

H+ Underground: a transhumanist biohacking primer
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The question of what makes a human unique is timeless. This our ancestors' ancestors asked themselves as they sat discussing stars and gods around their hearth fires. We have constantly been asking ourselves what separates us from the other species of Earth.

One answer to this is our drive for self-improvement. Another is our sentence: the peerless ability formed of introspection, logical intelligence, empathy and abstract thought. The combination of these two is the philosophy of transhumanism, which seeks to improve life itself, for all of humanity. We are able to take steps towards this Cyclopean and nebulous goal through technology. This essay will examine traditional transhumanism as it has emerged since the late twentieth century, and compare it with a newer permutation. I will then discuss certain experiments which I have carried out in the name of transhumanism, their results and what I have learned.

one: transhumanism

Transhumanism is the desire to change human life for the better through technology. A life so altered as to no longer be human at all is called *posthuman*. Philosopher Nick Bostrom, of Oxford University, sees the movement as beginning thousands of years ago when our ancestors sought to extend their own lifespan¹. He defines it as simply the quest to “extend the capabilities” of a human body and mind. The former World Transhumanist Association, now known as Humanity+, speaks in its *Transhumanist Declaration*² of overcoming certain limitations which are perceived to halt humanity's progression towards realising its full potential. In its *Transhumanist FAQ*, it defines the philosophy³:

(1) The intellectual and cultural movement that affirms the possibility and desirability of fundamentally improving the human condition through applied reason, especially by developing and making widely available technologies to eliminate aging and to greatly enhance human intellectual, physical, and psychological capacities.

(2) The study of the ramifications, promises, and potential dangers of technologies that will enable us to overcome fundamental human limitations, and the related study of the ethical matters involved in developing and using such technologies.

In practice, modern transhumanism is a combination of these two basic principles: firstly,

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- 1 Bostrom, Nick. *A history of transhumanist thought*. Journal of Evolution and Technology, vol. 14, issue 1. 2005.
 - 2 The Humanity+ Transhumanist Declaration (<http://humanityplus.org/learn/transhumanist-declaration/>). Retrieved 7.04.11 11:20
 - 3 The Humanity+ Transhumanist FAQ, question/answer 19: “What is transhumanism?” (http://humanityplus.org/learn/transhumanist-faq/#answer_19) Retrieved 3.04.11 13:04

transhumanists seek methods to help them overcome human limitations of the most innate kind. These often include that which has heretofore been inevitable: ageing, death, imperfection. Our physical strength and mental acuity, potent though they may be, are baselines for improvement in transhumanist eyes. Secondly, transhumanists seek to give humans new capacities that the unmodified body is not equipped to allow, or they seek to extend its existing capabilities. Together, these two ideas - an existence more capable, less limited - form what most people know of the movement.

Some brief history is in order, here, to give context. The word “transhuman” has been in parlance since the exploratory days of the 1960s, when it began to be used by a futurist named FM-2030, who was a lecturer in California. He published a book in 1983, titled *Are you a Transhuman?*⁴ aiming to bring the word, and the philosophy, to the general public. By this point the futurists, whose business had been mostly in predicting details of future society with either warnings of doom or cries of elation, had largely been absorbed into the fledgling transhumanist movement. The two words are now synonymous in common usage. The World Transhumanist Association was founded in 1998, by Nick Bostrom and another philosopher named David Pearce; it released the original *Transhumanist FAQ*, a seminal document which is often used to introduce newcomers to the movement, in 2002. This association became the organisation known as Humanity+, which publishes the transhumanist digital magazine *H+ Magazine*⁵. It continues to this day.

Because there are so many currents of thought within transhumanism⁶, applications of the philosophy are manifold. They can include cryogenics for immortality, attempts at hormonal solutions to ageing, and cybernetics to add to our capacities within the modern environment, correct medical problems and improve our quality of life. It has been frequently argued that almost everyone living in a First World society benefits from at least one transhuman technology: vaccinations, pacemakers, contact lenses, laser eye surgery, piercings are all unnatural, artificial inventions and candidates for H+ technologies.

The intelligent audience will notice several things when reading the official publications of Humanity+ or published summaries of the work achieved to date. The entire movement, from the editorials of *H+ Magazine* today to the joyous writings of FM-2030 forty years ago, has been excruciatingly theoretical. Very little in the way of actual applicable transhumanist technology has been brought to the general public; cryogenics exists, but it is prohibitively expensive and like purported hormonal treatments for ageing, it does not achieve the aim its inventors set out to. Nobody has yet become a posthuman and nobody can try, as the field stands today, without tens of thousands of pounds in savings to spare. Although Dr. Kevin Warwick of the University of Reading⁷ has worked with human nervous control of robotic prosthetics and “purely electronic communication between the nervous systems of two humans” - that is, stimulation from input by Warwick's wife into his nerves - these experiments' results are not available to common people. You may read Warwick's published papers if you subscribe to scientific journals; but you, the reader, cannot replicate his methods without a private surgeon, research grant and laboratory of your own. You cannot buy proprietary implants based on his findings, nor would you be able to fit them to your own body if you could.

This is a symptom of the problem that repeatedly, endlessly plagues all transhumanism: exclusivity. It bars people's participation in the practical side of the theory. It makes money a

4 FM-2030. *Are you a transhuman?* New York, USA: Warner Books, 1982. This book is available in its entirety online at http://fm-2030.narod.ru/ARE_YOU_A_TRANSHUMAN.pdf.

5 H+ Magazine (<http://hplusmagazine.com/>) Retrieved 30.03.11 19:42.

6 The Humanity+ Transhumanist FAQ, question/answer 46: “What currents are there within transhumanism?” (http://humanityplus.org/learn/transhumanist-faq/#answer_46) Retrieved 30.03.11 00:01.

7 Dr. Warwick's biography lists his activities in short, located on his UoR home page. Kevin Warwick's home page (<http://www.kevinwarwick.com/>) Retrieved 5.04.11 18:34. This is also the source of the quote “purely electronic...”

prerequisite condition for the improved quality of life that ought to be humanity's by right. It leaves the general public largely ignorant of a philosophy that has the potential to radically alter every aspect of their lives. It is what led to the creation of a movement without a name, a counter-group that quests after practical developments accessible to all.

two: underground

This movement has been called by some “grinding”, and by others “biohacking”⁸. (I personally prefer and shall use the latter term, since it is what others call me, but they are interchangeable.) On this subject there exists very little formal information; biohackers, as a rule, are ordinary members of the public, and document their work privately. There are no grinder scientific journals. The movement is anarchical, but cooperative; biohackers share data, findings, thoughts and techniques⁹.

At its simplest, biohacking can be said to be an offshoot of transhumanism, a splinter group of a splinter group. It shares the goals of its parent philosophies: human improvement through technology, and the development and study of that technology. Indeed, referring to biohacking as separate from transhumanism is an error: it is really a specialised sub-type. However, it is far less concerned with the future state of humanity as a result of such improvement, or with academic discussion on ethics and social change. While transhumanism is a philosophy, biohacking is something else; it is closer to a fledgling branch of science, without any of the funding or unified knowledge, made up of everything and anyone the public has to offer. It is an underground, with no admissions policy and no qualifications necessary. It is about what small, cheaply-produced “hacks” can be tweaked into the human body. These are generally implanted devices but could also include “homebrew” designs of anything else: legal drugs, other types of devices such as haptics, and anything else considered an enhancement to the body. A prerequisite of such hacks is that they are available to everyone who wishes to learn about them; results are generally placed on blogs and websites, and usually code is 'copylefted' under the GNU General Public Licence.

The first and major difference is that biohacking, by its very nature, is done by and for those who have little money to spare. Traditional transhumanism often involves incredible expense, and it tends to assume that this is an inevitable cost. It is rare to find a grinder who would ever be able to afford cryogenic vitrification. Indeed, as previously stated, the fact that the main transhumanist options are not only prohibitively expensive, but also definitely not solutions to death or ageing, make them widely perceived as “wastes of money for rich people”, driving newcomers to the underground in search of something that will not waste what little finance they have. In fact, economic difficulty is what leads many members to become hackers in the first place, since even common transhumanist books cost more money than they have to spare; within the newer movement, those with low budgets can contribute to the forefront of the development of humanity without a multi-million-pound philosophical institute's backing, or a research grant on top of a University degree. Many feel excluded by the purely philosophical tone of discourse when they have no background in philosophy. Biohacking is a way away from this, a source which at least “talks straight”.

Biohacking is distributed, communicating via the Internet. This is also partly true of transhumanism, which is clustered around several organisations whose main presence is on the Internet, with some boasting substantial offline presences as well. The biohacking movement cannot parallel these; when we work offline, we work for the most part in solitude, whereas transhumanists

8 I first saw the term used to describe myself, by a stranger on a gaming forum. It pops up frequently also at Grinding.be, a biohacker news hub (<http://grinding.be/>). Last retrieved 02.04.11 18:21.

9 I am one of the original members of this movement, and will attempt to contrast it with traditional transhumanism in as unbiased a manner as possible, but my affiliation must be taken into account when considering my argument.

can attend conferences and meetings on regular schedules if they so choose. The traditionalists' online presences are rather more centralised, with websites and communities which focus on discussing the deeds of a few and the received wisdom of authorities such as Natasha Vita-More or R.U. Sirius. They have support from Humanity+¹⁰, the Extropy Institute¹¹ and the Kurzweil AI forums¹², amongst many other smaller sites; biohackers perform experiments on their own, but log them at the hub biohack.me¹³ and receive news of others' successes and failures via grinding.be¹⁴, where they add to the community wiki and discuss thoughts on the message board. There are email lists, discussion groups over Usenet, Yahoo! and IRC, a myriad of private forums and blogs, and smaller news-gathering websites on both sides. Strong social networks are an advantage of both, but it is the biohackers who have sites specifically created for working together on problems, one of the founding imperatives of biohack.me.

Such problems differ vastly from traditional transhumanist pursuits once one digs past the surface category they occupy. In comparison to issues tackled in the 1990s and early twenty-first century, biohackers' small experiments seem trivial, useless in the wider scope of human progress. It is exceedingly common to be asked with utter bafflement *why do this?*, by onlookers who see much pain and expense for a tiny device with a very specific, medically unnecessary function, one that they would often not accept themselves even without the associated costs. A transhumanist is the human who writes a startlingly prescient book about the way future laws will have to be adapted and rewritten to cover the changing needs of people with extended sensory input. A biohacker is the one who sits at their kitchen table sterilising their hands so that they can insert a prototypical sensory extension device.

Our output too is different, but complementary. The old school produced books like James Hughes' *Citizen Cyborg*¹⁵. The new school creates single experiment logs, shared over multiple sites, tiny building-blocks of experience and information. A truly useful approach uses the books as guides and the experiments as tools, together.

It is instrumental to look at this issue also as a difference in design techniques. A transhumanist is quite like a software architect using the large, verbose and codified Unified Process, whereas a biohacker is more like an Agile programmer, free to work closer to the way they'd like to so long as they remain responsible. The Unified Process has been around for far longer, but is considered to be a little less grounded in realism. Only one architect works on a project, whereas many programmers do; the architect uses codified design tools and rigid structures, but the Agile programmers have considerable leeway to create their own process for development as long as it works. The architect is concerned with the wider structure of the project as a whole, whether it will work, and what the client will think of it; the programmers each just want to get their own little nugget of the task working. They work independently, but they'll help each other out if they're asked to, and they work together to get their modules to interface for the good of the project. They have only surface knowledge of the Unified Process; the architect does not need to understand how to debug the programmers' code. Both kinds of person are necessary for a successful project, but to work with the architect successfully, the programmers have to change their paradigm a little, and vice versa.

This schism is a double-edged sword. Biohackers were created out of the frustration of many with the stagnation of the existing H+ groups, who seemed to be eternally mired in intricate dissections

10 Humanity+ home (<http://humanityplus.org/>) Retrieved 20.03.11 21:02.

11 The Extropy Institute, which has closed but now forms a social hub (<http://www.extropy.org/>). Retrieved 20.03.11 20:34.

12 Kurzweil AI Forums (<http://www.kurzweilai.net/forums>) Retrieved 21.03.11 12:02.

13 Biohack.me (<http://biohack.me/>) Retrieved 22.03.11 15:07.

14 As in footnote #8.

15 Hughes, James. *Citizen cyborg: why democratic societies must respond to the redesigned human of the future*. Colorado, USA: Westview Press, 2004. ISBN 0-8133-4198-1.

of nothing but very well-informed guesswork about the potential of humanity. It seemed to us that without a contingent of human beings, learning from each other's mistakes, to get up and *do something* about the implanted devices we spent all day talking about, the future we dreamed of could remain nothing but evanescent mist for another century. However, there is a concrete and permanent necessity for the theoreticians of our world, the respected authors who bring transhumanist dreams to the public, or the scientists with actual laboratories and real surgical assistance; though we are free to investigate the actual devices however we wish, it is these people who can influence social authorities and their policy. It is the old transhumanists who can truly bring devices to everyone, even if it is hackers who are in a better position to actually develop those devices. We lack the public reach of Ray Kurzweil or the authority of Dr. Kevin Warwick, and they lack our grass-roots community and collective, collaborative power. These architectural differences make the two groups immediately discernible to outsiders, but in fact matter little in our eventual goal; if a biohacker's invention is successful, it becomes popular. If it becomes popular enough, with time its use will become common amongst the hackers, and spread to their friends and supporters. It will be noticed by mainstream transhumanists and recommended to them. They will try it, since the beta-testing will already have been completed by the hackers themselves and the device will be as painless as possible. They will recommend it in turn, and write about it, and in this manner the groups end up working together in the end. I have seen this happen with the creation, development and distribution of the Northpaw device¹⁶ a haptic wearable compass created by the Sensebridge hacker collective. I have no doubt that it will happen with other devices as we create and refine them.

All these differences make the two groups distinct, but that is no reason why we cannot work hand-in-hand with our colleagues. Without the structure and public influence of the older faction, biohacking has little chance of being taken even remotely seriously. If Ray Kurzweil were to start suggesting that we were doing the right thing, our numbers would triple overnight; Facebook groups and donations and suggestions would flood into our close-knit hubs of discussion like a tsunami into a harbour. Since Dr. Kurzweil has never heard of us, however, the divide remains at the time of writing; biohackers continue to be frustrated with the head-in-the-clouds attitude of conservative transhumanists, and they in turn continue to see grinding as an exotic species of self-harm that occasionally stumbles upon some good results.

three: experiments

Having set up the context in which I carried them out, it is time to discuss the experiments I myself have performed. I work within a niche of biohacking: I seek sensory extension, that is, the addition of new senses to my body or the expansion of the senses I already have to give new input to my brain, or both. To this end I desire functional subdermal electronics which can provide me with capabilities my existing organic system regretfully cannot support, and further to that end, I have experimented thoroughly with the basics of implant design, installation, maintenance and removal. I have also become somewhat of an expert in the procedures necessary to safely install these devices into the flesh, and to remove them when the time comes. This is an unfortunate necessity not relevant to this essay save in passing mention.

Because of the attendant pseudosurgery, though, I cannot describe these experiments without giving the following caveat. I am unconnected with the medical professions. I am not a doctor, surgeon, nurse or even friends with any medics; I am a biohacker. I describe the experiments I have carried out of my own free will so that others might learn from their consequences, negative as well as positive; I

16 The Northpaw project homepage. (<http://sensebridge.net/projects/northpaw/>) Retrieved 06.04.11 19:03.

am not giving a guide. It was and continues to be agony of the highest order - for me, the knowledge that results is worth any pain. I would die for it. You, the reader, would most likely not, but if you copy me you risk your life and health. Inform yourself and decide for yourself; I am not encouraging you. The majority of readers will not want to follow me in any way, and this is as it should be.

I did not start off intending to look into sensory expansion, but was catapulted into the niche by my first experiments. The first implants I investigated, after some cursory toying with RFID¹⁷ ampoules used for security, were invented by an American piercer, tattooist and body modification artist called Steve Haworth. They are small disc-shaped magnets, made of the rare earth metal neodymium and coated in gold leaf and medical silicon to make them safe for implantation ('bioproof'), with a 2mm radius and 1mm depth. They cost about forty to fifty pounds each. Haworth invented them so that the user could pick small metal objects up and tell what was magnetic; I had one professionally installed, during a brief legal window before they were banned in Britain, and quickly discovered a bizarre tingling sensation when near electronic devices that were turned on.

At first I put this down to the implant's vibration, but after this occurred separately I realised it was not the same sensation. It was positioned in my fingertip, and I eventually worked out that it was resonating with the electromagnetic fields from the devices, generating a charge of its own which would ordinarily be far too small to perceive. But in such a nerve-dense area, it was actually stimulating the nerves - what I was feeling was a new sense altogether. It has a range of about 10-30cm depending on the strength of the field being sensed, and feels a lot like a gentler "pins and needles".

I set about obtaining more nodes, determined to find out whether this sense would have a merely cumulative effect or whether the little nodules would synergise, as eyes and the nerve endings for touch do; within a short space of time I was nearly at the maximum of six¹⁸ after some home implantation. I did not get the answer to my question of synergy¹⁹; I did, however, develop a far more cost-effective way to produce the nodes, one that involved neither gold leaf nor silicon injection moulding but rather a safe compound called Sugru²⁰. The technique is now in use by other hackers to produce these and other implants, and I sense electromagnetic radiation. The experiment was, in my eyes, a valuable success.

My current project builds on what I learned during the course of the others, and is currently in the very early stages of collaborative development (it sparked the creation of biohack.me and another similar site, selfmodifier.org, specifically to deal with the interest.) I aim to develop a haptic, subdermal compass, using a microcontroller and a ring of sixteen subdermal electrodes as output. It will be powered from an internal charge-holding cell, which is recharged nightly by an inductive loop whose counterpart resides in a "charging pillow".²¹ The electrode closest to North gives off a constant signal, making the device a sensory one rather than one which needs to be checked; a Web search of the name I gave it, the 'Southpaw', will show its current progress. It promises to be a rewarding experiment to carry out, with much to be learned and implemented.

What I learned from these experiments was primarily the principle of nerve stimulation. It is common knowledge that nerves are simply electrical conduits serving the central nervous system, and that areas of the body such as the fingertips and cornea are very nerve-rich. Sensors in the body, such

17 Radio Frequency Identification. A ubiquitous technology usually used to track stock items in shops or cows in fields.

18 The thumb and index fingers on each hand cannot be used for nodes, due to the discomfort, and they cannot share fingertips because of their larger size, so a full array of the nodes is six per human.

19 Far more sensitive instruments are required in order to measure the current properly than I, with my car-battery voltmeter older than I am, can provide.

20 I did not invent or name Sugru, which can be looked up on its website (<http://sugru.com/>) Retrieved 8.04.11 10:03.

21 More details of this design as it evolves are best found on the Discussions part of biohack.me, under the label "southpaw". I am a regular there and will probably answer your questions myself.

as nerve ending corpuscles, set off nerves with electrical conduits. There is no reason why artificial sensors cannot do this too. They need to be no more complex than simple magnets; anything that generates a charge will do the same job the nodes do, if there are enough nerve endings in the implantation site and enough charge. (There are very few places in the body with enough endings, and I have found after much trial and error that nodes can only be placed in the meat of the fingertip pads.) This is what my neodymium nodules are doing, and it is how the Southpaw will output data. It is a simple, elegant and reusable concept: any kind of device, so long as it functions subdermally, could use electrodes to provide output to the nervous system. Indeed almost anything can be attached to an electrode and redesigned to output current. Anything could be a nerve-stimulating device so long as it fits beneath the wearer's skin, and therefore almost anything could function as a rudimentary sense. The possibilities are staggeringly close to infinite.

Another interesting observation: once they have been successfully installed and the user has had time to adapt, the implants function just like any other sense. They give sensation when something's there, and none when it's not. The input is suspended when I sleep, just like the other senses; as far as the community of those who have these devices can tell, they have been assimilated neatly into our nervous systems and now act as if they were always part of us. They are unintrusive and as "natural" as can be - I am no worse off for having them, and the extra data they provide about the everyday world fascinates me.

four: conclusion (hopes)

I have already stated numerous times that a schism exists between biohackers and other transhumanists. I wish that were not the case, and I hope to see it narrow as time goes on and the technology we both advocate becomes more mainstream. I hope to see my own experiments, the biohacker community, and transhumanism itself grow as my life continues, and to work together with anyone who is allied to any of these causes. I do not think I will live to meet a posthuman, and I have doubt that I will meet a true transhuman during my cursory lifetime either, but I relish the work I can contribute towards these states of being and I take pleasure in gradually understanding and honouring with refinement the far greater work of others. It would be trite and naïve, too, to think that the ideological gap between biohacking and the rest of transhumanity will ever disappear. What happened to the old gap between futurists and transhumanists gives me hope that one day, biohackers will be seen as the same kind of person, in a different light: just as valid, their contributions to the movement just as valuable. I hope to see other people grow interested in grinding, take up the cause, and do more for it than I and my feeble experimentation ever could.

I hope to see the Southpaw project mature into a useful and informative device for hackers to use, and to see its principles reused by others who can implement them in even more useful devices. I hope to hold the first prototype in my own hands, test it under my own skin, and later refine it alongside others who have done the same.

Like every other transhumanist, I look forward to the future with anticipation, with pride, and with a numinous awe for our species and its transcendence of Nature.

In the words of author David Zindell: "Those who would bring light must endure burning." We endure it with joy.

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Kurzweil's Singularitarianism website (<http://www.singularity.com/>).

Anders Sandberg's transhumanist resources page (<http://www.aleph.se/Trans/>) Sandberg is a noted transhumanist, and this page links all his essays and writings together. They are well worth reading if you are at all curious about H+.

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A particularly interesting take on the singularity idea by mathematician and singularitarian Vernor Vinge (<http://www-rohan.sdsu.edu/faculty/vinge/misc/singularity.html>) - please let it be noted that I don't share this idea, common though it is. I include it for context and interest to the reader.

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