

A Tale of Two Murphys

An interview, conducted in 2023-2024, by Ben McCall of two founders of the Planetary Limits Academic Network (PLAN): Dave Murphy, a prominent scholar of the energy transition movement, and Tom Murphy, a physicist who focuses on how fundamental principles can be applied to the Earth system as a whole. In this interview, we explore the continuum of perspectives within PLAN along a spectrum that might be labeled “doomer” on one end and “techno-utopian” on the other. Neither of the conversation’s participants could be labeled as either of these extremes, although it will be clear that they each lean more toward one side than the other.

Ben: Dave, you’ve often expressed a sense of optimism about humanity’s future, in spite of the planetary limits we face. Can you say a bit about what makes you optimistic?

Dave: I guess I would answer this question two ways. First, I would frame the issue in a different way. As written, it posits an optimistic outlook for the future vs. some “scientific” issue of planetary limits. These two should not be viewed in this way. Planetary limits is a concept discussed much in the scientific literature and one in which, at least to me, there is little doubt. There are indeed planetary limits. The second issue is the outlook I choose to take for the future, which is based on nothing scientific at all. I guess my point is that these two things are not mutually exclusive, one can understand planetary limits and be optimistic.

Second - why am I optimistic? If we continue with the continuum that Ben brought up on the intro, I would say that there is a tremendous amount that can be accomplished in the middle between techno-utopian and doomer. This middle space can simultaneously acknowledge planetary limits and the dangers associated with deforestation, species decline, climate change, etc., and advocate for positive change in our energy systems. It has also been my experience that despair and doomerism are ineffective change-agents. No politician is elected on a slogan “It’s all over.” But the real reason I am optimistic is probably pretty simple: I have kids and I can’t tell them the world is over before they even grow up.

Ben: Tom, what degree of optimism do you have about humanity’s future? How does your perspective contrast with the one Dave has expressed here?

Tom: I make a distinction here between humanity’s future and modernity’s future. Many people conflate the two, as I once did. As I see it, the brief flash of modernity is incompatible with planetary limits, and will necessarily terminate one way or another. It is for this reason that I no longer focus on energy systems, since keeping modernity powered does not seem to be an appropriate goal—essentially kicking the can down the road. Access to a large amount of exosomatic energy is exactly what has enabled modernity to carry out its atrocities against the more-than-human world via deforestation, habitat fragmentation, extermination, and extinction—and to swell human populations to precarious heights via industrial agriculture. Technological innovations, such as renewable energy, tend to *enhance* or at least promote continuance of our destructive practices—irrespective of CO₂. Unless we change something deeper, we can expect more of the same behaviors and outcomes.

So, where is the optimism in all that? It's simply that humans do not *have* to operate this way on the planet, as many amazing people have demonstrated over almost the entire duration of human habitation on Earth. Our biological hardware is fine, and indeed rather remarkable. However, the operating system we currently run in our brains, called modernity, has fundamental flaws that will self-terminate the enterprise via disregard for ecological and planetary limits. Humans are incredibly plastic and adaptable. A newborn does not yet have this operating system installed, meaning that enormous changes are possible under different material and cultural conditions. I am not saying that a reversion to hunter-gatherer lifestyles comes next, even though we know that mode to be well-tested. We can try something new that might have some elements of hunter-gatherer ways and some elements of modernity, while perhaps being unrecognizable to either. In any case, I am “doomerish” on modernity as a misguided enterprise, and think we will need to face letting go of it. Recovering from overshoot is unlikely to be fun. My optimism lies in knowing that—after the dust settles—humans are *capable* of forming meaningful, respectful, and sustainable relationships within the community of life—founded on humility rather than hubris—as a *part* of nature, not *apart* from it.

Ben: Dave, I'm curious to what extent you agree with Tom's assessment of modernity's future, as a distinctive concept from humanity's future?

Dave: What is modernity? I think we need to define further what we are discussing. Is insulin production part of modernity? Cancer medication? Vaccinations? Food production systems? Probably not the high-powered fossil fuel variety of food systems, but what about agro-ecological food production systems that are organic but probably use some fuel in tractors etc? Are all technology and energy applications, aside from primitive tools etc, out in this vision of the future?

If we are saying that all the advances of modern medicine and society that require, for example, plastic or energy must be abandoned after the “dust settles,” well then I am not sure what to say. I feel as though it goes against human nature – not to mention unethical – to advocate for a future society that knowingly rejects the basic medicines and technology that are required for the survival of so many people.

Assuming we are not discussing that type of future, the question then becomes one of line-drawing. What is considered part of the “modernity” that must be rejected and what is part of “modernity” that we will keep? Insulin production is a great example. Millions of people around the world require insulin to stay alive, and that insulin is (I assume because I have not researched this) produced in fairly advanced facilities using lots of new technology and energy resources. If we want to maintain insulin production in the future, then we must maintain supply systems for the production of that insulin which will also entail the requisite material extraction from Earth and energy consumption.

The production of insulin becomes one of minimizing impacts rather than eliminating them. The energy transition represents the best way to minimize impacts associated with energy production systems, so I advocate for that, acknowledging that there will indeed still be impacts. The energy transition doesn't "save the world," but it has the potential to provide essential and non-essential goods and services with much lower impact. Why spurn that opportunity if we know we will need to continue to produce goods and services in the future?

Conspicuous consumption and much about our fossil-fuel powered growthism must change if we are going to have some sort of harmony with Mother Earth, but I think collapse is neither the best nor the only way to get there. Recent research shows that just the electrification that occurs as part of the energy transition will lead to a decrease of final energy demand of 40% globally due to more efficient end-use of energy. That is a massive decrease in final energy demand, which translates to an even larger decrease in primary energy demand. And, as Amory Lovins wrote about this topic 40 years ago, people often overestimate the impact that occurs due to Jevon's Paradox. People don't do more laundry because they have purchased a more efficient washing machine. For sure, they may drive a bit more if their fuel costs go down due to a more efficient engine, but people that buy electric vehicles are not driving so much more to actually increase energy consumption. I think it is a mistake to assume that the trends we see at the very beginning of the energy transition - i.e. that renewable energy has largely added to- rather than substituted for- other energy consumption - will continue in the future.

Ben: Tom, I wonder if you could offer a definition of modernity, and say a little bit about what elements of modernity we might expect to retain in the long run?

Tom: Modernity is the dazzling and manifestly temporary fireworks show that we find ourselves living within, and to which we are wholly inured, so that we lack perspective on what might possibly be viable in the long term. Modernity, via rapid and grossly unsustainable expenditure of a one-time inheritance, puts humans so completely out of context as to render meaningless any artificial attempts to draw lines regarding what may or may not be part of the future. We only fool ourselves to think that we can play such a game, or that our ethical preferences have a say over what's possible. We have far less agency than the recent windfall has led us to believe. The menu is not for us to decide, as we are embedded passengers within—rather than creators or masters of—the natural world, upon which we are utterly dependent. We have *some* agency, in that we could—in principle—decide to prioritize ecological concerns over modern expectations and live conservatively within the perceived limits.

Pursuing this further, we don't arbitrate what is or is not sustainable, any more than we decide how strong gravity ought to be today. Since our true context is as an evolved biological species operating within a larger and exceedingly interdependent community of life, we must assume that the health of that broader community is vital to our long term success—including the vitality of unknown species having co-dependencies we likely will never understand. The present

cocktail of ecological ignorance and destruction is akin to sawing off the branch on which we stand, enamored of our power and technology to carry out such an operation.

Since 1970, the average decline in vertebrate species is about 70%. Wild land mammals—now comprising 2% of total terrestrial mammal mass compared to 96% in the form of humans and domesticated animals—have been eliminated to the point that only 2.5 kg of wild land mammal mass remains for each human on the planet. This was 80 kg per person in 1800, and 50,000 kg before civilization sprang up. They're almost gone. A major disruption in global food supply—perhaps instigated by fossil fuel shortages—could essentially finish the job. To reinforce an earlier point, these declines—similar in birds, amphibians, and insects—are not primarily due to CO₂, but trace to the much longer pattern of modernity's expansion and heavy use of energy and nature's provisions.

In light of this, the prospect of maintaining insulin for human health is in doubt, as doing so requires some threshold in technology, mining, resource extraction, energy, pollution/waste, etc. that may be well over the line of what the community of life can accommodate in the fullness of time. Can we justify prioritizing insulin over ecological health, and is it even a valid choice in the end? If one nation had a long history of expansion, overrunning and displacing technologically inferior and peaceful nations to the point that complete elimination/dominance was in sight, is it justifiable to prioritize health care of that nation's citizens before trying to end the war against innocents? The question is even more poignant when the expanding race cannot themselves survive if indeed managing to eliminate the "competition," although few seem to be aware of this built-in peril of "success."

So, I think it is not within our capacity to decide how much of modernity's perks we can keep. Ecological context comes first, which we ignore to our ultimate peril. We have zero evidence demonstrating long-term sustainability while enjoying modern conveniences like insulin, but ample evidence that the current system is woefully far over the line, by perhaps orders-of-magnitude. Any number of tweaks to a grossly unsustainable system—changing the source of energy that drives the machine, for instance—are unlikely to change its fundamental character or aims. It seems like too much to ask that modernity's forward march will inexplicably, luckily, reverse course on ecological harm without its becoming the overriding, non-negotiable priority, based on the track record thus far.

Therefore, I would again guess that modernity, in its fundamental structure, is incompatible with planetary limits, and thus has no path to unsustainable continuance (an oxymoron, in any event). How much we must abandon is very hard to say, but I would be prepared to believe: most of it. Mind you, I don't relish this in any way, but it's not for me to judge.

Ben: I'd like to interject a clarifying point here: I don't believe that Tom is advocating for a loss of the beneficial elements of modernity, but rather inferring from available data that planetary limits simply won't allow modernity to continue. Dave, earlier, you said "If we are saying that all the

advances of modern medicine and society that require, for example, plastic or energy must be abandoned after the 'dust settles,' well then I am not sure what to say." It does sound like Tom thinks that such advances likely cannot be sustained (not that they would be intentionally abandoned), so I wonder what you might say to that. How confident are you that we get to choose?

Dave: At its core, our differences seem to be about choice, that is, whether there is a choice. If I may summarize your argument, it is that humanity may deceive itself into thinking they have agency over their fate, but the ecological reality is already written in stone. There is some sort of catastrophe ahead, as modernity is careening past planetary limits, and our current efforts at sustainability, e.g. global biodiversity policy or the Sustainable Development Goals or whatever, amount to playing music on the Titanic.

Ok - I'll bite.

How is your argument any different than the Malthusian argument of the 19th Century? Thomas Malthus was convinced that society was going to collapse as food supply would be outstripped by population which would lead to massive starvation and death. That did not come to pass.

Then came the Limits to Growth paper in 1972 claiming that a combination of factors are indicating that the world is heading towards overshoot and collapse will follow. That has not yet come to pass either.

More recently the peak oil advocates, of which I was one for a time, claimed that peak oil occurred in 2007 and that massive price spikes were inevitable. Oil shortages and recessions were soon to come to pass, and for some, this meant that the world was again on the edge of collapse. Indeed, many saw this as validation of the Limits to Growth model. Yet, here we are 16 years later and oil shortages are not a reality. Quite the opposite happened in fact. Despite all the data and scientific analyses predicting imminent oil depletion, oil production in the U.S. boomed, largely due to technological innovation.

The message then shifted ever so slightly. It wasn't the peak of "oil" but the peak of "cheap oil." Peak conventional oil is indeed here, we were told, and what we see now is expensive, low EROI oil that will work for a bit, but, in the end, will fail. (Read: we aren't wrong...just delaying, again, our call for the future collapse of the world due to oil depletion). But my most recent research indicates that the EROI of oil was never really that high, and renewable energy has a higher EROI than fossil fuels.

But before you think I am a complete techno-utopian (I am playing a bit of devil's advocate 😊), I would like to say that I think I understand the doomer response to these arguments as well. "We haven't collapsed yet, but we have made the collapse possibly far worse by further extending the footprint of modern society." I agree to an extent. I do think we are still abusing what Schumacher called the "tolerance margins" of the Earth, which are indeed finite. The ecosystem of Earth isn't infinitely resilient. Every additional degradation of the environment in

the name of economic growth will make the inevitable collapse and recovery harder. The trajectory of the ecological health of the planet has not changed over the past decade, and that is what matters in the end.

Yet, I am struck mostly by the confidence in the doomer argument that the future must entail a broad, full-scale collapse, and I think it is important to think about what we mean when we say "collapse." What does collapse look like? The logic presented is so simple: overshoot is here, so correction must follow. And just to be clear, I think as well that a correction will occur, but I must admit that the shape of that correction isn't set in stone, and I would say is very much largely unknown.

Isn't the most likely outcome some sort of long, muddling-through period by which economic growth reverberates between periods of growth and stagnation while the energy system is slowly transformed? Not necessarily the boom times people are used to, far from the last 150 years of grow-grow-grow, but also not a complete collapse of modern society. I could make an argument that this process has already begun.

Unfortunately, I see war as another possible form of collapse. The "West" led by the USA and NATO seem to be on a crash course with "The East" led by Russia, China and Iran. If this does come to pass, ecological health will be the last thing on anyone's mind, and, though some of the foundational reasons for the conflict could be related to resource use, the war would not be solely, or even largely, about ecology or ecological overshoot in general.

So there is so much we don't know about the future, which brings me to my next question: if we don't know the precise direction of the correction (i.e. collapse, muddling through, etc), what is our ethical responsibility today? What is our responsibility to ourselves, to our local community, or to the global community?

It is my contention that most of the people in the world are, as you describe, "innocents." I am from the U.S.A. Does that mean I am responsible for Trumpian foreign policy? I didn't vote for him. Are people in corrupt areas of the world lumped in with whichever despot is in charge? Are all people on the planet today responsible for the trajectory of modernity? There are 2 billion people on this planet in poverty, what are they responsible for? The point is this - the vast majority of the people on Earth are not willfully driving Spaceship Earth as it careens out of control, but they are on the Spaceship nonetheless.

Do we have an ethical obligation to other members of that Spaceship, i.e. society? Does each of us have an obligation to "love thy neighbor?" If so, what does it mean to love thy neighbor in this context?

Perhaps our differences, at their core, come down to this question: what are we to do now?

Reading your response one would understandably conclude that it's "bunker-building" time. Abandon ship everyone! It seems like any individual efforts are meaningless considering the

overall trajectory of the planet. But isn't that overall trajectory simply the sum of individual decisions? If we can change one individual from overconsuming to sustainably consuming, then doesn't that help? Scale that to a society and then, perhaps, the world? Perhaps that is naive, but perhaps it is exactly what is needed. Think global, act local, right?

It is not for us to judge whether the Earth can or cannot sustain the current trajectory of modernity, that is simply a function of the ecology, but it is for us to judge what we do about that ecology right now. Choosing to do nothing, to fiddle while Rome burns, is in fact a choice, and one that carries consequences for all around us. Our actions today influence the ecology of Earth, and therefore its sustainability, so why not try to improve? The reality is that the vast majority of the people on this planet are innocent, have very few resources, and therefore don't have the luxury to ponder such concerns, let alone do anything about them. These conversations exist only for the privileged (of which I am one as well).

We do not know what the future looks like, and if there is a possibility that insulin production and clean water and other features of modernity can be saved, and therefore more of our neighbors can survive, then we – those that have the capacity to ponder such things – are ethically obligated to do our best to achieve that future.

Ben: It's delightful that we have forged agreement that there *will* be some sort of correction, or collapse, or muddling...that is, that modernity as we know it cannot last indefinitely. There seem to be two major points of contention remaining: (1) what this correction/collapse/muddling is likely to look like, and (2) what ethical principles should guide our actions in light of the knowledge that such a transition is coming. Let's try to focus on (1) for now, and come back to (2) later in the conversation. Dave proposes that the most likely outcome is a "long, muddling-through period by which economic growth reverberates between periods of growth and stagnation while the energy system is slowly transformed." Tom, I sense that you have a different sense of the likely outcome: could you offer your perspective on the likelihood of Dave's proposed outcome, and perhaps the likelihood of other potential outcomes?

Tom: Well, predictions are hard—especially about the future. That said, the physicist in me looks for encompassing principles to help at least differentiate the possible from what is likely impossible, independent of what's familiar or appealing. In doing so, I tend to step back from a messy decades-scale view, thinking instead on timescales of centuries or millennia. These are civilization-relevant timescales, and can help us avoid pursuing decade-scale efforts that are likely to fall into the same traps by delayed, alternate routes—while accumulating further, often irreversible, ecological harm in the process.

For instance, it is easy to see that growth—which has been a bedrock companion of modernity—cannot continue for much longer. So, why try? Fossil fuel use will necessarily decline, forming a pulse in time. Human population—temporarily inflated by agriculture's heavy dependence on fossil fuels and other rapidly depleting gifts like aquifers and soils—will likely

follow suit, exacerbated by climate change. A look at ore quality over time confirms that the low-hanging fruit is long gone the world-over, so that it becomes increasingly harder and more ecologically destructive to maintain the past century's sprint in materials extraction—necessary for renewable energy technology. Recycling also hits quantitative limits, in that only a few dozen cycles are practical before the recovered resource dwindles to insignificance. A forward, literal extrapolation of global ecological trends of the last century would leave us with no forests, wild land mammals or insects within a few human lifetimes—especially as firewood and hunting might offset faltering energy and agricultural outputs.

The celebrated hockey stick curves in GDP, energy, materials, population, etc. are direct manifestations of the rapid and temporary draw-down of a non-renewable inheritance. These curves will have to come back down, likely by an order-of-magnitude or more—perhaps in self-destabilizing feedback. I don't see them “defying gravity” and hovering at some high level, given biophysical and ecological constraints. Not only is this moment we call modernity ludicrously atypical, but it is fundamentally, inherently unsustainable—meaning that its failure is basically guaranteed (not a choice). Don't get too attached. If my prognosis seems extreme, it is only because the present condition to which we have become inured—atop our hockey sticks—is itself extremely precarious.

Again, failure of modernity is not the same thing as failure of *humanity*. We have other options. Whatever much-reduced flow comes out the other side, it can have some very positive features. The bottleneck in getting from here to there is very hard to think about, and likely to be unpleasantly turbulent. But we *can* think about what long-term sustainability *could* look like, and start calmly sloughing off the deleterious trappings of modernity—rather than engaging in what is likely a futile attempt to continue some familiar, comfortable version of modernity by alternate means only to make the ultimate transition costlier. I believe that a successful result would be unrecognizable to our modernity-acclimated eyes, involving values foreign to most of us today.

Ben: We'll come back to the near-term (decadal) question of modernity and ethics, but let's focus for now on the mid-term (centurial/millennial) scale that Tom mentions. Dave, what do you think we can confidently assert about what a “sustainable” civilization would look like on the ~1000 year timescale? Are you inclined to agree with Tom's perspective, or are there substantive points of disagreement here?

Dave: The population of the Earth was roughly 300 million in 1000 AD. One thousand years later it is 26 times greater, at 7,800 million. I doubt that the population of the planet will be 26 times greater in 1000 years, at 202,800 million. That is about all I can confidently assert. I don't think future societies will be anything like the past. I agree that we are now in a precarious position with a society that was built upon *stocks* that are running low, but we are also transitioning to *flows* that are inexhaustible. The system we are moving towards is also much more efficient. What we disagree about seems to be less about whether the future will be

different, but more about what we know and don't know about the future and also what we are to do about it now. So I see possibilities, but how those possibilities unfold is unknown.

So when presented with this type of situation, I strangely think of the hawkish former Secretary of State and friend-to-few-scientists, Donald Rumsfeld, whose musings about such prognostications are without parallel:

Reports that say that something hasn't happened are always interesting to me, because as we know, there are known knowns; there are things we know we know. We also know there are known unknowns; that is to say we know there are some things we do not know. But there are also unknown unknowns—the ones we don't know we don't know. And if one looks throughout the history of our country and other free countries, it is the latter category that tends to be the difficult ones.

Borrowing this analytical framework, I might suggest the following:

Known-Knowns: There are planetary limits.

Known-Unknowns: The scale and duration at which modernity can continue in the future based upon renewable energy.

Unknown-Unknowns: I feel as though there is much unknown about the future and we should be humble in our approach (e.g. nobody foresaw with any accuracy the timing and scale of the war in Gaza, or the rate of adoption of solar power). But I get the impression that the doomer's perspective leaves less doubt. There is little room for anything unknown when the fate of modernity is "basically guaranteed."

This conversation also reminds me of something I heard at a Peak Oil conference years ago. An investor was asked "how do you think about long-term investing?" The investor's reply was "I tend to think about getting the short-term right, and, over time, that means I get the long-term right as well."

I bring this up simply to say that we need to think about civilization today and in the future, and hold them both equally. Just because it is hard to predict what might happen in the "messy decades-scale" view, doesn't mean we should abandon hope for people today. Aren't decisions made today civilization-relevant as well?

Ben: I definitely want to return soon to the topic of decisions being made today, and near-term impacts! But for now I'd like to stay focused on the long term – I think if we can come to a shared understanding of the constraints that planetary limits place on the long-term, that will help inform better/appropriate near-term decisions.

The picture Dave has implicitly painted here, of the possibility of a “neomodern” civilization that can persist for thousands of years relying on inexhaustible flows rather than depleting stocks, is certainly an appealing one! Dave has suggested that “the scale and duration at which modernity can continue in the future based upon renewable energy” is a known-unknown. Tom, I sense that you would disagree with that suggestion, or that you would at least say there are known-known constraints on that scale/duration. Am I right?

Tom: Right—I think we *can* say more about what is likely to succeed or fail. By definition, unsustainable systems (like modernity, I would say) are guaranteed to fail. Even centuries ago, when the scale of human activity was lower by orders-of-magnitude, we were *already* ecologically unsustainable as accumulating declines began to become apparent. The trends are now alarmingly steep: more decidedly unsustainable and thus unambiguously marching toward failure.

I wish I could share optimism for inexhaustible flows and continued efficiency improvements—to great personal relief! But many factors intercede, for me. Energy—while very important to modernity—is only one part of the story. If *any* element critical to modernity is exhaustible, then it won’t matter if another is inexhaustible. For instance, even tireless energy flows like sunlight, wind, and the hydrological cycle are diffuse and require an enormous amount of “stuff” in the form of non-renewable materials to capture, convert, and store the energy. Ecologically harmful mining would therefore need to continue indefinitely (incompatible with planetary limits), to replace worn devices. Recycling is not an everlasting answer: it might *extend* the clock a few more centuries, but can’t change the end result. Meanwhile, efficiencies already tend to be within a factor of two of theoretical limits, so not much gain remains in that quarter.

Beyond the confines of energy, modernity relies upon rapidly declining stocks and overtaxed flows in the form of aquifers, soils, materials, forests, and fish (to name a few)—sadly resulting in permanent, accelerating species loss. Meanwhile, enormous waste and pollution streams (beyond CO₂) overwhelm the assimilative capacity of the ecosphere. Not only does the chimera of inexhaustible energy fail to address these dimensions, it is *precisely the availability of large amounts of energy* that *drives* these destructive trends. Powering modernity by alternate means could easily end up hurting more than helping, where it counts.

It is true that *biology* has figured out how to make indefinite use of inexhaustible flows, using a bare minimum of common minerals. But artificial systems are nowhere close to achieving such a feat in energy or any other domain. I don’t see us getting there, and certainly not soon enough to matter. To illustrate the gap, we are utterly incapable of running a controlled artificial ecosystem that can support human life—even for months, let alone indefinitely. Relatedly, the space station routinely replenishes its oxygen via costly rocket delivery from the surface so that inhabitants can breathe (aggressive recycling can’t keep up).

Humans are a powerful species, clearly *capable* of planetary exhaustion. It seems the only way we can live sustainably is by putting ecological health *first* and—through this lens— either

rethink or abandon every human (cultural) construct. I doubt the result is something we would still call modernity.

As for feeling our way forward, I would prefer to avoid likely dead-end paths that could simply dig the hole deeper. My hope lies not in technological provision of the very energy that destroys environments, but in deciding that other goals are more important for humanity.

Ben: Dave, what do you see as the flaws in Tom's argument here? [Note: for the moment, I'm keeping the focus on the millennial timescale...we will soon come to near-term timescales!]

Dave: I am sorry to disappoint, Ben, but Tom's perspective leaves little room for agreement.

First, energy and technology are neutral. The statement "precisely the availability of large amounts of energy that drives these destructive trends," is incorrect. The existence of donuts doesn't drive weight gain, the decision to consume them does. The availability of large amounts of energy may enable destructive trends, but it does not drive them. Humans are steering the modernity spaceship. We are the ones choosing overexploitation of nature and trading that for short-term growth in GDP. We created these mental constructs and we can create new ones that are more harmonious with nature.

Second, the statement "If any element critical to modernity is exhaustible, then it won't matter if another is inexhaustible," is clever trickery. The statement is true when taken in the abstract, but apply that as a hypothesis to the past 250 years and it fails miserably.

For example, let's propose this hypothesis:

H1: Horses are the most powerful tool in agricultural production.

If testing this hypothesis in 1650 A.D., we would probably support the hypothesis, but testing it today would clearly result in a rejection.

Or, for another example, take this:

H2: Whale oil is critical for modernity.

Well, if this hypothesis was posed in 1850 A.D., then H2 would similarly be supported. Today? Not so much.

The point is this: the economy is evolutionary and adaptive, and an element that is critical today might not be critical in 30 years, and this ability to shift resources has been shown time and time again over the past centuries. Why do people keep ignoring the ability of the economy and human society to adapt to constraints? And before I get cast aside as a techno-utopian, let me

state my views on this. I do not think that technology can solve humanity's biggest challenges, but I don't see them as limiting them either. I simultaneously hold the views that technology can alleviate many (if not most) of our resource and technical barriers to sustainability, while also holding that the biggest challenges we face are not solved by technology. They are not mutually-exclusive views. Can these technologies provide a sustainable future? Yes – they can. Will we get there via technological invention alone? No.

I could spend the next 10 pages writing about all of the analyses that have been done over the past few years indicating that there are no major material constraints to the energy transition, that we have more than enough technology and “know-how” to provide stable grids with intermittent power, that we can produce enough water and food via ecologically friendly agro-ecological practices to feed the billions on earth, that most of the challenges we face in modernity are human-created and therefore human-fixed. But, to what end?

We are avoiding the heart of the matter, which is summed, I think, in the following two questions:

First, what does it mean to be sustainable from Tom's perspective? Inferring what I can from his comments, it seems that any human perturbation to natural ecosystems is unsustainable, or perhaps another way, any interruption to the natural energy flows through a natural ecosystem is inherently unsustainable. Modernity was unsustainable before the industrial revolution, according to his perspective, and now is even more so. Not only is there no space in this view for what is described herein as modernity, there isn't space for humans or any type of human society. Until we have a clear picture of what sustainability means we will simply talk in circles.

Second, I posed these questions earlier and they went unaddressed and yet I think they are core to our disagreement, so I will repeat them here: “Do we have an ethical obligation to other members of that Spaceship, i.e. society? Does each of us have an obligation to “love thy neighbor?” If so, what does it mean to love thy neighbor in this context?”

The ultimate question, which brings us around to the beginning of this conversation, is whether we as a species and society can adapt in the future to become more sustainable, and perhaps at some point, just plain-old “sustainable.” Tom and I agree on one point, and that is that getting there will require cultural change. It is the “how” and the “what” that causes discord. That is, how human society will shift to a sustainable version of itself and what that sustainable version looks like. I disagree that we need to rethink or abandon all human cultural heritage. I think the solutions will come from building on that accumulated cultural knowledge, particularly from, for example, indigenous communities that lived in harmony with nature for millennia. What do we humans gain from abandoning human culture, which is perhaps the defining characteristic of our species?

Ben: Tom, I'm sure there's a lot in Dave's remarks here that you'd like to respond to, and in the fullness of this conversation we can get to all of that. But for the moment, I'd like to turn our attention to the two questions that sum up the "heart of the matter" for Dave. Let's begin with his first question: What does it mean to be sustainable? Is any human perturbation to natural ecosystems, or any interruption to the natural energy flows through an ecosystem, unsustainable? Where is the space for humans, or human society, in this context?

Tom: To me, sustainable means living in a way that does not lead to rapid declines in ecological health or non-renewable resource stocks. The timescale for defining "rapid" must be in the context of evolution, which probably means at least tens if not hundreds of thousands of years. Proponents of modernity would likely call this timescale outlandish, which is actually part of the present problem. Humans have been on the planet for millions of years, and *Homo sapiens* for hundreds of thousands. So the number has a basis.

At a gentle-enough pace of change, the community of life has a fair chance of adapting. Sustainable does not mean static: evolution is never static. Perturbations happen all the time, accompanied by adaptation. Sometimes perturbations are enormous enough to cause mass extinctions, the sixth of which appears to be underway. One could make the argument that—like volcanoes and asteroids—humans are of this world and that causing a mass extinction is fair play: it's all just nature doing its thing. Maybe, but I won't label that outcome as sustainable.

Humans obviously have a place on the planet, as *part* of nature. Human societies and cultures have a place. Nothing excludes this, and indeed human cultures have coexisted in a more-or-less sustainable fashion for eons. The statement that "there isn't space for humans or any type of human society" goes too far, in my view, as we have loads of evidence to the contrary, unless Indigenous people do not qualify as any type of human society.

Before getting to future possibilities, I should address megafauna extinctions. I don't want to paint pre-agricultural humans as angels: we are now and always have been no more or no less than animals on this planet. Humans represented a significant evolutionary perturbation. In Africa, the co-evolution of humans and other animals allowed megafauna to persist—understanding this gangly ape to be deceptively dangerous. Elsewhere, migration of humans outpaced evolutionary adaptation—but such things are not unique to humans in evolutionary history, and the result was still "by the rules." Today, the pace of extinction is orders-of-magnitude higher. Importantly, I can't as easily excuse the current behavior, as **we now know better**.

So yes, I classify modernity as (woefully) unsustainable based on the ecological nosedive and its substantial reliance on numerous non-renewable resources. I classify Indigenous hunter-gatherer cultures as being demonstrably sustainable—at least effectively so. That doesn't

mean these are the only two choices. What's exciting to me is that we might yet invent new modes that perhaps blend elements of both with new ideas: I'm not calling to "abandon all human cultural heritage." But to be sustainable, we may have to reject a *majority* of modernity's tenets, and would do well to build on a worldview closer to that of our sustainable ancestors—at least in adopting humility as foundational in our relationship to the community of life.

We have demonstrated ample capacity to destroy ecological health. Given this, success (synonymous with sustainability) requires prioritizing the health of the more-than-human world *above* human concerns—as incongruent as that notion is with modern cultural values.

Ben: Dave, I might now challenge you to offer a concrete definition of "sustainable," if you disagree with Tom's definition.

Dave: If Tom's definition of sustainability is "living in a way that does not lead to rapid declines in ecological health of non-renewable resource stocks," and the assessment of such rapid declines is to be conducted on the scale of tens-to-hundreds of thousands of years, then how should we be thinking about modernity? Surely the past 250 years is a mere blip on these orders of magnitude, and, if we are able as a global society to gradually move to a sustainable planet, even if that move were to take the next 200 years, would that not be within the timeframe of sustainability as outlined herein by Tom?

Is, or is not, culture valued in Tom's view of sustainability?

Tom wrote: "It seems the only way we can live sustainably is by putting ecological health *first* and—through this lens— either rethink or abandon every human (cultural) construct."

To which I responded with this: "I disagree that we need to rethink or abandon all human cultural heritage. I think the solutions will come from building on that accumulated cultural knowledge, particularly from, for example, indigenous communities that lived in harmony with nature for millennia. What do we humans gain from abandoning human culture, which is perhaps the defining characteristic of our species?"

Then Tom commented: "Humans obviously have a place on the planet, as *part* of nature. Human societies and cultures have a place. Nothing excludes this, and indeed human cultures have coexisted in a more-or-less sustainable fashion for eons."

It is possible we are talking past one another here, so please clarify if I missed anything, but the question I have is, which is it? Is human culture important to the future sustainability of planet Earth or do we need to abandon human cultural constructs?

Ben: Tom, we'll come back to the question of human culture in a bit, but let's first turn to Dave's second "heart of the matter" question. Given the context of the (from at least your perspective) unsustainability of modernity, what ethical obligation do we have to the people currently living today? What does it mean to "love thy neighbor" if the future of modernity is bleak?

Tom: Inverting the order, the "love thy neighbor" part is simple for me. My neighbors include newts, eagles, squirrels, salmon, bees, and the plants, fungi, and microbes that make it all possible. I love them. We are nothing without them. The real world is one of innumerable relationships—humans being one of many millions of nodes, incapable of existing in isolation. We are not the masters, the owners, or the most deserving. Just as we reject the "master race" stance of Nazism, I hope we can reject human supremacism, and repudiate a dominant "Human Reich" regime on the planet.

That said, I love humans too. Humans are incredible: adaptable, intelligent, funny, empathetic beings. I don't much like how modern culture *abuses* these gifts at the devastating expense of non-human (and some human) lives. But that's only the *modern* way, and not baked into human DNA—as evidenced by tens of thousands of years of living under very different cultural norms that are practically unfathomable/nonsensical to denizens of modernity.

Our ethical responsibility, then, extends to the entire community of life. If we define "people" as *all living beings*, then the original question takes a different tone. If this seems absurd, I ask: how would the denial of "people" status to other life avoid strumming supremacist chords?

But, confronting the intent of the question: what ethical responsibility do we have to the humans alive today? I would say: we owe it to ourselves to be honest about planetary limits. To the extent that we can look to the long future and delineate the sustainable from the unsustainable, we ought to do our best. We honestly don't know how to make modernity sustainable. Giving people the impression that we can continue business as usual but powered by different technology might be one of the most unethical things we could do—if it turns out to be missing the larger truth, perpetuating/exacerbating ecological damage and courting chaotic collapse.

People may wish to hear good news, acquire goods and comforts, and maintain the familiar. But if we suspect that modernity is unsustainable, then let's say so. I have faith that many are prepared to accept a retreat from "the modernity dream" if they understand the associated nightmarish damage to life and non-viability for future generations. In my view, our current culture is not honest about these things, proclaiming that we (in the human-only club) can continue to have it all.

If a proposal cannot validate a robust pathway to sustainable operation for the long haul and convince us that it is unlikely to constitute a net harm to the community of life (even indirectly), then is it ethical to pursue it? Choices that self-terminate within centuries or millennia strike me as unethical and ignominious—depriving future humans and countless other species of their lives and livelihoods. Do we care more about prolonging a temporary fireworks show or about the enduring health of all life on Earth?

Ben: Dave, I'm guessing that your sense of ethics gives a higher weight to sustaining the current "temporary fireworks show" for the benefit of today's currently living humans...but Tom's analysis would suggest that implies giving a lower weight to the needs and desires of future humans, as well as the rest of the community of life? What do you think Tom is missing here?

Dave: NOW WE ARE GETTING SOMEWHERE...:)

"I would say: we owe it to ourselves to be honest about planetary limits. To the extent that we can look to the long future and delineate the sustainable from the unsustainable, we ought to do our best."

We ought to do our best indeed, in fact we are ethically obligated to do our best for all life on this planet. It is clear that we may differ a bit on the spectrum of biocentrism to anthropocentrism, but the key is that we agree that we need to be honest about what is and is not sustainable, and then do our best to pursue the sustainable option.

So - how should we pursue that? Given your previous answers on sustainability measured on the scales of thousands of years, we have the time, we just need the right mindset to get it done. For me, I think we need to pursue the energy transition as quickly as possible (to reduce GHG emissions), promote policies to lift people out of poverty (which, among many other important health and social benefits, reduces population growth rates), create economic systems that do not require increases in physical output year after year to maintain economic well-being levels, pursue agro ecological food production systems (which have been shown to be able to feed the entire planet without the use of fossil fuels for fertilizers), and all the other amazing ways in which we can provide high quality of life at very low impact. Is there really any other choice?

Ben: Tom, how should we pursue the sustainable option? Is there another choice besides the route Dave has proposed?

Tom: First, I want to point out that my quote was "rethink or abandon" human cultural constructs. The *rethink* part comes first, and certainly allows selecting and amplifying positive cultural qualities accumulated by various cultures over the past. Culture is a non-genetic set of principles that we use to shape how to live. Humans will never be without culture, but some are more sustainable (valuable) than others.

Second, evaluating sustainability on evolutionary timescales does not mean we have the luxury of similarly long timescales to change our ways. Ample evidence shows that we can cause enormous ecological damage on *much* faster timescales (decades)—thus our predicament. We

would be wise to reverse course comparably fast. A fundamental asymmetry operates here: sustainability needs to be assessed over very long timescales, while *unsustainability*—modernity’s bailiwick—can be arbitrarily fast. Full-scale nuclear war illustrates this principle in the extreme: many millions of years of evolution wiped out in moments.

The path Dave illustrates has nice features, but does not attempt to address ecological sustainability on relevant timescales. Even with zero GHG emissions, raising the poor to average global standards, stabilizing and feeding a population of 8 billion without fossil fuels, and maintaining current physical output (ending growth), how could Earth pay its annual salary (of non-renewable demands and waste streams) for very long out of the finite environmental inheritance?

Those lifted out of poverty would finally be able to afford more material goods (possibly a car, house), eat more and better food, enjoy climate control, etc. I am not saying that I would not *wish* such things, but they all act to increase the scale of the human enterprise. The only “bank” available to fund this “pay raise” is our overtaxed Earth, in the form of more non-renewable materials (mining), more manufacturing (pollution), more land use (deforestation, soil erosion, runoff, aquifer depletion), and more energy (materials and manufacturing again). Now we try to lock in this higher demand for the long haul (steady “burn” rate)? We appear to be well into overshoot, so neither an increase nor holding steady seems possible. Even redistribution that equalizes all to the current global average does not reduce the absolute scale. The ecological nosedive is so rapid that maintaining a scale even resembling that of modernity will most likely finish the job, whatever the technology.

My point is that we need to be extremely careful to assess what *can* work for the long term, rather than aim for a pleasant near-term extrapolation of the familiar that only continues to degrade ecological health and is not based on a realistic evaluation of long-term sustainability in its full context.

Do we have another choice? Of course! We could become disenchanted with modernity as an unfortunate dead-end and explore other ways to live and relate to the world. It can’t happen overnight, but we are under no obligation to follow a “modernity lite” path to failure. Attempting to do so could make life worse for more people and animals, in the end.

Ben: Dave, it seems that Tom is suggesting that your proposal (clean energy transition, lifting people out of poverty, and the like) is not sustainable, and indeed would position us for increasing ecological devastation in the coming decades. He seems to instead be suggesting that the only way to achieve sustainability is through a radical rethinking of our relationship to the natural world, presumably with correspondingly radical changes to our energetic and material throughputs. I know you’re a proponent of the precautionary principle...so why shouldn’t your proposal be viewed as too risky, given the stakes involved?

Dave: Thanks for clarifying your points on culture! I agree that there is a lot to be gained from the accumulated history of humanity!

I also agree and it is a very good point that unsustainability can occur on very fast time lines while the assessment of sustainability should be over longer time scales. That said, couldn't an "act of unsustainability" in one time period be compensated for by "acts of sustainability" later on as long as permanent change hasn't occurred?

To the larger issue...We have spent pages trying to get to the bottom of our differences, clarifying what is meant by modernity, sustainability, timescales, etc, and it is becoming clearer to me through these exchanges that Tom has made an a priori assumption about the future, which he stated in his last post: "The ecological nosedive is so rapid that maintaining a scale even resembling that of modernity will most likely finish the job, whatever the technology." Of course, since the future hasn't happened yet, we cannot prove or disprove this assumption, relegating it to a form of metaphysics, or a belief system, or, as Schumpeter called it, a "preanalytic vision."

The preanalytic vision, developed by Schumpeter, is defined in Daly and Farley: "analytic effort is of necessity preceded by a preanalytic cognitive act that supplies the raw material for the analytical effort." Importantly, Daly and Farley describe that

"One might say that vision [i.e. pre-analytic vision] is the pattern or shape of the reality in question that the right hemisphere of the brain abstracts from experience, and then sends to the left hemisphere for analysis. Whatever is omitted from the preanalytic vision cannot be recaptured by subsequent analysis. Correcting the vision requires a new preanalytic cognitive act, not further analysis of the old vision."

It seems to me that Tom's analytic effort—which is on display in the pages herein—was preceded by his vision that "maintaining a scale even resembling that of modernity will most likely finish the job." My vision—one in which we make incremental (hopefully large) gains over the next few decades, becoming more sustainable through time and level-out population growth through the demographic transition - is an impossibility to Tom not because it is wrong or incorrect, rather it is impossible simply because it is omitted from Tom's preanalytic vision. Thus further discussion will, I fear, remain futile.

In many ways, what Tom is calling for is a paradigm shift towards collapsism, in a way that ecological economics calls for a paradigm shift away from neoclassical theory. For ecological economists, the idea that society could have a steady-state economy (i.e. more or less what I am calling for), was (and is) inconceivable for neoclassical economists because the idea of a steady-state economy was omitted from the growth-based models on which neoclassical economics was built. In other words, steady-state economics is impossible in a neoclassical vision of the economy, just the same way that steady-state economics is impossible in a collapst vision of the future.

I would also like to say that collapse is still possible in the spectrum of futures in my vision, it is just one I hope doesn't happen. So in this way, Tom's vision is more restrictive than mine. I do not require a paradigm shift to see that collapse could happen, but I also do not need a paradigm shift to see sustainability happen either.

But I would like to bring this conversation back to ethics at this point, because that is where I get stuck. What happens to people in Tom's radical reboot of human culture on Earth? The implication (though never stated explicitly) is that sustainability is only possible in Tom's vision if there are way fewer people. Is that correct? If so, how do we get there? Do we just accept that many millions (if not billions) of people must cease to exist to be sustainable? How do we approach that subject?

I said in the beginning that I am optimistic because I have children. My kids are my joy in life, and it seems not only against our basic biology but also ethically dubious to try to tell people how many children they can or cannot have; in other words, policy solutions limiting children is not an option. So how do we do it? War, famine? My guess is that Tom's response will be that it is out of his hands, but suggesting that only one future is possible, and that that future must also have many millions (billions?) fewer people in it, requires at least addressing the pathway to achieving that. And that is where the ethics come into play. Who are we to assess which people around the world, which generations (today or future) are more or less important? Everyone is of equal importance and deserves life. So, I think we really don't have any choice, we are required to, as Tom put it, "do our best." Yes we have grown to a size that is problematic right now, but that doesn't mean it has to be in the future. How are you going to "do your best?" How will any of us do our best? For my part, I will raise my kids to be environmentalists, feminists, and change-makers, instilling in them (as best I can) virtues and ethics. I will also produce as much good science as I can and never submit to nihilism and defeatism, no matter how bad the global environmental, political, social, or economic situation may get.

To be clear, I don't disagree that population is a driving factor in environmental degradation. It clearly is. For me, the demographic transition is the only way to reduce growth equitably (and probably ethically), and it has shown itself time and time again to work. It doesn't require endless economic growth, rather (among other things) gender equity and poverty reduction are required, both laudable goals by themselves.

Ben: Tom, is the difference between your vision of the future and Dave's indeed a metaphysical one? Or can you make an argument that Dave's vision is indeed "wrong or incorrect"? [Also feel free to comment on the ethics question...or we can return to that in the next exchange.]

Tom: Dave raises a good point about pre-analytic vision. And it remains true that we cannot know the future. I have arrived where I am via a combination of data, extrapolation, fundamental drivers, and the precautionary principle.

I do not believe that I exclude steady-state-modernity notions because my biases have precluded my considering that state: I was once a big fan! My objection is about continued reliance on non-renewable materials (via quantitative assessment of recycling longevity) and continued ecological harm—whose prevention/reversal is effectively omitted from “transition” pre-analytics. Extinctions and non-renewable depletion are permanent costs that I would rather not continue racking up, steadily.

I would not call our difference metaphysical so much as contextual. No matter what each of us considers in our metaphysical framework, Earth is suffering irreversible losses at a rate not seen since the Chicxulub impact 65 million years ago—a condition that is not subject to our preferred cosmologies. But speaking to metaphysical differences, my foundation is that we belong to the world, rather than it to us. Maybe that core tenet makes my positions seem alien, influencing my values and what I consider to be important.

While I am a big fan of acknowledging the tennis match between right and left hemispheres, the exercise can be a long volley that spans decades and allows numerous corrections. This allows the pre-analytic vision to adapt and re-form based on analysis: rinse and repeat. If I look at my writings from a decade ago, my metaphysical (pre-analytic) realm was missing many pieces that I now possess, informed by analytic exercises and wrestling with their ramifications.

Among these, and germane to the present discussion, I recognize that just because the demographic transition repeatedly “worked” for the Western world in the past (ask critters how well it worked) does not mean it will work similarly for today’s poorer countries. The context has changed, dramatically. 70 years ago the world had a third as many people, a fossil fuel glut ahead of it, and a bounty of low-hanging fruit (materials) and unexploited ecosystems around the globe. A demographic transition: 1) takes many decades; 2) has always involved a significant population surge, as death rates fall well before birth rates; 3) results in greater affluence (per capita resource demand); so that 4) the aggregate resource burden on the planet soars from the combined effect. Earth had the (non-renewable) cash-on-hand 70 years ago, but can no longer afford a rinse and repeat. This is a case of analysis reshaping pre-analytic vision.

Similarly, my statement about the ecological nosedive is not a starting point for me, but a relatively new awareness resulting from data and analysis. In 2023 I produced a plot of wild land mammal mass per human on the planet, over time. The result is startling. It changed me. It was not part of my pre-analytic metaphysics before performing the analysis, but will be going forward. As mentioned previously, only 2.5 kg of wild land mammal mass exists per person on the planet: it’s almost gone. In 1800 it was 80 kg, and already beginning to fall rapidly. This has happened not because of CO₂, but via deforestation, resource extraction and its associated ills, habitat fragmentation, overhunting, extermination, pollution, invasives, human-disbursed disease, and displacement by the human enterprise (i.e., modernity). Climate change interacts with these things to make a dire situation even worse.

Given the accelerating steepness of wild population declines, I am left to ask: what action would possibly result in their stabilizing or turning back up? The phenomenon is so steep, it would

take an enormous, concerted effort to arrest the fall, and that won't happen by accident as an unintended byproduct of demographic or renewable energy transitions. In fact, those things would appear to dial up pressures on the ecosystem via resource extraction—not to mention all the things we elect to do with the energy (hint: ecological restoration is not high on the list).

The sixth mass extinction appears to be underway now, and it's happening fast. I would feel much better about modernity's transition ambitions if the ecological crisis was modernity's primary concern, but it takes a back seat to satisfying short-term human demands in a state of overshoot. To be clear, I am not defeatist or nihilistic about this: I am agitating hard to do something different—get people to think differently—hoping that we can avoid the worst unforced errors. I'd rather we collectively not have to see it to believe it.

As for ethics, I will just say that the scope must extend beyond humans alone, and well beyond the present century. My own "who are we" question is: who are we to consign entire species to the dustbin—avoidably? If satisfying the short-term wish list of one culture (that of modernity) extinguishes several species per day, I don't know how to ethically justify those priorities. More maddeningly, doing so runs a sharp risk of promoting our ultimate failure anyway, as we—especially modernity—will struggle in the ensuing ecological collapse. I see the situation as simply unfortunate. We find ourselves holding the wolf by the ear: we can neither let go nor hold on indefinitely without suffering harm. We don't have the luxury of stipulating that present-day humans suffer no downside. In fact, it is not unreasonable to expect the downside to be in proportion to the magnitude of our current transgression of sustainability. Fairness will not always appear to operate in our favor.

Ben: To bring this conversation to a close, I'd like to note that this wide-ranging discussion has laid bare a number of important disconnects between the two Murphys' very different perspectives. Dave seems convinced that a just energy transition must be pursued in order to address the fundamental underpinnings of our current metacrisis; Tom seems convinced that such a transition, even if possible, could not be sustained for ecologically relevant timescales and might even accelerate the damage. Tom believes that modernity cannot be salvaged in any meaningful sense, while Dave considers the assertion that we cannot fix our problems to be an abrogation of our collective responsibility. There is also a big difference in perspective about the timescales that we should be paying attention to: an optometrist might diagnose Dave with myopia (nearsightedness) and Tom with hyperopia (farsightedness), but it's a significant challenge to bridge visions of decadal timescales with millennial ones (we need bifocals!). Another significant disconnect stems from values: should we place more emphasis on reducing suffering among humans alive today or in the near future (as Dave might propose), or on enabling humanity and other species to flourish for millennia to come (as Tom would suggest)? A final distinction I'll note relates to agency: Dave is firmly convinced that humans control our destiny, while Tom emphasizes the limitations of the boundary conditions imposed by our finite planet and our ecosystem.

However, it's also worth emphasizing that our two interlocutors have much in common, beyond their last names and their years of work on the Planetary Limits Academic Network. Both agree that modern human practices are not sustainable, and that continuing on our current path increases both the risk of collapse and its severity. For either Murphy, business-as-usual is simply not an option. Also, both clearly care deeply about the happiness and well-being of both humans and our more-than-human kin, albeit perhaps in different proportions.

Yet it was striking to me the extent to which our two Murphys hold such different worldviews, despite sharing a broadly similar understanding of the facts of our current predicament. At times it seemed like they were talking past each other, unable to understand how the other saw things the way they did. Dave maintains a surprising (if not also inspiring) optimism that humanity can craft a bright future through an energy transition; while Tom seems to clearly think for modernity, the party's over. In this Tale of Two Murphys, it seems it was the best of times, it was the worst of times.