A Sample NeuroSafe Consulting Report

William Softky
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What is Neuromechanical Safety?

Just as certain kinds of air or water can be safe, or poisonous, certain environments can by their very structure be safe or unsafe for a human (or even animal) nervous system, because of the patterns they contain. The concept "neuro-safe" is meant to protect nervous systems from such damaging information, and the NeuroSafe trademark is mean to keep that meaning uncorrupted.

Fortunately, we have measurement principles that can tell us how neuromechanically safe an environment is. The principles for deciding what is and is not neuromechanically safe are not up for sale, nor up for debate. Those principles are deeper than mere evidence, being based all the way down in physical laws of information flow through space and time. Those are the laws and principles we can use to protect ourselves and those we care about from environments and interactions which undermine our nervous systems.

One can use scientific, statistical measurements of anything a brain might consume: smells, tastes, sounds, mechanical vibrations, reflected light.

About This Report

This report describing principles of neuromechanical safety attempts that feat uses standard scientific measurements which could be applied equally to light, sound, or physical vibration.

Light will be the focus in this report, in particular comparing sunlight, incandescent "Edison" bulbs, and LED lights that anyone might encounter in a home. If you as a customer have paid additional fees for personalized evaluation, this report will also contain measurements of your specific devices side by side with the "official" ones, to compare in context.

This report is meant for you the human reader, not for the scientific record. So it doesn't need footnotes or references. For further detail one may investigate:

➔ **add links**

- My few dozen lay articles on the international news site Fair Observer
- Two unrefereed works on the physics site ArXiv.org, one explaining brains in terms of physics, the other explaining Life in terms of information theory.
- The 60-page refereed work with Criscillia Benford in the MIT Press publication *Journal of Neural Computation* (available free on ArXiv)
- Two short videos about LEDs under my name on YouTube with "Mad Scientist" in the title.

Foundational Facts about Nervous Systems, Trust, and Sensory Sensitivities[1]

Fact #1: Nervous systems make 3-D Models

Ever since the moment 500 million years ago when a flailing worm (with its segmented nervous system) evolved into a wriggling sea-snake (with a brain in a skull), brains have been model-making engines. Brains' primary task has always been to create a single, constantly updated model of the body and things nearby.

The algorithms computers use for making 3-D models share the name "tomography," like in MRI machines or self-driving cars. That process is so difficult, demands so much specific data, and must so absolutely obey mathematical laws that we can deduce much of what brains need entirely from the fact that they make 3-D models.

Furthermore, you don't even need to know how the brain pulls off that trick. You only need to know how the brain could possibly trust that it actually succeeded. The process of trust also follows mathematical laws, laws indistinguishable from the ones we already understand for self-calibrating and self-tuning instruments.

Fact #2: Trust is a calibration algorithm

Roughly, trust works by alternately zooming in and zooming out. When things already make sense, investigate more closely, gather more detail, fiddle more finely, and take longer, all of which improve the 3-D resolution of whatever it is you're touching, looking at, or hearing. On the other hand, when uncertainty strikes or something seems wrong, back off, go big, switch things up, even turn the dial all the way both ways. All of those reset and recalibrate the bigger picture, so it can be further refined.

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[1] Based on the 60-page mathematical paper *Sensory Metrics of Neuromechanical Trust* by Softky & Benford.

This is how both kittens and human babies investigate their worlds, and how humans make sense of ours. It works so well, and we get so good at it, that our certainty reaches 100%, as it should in the real world. Our brains were built to trust 3-D implicitly.

Unfortunately our trust-circuitry can be hacked by artificial stimuli in deeply unconscious ways. We can feel that same 100% certainty when things aren't really real, as with photographs, television screens, and interactive environments like so-called "virtual reality." We might consciously describe the experience as "real," but the deep unconscious isn't fooled, and over time becomes alienated and anxious. Such deep anxiety about reality itself is bad for us. It is behind much of global mental misery, from aches and pains to loneliness and hate.

Fortunately, the same principles that explain how our brains become dazzled and irritated also tell us what our nervous systems need to get on track again.

Fact #3: Trusting 3-D demands proximity, bandwidth, and natural statistics

When a child clutches a toy, it knows the toy is really there because the micro-vibrations from its fingers go into the toy and come right back *without delays*. Back-and-forth interactions are the core of how all nervous systems work, like ping and echo, serve and return, call and response. The same for touch, sound, and light.

In particular, the precision of the mental 3-D model is directly proportional to the precision of the return timing. Better timing means more bandwidth, higher frequencies, and better results. Quick and sharp timing is how the brain works. It's perfect for real physical things whose delays are consistent, but touchscreens insert weird delays. Even screens themselves flash on and off, blocking our native zooming-in circuitry and imposing a resolution limit.

The final ingredient brains need to trust themselves might be called "natural texture." They evolved to touch and look at Nature, which has the same shapes and textures both small and big (moss shaped like trees, gravel shaped like bounders, ripples shapes like waves). Those shapes are self-similar, meaning zoomable, which means our brain's zooming-in algorithm will always work.

Those special fractal-like shapes allow the brain to make very good models of environments or textures, like "tall grass," relative to which unexpected things (like "snakes") stand out. Our native sense of "something isn't right" is at core a statistical sense, so environments more like Nature are the best ones for our brains to operate in. Whatever statistical distributions and curves Nature usually provides, those are the ones we ought to reproduce in our homes and offices.

In summary: to the degree that artificial light sources have different textures and statistics from natural sources, to that same degree they can disrupt and even damage neural circuits whose sensitivities are entirely tuned to the natural version. The measurements below provide examples of what to look out for.

Light as Vibrations

One can use scientific, statistical measurements of anything a brain might consume: smells, tastes, sounds, mechanical vibrations, reflected light. In this report we stick to light, and further restrict our measurements to the quality of light itself, in terms of color spectrum and time variation (which can be measured in complementary ways).

Our brains evolved to see by sunlight, making it their native, optimal interface. Anything different from natural sunlight is bad in proportion to the difference.

Foundation of Recommendations

By measuring how artificial stimuli (like LED lights) are different from natural ones, we can decide roughly which ones are most likely to irritate our brains and senses. The most general approach to creating NeuroSafe environments is a simple principle: the more unnatural the profile, the more irritation. The most specific approach is to measure your actual environment, using instruments and techniques like those described above.