

# Atom Smashers

This is a pretty old track - probably made around 2011 or so.

To be honest I am a little ashamed about the fact that half the tracks on this album have been around for absolutely ages. Many have been sat on Soundcloud, there for all the world to hear. This feels like I'm short changing the people who buy the album somehow. But my thinking was this: if you've been working on tracks for ten years and you want to make a new album, then why not simply select the best ones that fit together with some kind of unifying concept? Why not just try making the best album you possibly can from the material available? So that's what I did. I'm sincerely hoping that the next album will be 100% new and shiny. In fact I culled one killer new track off this one because I felt it would better suit the concept for the next one, which is already in progress as we speak. Anyway, enough of such distractions, what about atoms?

## Musical Energy: Repetition is a Microscope

The ability to play with time is the most compelling thing about music, and especially electronic music, for me. Taking many days to construct a few minutes of auditory experience is a strange and wonderful process. Ever since I discovered as a child the ability to record audio on a tape machine, I've been fascinated by it. Even things that are nowadays trivial, such as recording something and playing it backwards, is still captivating to me. The fact that you can capture your living sensory experience, which is seemingly resolutely linear and forward marching, and then chop it up, rearrange it, stretch and compress it and create all kinds of weird sculptures out of it... this process never gets old.

One of the defining aspects of our living experience is rhythm. The rhythm of days, the rhythm of walking, the rhythm of habit, the rhythm of speech, the rhythm of our inner thoughts. The beat of what you are doing affects how you relate to it, altering the tempo of your sensory experience alters your mood. As a music maker you can craft twists and curlicues of time, and in doing so you also form the quality of your mind. You force the surges of electromagnetic energy in your brain to conform to the rhythms of your own design. You change yourself. You give others the ability to change themselves.

The circularity of time in electronic music is vital for the density and level of detail at which you can experience it. The more the loop repeats, the more detail you can hear.

The more you hear the same thing, the more your mind perceives in it. Each time you circle round the resolution of your perceptual predictive model increases.

If you take a one second snatch of white noise, it just sounds like undifferentiated noise. But if you loop it, every time you hear that snatch of noise you will hear more and more detail, more and more patterns will emerge. In one experiment it was found that people who had listened to a loop of white noise could recognise it months later. The same principle and more so applies to beats. The more you listen to a loop, the deeper you get into the nuance of it. A loop is like a microscope, but in time not space. You can zoom in on tiny snippets in the sound that would be imperceptible if you just heard the sound once.

The reason you can dance to a techno track you have only heard once is that it repeats so many times that you come to understand the sound in great depth by the time the track is half way through. A pop track needs to be heard a few times before you get it, a dense classical piece needs to be heard many more times (as with *The Planets*, my favourite classical music is stuff I've been listening to since an early age, listening to and *really* enjoying a completely new classical piece is, I'm sorry to say, quite difficult). Techno is interesting because it took the necessity of repeated listenings and baked it into the track itself, rather than relying on radio airplay to repeat the entire song.

A perhaps unfortunate aspect of music making is something called the "mere exposure effect". This is the often overlooked but quite bleeding obvious fact that people like stuff they have heard before more than stuff they haven't heard before. In other words, play them the same old shit over and over again and they will like it more than something new, original and amazing. Sad isn't it? As a musician you need to steel yourself against this uphill struggle fairly early on. In my first band we knew we had to play covers in order for people in pubs to tolerate us. The good news was that playing covers was also exactly what we needed in order to learn our craft. Covers are fine, but what really pisses me off is supposedly "new" music which abuses the familiarity effect in order to get people to like it. Music that is as close as possible to other music without the artist getting sued, or music where *literally* the only decent bit about the track is the sample that it uses. It pisses me off even further when no one notices this. It pisses me off even beyond that when entire genres are based around it.

The good news is that [familiarity can help people to appreciate complex music](#). In other words there is no need to repeatedly play them simple dumb shit, you might as well repeatedly play them good interesting stuff, the familiarity effect will win regardless.

The key is to deliberately give the interesting stuff exposure. Which used to happen, and could, through some mad quirk of fate, happen again.

## With ever increasing energy, one explores new territory

To increase music's effect on your mind, it behooves the listener to move their body in time to it. The more expressively you and fully you move to the music, the deeper will be this experience. When I dance I do try to express something about the music I'm listening to. The dance has to be somehow appropriate. It's not just about being in time, it's also about some gestural meaning. The music flows in through my ears and out through my body. There is a way of dancing that faithfully expresses what you are hearing - in other words some moves are "appropriate" and others are "inappropriate". In the same way that your auditory perception becomes more detailed with more repetition, the ideas you have for what body movements that will suit the beat becomes more detailed, but since it is a creative act, more possibilities are added to the range of appropriate movements you can make. I say "ideas" for moves... when I'm really dancing I don't think they are ideas, they are beyond and deeper than ideas really, when you are really carried away by the music you are barely thinking at all, movements appear on their own almost. Your conscious brain, the thinking intermediary between sound and movement becomes progressively less active as you dance, till eventually there seems like there is simply a direct connection between the beat and your limbs and your brain switches off. 'Tis a blessed thing.

A really good beat will become progressively more "inhabitable" and more "flexible" in terms of its danceability as it keeps going. More possibilities open up for your body to express itself. As a dancer, when you get into a groove, you can do more and more with your body without it being "wrong", the beat becomes more flexible and elastic, there's more shapes and movements you can make that poke the beats in different directions. At the peak of a night spent dancing, the sense of agency starts to melt and blur, and simultaneously to the music making you dance, your dancing is making the music. In the old days I used to think I could actually change the music by dancing. I may have been mistaken.

One of the big differences for me in a really good dance and a half-arsed one is how flexibly and varied I can make my body movements<sup>1</sup>.

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<sup>1</sup> Techno is not always good for this, it's a very linear up-down, binary fist-pump kind of movement that you end up with. [Soul-Train](#) would not have been very interesting to watch with that kind of techno. Imagine a remake of Soul Train that merely featured white blokes in Super Dry Jpn jackets pumping their fists to kick drums. Dissatisfactory.

And dancing does transform how you feel. A really good rave is an utterly different state of mind from our normal everyday reality. How weird is it that we can gather in a darkened room, jerk our bodies around whilst listening to weird abstract noises and this makes us feel brilliant? Bizarre creatures we are.

I would say the importance of *expressive* dancing has been forgotten somewhat. For one thing, I think it is somehow traditionally seen as an unmasculine thing to do, which is utter nonsense. Every culture worth its salt has placed importance on a man's ability to dance. As a man, your ability to dance not only expresses your physical bodily fitness, but also your mental and spiritual creativity. The trouble with highly masculinised dance music is that much of the creative options of the dancer have been stripped away. I don't mean fake "sexy dancing" like on music videos for morons, I mean dancing with utterly wild abandon like you will see in footage of 90's raves: stupid hand movements, feet spending more time off the ground than on it, throwing crazy contorted shapes, contorted facial expressions, that kind of thing. It would be nice if this wild abandoned dancing could be melded somehow with the more professional athletic dancing to generate something really spontaneous but also impressive... It would be nice if more dance music had more respect for the culture of actual dance. There is, of course, plenty of scenes that are *all* about incredible dancing. But as with all scenes in the internet age, those scenes are totally focussed on the dancing, and everything else is a trifle secondary. There is no scene for expression in both music *and* dancing, because the slightest preference for either will rapidly silo you off into your own special scene, your own YouTube filter bubble, your own meetups, your own culture, your own language, your own set of values, and your own specific vision of what excellence is. This tendency for splitting and narrowing is what I call Cultural Dark Energy. My band Standard Planets had a song about this. Dark Energy is what is causing the universe to expand at an ever increasing pace, moving galaxies away from each other. Eventually Dark Energy will leave everything isolated and make communication impossible. As in the macrocosm, so in the microcosm: there is something similar at work in culture right now that means we are splitting into finer and finer niches of interest, and this is making communication and unification harder and harder. What we need is to bring different arts together again. We need more multidisciplinary scenes to create whole, diverse, total experiences. We need to somehow generate the gravitational force that will start joining humanity's cultural cosmos together again.

For me there's a huge difference in how my dancing feels at the end of a really good night and at the beginning of one. At the start it's as if my body is somehow inside a mental cage of repressed up-tightness. As if my body is literally not allowed to move by

my mind. I feel dorky, I feel middle-class, I feel square, I feel white, I feel like an unhip Dad who has wandered into his teenage daughter's bedroom whilst she's playing some shit that he doesn't understand. It takes a good hour or two of demi-dancing to break myself out of that cage.

And once I'm out of the cage then there is an immense sense of freedom. Alcohol or drugs helps of course, but far far less than you would think, the main thing is the quality of the music, but it really comes down to just putting the damn time, mental attention and energy into the dancing. That is the thing that will free you up<sup>2</sup>. I feel this has been forgotten. People simply aren't putting the hours in these days. In my day we'd lose 5 kilos of sweat in one night. Stop nattering in the smoking area and do some goddamn *work*, kids<sup>3</sup>.

The freedom you experience through *really* dancing is highly contagious, of course. People are watching each other dance, looking for cues in other people's physical movements about what's happening, and other's dancing tells you what they're feeling, and tells you what you could be feeling too. We are pack animals, and we look to the pack to give us queues about what's going on. When you see other people dancing like loons, you immediately receive a magical burst of energy yourself via some social mirror neuron or other. The fact that they've let loose gives you permission to loosen up another notch. And of course, if people see *you* dancing with a bit ofchutzpah, they get an energy boost as well. It can be immensely satisfying to be the person who raises the energy in the room purely by dancing. You are a radiator of good vibes. You are beaming out free energy like some freaky long lost invention of Nicola Tesla's. This burst of energy reverberates around the room, and comes back to you. And so, on a good night, the whole system feeds back and huge amounts of feelgood physical energy is built up. And the converse is true also. At a shit night every is wandering around shiftily glancing at other people, looking for that burst of energy and not finding it, all they see is other lost people's empty eyes, also searching for the evaporated magic, and the whole place feels like a cavern of zombies forlornly looking for human flesh that was consumed long ago.

But back to the good nights. At a certain point, after your own internal barriers have come down, the interpersonal barriers come down too. People start smiling at each other. Yes, even in London. It really happened. You look at someone who looks like they are having a good time dancing, they look at you, you grin at each other like idiots, that

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<sup>2</sup> But then it has to be said that a quality pill will take the whole thing to a completely different level.

<sup>3</sup> People underestimate how damaging the smoking ban was for club culture. Along with all the other things ruining rave, the fact that half the people weren't actually in it may have been the biggest buzzkill.

smile is not crafty, sleazy seduction, it's an honest, openly beaming grin that says "you look great! and I'm feeling great!", "me too!". There's no agenda there, at least the only agenda is to have a fantastic bloody time. This lack of agenda leads to a deep sense of trust, and the human connection is so honest and open it feels almost like you have rediscovered humanity's fundamental innocence. Ecstasy was at some point called "Adam" for this reason. It can be like uncovering your innocence, your common humanity, rediscovering a basic kinship. You realise, that no matter how shitty we can all be, deep down we all just want to feel good, and we want other people to feel good too. The only reason you would ever want someone else to feel bad is that you feel bad yourself. And if everyone just *felt better*, the world's problems would be solved. And in this room right now on this night we all feel really quite fine indeed. By simply collectively agreeing to feel good, we have brought more light into this often dark existence. Dancing then morphs once again, up another level of expression, from expressing the nuts and bolts of the musical components, to becoming more about expressing the collective feeling-great that is being passed around the room. People are now dancing both musically and personally, rhythmically and emotionally, collectively and individually at the same time. Everyone is feeling fabulous, and you can see it and feel it as one body. The fact that you have opened up with strangers means you can open up more with your friends too, and afterwards you will feel a lasting deeper bond to those people you had that experience with.

This is what dance music can be, and these experiences rank amongst the best and most profound moments in my life. Indeed, I venture to say that the experiences that have been had at the very best raves rank alongside the best experiences of any human being throughout our entire history. Seriously. We are talking about *pure unadulterated joy* here, and this is so extremely rare and precious. Where else have you felt this? When else can you say you have experience hour upon hour of unclouded bliss? I say never. There is no other experience where I have felt so free, so joyful, so connected, so energised. This kind of peak experience should be cherished and protected by our culture as fervently as the family, or the nation state, or economic growth, or scientific progress or anything else that we believe fundamentally contributes to our wellbeing. Of course this isn't what happens. This blissful experience has instead been at first actively suppressed and slandered, then exploited and trivialised, then crushed, abandoned and left to die of starvation in the fucking gutter, and society at large seems not to give a shit about any of it. I believe this is because we don't see subjective experience as being *real*. I'll dig into this devaluing of subjective experience in a later chapter.

This peak rave experience is what separates dance music from other forms of music, and why I have spent the majority of my time trying to make music to play in an environment such as this. A really good rave is quite simply the most magnificent way to experience musical bliss, period. Who wouldn't want to make the music that gets experienced at the peak of such a night? Who wouldn't want to contribute to that experience? Who wouldn't want to push it even further, tip it into something even *more* amazing and transcendent?

And in the heady days of the 90's we really thought that this experience could change the whole world for the better. Once we have experienced that level of openness, trust and bonding with thousands of people at once, surely that changes the way we think about others and the way we live our lives. Despite all the divisions, we are capable of getting together with a diverse group of other humans, and having an A-1 awesome time. And you can still tell, those who were "there". I think there's a kind of mutual understanding and a bond between those who were raving in the 90s, there's a difference in something-or-other between those who were there and those who weren't. I'm sure younger people still experience that bond, but there was a level of commitment and belief which has maybe gone off the boil in the intervening years. I really don't know whether this is because the whole thing just didn't work, and this world changing potential was a figment of our whatever-fuelled imaginations, or whether it really could have made a difference and was therefore deliberately sabotaged by the people that it threatened. There's arguments for all these things. All I know is that despite appearances it's not over yet.

I also know that it is vitally important for club artists to create music that allows this socially-transformational bonding thing to happen, and to some extent that means wiggle-room in the beats that allows people to dance in their own way, and to a certain extent that means lowering the tempo, forcing it less, and cramming it less with overt instructions about where the down beat is. You have to give the room some space to find their own identity, allow some breathing room for people to look around and realise who they're with and what the hell they're doing. I have, on and off, tried to work on music that decreases the tempo, dials back the energy and provides more intriguing possibilities for different types of dancing. This track is exactly such a track. The decrease in energy seems to not quite land on real dancefloors, which disappoints me.

I've not been too good at "social" music, music that's designed to bond people. I think this is because, firstly, I'm not a very social person, and secondly because I'm always tempted to just smash it as hard as possible, because, to be honest, my best moments in dancing have been in a world of my own, where it's just me and the music. The most

extreme states of mind have been pushing beyond the social, and into whatever world of sound is beyond that. The interpersonal connections I talked about above are important, but the final little push to complete transcendence is just when sound becomes its true essence, completely impersonal and devoid of personalities and ego and almost anything other than pure energy. I genuinely feel that at some points whilst dancing I have experienced a form of transcendental enlightenment where my mind and body melded completely with the music and the rest of existence, time, space and self completely dissolved. These transcendent moments generally accompanied the more extreme forms of music, rather than that music designed for "social" listening. The kind of music that allowed me to transcend was far more "abstractly intense". I guess well known artists I would most associate with "abstract intensity" would be Aphex Twin and Jeff Mills. But mainly it was to sets that I had no idea what was going on or who was making it happen, I just danced.

Whilst I did hear Acid House in 1987 when it first broke into the charts (my favorites as a 14 year old being S-Express and Pump Up the Volume), I first *really* experienced dance music in its intended environment at an Indie club, actually. It was at a night called Feet First at the Camden Palace (now [KOKO](#), a lovely, multi-level baroque theatre venue), at the end of the night, the last half an hour or so would be dance music (or sort of early indie/techno cross over stuff like [Leftfield's Open Up](#). Listening to that track now gives me occasional memory flashes of that naive sweatiness of the early 90s), lo and behold I found I *really* enjoyed dancing to this, and wanted a *lot* more than half an hour. The next thing that happened was that a few friends went to see Astralasia at the Marquee club. This was the first time I ever took LSD, I took a miniscule amount, but it was certainly enough to do something intriguing. Astralasia left me meh, seemed kind of silly. But then some DJ came on and played proper, squelchy TB-303-based acid for the rest of the night and then I was truly and madly hooked. This was like FREAKY ALIEN NOISE that made me dance like a nutcase and completely forget who I was or the world I lived in. As someone who wasn't actually that happy with themselves or the world at that point it was a huge release, like discovering a parallel reality that was way better than this one.

For some reason the music hooked me far more than my friends at the time. I became a serial clubber, and they didn't. And to be frank, my appalling inability to maintain relationships meant that at the start of the second year when we all had to move out of halls of residence, and the fact I only had £60 a week and I had to move to the arse-end of Streatham, meant that I became isolated from all the friends I made in the first year and things turned pretty bleak, socially. So then I just went clubbing on my own. I had

to find Techno nights on my own<sup>4</sup>, drink a four pack of Murphy's on the bus to the venue on my own (I couldn't afford drinks inside), join the queue on my own, and then dance like a nutter for the entire duration of the night on my own. Then collapse onto the night bus back on my own. What a weirdo. Whilst it was desperately lonely in some senses, in other senses it was awesome, pure. Can you really be lonely in a packed club dancing like a mental mosh-diva with a load of other blissful sweaty beautiful ravers? No. You feel a bit awkward in the queue beforehand, but not inside.

To me, being on my own in a club is still, in some weird way, the *purest* way to do it. Just me and the music, me and the rave, me and *everyone* else there, me and the sound, absolute unadulterated sound. And eventually no separate solitary me, no music outside of me. Just 100% dance energy. No talking, no drinking, no queuing at the bar, no smoking, no drugs, no distractions, no chilling out, no idea who was playing, no worrying about where my friends were or if they were having an equally good time or wanted to go home or didn't like the music or thought I was dancing too crazily, no paranoia, no worrying even whether *I* thought the music was any good or not, because I really didn't know enough about it to judge, and since there was no one I knew to judge my judgements, I could dispense with them entirely. Sure, some tunes had a bit of extra genius that tipped me right over the edge, but there was never a moment where I thought, "this is less good and I won't dance to it". Just dancing forever, drinking in that undiluted musical and cultural energy.

Actually, whilst a lot of what I would tell my 18 year old self would be in the vein of "sort your damn attitude out, kid", I suddenly realise in the process of writing this that am really fucking proud of myself for having the strength of musical conviction and independence of mind to have done this. I found what was amazing and I went for it. Good on ya. I suspect most people just get into the music that their friends are into, not so many people go to clubs on their own, or would even see the value in doing that. London was, in fact, fairly scary back then, especially to a kid from a small village, so it would have been remarkably easy to have just stayed at home. Given the now legendary status of the stuff I went to see back then, had I been less independent minded I would have utterly missed out on a priceless moment in musical history. One of those

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<sup>4</sup> Nights that I can recall going to on my own: Final Frontier, Sabresonic, Drum Club at the Sound Shaft, Eurobeat 2000, Turnmills (can't remember the night, Essence or The Gallery?), Megatripolis. Acts and DJs I saw: er, dunno, I was absolutely clueless at the time. All I did was turn up and dance. However I'm *pretty* sure I would have seen Andy Weatherall (RIP), Claude Young, Alex Knight, Laurent Garnier, Carl Cox, David Holmes, Charlie Hall, Mark Broom, Darren Emerson, Frankie D. I'm sure there's more I could piece together using some internet archaeology but that'll have to wait.

extremely special waves of human culture that you need to be in the right place and right time to experience. For real.

The official story is that going out with loads of friends is great and being a billy-no-mates is terrible and sad. And, yes, generally, I was not happy, and I was in the process of disappearing into a negativity hole of my own making... But, y'know what, in some ways the universe compensated for that hole by feeding me some truly incredible music in its most unadulterated form. And in the end it *was* the music that was the way out, and the way back to finding friends I loved.

Eventually I did find truly excellent clubbing buddies, found a close-knit scene where everyone was into my kind of music (and even *my* music), and lived happily ever after. Oh, until I moved away from my home country, we all got old and tired, everyone had kids, and a global pandemic outlawed all forms of physical social interaction. Until *then* I lived happily ever after.

You, my darling rave companions notwithstanding, the solitary clubbing experience had established a musical core of me, and that core was the feeling of dancing absolutely obliviously: entering into the music in quite a solitary fashion. From that point on, when I *did* go clubbing with friends, one important thing was that the social bonding and feelings of unity had to have *already* occurred that same night, otherwise the solitary thing became lesser in some way. Whilst breaking on through to the other side became harder in some respects, the fact that your friends were on board and also broke on through raised the whole thing up a level. So the social unity needed to precede the transcendence, I couldn't go beyond everything unless I had already bonded with my mates and the crowd, and received validation that we were all going there together. No raver left behind, as it were<sup>5</sup>. It was somehow vital that everyone should be having a good time before I felt liberated enough to go stratospheric, where my eyes would close and another world would be entered. I guess that's because, metaphorically, society always has problems, and I don't feel I can "leave" until they seem to be sorted. So dancing on a dis-unified dancefloor would preclude the complete absorption of mind into music. This is why in DJ sets, if you're going to go for super extreme mind obliteration, you need to build up to it. You can't just smash it from the word go, because not everyone will be on board. The acceleration from normality will be too great, and people will fall off the back of the truck. The kind of music that will twist your mind into a fractal wormhole has to wait until the room has achieved a kind of

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<sup>5</sup> Though occasionally I will still just wantonly leave people behind and go and dance on my own. Sorry. Just imagine me as some kind of traumatised rescue animal that has to hide in a bin every so often.

coherence via other, more inclusive kinds of music that encourages empathetic human bonds.

## Trance

So what *were* these experiences that I could only obtain by dancing for ten hours completely on my own in a world of rhythm and sound?

Well it'll be difficult to describe, because I'm not actually *there* right now, I'm just sat in my fucking office/studio (where I have been sat, locked down, continuously for the last 9 months) and I might be just making shit up. And obviously, if when I was dancing my tits off in a club, it would have been a bit of a task to get out a notepad and jot down what I was experiencing without ruining the flow somewhat. But there are several components:

Extremely long/deep structures going deeper than any single track or even DJ set

Sound becoming an immersive 3D space, becoming visual

Loops becoming lines

Dissolving of boundaries of self, being able to control the music by dancing

Glimpses of the void beyond the deep structures (the chimes in this track are meant to be that)

Superhuman energy levels.

Getting into this will have to wait for further research.

## Is this Dance Music?

But anyway, whilst this track has a reasonably heavy beat and a bassline, it doesn't seem to work particularly well in a club (to my dismay). I *was* actually making this for the dancefloor - the main synth arpeggio is precisely the kind of synth riff that allows people to throw odd shapes into nooks and crannies with their hands and whatever. It is perhaps too slow - it's another one about 100bpm. I don't really know why 100bpm has never taken off for dance music. To me it seems perfect. Maybe it's because I'm tall and my resonant frequency is lower than most people? For some reason I kept hitting on this speed for combinations of melodic elements, vocals, hefty bass and chunky drums, as it seems to leave room for all those things, any faster and you stop being able to do all three of those things because there isn't room. But maybe the energy level is just not high enough to keep the momentum of a dancefloor going? My wife would definitely disagree because she says this is her favourite track of mine ever - and the reason this track is on the album is because of her. And I'm really glad of that. Hardly any of my

tracks give me chills & goosebumps, it seems a tall order from something that you've heard a zillion times before and tweaked to death, but this track still does. I do hope it has a similar effect on you.

Speaking of tweaking to death, some of my favourite moments in this track came quite late, years after the original was made. This is usually a recipe for ruination but I think I managed to stave off complete disaster. For instance the bit of sparsity and silence that occurs just before the main synth riff comes in at 1:06 is a pretty neat set up moment. To some extent knowing how to create these set up moments entails knowing what's good about a track, and knowing that can sometimes only come after a long time of living with it. I know that that is a killer synth riff so I knew I had to announce it in some way.

## Atoms, the smashing of

I have always been quite keen on atoms. Where would we be without 'em eh? One of my favourite books when I was a child was "The Story of the Atom" which I can't find anywhere online. One reason was that I liked the cute little Mr Atom character, but also there was something very satisfying about the notion that everything in the whole world was built out of these little building blocks that were really so simple. It was like discovering the whole world was actually built of Lego. Nanoscopic lego. Lego that contained huge amounts of energy. Lego that was manufactured not in Denmark but in exploding stars. I even memorised the periodic table, for some unknown reason, probably because I was a little smartass. Can't remember much of it now of course. So that was pointless. Maybe I'll try memorising the lyrics to Tom Lehrer's [brilliant song](#) instead.

The other thing that was fueling my interest in atoms, was that I was also into atomic bombs. Yes, I enjoyed looking at mushroom clouds, and enjoyed trying to imagine and get my head round their explosive power. I find photographs and videos of nuclear explosions to be quite bizarrely, terrifyingly beautiful. Not that I ever thought that nuclear weapons were nice things to have around, or that I was impressed with their military capabilities to kill people... it was rather... that much *energy*, that much effect on the surroundings, that ability to smash stuff up is inherently awe inspiring and fascinating. And all from tiny atoms hitting other tiny atoms.

Is this morbid and perverse? Well, the sun is a huge thermonuclear explosion<sup>6</sup>, but it's not morbid to be fascinated by the sun's power. That power is keeping our planet alive. It's not perverse to look at videos of the sun. I recommend watching the [4K videos of the sun](#), and trying to get your head round the fact that the loops of glowing plasma that spew from the surface are many many times the size of the earth. Watch the peculiar writhing little gobbets of energy that get sucked back into the sun by magnetic fields - those little fiery squits are the size of planets, dude.

One of the first real interests I ever had, from the age of maybe five, was space. In retrospect this seems strange, as I had barely even begun to find out about the planet I was living on and yet I was already obsessed with getting off it. I spent many hours imagining stars and planets, and drawing pictures of them. When I was a kid scribbling solar prominences and flares with red and yellow crayons, it was impossible to watch 4K timelapse videos of solar activity on a vibrantly colored 48 inch TV screen, so I had to make them myself with crayons. I love the fact I can watch such stuff now. I don't draw it with crayons anymore but I always attempt to have some atomic-stellar explosiveness in my music. I've always loved music that has a sense of immense, cosmic scales.

In fact I spent quite a lot of my youth, and indeed quite a bit of my adulthood simply trying to imagine big things. It's fun, for instance, when you're looking up at the night sky to really try and grasp how big it is. Impossible, but fun. Despite being impossible, it does actually reward time and effort. You have to lie back, and start from something you know. Like the size of your city, then mentally zoom out to your country, your planet, your solar system. All the while trying to somehow keep track of how little you are getting. Then, instead of feeling that you're lying on your back looking upwards, try to imagine you're upright, but stuck to the side of a planet looking outwards, and then imagine you're stuck on the bottom of a planet looking downwards. All of these viewpoints are just as valid. In space there is no up, so height may as well be distance which may as well be depth. You're stuck on the ceiling above a chasm that is billions of lightyears deep. Infinitely deep. Infinite vertigo. Yes, I'm a massive space nerd. And so is Musk fanboy Mike Trollfield of course, he'll be talking about it later.

Once you've tried imagining big things for a bit, then you can imagine small things. Atoms aren't *so* small actually, if you knead a piece of dough for five minutes your initial first fold will have been stretched to a single molecule thick. Easy.

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<sup>6</sup> Technically I don't think it is an explosion, but, breaking news: having respect for science doesn't actually mean you have to be relentlessly pedantic.

Infinity is a fun one to try to imagine too. Beyond big. Beyond beyond. I think when I was a child I might have been better at imagining this stuff than I am now. At least I had more time for it. At least I still try, unlike many adults, whose wonder, curiosity and imagination seems to have withered and died.

Nuclear blasts may be at the limits of the most extreme thing we can really imagine, you can kind of get your head round an entire city somehow, then you can roughly get your head round the whole thing being incinerated by a gigantic fireball in an instant. Supervolcanoes that throw 100 cubic kilometers of rock into the air, they start to get a bit too hefty to really mentally picture. Meteor impacts that smash entire countries are much harder to imagine. Supernovae... forget it. For some reason my mental picture of a supernova is actually smaller than my mental picture of an atom bomb. But it's a bit bigger. Like 10,000,000,000,000,000,000,000,000,000 times bigger.

There's one video of a nuke going off where you really do get a sense of scale. It's an [underwater test](#) where there's a bunch of decommissioned battleships sitting on the water, and then kablwhoomphsh, the whole place just explodes upwards and all the boats just disappear in a flash of boiling water, and these are *massive* boats, that just evaporate in an instant. Thousands of tonnes of radioactive water then slowly pours out of the sky. And that bomb was only 23 kilotons. A relative tiddler. H-bombs got to be over a thousand times that power. Total insanity.

The story of how the atom bomb was developed also fascinates me. The spectacular timing of it as well - to neatly coincide with the end of WW2 (and not the beginning, or before, or after) is a truly astonishing thing. There's this terribly contingent series of events, for instance the discovery of the neutron is put back a few years because someone goes down a blind alley, someone else doesn't read a particular paper, so on and so forth, all of which delays the Bomb by a few years. The "liquid drop model" that spurred the advance toward the splitting of the atom was born during a random chat that Lise Meitner and George Gamow had during a walk round campus. It is peculiar to think that they might have had this walk a year earlier, resulting in public access papers detailing how to split the atom, resulting in German A-bombs. Or they may have had this walk a year or two later, resulting in no Manhattan project, and no Nuclear arms race. And then if you think about what would have happened if the bomb was developed just seven years earlier and both the Nazis and the Allies had a bunch of them before the war kicked off...? Have we been anthropically selected such that this never happened?

Anyway I highly recommend reading ["The Making of The Atom Bomb" by Richard Rhodes](#) for an in-depth and gripping account of this history.

Another geeky thing I'm into is watching lectures online. Like, proper university lectures. I don't know why I should be slightly embarrassed about saying this, I guess because I feel simultaneously too nerdy and uncool and also too show offy and I'm-so-smart, but how could both those things be true? In the years between graduating in 1997 and starting my Masters in 2009, I slowly forgot most of my physics degree. This bugged the hell out of me, firstly because it was interesting and deep stuff, secondly the idea of forgetting something you struggled so hard to learn infuriates me. I mean what was the point? You could ask that question and then refuse to learn anything ever again, or you can bite the bullet and determine that you are going to refresh your knowledge periodically and damn well keep it in your head. Until you die, when all those hard won neural patterns will rot and disintegrate.

Anyway, in around 2010, after the last album came out and was experiencing a vague unease at my musical pseudo-career, I started getting back into Physics. But now with all these amazing resources such as online lectures, where you can learn from some of the best teachers at the best universities out there. So I dug back into Quantum and Relativity with Leonard Susskind, Linear Algebra with Gilbert Strang, information theory with Seth Lloyd and so on and so forth. I mean, these people are modern day academic legends, and it was a true honor to have access to this material. So when I rant and winge about the internet (I will, oh yes I will) bear in mind that I consider it a priceless resource, not least for my own education.

I was pleased to discover that MIT and Stanford are not populated with super-geniuses learning brain meltingly incomprehensible six meter equations - they're smart there, sure, but they also had teachers who were truly dedicated to explaining things well, and getting to the essence of *why* they were learning what they were learning. These are skills that were sadly lacking in many of my lecturers. I remember a couple of them couldn't speak or write at all intelligibly, it was like being lectured on Optics by a very drunk camel. Maybe MIT and Stanford and the rest are actually worth being a tenth of a million bucks in debt for a good proportion of the rest of your life? Maybe. Or maybe you could just use YouTube and learn it yourself.

And it was in one of those lecture binges that I happened across the words "Atom Smashers" in a lecture and decided to sample it. Both vocal samples in this track come from one of those lecture series I was watching in 2010, Walter Lewin's Electromagnetism. Everyone who ever made electronic music in the late 90's has a

little alert notification system in their head when a samplable phrase pops up anywhere at any time. My inner Big Beat producer immediately poked me when these words were uttered. When I time-stretched his voice



*The hot look in the late forties. Though the gentlemen seem more enraptured by the mushroom cloud than the lady wearing it.*

it completely changed its character, took on a almost feminine sensuous indulgent quality, which slides over the beat until it smashes into the "ping ping" vibraphone sound in a tiny pinprick of energy, that seems to rhythmically spiral off the beat like the spiral paths of subatomic particles in slow motion. Furthermore they also suggested the melody, which is an again, very feminine kind of vocal somehow designed to convey the sheer sexiness of the huge power that physics gives us. I do believe there is something sexy about atomic physics. It's a kind of 1940's sexiness, the sexiness of those long legged, cone-breasted, rose lipped dames that they would paint on B-52s. The illicit sexiness of conducting an affair with a spy during wartime. The sexiness of military uniforms. Or the sexiness of a scantily clad woman with a mushroom cloud on her head.

Anyway, the atom smasher Walter Lewin is referring to is not The Bomb, it's a particle collider. As in the LHC.

So is the LHC worth the megabucks they spend on it? I'd say yes, because I'm a nerd, and they'll always tell you that it was at CERN that they developed the precursor to the internet, and who knows what other spin offs will emerge from it. Some people say that it's a portal to the demonic realm, but that sounds unlikely doesn't it. Even if it was, how scared should we be of sub-atomically sized demons? Not very, considering their lifetimes are strictly limited to picoseconds. And how do subatomic demons learn anything or pass on their DNA if there's nothing smaller than them to store the information on? Genuinely curious<sup>7</sup>.

But sometimes I do wonder whether the knowledge of the Higgs boson will ever directly translate into useful technology. Perhaps in a few thousands of years. But I dunno if that justifies the \$15bn cost. But I think a fusion reactor would be more worth spending money on, ITERs budget is similar at \$20 billion, I would beef that up before I built another collider.

So then. I know you're tired. When I tell you that this is the last track on side one, and there are still another seven chapters to go, you have a desperate urge to bin the whole thing and to book a spa weekend to recover from the trauma. But we're here now, and it has to be done. The spa resorts are all shut. Both you and I know that you have nothing else to do, and next time we speak you will have *absolutely no* excuse for not having read and thought deeply about every single aspect of what I have written here. So then, we must once more cede the spotlight to someone who will exacerbate the trauma. It's our best enemy Mike Trollfield, and he's here to corner us into a pub alcove and bellow at us about nuclear power and the space program. Why? Because he's like that. Mike doesn't so much have an axe to grind, as have an entire fleet of logging machines to refurbish. But like Enrico Fermi's mum used to complain about her son's long nights out in the lab, he's only doing it to get a reaction...

## Clean Energy: Part Two

*Mike Trollfield*

Less ridiculously than being scared of subatomic demons, but still ridiculously, people are still very scared of nuclear power. This is unfortunate as it is one of the many tools

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<sup>7</sup> Genuinely sarcastic.

we have to make the transition to clean energy. It disturbs me that the majority of green parties have the intention to phase out nuclear.

At one point Cursor Miner was lining up problem/solution tracks he considered Atom Smashers as a problem track and Clean Energy as a solution to that. But this is wrong. Actually Nuclear energy *is* clean energy.

In [this talk](#) we learn that coal causes 161 deaths per Terrawatt hour. We learn that nuclear causes 0.04. In other words nuclear energy is 4000 times less dangerous than coal. Bizarrely, it's also less dangerous than wind and hydroelectric (presumably because of the dangerous construction work? More people fall off the top of wind turbines than get killed by radiation?). Solar is safest of all, though perhaps a badly installed solar panel could fall off your roof and smash your head in.

Why do people not know this? Well, again, because stupid. I suspect people are scared of "nuclear" because it sounds the same as "nuclear bomb". You hear nuclear and mini mushroom clouds appear in your imagination. There's no such thing as a coal bomb, so it must be safe. Not true actually, explosions happened with alarming regularity in coal mines. In fact the reason there's no such thing as an actual coal bomb is not because it's safe, but because coal has got hardly any bloody energy in it. It's exactly the same deal as with terrorism and cars. Atomic power is exciting and freaky, makes good TV (*really* good TV, watch the excellent [Chernobyl](#) mini-series if you've not already), radiation is invisible and spooky, it glows eerily and makes you scared. It's basically concentrated ghosts. Coal is normal and boring and kills people every day, who cares.

In fact, the pollution from coal and oil kills *millions* of people a year. That's millions. About as much as the coronavirus. The number of deaths from the Fukushima "disaster"? Zero. The Tsunami that caused the disaster killed 15,000. And yet it's only the nuclear power station problem that we remember. Because being killed by water isn't as thrilling, and doesn't fit into your "oooh, we're meddling with forces we don't understand" primitive superstitious rehashed Judeo-Christian narrative. Because stupid people can understand a coal fire but not a fast breeder reactor they label the latter as dangerous and ungodly and want it banned. I suspect if you did a survey asking people whether a nuclear reactor like Fukushima could produce a nuclear explosion like Hiroshima many people would say yes. It sounds equally Japanese, yes, but it can't.

Everyone's heard of Chernobyl, which killed maybe 40 people at the time, and possibly up to 4000 people due to elevated levels of cancer over many years. Clearly not good no,

clearly terrifying. But [look at this list of industrial disasters](#). Many energy production disasters are way worse. Have you heard of the Laobaidong colliery coal dust explosion in China that killed 600 people? Have you heard of the Wankie coal mine disaster in Zimbabwe that killed 400 people? No, and with a name like "Wankie" you'd think you'd remember that wouldn't you? Maybe being in a coal dust explosion in a narrow tunnel deep underground far is more pleasant than radiation poisoning? Hmm. But still, I don't see why that should mean we can just ignore these miner's deaths (I admit, as a Miner, I'm biased). Wouldn't you agree that your assessment of risk here is a bit, well, wanky?

Furthermore, when considering the Chernobyl plant you are looking at a reactor that was built in the seventies, by a regime known for systemic corruption and disregard of human life. Modern reactors are far safer. And getting safer all the time, unlike fossil fuels, the use of which is getting more dangerous all the time.

So then there's the question of what to do with the radioactive waste. It's a difficult question. But try and gee your puny imagination up a little and compare the *scale* of safely storing containers of radioactive waste, with the scale of what to do with a trillion tonnes of carbon dioxide in the atmosphere, the scale of what to do to hold back rising sea levels from inundating coastal cities all over the world. The scale of entire countries undergoing droughts and crop failures. It doesn't even *remotely* compare. In fact I would say that the biggest future risk to nuclear waste containment is the negligence of a civilization that has collapsed due to climate breakdown.

## How Destructive Are We, Cosmically Speaking?

So the trendy thing is to say that humans are "destructive". And that seems impossible to argue with. The other phrase that trips off people's tongues is that we are "destroying the planet", and we accept that as gospel too, and the result is not a change of heart and collective action, but apathy and depression. I'd like to tweak this narrative a little. We are damaging the planet, not destroying it. The more important things are, the more you have a tendency to hysterically exaggerate it. Please do not. The more important things are, the more you have a duty to speak precisely about it.

As I said, there's not just a binary outcome of complete planet-death and being fine. So don't whinge about not being able to make a difference.

Sure, if you knew without a shadow of a doubt that we are really really utterly done for, and if you knew for sure that current behaviour will kill absolutely everyone and everything on the planet, then and only then can you say that your effort will not make a difference. But even in the worst case scenario, even if humans die out, there's several shades of Armageddon beyond that, how many of the mammals will be dead? What about being reduced to a few tough plants and insects? What about being reduced right down to only bacteria? Can we kill all the bacteria? Fat chance! That mother's splitting every twenty minutes.

So next time you hear someone say "we're killing the planet" please be fully honest with yourself and admit that this is alarmist nonsense. Even if we tried as hard as we could, devoted every single second of our waking lives for the next hundred years to eliminating life, even if we spent the next thousand years doing nothing else but building nuclear bombs, and we then let them all off at once, there will still be radiation-proof bacteria that live two miles under the ground that won't even notice. There ain't no killing those guys. To "kill the planet" you would have to scrape off the top ten miles of the earth's crust, oceans and all, and send it all into the sun, and if you missed even a few little bacteria in that process they would simply go ahead and spread all over the planet once more. And with another four billion years left on the clock they might even have a chance of evolving into something that can still get off the planet before the sun eats it.

So there's still a sliding scale, even there. Personally, I'd rather have multicellular organisms left over rather than just unicellular, it's still worth trying to take a nibble out of that total and utter destruction IMHO.

Responsible scientists say we are undergoing the sixth mass extinction event. This sounds big. But, for one thing, if you're worried about "destroying" nature, that number six should sound reassuring. The planet's done it five times before. It is we that are the noobs here. And if you take a closer look at the last mass-extinction event, you realise we haven't a hope in hell of matching it. I think to cement yourself in the canon of any list of events you should at least take the scale of the previous one and use it as a yardstick. And that let-all-the-nukes-off-at-once scenario I mentioned doesn't even come close. The power of the asteroid that wiped out the dinosaurs was *two billion* times that of

the most powerful hydrogen bomb ever. We have a measly 7000 nuclear weapons. In other words, even if the worst possible future awaited human civilization, we would still need to try at least 300 times as hard to make it into the mass extinction hall of fame. Damn. Due to all the crap that it threw into the atmosphere, the Chixulub event plunged the planet into complete darkness and lowered the average temperature by 15 degrees. 15 degrees colder! Holy bitch! Four degrees warmer is (literally) a day at the beach in comparison. Then if you ponder upon the fact that a single nuclear weapon could have redirected that Chuxulub asteroid, and we could even spot it coming... then our science driven "destructiveness" seems to have a somewhat different aspect.

There is also an interesting "diversity rebound" effect from mass extinctions. They are a bit like forest fires, in that they clear the ground. and new and more diverse forms then emerge. But don't get too chirpy - that rebound takes about ten million years.

Maybe you think that melodramatic exaggerations like this are helpful, that they inspire a sense of urgency and motivation. They don't. All that happens when you say such things is that people get more and more fatalistic and hopeless, and when was the last big problem you solved by kicking off tackling it in a spirit of fatalism and despair? Anyone?

And what has begun to infuriate me is that these misleading and hysterical exaggerations are treated with veneration on the left, when in fact they amount to gross distortions of truth as much as anything we like to decry on the right. For instance, if someone on the right were to describe immigration as an "invasion" you would scoff and say something to the effect of "Uh, yeah, are there literally armed forces of foreigners riding over our borders in tanks destroying everything in their path? No? Well, then it's not an invasion is it, you twerp". What in fact is happening is that someone is concerned with the dilution of the culture of their home country, and then suddenly they get hysterical and want to cause maximum panic and hence they reach for the most extreme word they can think of. Stupid, right? Yes, but, open your eyes - we on the left do this *all the time*, not only that and we don't even *know* we're doing it, we don't even see it as being in the same category of epistemological abuse. To quibble over the mere matter of whether what you have said is truthful or not is all of a sudden seen as

grotesquely distasteful when it comes to things that *you* care about. We are “killing the planet” and to dilute that statement in any way is to somehow defect from the cause. Well, all I can say is that this tactic ain’t going to work. Even eco-alarmism does gain full political traction, it won’t be able to tackle the problem in any harm minimising way because it is fundamentally mis-attributing projected measures of harm, which is mathematically provable to cause more harm than a more truthful weighting.

## What Would Make it Worth It? The Space Program “Versus” The Environment

So an interesting question to ask is - what creative act could make our destructive acts justified? What kind of thing could possibly be as cosmically significant so as to counterweight a 6th mass extinction?

Let’s run with a bit of hippy superstition for a bit: I sometimes imagine the Earth as a dandelion. At some point the pretty yellow flower starts to fade and wither and turn brown. It looks as though the plan(e)t is dying. Then, in place of the petals, the plant uses all its remaining energy resources to build fluffy flying machines, designed to carry the DNA of the plant on the wind, and carry it far away so that other Dandelions can grow in many other places. When the seeds have gone, the whole structure appears to wither away.

It may be that planets have a similar life cycle. It could be that the planet is conducting some kind of big push, where it gathers all its resources for its reproductive act - the sending of seeds into the cosmos. We may be the things sucking up and withering the plan(e)t, but we could be the builders of those flying cosmic seeds. No one ever said giving birth was easy. Maybe a plan(e)t dies once it reproduces, maybe other planets did this before to seed ours.

A baby will not leave the womb unless forced out by the mother's contractions. It's no stretch to imagine that life will not leave a planet until it is forced out. Maybe if forced to reconstruct an ecosystem on earth you learn some tricks that'll help you construct one on Mars, or in orbit. Who knows? To be honest this

idea just feels like I'm scrabbling around for a bright side. Maybe there is no bright side. But maybe you and I need a bright side to keep functioning.

Of course there is no planetary reproductive cycle. Life has been on Earth for a third of the age of the universe, there's simply not been nearly enough time for a cosmic reproductive cycle to get going, let alone time for it to evolve into anything complex. The likelihood is that we are here through a series of freak molecular accidents in the ancient seas. The likelihood is that there is no guiding force pushing us anywhere. The likelihood is that we are trapped and alone.

To refuse to go into space is to say we're happy with being trapped and alone.

I don't believe the space program is opposed to ecology, I believe it complements it. If we can live in space, then this is a great thing for nature, as we become less dependent on the Earth's resources. Perhaps Earth one day could even be left as a natural park, a living museum of life's origins. Nature would be allowed to flourish, the old cities and heritage sites could be preserved, and the real business of progress and creativity, and all the resource hungry things that threaten earth's ecosystem could happen elsewhere - in space. The Earth would be better off with less humans, space would be better off with more.

If we discover a "habitable" planet or moon that is not inhabited? There may be several in our solar system, potentially even habitable by extremophile bacteria from Earth. Even seeding a few bacteria into this world would be the second most creative act in the entire history of the known universe. Even without humans living anywhere, we could be starting a completely new tree of life. The bacteria, if they survived, would evolve and become who knows what. We could start that program now, but first we would need to make sure that places like Europa and Enceladus are truly barren and lifeless, because extinguishing things that are already there would be just one more supreme act of destruction.

What if in the further future we go out into deep space and end up creating a galactic web of life? Billions of planets full of living things, each evolving separately into myriad unique fantastic varied forms? I don't mean a galaxy full of humans, I mean a galaxy full of diverse endlessly creative evolving beings.

How is that real potential that we have not one of the most valuable and astonishing aspects of planet earth's ecosystem? How can you say humanity is a cancer when we have such vast creative life-giving potential? How many cancers do you know that have built spacecraft? How many cancers do you know that have sent musical recordings into deep space?

Cutting our life giving potential off and saying that life forever stops at the top of the atmosphere on one single planet seems to me a depressing and lonely future. Decreeing that space should forever stay lifeless seems a grotesquely narrow and destructive act - because you are closing off an unbounded cosmic future for life, diversity and consciousness. Earth will not last forever, we are its best chance to live on after the sun engulfs it. The last stars will extinguish 100 trillion years time. So by escaping the Earth, you can extend the lifetime of life by a factor of at least ten thousand. This is well worth trying, and astoundingly, we are *on the verge* of being able to accomplish it. Going from brief forays into space to sustainable living is a mere detail compared with the long struggle of evolving from bacteria to monkeys. An unboundedly creative infinite cosmic future is practically on our doorstep.

### About that "Billionaires Escaping To Mars" thing

When I absentmindedly mis-scroll to the comments section on space stuff I discover that there is, for some reason, the perception that space-billionaires want to create colonies in space in order that they can trash Earth and then escape. Huh? Does anyone think about the shit they type?

One more nonsensical conspiracy theory to add to our list. Firstly: no matter how much we ruin it, Earth will never, ever, be as harsh and desolate as Mars or the Moon are currently. If you had Mars-colonising amounts of cash you could far more easily escape devastated parts of Earth by buying some isolated, gated island in some remote location on Earth. That island would be far more pleasant than anywhere in space. Even if Earth becomes a radioactive, toxic desert wasteland it would still be easier to live here than Mars, which *already is* a radioactive toxic desert wasteland, but with a puny trickle of solar energy and bone-witheringly feeble gravity. Investing in that project from a purely elitist, selfish, greedy motive makes absolutely no sense. Do you see billionaires rushing

to buy holiday homes in the sub zero ice deserts of Antarctica? Mmm, nope. Is Mars like the French Riviera but without the hassle of poor immigrant trinket sellers? Mmm, nope. A good conspiracy should at least make some tiny amount of sense from the conspirators perspective. Poor marks for that one.

It is as if I announce to you that I'm going to go extreme endurance camping in Siberia for the winter, and your response is that I shouldn't just destroy my existing house for the sake of living in a tent in Siberia. Er, I'm not destroying my house by going camping in Siberia. I'm just going camping in Siberia. If my house gets destroyed by other people whilst I'm out that's really damned unfortunate, but a completely orthogonal problem to me going on this camping expedition. And, for the record, I *do* prefer my house to my tent in Siberia, my house is warm and comfy, and a tent in Siberia is not. I'm not going because I can live in luxurious comfort away from all you filthy poor scum, I'm going because it's an epic challenge, and I might learn something there, and ultimately I want my life to be an inspiring and spectacular adventure. Remember them? No, you might be too young.

Posted on literally every article about space exploration are reams and reams of comments that say, word for word, "Why are we going into space when we need to get our act together down here on earth?". Every time I see this I think three things - first, why are they mutually exclusive, second, why could you not not post this under anything else? Why space in particular? Why not post that on an article or video about, well, anything. "Why are we making more superhero films when we could be getting our act together on Earth?", "Why are we doing up our bathrooms when we could be getting our act together down here on Earth?", "Why are we going to Zumba lessons when we could be getting our act together down here on Earth?", "Why are we posting moronic, misinformed and unoriginal opinions under internet articles about the space program when we could be getting our act together down here on Earth?".

The very fact that it is *precisely* the topic of space exploration that elicit these comments questioning our treatment of our planet indicates that the space program is, actually, giving us a wider perspective on our place in the cosmos and bring home to us that our planet is tiny, fragile and incalculably precious. So by complaining about it you have made the case to engage in it. QED.

The third thing that crosses my mind is - did you not read all the other comments saying exactly the same thing on every single other article about this topic? Is this literally the first time a single thought about this issue has crossed your mind? Is this actually the first thought about *anything* that has crossed your mind? Where have you been until now? Are you simply a opinio-bot that was programmed by a teenage hacker three seconds ago? How are you contributing to the debate if you are advancing it by the same, initial, naive, illinformed, baby step that the debate advances every single time it starts on every single fucking article on every single fucking site every single fucking day of the year?

An attempt to remedy this endless repetition of the same tired old arguments is made by a website called Kialo. Here you can see a map of all the arguments, in a disc/tree like structure. You could imagine that every site where arguments tend to spring up in the comments (i.e. all of them) could have such mapping software, that analyses your post, shows you where on the map you are, and then you can simply navigate the map instead of rehashing the same old arguments and insults. It now hits me that I should look at these debate maps every time I begin to write an article like this. To do otherwise is simply to be ill-informed.

[Here](#), for example is the space budget debate.

So I take a look and there's already a good point there. Thanks, Kialo. Some one says we should be spending space money on providing clean water to those who need it. The next step: Why is it clean water that should get space money, why not homelessness, or deforestation, or cancer research, or road safety, or sex trafficking, or clean energy, or any one of the zillion problems "down here on Earth"?

Why is the space program that gets the chop first when it comes to using cash more altruistically? If you are looking for obscene wasteful extravagance, then there's plenty of that "down here on Earth". We spend 15bn a year on watching men try to kick a ball into a net, and they rarely manage it. We spend 400bn a year on devices designed to kill other people, which in reality we don't even want to ever see used. As we have already discussed, we waste half a trillion dollars a

year just sitting in traffic jams. We eat half a trillion dollars worth of junk food a year. We spend 1.5 trillion on tourism, which you may think of as "exploration", but is just people going to see and photograph things that millions of other people have already seen and photographed. We spend a trillion dollars a year on "Personal Care, Beauty and Anti-Aging", and let's face it, we still look like shit. As I mentioned earlier we spend 5 trillion a year subsidising global warming. And we need spend half a trillion a year on advertising in order to persuade people to keep spending all these trillions on all this pointless fucking crap.

And you would sustain all this banal trivial fuckwittery and yet cut the pursuit of exploring, learning about and experiencing firsthand the deep majesty of the wider cosmos? Mate. That is really desperately fucking sad.

It's also just economically wrong-headed.

Jeff Bezos makes the distinction between staying on earth with finite resources, and going into space to open up access to unlimited resources. And this is exactly right. If humanity wants to keep developing and growing, it has to go into space. There is a triangle of possible futures. In one corner is staying on earth with ever more strict rationing of resources, in another corner is staying on earth with strict population control, and in the third corner is moving out into space. Do you choose to be limited, or do you choose to be unlimited? To me that is a no-brainer. And you say: why should we listen to Jeff Bezos when he's a naughty man who doesn't pay enough tax? And I say stick to the damn topic of the conversation, we're talking about the cosmic future of sentient life, not tax law. You had your turn earlier, remember, and you'll get it again later.

There's nothing up there, you say? For a start even empty space, in our neighbourhood, is not empty. It's chock full of unobstructed, glorious, radiant sunlight. The amount of solar power available out there boggles the mind: 400 yottawatts. And if you've never heard of a yotta-thing there's a good reason for that - a yotta-thing is  $10^{24}$ , a trillion trillion things, and we rarely encounter that many of anything. Not even Jeff Bezos has yotta-things. Right now we're using about 1 terawatt: that's a trillion watts powering the entire human race right now from all types of energy generation. So out there is a cool four hundred trillion times humanity's total power consumption, just pouring out

into the void, going unused. Next time you curse your evil, wasteful, ecocidal self for leaving the bathroom light on, ponder upon that.

There are also whacking great lumps of precious metals up there. Not buried under unique delicate ecosystems, not under indiginous land steeped in oral history, not next to highly poisonable rivers that people and wildlife rely on for drinking water... just floating about waiting to be picked up. Many asteroids are estimated to be worth half a trillion each in material resources. We could double our species' face cream budget just by snagging a single one of those.

So you have abundant energy, and you have materials. With the right know-how this is enough to build *anything*. So we *need* that know-how. To me it seems grossly negligent to not put some effort into learning how to live, work, and build self sufficient outposts in space.

So we need to get up there eventually. However then the question is *when* do we need to go into space? Maybe not right now? Maybe things are so urgent we need to hold off a bit, spend 100 years sorting things out on Earth? Maybe the ecological situation is pressing enough to divert funds into sustainability instead? If I was Elon Musk or Jeff Bezos I would have to think long and hard about directing energy into space programs, when more urgent things could be done. Musk attempts to do both of course, and in the process has just pipped Musk to the title of world's richest man. The fact that someone can become the richest man in the world and their only comment is "That's strange. Ah well, back to work" is a cause for a celebration I think. The fact that the world's richest man pulls ridiculous space stunts with Bowie and Douglas Adams references thrown in is also cause for celebration. If you compare richest people over history and ask yourself "how did these people become rich?" and "what are they doing with their wealth?" you will again see tremendous progress. Once upon a time, the richest gits in the world would have piled up their fortunes by warring, plundering, rape and enslavement<sup>8</sup>. Now they achieve it by tinkering with silicon, electrifying transportation and recycling spaceships. This is *progress* I tell you. The fact there is a car heading into space with "Don't Panic" written on the

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<sup>8</sup> The world's richest man at one point was Ghengis Khan. The #meeto movement in Ghengis's time really had their work cut out, trust me.

dashboard and Starman playing on the radio is also brilliant, brain-tingling, silly, amazing, fun and inspiring. No, he's not perfect. But I already yelled into your thick ear that no one is perfect and if you demand perfection then you will completely fuck everything, so I don't need to now whinge about how the man can facilitate the two most inspiring achievements of the past decade and yet you people can only moan about the fact that his kid is called something stupid and how you should all just crowbar open your mundane little gossipy minds for once and try to get some perspective. No, I don't have to do that.

Again, people misunderstand the economics of this. It's not as simple as these billionaires having a fixed amount of money to spend on venture A or venture B, and that money vaporising forever once it is spent. To a certain extent their investments are opening up possibilities for new economies. It is fully possible that by spending 50bn on space and 50bn on sustainable technology that you kick start two industries eventually worth 1tn each, whereas if you invested 100bn in sustainable technology, you still only kick start a single industry worth 1tn. Obviously to have both is better, and it often pays to spread your bets by "diversifying your portfolio". When we talk about entire industries worth billions and employing thousands of individuals and opening up new untapped opportunities, it is not a linear, zero sum game. Oh, unless you refuse to leave your finite planet with finite resources of course, when things will indeed become a zero sum game, in fact they will become a *negative* sum game. So if you want your parochial misunderstanding of economics to become a reality then not going into space would be a good way to go about it. Again it's the "household finance" fallacy where you imagine that once you spend money, it has disappeared. And this is a fallacy you find everywhere on the political spectrum, from people moaning about billionaires spending habits, to people moaning about immigrants taking all the jobs. They are all equally thick. Creating a viable space economy is not taking away from the Earth's resources - it's adding to them.

Similarly the Apollo program did not make everyone poorer by exactly its cost - in fact it returned [7 dollars for every dollar invested in it](#), and many estimate that the return on investment from today's space program is even higher. So yeah, maybe there was an argument for investing that 100bn in environmental protection, or poverty alleviation, but then there's also an argument for holding

off and then investing the 700bn we *got back* from Apollo into poverty alleviation. Right? Except, you guessed it, putting money into poverty alleviation is not zero-sum either, so you would have to look at net benefit from both of those programmes and work out which was the best investment. Complicated isn't it?

And if you're worried about spoiling the pristine desolate environment of Mars or the Moon, and you're scared of the word "colonising" because it brings to mind imperialist genocide, well just don't. So you think life "spoils" planets? You think Neil and Buzz's footprints "spoil" the moon? Current estimates place the number of planets in the observable universe at about  $10^{21}$ , with at least as many moons. I doubt that twelve guys' flags and footprints have spoiled all that. That's a heck of a lot of wilderness. Dead planets are  $2^{69}$  a penny. If the ratio of "spoiled" to "unspoiled" planets is that high it would be ethical to spoil the shit out of a few thousand more just for diversity's sake. If the ratio of uninhabited planets to inhabited planets is a few billion trillion to one, it wouldn't hurt to halve it don't you think?

## We are already in space, we need to get better at it

When I was a kid I had a book called "Spaceship Earth", a phrase coined by Buckminster Fuller. Earth *is* a spaceship, learning how to sustainably live on Earth *is* learning how to live on a spaceship, and conversely, learning how to sustainably live in a spaceship *is* learning how to live on Earth. They are part of the same project of learning how to live in this universe. They are part of the same progressive scientific endeavour that creates the technology by which you live comfortably on Earth and which may one day soon create the technology by which people may comfortably live in space.

[David Deutsch](#) also makes the excellent point that we do already live in spaceships. In Berlin in the winter, if you weren't surrounded by the artificially constructed environment of your clothes or your house, you would be dead within hours. Like a spaceship, it is your house that supplies you with vital things like water and warmth. If we didn't have the life support system of our transport and agriculture systems, billions of us would be dead within weeks. We are already living in an artificially constructed spaceship, like it or not. It was

only by constructing these artificial environments that humans were able to stay alive, evolve and inhabit diverse parts of the world in the first place.

So, again, the Earth is not "nurturing" us. It's not like we could have just dossed about for a few million years, indolently plucking grapes from a vine that nature oh-so-generously provided us within arms reach of our comfy mossy recliners. I think this is extremely patronising to our ancestors, and patronising to hunter gatherer societies. Their life isn't a stroll in the park. Gathering is graft, hunting is not just a posh laugh either. It's damn hard to get enough to eat and drink, and you, mate, you wouldn't last 5 minutes. People who moan about how nightmarish it is living in modern technological society are being spectacularly entitled and ignorant.

This attitude is also stupendously condescending to animals. One thing that struck me on a Baltic sea beach this summer was the difference in body language between the humans and the animals. There were three species of animal on that beach: seagulls, crows and humans. The humans were lounging about, lying down, eyes shut, earbuds in, chilled. The most aggravated they got was when the queue for the cold drinks hut was moving too slowly. The birds, on the other hand, were seriously up tight. They were cautiously tiptoeing around, looking this way and that, they were tense, they were jumpy, they were paranoid and suspicious of each other and of us. They were hunting desperately for any scrap of anything to eat. They would fly away at the slightest unexpected noise or movement. This was *not* a relaxing day at the beach for them. The only time you see humans with body language this jittery is when they're about to commit or having just committed an armed robbery. And that's my point: being an animal is dangerous. You could get killed and eaten by some other animal at practically any point. You cannot relax for a moment. You don't know where the next meal will come from, or who might steal it from you. Being an average wild animal is analogous to being an extremely poor human living in the roughest and most lawless ghetto. And I don't mean that condescendingly to either animals or the poor, the opposite in fact. They're the ones staring the reality of living in this universe in the face. It is we who inhabit an almost hermetically sealed spaceship.

The reason that humans at that beach could just chill out was because they had constructed an artificial technological and cultural environment around them, a spaceship within the space of Earth's ecosystem, that meant they didn't have to constantly worry about the threat of finding food or becoming food. My biggest worry was not accidentally letting my gaze wander to the nudist section of the beach and getting an eyeful of the wrinkled, flabby flesh that had grown to an excessively ripe old age (and girth) thanks to the protection of the spaceship they were in.

The question of how to live in space comfortably is the same as the question of how to preserve this planet for future generations. Sustainable Mars habitations raise the same questions about cultivating ecosystems as we struggle with down here on Earth. What we definitely won't be able to take into space is our wastefulness. In an environment as harsh and unforgiving as space not a single ounce of one's resources can be wasted, not to start with. A valuable lesson that could be brought back to Earth. In the end, adaptation and survival comes down to diversity, and to exist on Earth and in Space means that life exists in more diverse places and can do more diverse things than it would if it were just on Earth.

Something to ponder is that the most common life form we know about that is living in space right now is not human astronauts, it is bacteria. Gut bacteria inside the human astronauts. If we really live in space it won't just be us. It'll be Earth's bacteria too, our fungi, our plants, our fish, our insects, maybe even our animal companions. If we go and survive, some significant part of our ecosystem has to go and survive out there too. How can that be bad for nature? Ask your intestinal bacteria: "Hey guys, do you want descendents living on frikkin *Mars*?" My gut feeling is that my lot are well up for it.

What we're weighing up here is 100 trillion years of limitlessly diversifying life spreading throughout our universe, against a few billion years of life on  $10^{-19}$  of a percent of that universe. In my view, the creative potential inherent in the former is so huge that we would actually be justified in jeopardising the latter to achieve it. In order for a diverse flourishing living cosmos to sprout from us here on this small, single planet, there needs to be a technologically advanced species on it, and they need to attempt to learn how to live in space. And the only way to

learn that is by doing it. Maybe that species needs to learn something fundamental before creativity on a cosmic scale is possible and safe? Maybe there's a big lesson that we need to learn before we go into space in order for our legacy not to simply be a bunch of killer robots turning every planet into grey goo? I wistfully imagine that lesson will be learned in the process of the climate crisis.

In the end, if you gave 100bn and *forced* me to exclusively choose between investing in a space program or a clean energy program, there would be no alternative but to pick Clean Energy. It hurts me to say that because I am such an avid space enthusiast, but right now we are all in one spaceship, and urgent maintenance is required.

But, really, that is *by no means* the choice we're facing. It is not a binary choice. The idea of it being a "choice" emerges from your simplified mental model of the situation. Your mental model is now picturing two globes, Mars and Earth, you're holding one in each hand and you're trying to think about which one is more important, and you think "Wow, Earth is way more important! What a revelation! Cancel the space program and spend the money on Earth!". But that mental model is decidedly substandard. Mars looks like a simple red marble from space. Earth looks like a simple blue marble from space, but Earth is not that simple when you get down here. There are a million and one insanely tricky problems on Earth, putting all of those on the left dish of the scales and putting Mars landings on the right dish as if you could solve all the problems on the left with the money you get from cancelling the right is fatuous. Let me tiredly tug on my now very worn out False Binary Alert Klaxon. Phuuuu.

But really, money spent isn't the point. Money is just a means to an end. And what is the end? To do cool shit. Ultimately the reason these billionaires want to go into space is that it is just really awesome. Just because you have forgotten what awesome looks like doesn't mean everyone has. Just because your balls are floating inertly in a jar of formaldehyde in an obscure medical museum doesn't mean everyone else's are. They want to do it because they think it fucking rocks, and what is wrong with that? You can take what they say at face value. They're just space enthusiasts, that's what inspired them as kids, that's what inspired me

when I was a kid, and it still inspires us now. That's what makes us want to get up in the morning.

Exploring space is simply a fantastic, stirring adventure. It is the greatest adventure left to us. Most importantly, it is the start of a million more adventures. If you can't see that then, sorry, but there's something a bit dead inside you. You have lost whatever sense of wonder it is that I feel, that sense of marvel and thrill that makes life worth living. Your mind has become so habituated to bitching about anything and everything, that you can no longer do anything else but whinge. You were born, presumably, with some sense of wonder and enchantment in the universe (though you were a somewhat insipid, lumpen and inert kind of child I'll wager), but over the years that little vital sense of delight you did have has shrivelled up and etiolated, and is now undisputedly extinct. I regret to inform you that there appears to be no hope for you ever experiencing the tiniest glimmer of fascination or joy ever again. The most magnificent, stunning, world changing event could happen tomorrow, and you would utterly fail to appreciate any aspect of it, only seeing in it a dim reflection of your own jaded bitterness. You have become a mean, fossilised carper obsessed with your own miserly penny-pinching puritannical virtue, to the expense of all who would dare do anything extravagant or ambitious or glorious. You: a resentful, quotidian, dried up husk of an individual who can only squint at life through the dark, narrow, spleen encrusted spout of your own cynicism. It would appear to me that the bright, keenly blazing flame of curiosity that has propelled humankind along its spectacular voyage toward an enlightened cosmic destiny seems to be utterly extinguished within the wretched depths of your sodden, tepid soul. I'm sorry to hear that. Please leave off poking at the almost-expired figure of humankind's visionary spirit, so that those of us who do still have the capacity to dream can try to resuscitate it.

No but really. How can you not be inspired by the idea of exploring the universe? How can you watch footage of the formidable Saturn V, the most powerful vehicle ever built, soaring impossibly, majestically, up into the sky on a journey to the frikking *moon*, and just grumble at such a waste of taxpayers money? How can you watch as a pair of gigantic boosters breathtakingly returning from space at thousands of miles an hour to land elegantly, synchronously, with exquisite precision, on delicately balanced on blazing pillars of flame to gently rest upon

their landing pads, and simply dismiss it as a *nouveaux riches* self indulgent folly? How can you gaze upon the staggeringly vast but razor thin expanse of drifting, intricately banded shards of ice - Saturn's rings as captured by the Cassini probe - and whinge about bothering over such a frivolous exercise in astro-nerdery? Please, try to wake the corpse of your imagination up just for a second... Life, that has stayed resolutely stuck to the surface of this planet for four billion years, might soon make a journey 300 million kilometers into the void and establish a foothold on what looks to the naked eye to be a tiny pinprick of pink light, and real actual men and women might live and experience their existence under a different coloured sky, passing their days and years of different durations on an entirely different world. How can you consider that idea and not be full of wonder and humility and awe and excitement and anticipation and admiration? No? Nothing? Hello? Is there anyone in there? What is wrong with you?

Sometimes we need to sort out bad things, sometimes we need to do awesome things. In my view, without the latter, there's no point whatsoever in doing the former. To give up on exploration, to give up on progress, to give up on doing new things, to give up on reaching out, to give up on big dreams and astounding achievements, this would be something that would make me give up on my own life. The fact that other humans are doing incredible things gives me joy and pride and excitement, where simply "fixing things" does not. Some of us are just built that way, and we will be the ones that bring the illumination of life to the cosmos, not you.

## It'll Be OK (More or less, well, depends how you define "OK")

My brain seems to get funny when I think about the potential collapse of civilization, it all seems so fragile. Some days when I'm feeling stressed and panicky, it feels as though we're all just hanging on by our fingertips. We could all just... SNAP at any moment. All of a sudden we're all at each other's throats. People think that collapse will be sudden and dramatic. Inevitably, Mad Max will pop into your head<sup>9</sup>.

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<sup>9</sup> Which is in itself interesting, as to me the very bleakest of dystopias are depicted in 70's films. Some of them are completely inhuman ordeals with not a single glimmer of hope for humanity. Whilst dystopian

We like to think that the veneer of civilization is very thin. Seeing the way people behave at boxing day sales would appear to bear that out. But on further consideration, civilisation is more resilient than you'd think. There's people who reckon that if the banking systems go down and there's no money in the ATMs then we'll all just sorta start killing each other and then it's *The End Of Humanity*<sup>TM</sup>. Similar feelings surround petrol stations, of all things. The last drip comes out of the nozzle and then it's full on Battle Royale. Gimme a break. I've not visited a petrol station for about four years and to be honest I'm feeling less homicidal than I've ever felt. Another one of those privileged cosseted, blinkered, melodramatic views of reality. For a start you obviously live in a certain time period, in a certain country, with certain stuff you consider essential, but isn't. You live in a country that's not had a collapse in recent memory. You never knew a time where luxury goodie yum-yums like cash, 4K video and petroleum didn't flow freely and you can't imagine living without it. Well turns out you can, turns out we did! Turns out people are doing, still, in other places you've never been to.

False Binary Alert Klaxon! It's not just a binary switch between Beverly Hills 90210 and *The Seventh Seal* - there's plenty of levels of varying dysfunctional rubbishness in between<sup>10</sup>.

Plenty of civilisations have collapsed. The Soviet Union collapsed quite recently, things were shit, gangsters took over, then an ex-KGB agent took power, but they're all still getting through, being Russian, using perfectly functional smartphones to post their Hey-look-Russians-being-crazy-again memes. Cambodia's civilisation collapsed, Rwanda's civilisation collapsed, Syria collapsed, Greek civilization (both ancient *and* modern) collapsed, China collapsed, the Roman Empire collapsed. The city I live in today was 92% obliterated in a few short years, at the end of which German civilisation had, basically, collapsed. I'm happy to report it seems OK now, architecturally impoverished maybe, but generally OK.

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science fiction is very much in vogue, it always maintains some hope and moral direction. I don't actually think that today's popular culture is so much bleaker than at the time of my birth.

<sup>10</sup> Actually, the plague years weren't that apocalyptic, given that all the other creatures on Earth were doing just fine.

Collapse is truly awful, by our shiny-comfy standards, but it's not *The Dawn of The Dead*, sorry to disappoint you. Your romantic ideas of being plunged back into the Stone Age and wearing squirrel-fur loin cloths like Conan the Barbarian, or red leather thongs like Sean Connery in *Zardoz* will not come to fruition.



*You in 20 years. Not.*

Civilisation may collapse in your country in your lifetime, but don't get too hyped about it, it'll just mean extra hassle, more drudgery, less new toys, more oppression and violence and less drinking beer in the sunshine. Just because you personally can't *imagine* it doesn't mean everyone will instantly die or go insane when it happens. To think that when *your* country collapses things will be more exciting and special than the stuff that's currently going on in Sudan, the DRC, Syria, Haiti, Puerto Rico or any other dysfunctional "shit hole" is extreme hubris of an exquisitely ironic bent.

Plenty of people would probably have predicted the collapse of civilization in the event of a terrifying pandemic. Nope. We're all still here. We're even mostly still being nice to each other (not on Twitter of course, but then that's not what it's designed for). After a brief, panicky flash of concern for the cleanliness of our buttocks, we steadied out onto an even keel again. With the exception of a few

conspiracy numpties, people struggle on through. And this is what will happen when climate change really kicks in. Things will suck, but people will get on with it, and they will turn out stronger people than us, inevitably. You might worry that western people these days are too "soft" to cope with situations like WW2 or the black death, well yeah we are. But we also don't have to. Kids will get born, they grow up in a situation, they adjust quicker than my generation will ever do. I have hit the age where I'm kind of "stuck" the way I am and I hate that. I strongly suspect that when the going gets tough, I will be too old and feeble to get going. I fear for my older self for sure. I guess I should start saving for that red leather thong *now*.

Post-climate people will be people who probably won't panic and reach for their gun when an ATM doesn't work. People who will find alternative solutions when their local gas station shuts down. People who will learn lessons and have values we can't even imagine. People who will have a similar opinion of us as we have of decadent Roman slave owners, the torturers of the Spanish Inquisition, Nazi concentration camp guards, or any other of the degenerate immoral fuck ups that we've consigned to the dustbin of history. We'll be joining them in that dustbin quite soon. When Greta Thunberg bitterly lays into the generation that betrayed hers, we lefty liberals cheer her on, without really realising that it is *us* that she's berating. You and me. Really. Because, let's face it *we're* not going to sort it out. With our carefully sorted recycling boxes and our organic veg boxes and our cycling holidays we haven't even been able to stop the rate of growth of CO<sub>2</sub> emissions. The only things that slowed the rate at which we were chucking stuff into the atmosphere a tiny amount was a global recession and a pandemic, and look how much everyone whinged and bitched about those. Someone else will have to clean up our mess. Maybe the kids who are being born now, maybe the next generation after that. But eventually they'll do it and they'll probably have learned a lesson, the only way big lessons are ever learned by idiots, the hard way.

As I mentioned earlier, maybe our generation's job is not to solve the problem of global warming, but solve the meta-problem of setting up institutions capable of solving the entire class of problems that global warming is an example of. Just as Alan Turing, whilst solving the problem of working out what the Nazis were up to, solved an entire class of information processing problems that led to the

modern computer. And don't think that our scientific knowledge will somehow be lost in the cataclysm. There's too much of it. The internet is a decentralised distributed system and will be easy to revive if damaged. If you want to know how a piece of technology works, read a website, or just go to a landfill site and pick one up. There's millions of books lying around. Don't worry Gen ZZzz, in the dystopia you will inherit, there will still be WIFI!

I said in the Winston Churchill chapter that the WW2 is the creation myth of the modern world (we still call it the "post war" world after all. I still strongly doubt that post-pandemic will be a more persuasive term than post-war).

Environmental disaster will form the creation-myth of the next phase of human civilisation. Like all creation myths it will be traumatic, surreal and fucked up. Like all creation myths it will form the subconscious bedrock of future morality. Like all creation myths it will have a clear line between "before" and "after" some cataclysmic formative event. Like all creation myths it will have good guys and bad guys. You and I, I'm sorry to say, are playing the baddies in this tale, but as I said that doesn't mean we *are* bad.

Creation myths are destructive, but they are also creative (the clue is in the name). If you look at the technologies we use today, most of the true innovations were invented in either the second world war or the 1960s. If you consider that the 60s was a time of creativity that was a rebound from the war, and benefitted from the increased levels of having-our-shit-togetherness emerging from the war<sup>11</sup>. Then we can see that necessity is the mother of invention, and that a good old fashioned mega-crisis is the mother of all mothers of invention. The grandmother of invention if you will.

When our climate falls apart, that will necessitate some *serious* inventiveness. Whilst I'm deeply pessimistic about the amount of human suffering in store, I'm deeply optimistic about the amount of human ingenuity in store. What a shame that the latter utterly fails to justify the former. So I really don't buy the idea that

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<sup>11</sup> For example, the Saturn V that took astronauts to the moon was Von Braun's further development of the V2 flying bomb, the computer tech that was invented in the 60s e.g. [the mother of all demos](#) were running on the transistor, which emerged from war-time efforts to make diodes used in radar units, and the first computer science came out of wartime efforts to crack Nazi secret codes etc. etc. You might think that our free market and our academic institutions encourage innovation, but as I will discuss later, that's just bullshit.

civilization will "collapse" in the sense that we will literally be back in the dark ages or some such. If you really think about how much information would have to be completely erased to get back to the dark ages, it is actually impossible. Even if we totally wipe ourselves out, and rats then evolved to be as smart as we were, their archeologists could work out enough from all the shit we left lying around to skip over their own dark ages in a few decades. There's just far too many clues lying around.

My estimate of how close I am operating to my current creative capacity is about 20%. In other words I reckon could be at least five times as inventive and resourceful if really pressed, if my life depended on it. I think the same applies to humanity as a whole. We're currently occupying ourselves with designing slightly more chiseled looking cars, slightly silkier face creams, slightly tastier snacks, slightly flashier lights, slightly more desirable eurorack modules, laptops with slightly less connectivity, screens that extend slightly further towards the edges of their housings, somewhat bouncier trainers, a smidge more distracting advertisements, a notch more banality in reality TV, a few less problematic phrases... so not only are we all working at 20% creativity but we're also spending 80% of that 20% on a whole raft of useless fucking crap. So I would say that 96% of what we put our minds to all day is more or less worthless. Given a proper crisis, and some reasonable focus, I think we could do better. It might even be slightly fun at times. It might even be inspiring.

## Next Time

Thanks Mike. Is it me or has thinking about bigger topics mellowed you slightly? Do I detect a strain of humility in your voice as you contemplate the vastness of the deep cosmic future? Is the end of side one the turning point for Mike? Is this albook going to be a story of reconciliation? Are we going to welcome him back into our fluffy liberal bosoms? Maybe. Who gives a toss anyway?

So. Enough of mere opinion. What about real objective, indisputable, provable nice clean theorems? To get there we shall need to ascend the ladder of abstraction from physics to mathematics. That's right in the next chapter we're going to meet our skinny mathematical friend, One Dimensional Man.