doing and why, and maybe the path, the trajectory that we have. Disciplinarity is a good thing, too. It is not a bad thing. But it needs to be placed in a broader context, and interdisciplinarity can help us do that. It needs to be redone over and over again, because we are always in danger of being drowned in the sea of minutia.

WD: How do you get comfortable working in multiple arenas? Is it just by doing it? As you say, you teach classes outside your area. Is this learning by doing? Could you tell me about your own experiences?

CM: I think partly it is just a matter of time. Partly it is also accepting not being comfortable. I am still nervous at the beginning of every semester when I go into classes. I used to look at other people and say, oh, they are so comfortable and so confident in what they are doing, and I am not. But now, I see it as a virtue, of not being comfortable, and not being overconfident. I see some of those people as being a little priggish and too self-confident. I think there is a virtue in not being comfortable. Always recognising, again like Socrates, at least I know I don't know. Some of these people think they know it all. They are the greatest thing since sliced bread. At least I recognise I am not. And I tell students that. In my globalization course, students ask questions and I say, you know, I probably should not admit this, but I don't know the answer to that. And I could probably wing it and tell you this and get away with it, but I don't know. Give me until next class and I will see what I can find out about that. I've become more comfortable not being comfortable, not being an expert who knows it all. But it is scary in the academic world where the coin of the realm is to be able to claim that you are an expert in something. To reference Frodeman, he has a phrase that I have picked up and used, he is a 'specialist in the general'. I use that term for myself. I am a specialist in the general. I take as my model Louis Mumford, who never even got a bachelor's degree, and did history and architectural criticism and literary criticism and philosophy and anthropology. It is a weird combination of boldness and humility. I am still nervous. I keep thinking I will get over it, but I just accept the fact that you are never going to be a real expert, so that is alright. I really, in some ways, wish that I had had a better education in some fields. At Penn State I actually considered going back and getting a Bachelor's degree in Civil Engineering. I thought that would help me have a little more bona fides when doing engineering ethics if I had a degree in engineering. So I went to the engineering department and we looked at my old transcripts and figured out what I would have to do. And I started and realised it was going to take me away from too many other things and I just couldn't do it. But in some ways I look back and wish I had the discipline to do it.

WD: Do you think that STS students and practitioners should have a background in science, and or engineering?

CM: I think it is very helpful. I don't think it necessary, but my council to my own kids and grandkids is, get a bachelor's degree in science or engineering first. It is much easier to, at age 40 if you are a scientist, to become a humanist, than it is the other way around. And I think we need both. I was fortunate in that I did do a lot of science at university. I

have a Bachelor's degree in General Studies as well as in Philosophy and the general studies degree required me to do physics, chemistry and biology. I did a lot of math. In fact, I started out as a chemistry major. I sometimes really wish I got a chemistry degree. I was really close, but didn't end up doing it. I think that for an undergraduate, that would be my council. But, somebody in your [interviewer has undergraduate and graduate degrees in literature) position, I don't think it's necessary. You're going to come at STS or philosophy from a different perspective. Having a background in literature, having lived for three years in Mexico, being bilingual, those are really important assets. The failures in the US in learning languages are just atrocious.

WD: What does a pedagogy of STS look like? What is a philosophy of STS? What do you think STS pedagogy should be? How does interdisciplinarity play into STS education? For example, let's say I take a history of science course. Should I just look at the texts and themes from an historian's perspective? If I were a professor, how do I put philosophy and sociology into that course? Or, are these separate classes and should they remain so?

CM: It will depend on context. I am not opposed to disciplinarity. I think there is a role for a course that is just the history of science. And maybe just internalist history of science. If I were teaching a history of science class, I would start by situating the history of science, and say look, this is how the history of science got started, this is the way it has worked in relation to other disciplines. That would be kind of a framing mechanism. Then, we would do as high quality as I could muster history of science, and then at the end, come back out again and say, here is what we did for the semester, but here is some of the criticisms of the history of science, its narrowness. Scientists criticise because they say historians don't really understand what scientists do. Sociologists criticise because they say that they [scientists] don't really appreciate the social context. Place it in a context. You can't appreciate the criticisms until you have immersed yourself in the discipline. I am in favor of immersing yourself in the discipline but then, at the same time, after you have done it, step out and say, oh, this is what I was doing. Then, individuals, given their life trajectories, will be able to make different kinds of use of those disciplines. They are really useful for helping us throw light on aspects of reality, aspects of human experience, that we would not otherwise get. But the way we use them is going to be dependent on our personal life work and social historical context. I try to do this in my ethics course. I started out the semester saying ethics is a cultural achievement. It's a little like art. It's a little like music, like learning a new language. And now we are reading Aristotle, and I am not reminding students about that, but at the end of the semester we are going to go back and say this is complementary to a cultural world, a human life. You should understand how it relates to other things as well. That is what I think of as an interdisciplinary pedagogy. Since the world we live in is primarily influenced by science and technology, then interdisciplinarity is, to me, naturally going to emphasize the relationship between science and technology. And I do this through the ethics course. We are reading great books, and every now and then I will ask, does this have any relation to you as an engineer or life scientist?

WD: How is interdisciplinarity going to alter the university or how should it? Not just multi-culturalism, more languages, more perspectives in certain areas, but will it ultimately change the humanities or change the university in general?

CM: I think ASU is the most exciting and best model. Mike Crow has been able to stimulate people to rethink and break down some of the barriers between disciplines. There are increasingly at ASU fewer standard discipline departments. The Philosophy Department no longer has a graduate programme there. Philosophers have become embedded in other programs. There is an institute for bio-design that has biologists, sociologists, chemists, engineers and philosophers in it. That seems to me what is going to happen. There is going to be more institutes or units that are focused on problems or perspectives that are multi-disciplinary. CSPO, the Consortium for Science Policy and Outcomes, which is where I was on sabbatical, is a multi-disciplinary unit in the School for Sustainability. The standard departments are slowly, I wouldn't want to say phased out, but being subordinated to these cross, trans, interdisciplinary units that people are finding their primary home in rather than their primary home in a disciplinary department and their secondary activity in an interdisciplinary unit. It is slowly flipping a little bit. I don't think it would be desirable to get rid of all disciplines and all disciplinary departments. The question is, what role should they play? Should it be a support role or a dominating role? I think it should be more a support role.

Contact details:
William Davis, Virginia Tech University
widavis@vt.edu