Self-Driving AI builds habitat throughout uninhabited galaxies and most of the Milky Way. Virtual Reality efficiently creates unlimited space for as many people as possible. Many people continue living on planetary surfaces.

Details of how to build all of the technologies to make this possible are described here. Also, some discussion of what should be done and why. Something of a 'how-to' guide.

Reading

Terse. Somewhat a combination of a little 'policy' (mostly in the preface), a little 'philosophy' (mostly in the problemSolversGuide, defining real success as happiness) and a lot of technology designs.

problemSolversGuide

A guide to technology development for newbies. Mostly can be summarized as 'universe is very simple, just a bunch of electrons, photons, and here are the few useful things that can be made from those'.
*) Exhaustively defines real success as happiness.
*) Exhaustively explains the universe predominted by just electrons and photons is very simple.
*) Technology is simple (even biology) - feedback and logic gates.
*) Activities are categorically simple (eg. exploraton, PvP, PvE).
*) No handwavium or unobtainum.

cognitionSplicer

Brain copying and brain-to-brain connection software algorithms for neural interfaces. How to correlate neural activity recordings to synapses and connectomes. Amount of neural activity and electrode sites that must be recorded. Amount of computer time. Electrode site calibration from correlating neural activity to connectomes.

neuralBits

Neural interface (CNS) sufficient for virtual reality, brain copying, brain-to-brain connection. PCB layout, threads punched at breakaway. Why other neural interface designs would be less optimum for human brain as-is.

mechDive

Directional tunneling and similar tools for minimially invasive surgery, especially for PNS nerve interfaces. Mechanical full-dive VR exoskeleton and low-cost mechanical tactile pixels. Eddy current brake and artificial muscle bowden cable pullers to power exoskeleton and/or directional tunneling. These separate 'mechDive' technologies are closely related by their underlying mechanical technology, though minimally invasive surgery and VR exoskeletons are obviously very different purposes.

CARDinal

Object, position, rotation message specification for shared 3D spaces. Inter-process communication using that message specification between game engine and standalone programs (eg. flight model, avionics, VR desktop overlay). Limited trade between WORLDs without persistent blockchain. Anti-cheat by statistics and reputation without prohibiting automation entirely. Visual effects (eg. fluid physics) compressed and distinct from consequential actions checked by anti-cheat. Bandwidth estimates relative to existing and expected internet, Starlink, amateur radio cubesat, etc, networks. Possibly vaguely similar in principle to VRChat specifications.

lithoDive

Photolithography and high-resolution low-maintenance 3D printing tool, thoroughly automated and EUV compatible. Estimated time to prototype own neural interface and GPU hardware using this low-cost machine. Illustrations of best optical principles, compact optics packages, low cost optical mounts, etc.

positionTrackers

Track object position using a microcontroller with low-cost redundant inertia, magnetic, optical emitters/sensors, and laser speckle (equivalent to a laser optical mouse). Low cost PCB layout. Integrates rather than replaces existing VR controllers. Usable as a VR controller, VR exoskeleton force-feedback sensing, or as 3D printer calibration, etc. Similar to existing Oculus/Vive/etc VR controllers.

sleeveDive

Brain in a vat.

cryogenicComputer

Computer in a thin metal box. More compact, more reliably completely cooled to very low temperatures.

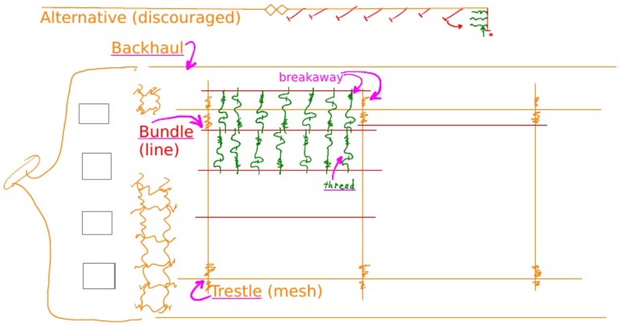
flightDeck

Flight 'simpit' chair, convenient and nearly typical avionics controls layout, flight sim computer (ie. 'gaming PC' peripherial wiring, mechDive full-dive VR exoskeleton mounting to pitch/roll/yaw axis.

modularAI

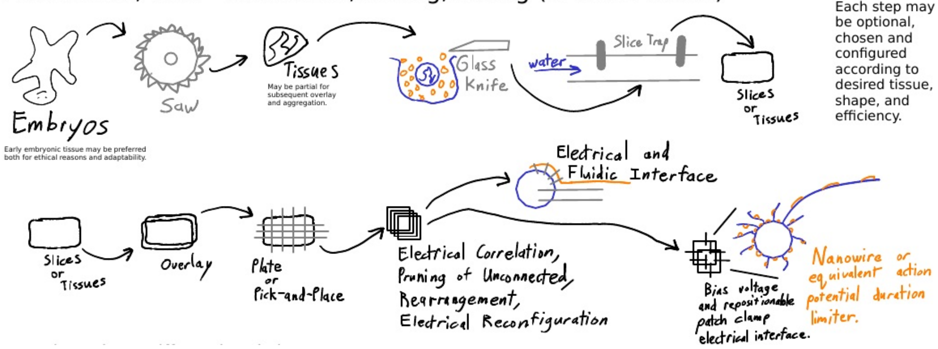
Self-Driving AI algorithm architecture. Self-Driving AI is 'Artificial General Intelligence' - where to go and where not to go is the problem all 'intelligence' always solves in a universe predominated by electrons photons. Algorithm illustrated passes messages to a shared bus, sending conclusions in a few categories into a feedback loop that causes behavior and modifies future behavior. Realtively low-priority, as the unsolved technical issue for the AI industry today is insufficient computer vision performance, with the industry already apparently making excellent progress.

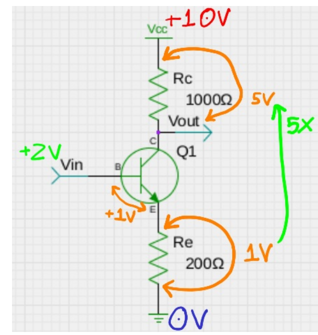
Thin threads are punched at breakway points by needle, then pushed (or injected).



One piece only. Single sliced polyamide (or similar material) substrate for CMOS fab.

Automated, Fast - Extraction, Slicing, Dicing (of brain tissue)



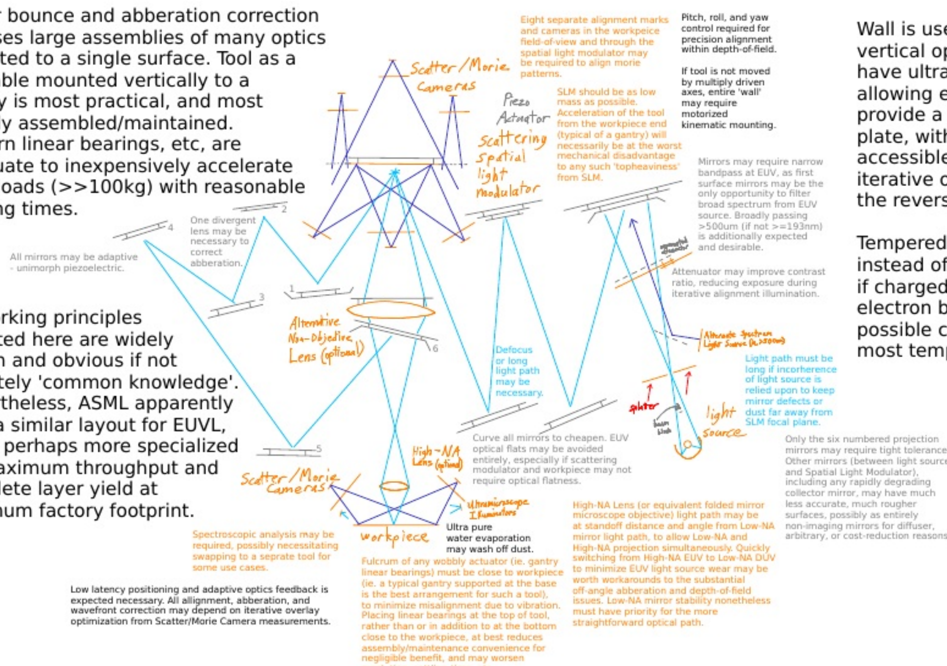


flatTool

Accelerating Wall of Large Heavy Optics

Mirror bounce and abberation correction imposes large assemblies of many optics mounted to a single surface. Tool as a flat table mounted vertically to a gantry is most practical, and most quickly assembled/maintained. Modern linear bearings, etc, are adequate to inexpensively accelerate such loads (>>100kg) with reasonable settling times.

All working principles depicted here are widely known and obvious if not definitely 'common knowledge'. Nevertheless, ASML apparently uses a similar layout for EUVL, albeit perhaps more specialized for maximum throughput and complete layer yield at minimum factory footprint.

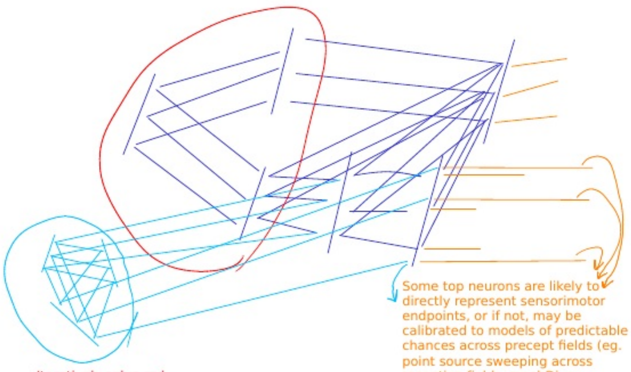


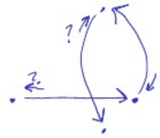
Wall is used as a dedicated vertical optical table, and may have ultra-fine-thread bushings allowing entire surface to directly provide a kinematic adjustment plate, with the adjustable screws accessible to stepper motors (for iterative overlay optimization) at the reverse side.

Tempered glass may be used instead of aluminum or invar alloy if charged particle deflection (ie. electron beam distortion) is a possible concern. Apparently most tempered glass is float glass.

Topographic Mapping from RPT Correlation

Software Algorithm Flow





Low temporal resolution correlations may reveal topographic mappings, but without clearly defining the typical directionality, or possibility of bidirectional feedback, only showing both topographic maps were simultaneously activated.

Deep topographic mapping may require high temporal resolution (telodendria ~50kHz?), neuroanatomical overlay (spatial position of electrode), and/or tracing the order of RPT events by RPT correlation of RPT events themselves.

Absence of any spatial position and temporal resolution less than 10x sample rate of minimum temporal difference may increase risk of requiring more solving by more computationally expensive genetic/ANN model iteration.

Some top neurons are likely to directly represent sensorimotor endpoints, or if not, may be calibrated to models of predictable chances across precept fields (eg. point source sweeping across receptive fields, mechDive measured force/position motor outputs) (aka. 'neural decoder').

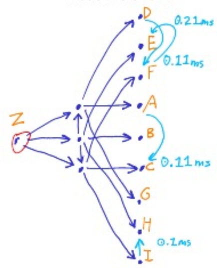
Iteratively solve red.

Find sensorimotor I/O (PNS) entry.

From orange. Action potentials may overlap with only small spike phase or duration differences.

Read only! Algorithm must NOT require arbitrary stimulation, which should only supplement recording data.

High temporal resolution and oversampled spatial resolution may be required and are feasible, constrained by SerDes bandwidth.

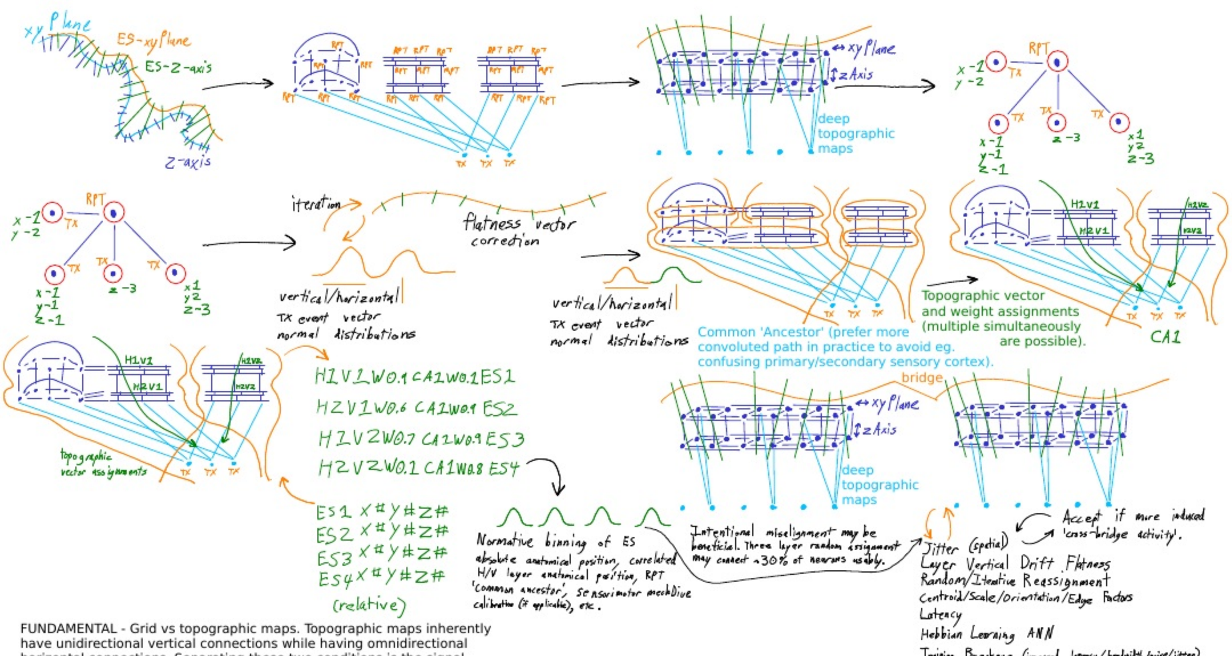


Neurons which RPT from a common vertical TX may be distinguished by their RPT of other neurons in a specific horizontal topographic map.

Only the RPT event F-->E, which occurs after D-->F, distinguishes E (of D,E,F horizontal) from B (of A,B,C horizontal).

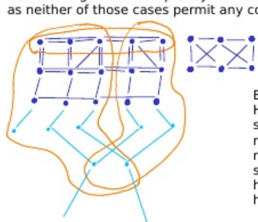
Center of all topographic maps - E,B,H - will RPT simultaneously from the same vertical TX at Z.

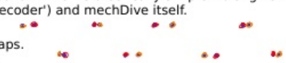
Both B and E will RPT from the same vertical TX event. Only E will RPT of horizontal TX events from processing within that horizontal topographic map.



FUNDAMENTAL - Grid vs topographic maps. Topographic maps inherently have unidirectional vertical connections while having omnidirectional horizontal connections. Separating these two conditions is the signal to noise to assert stastical confidence. Additionally, the distinction between a grid and completely omnidirectional synapses is not relevant as neither of those cases permit any computed overlay (ie. alginment).

FUNDAMENTAL - In practice even substantial misalignment may be tolerable. Minor scaling or layer mismatch, may be adequately accommodated simply by randomizing geometric overlay (ie. alignment) slightly, allowing at least some of the neurons to send precise - if not accurate - data to some of the other neurons. With adequate precision, VR retraining or outright plasticity is expected to be sufficient to adjust sensory perceptions. Moreover, mere VR sensorimotor connection can be achieved by PNS connection which is drastically simpler to align and to supplement by a variety of calibration techniques (aka. 'neural decoder') and mechDive itself.





Biological neural network (ie. 'brain') complexity may be less than tens of thousands of topographic maps. Human Connectome and Human Proteonome projects seem to support such conclusion. Should not be surprising considering the seeming absence of complexity in other tissues derived from similar genetic mechanisms. Much complexity of biological neural networks below horizontal topographic maps (eg. large numbers of distinctly different processing structures, large numbers of distinct neuron morphologies, etc) should not be expected either.
https://www.proteinatlas.org/humanproteonome/brain/human+brain
https://humanconnectomeproject.org

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Usage

```
./_consolidate_documents.bat
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Resulting 'document.pdf' and other PDF files are rather large binary object output (>15MB) excluded from git repository history. Rename 'document.pdf' to 'universalTechnologySpecificationTextbook.pdf' when appropriate.

Design

Mostly uses 'scriptedIllustrator' . Some files may use resources from other files, using path variables defined by 'zzLib_800-documents/consolidateVariables.sh' .

Unusually...
*) Some content (eg. Xournal files) is only combined into PDF output.
*) Xournal, text, and other files, are included.
*) MODULE scripts may be included by the 'scriptedIllustrator' documents.
*) Qalculate is explicitly set as backend by override of '_clc' and '_solve' functions.
*) Output of many separate documents is combined into a single PDF with Table of Contents.

Consequently, shell output and PDF are the intended output formats. Other markup (eg. HTML) is disabled by default, may not have been tested, would NOT completely include some content (eg. Xournal files), and would NOT be self-modifying as is.

Safety

Please use this information responsibly, especially in due diligence. Documents here show what is technically feasible, not what anyone can do, much less safely or economically. Expect software to freeze, machines to degrade, wetware to clog, and worse. Account for the plausibility of every component and assembly, design contingencies, and most of all, plan completely for every failure mode with redundancy.

To anyone contemplating implementing the technology described here as-is, BEWARE, documenting the obvious or useless was out of scope. Best practices, modern techniques, subtle pitfalls, and possible misconceptions, may not have been mentioned in every case. A very well educated intuition of the subject matter and unrelenting due diligence will be strictly required.

To anyone contemplating using invasive medical technology of any kind - DON'T - unless you can actually quantify the risks statistically from directly comparable experiments. Modern technology and science can quantify all of the relevant risks, but the sources of risk are very numerous and not all widely understood. Modern medicine is already arguably much too aggressive in understating the risks of introducing subtle yet severe lifelong deficiencies.

If you proceed with surgery of any kind with less than very strong abundance of caution and skepticism, you WILL cause serious collateral damage.

If you think the author is reckless or not personally all too aware of medicine gone horribly wrong, you would be very, very much mistaken.

Really, if you needed reminding that accidents costing life or limb are undeniably tragic, much less that outright direct brain damage is most tragic of all, then you should re-read this safety warning multiple times, and maybe not read other stuff here at all. Seriously, you have been warned, your accident is your accident.

Reference

https://github.com/mirage335/universalTechnologySpecificationTextbook
Git Repository for universalTechnologySpecificationTextbook

ACKNOWLEDGEMENT - Repository History

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