

Dr. Linas Vepstas

Curriculum Vitae



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DOCTORAL RESEARCH

“The Cheshire Cat Chiral Bag”

The **Chiral Bag Model** is a model of the nucleon consisting of a harmonic map of the chiral anomaly (the pion cloud as a Skyrmion or topological soliton) on the exterior, and a free quark spectrum plus vacuum contributions on the interior, coupled by the conservation of the axial current at the boundary. It predicts the low-energy properties of the baryon (mass, axial coupling) to within 10%.

WORK EXPERIENCE

Hanson Robotics

Robotics research & development. Good regulator theorem for action & perception via coupling of natural language to a vector-symbolic graph database (**OpenCog AtomSpace**) for inference and control.

2014 – 2019

Poulin Holdings

Machine learning of unstructured medical text, for VA Hospitals suicide prediction for US veterans.

2011 – 2014

Qualcomm

Linux kernel development. Binutils, GCC, Glibc, linker-loader, TLS & EH for the Qualcomm Hexagon CPU.

2010 – 2011 (CONTRACTOR)

Novamente/Cerego

Natural language processing, semantic frames for Japanese language education.

2007 – 2009 (CONTRACTOR)

IBM

Linux kernel development. **PCIe Error Recovery** (EEH), PCIe SRIOV. Hypervisor firmware.

2003 – 2007 (CONTRACTOR)

Gnumatic

Founder & CEO

Commercialize the **GnuCash** personal finance and small business accounting system. Raised \$1M USD seed funding.

1998 – 2001

Teleport Travel/Intransco

Founder & CEO; CTO

Web-based air travel and hotel reservation system. Early dot-com startup. Raised \$1M USD series A funding.

1995 – 1997

IBM

Advisory Programmer

Graphics Architect. Specify the OpenGL API. Interface with hardware (graphics chip design), CPU architects, I/O subsystem architects, OS kernel, compiler, marketing, product planning.

1988 – 1998

EDUCATION

1991 Visiting Scientist

Theoretical Physics
Uniwersytet Jagiellonian, Krakow, Poland

1990 – 1991 Post-Doctoral Fellow

Theoretical Physics
SPhT, CEA/CEN Saclay, France

1986 – 1990 Doctor of Philosophy

Theoretical Physics
SUNY at Stony Brook

1980 – 1984 Ars Bacalaureat

DEANS LIST
Department of Physics
The University of Chicago

AWARDS

2000 Honoraria

Recognition for Linux i370 on the Mainframe
Hitachi

COMMUNICATION SKILLS

CONFERENCES	AGI Conference – 2020, 2021
PRESENTER	Austin Science Club – 2018-2022 SIGGRAPH – 1995
STANDARDS BODIES	OpenGL Architecture Review Board – 1990-1995
GOVERNING BODIES	GnuCash Foundation 1995-present

REFERENCES

Dr. Ben Goertzel

FOUNDER Singularity.AI
EMAIL bengoertzel@gmail.com
PHONE Available on request

Dr. David Hanson

FOUNDER Hanson Robotics
EMAIL david@hansonrobotics.com
PHONE Available on request

SKILLS

Management by Walking Around

I am able to direct engineering groups to work towards a common goal, resolving issues and confusion over intent and direction. To get people enthused and working together. I have coordinated with marketing departments and product planning, helping set vision and messaging.

Founder

As founder and CEO of several startups, I've learned to work with customers, marketing, sales, suppliers, lawyers & VC's, finance and peer executives. I also learned to hate cold calls.

Technical Mastery

During my early career in hi-tech, I attempted a grand tour of every field in computer engineering, from CPU architecture internals, to compilers, OS kernels and database design & architecture.

I learned by doing, and made significant contributions to each of these. Specifically, FP select and other insns for PowerPC; the i370 port of **Linux to the Mainframe**; the **OpenCog AtomSpace** vector-symbolic graph database. Application development too: lead developer for the **GnuCash accounting system**.

I have made large contributions to more than 500 articles in **Mathematics** on Wikipedia, and have a broad survey understanding of most branches of mathematics.

RESEARCH

My work during the decade preceding the LLM revolution focused on alternatives to gradient-descent. Most early deep-learning results can be reproduced using a purely symbolic approach, simply by counting observations of (grammatical, syntactic) relationships. The idea of an n-gram is replaced by a jigsaw with (typed) connector tabs on it; the connectors expose the symbolic (network) relationships between systems. Vectors of jigsaws appear to capture semantic meaning, and behave much like the vectors in neural nets. The symbolic jigsaw (sheaf-theoretic) approach is explicitly compositional and hierarchical: a single symbol can stand in for another, more detailed network underneath it.

The hierarchical approach reinforces the idea that intelligence manifests not only at the human scale, but also at the social and the biological scale. Institutions, corporations and economic systems can be viewed as networks of relationships. The functional parts can be described as collections of typed connectors between subsystems, i.e. jigsaws. But this is the same kind of language used to describe biochemical reactions, and also anatomical, functional relationships. The hierarchical structure means that "it's jigsaws all the way down". Experiments on genomic and natural language datasets clearly show scaling exponents.

Scaling is characteristic of self-organizing systems near a critical (second-order) phase transition (there is a large literature on this topic.) Hierarchical arrangements of jigsaws captures this, and are readily encoded as software. These ideas have been painstakingly developed in the **OpenCog AtomSpace**, in **Link Grammar**, in the **Learn project** and the **Sensorimotor project**. The ideas, the theory, however, is generic.

The "hard problem" of consciousness and the unity of conscious experience remains. The foundations of why we cannot affect the past, nor remember the future remain open. Consciousness is imprisoned in the here-and-now; the formal mathematical, physical and computational basis for this remains unknown. This is the question that drives me.

SELECTED PUBLICATIONS

ORCID: 0000-0002-2557-740X

Linus Vepstas, A.D. Jackson (1990). Justifying the Chiral Bag. *Physics Reports*, **187**(3), pp 109-143.
doi: 10.1016/0370-1573(90)90056-8

Linus Vepstas, John Cook (1991). Multiple Command Set Support for Rendering Components **Multiple Command Set Support for Rendering Components**. *US Patent No. US-5504928-A*. *European patent application #92306537.9*- (applied in DE, FR, GB).

Philippe Flajolet, **Linus Vepstas** (2008). On Differences of Zeta Values. *Journal of Computational and Applied Mathematics*, **220**(1-2), pp 58-73.
doi: 10.1016/j.cam.2007.07.040

Linus Vepstas, (2010) Structure in Linguistics. *International Journal of Corpus Linguistics*, **15**(2) pp 357-362.
doi: 10.1075/ijcl.15.2.06vep

Christian D. Poulin. Paul Thompson, **Linus Vepstas** (2014). Text Based Prediction of Psychological Cohorts. *US Patent US-20140222719-A1*.

C. Poulin, B. Shiner, P. Thompson, **L. Vepstas**, Y. Young-Xu, *et al.* (2014) Predicting the Risk of Suicide by Analyzing the Text of Clinical Notes. *PLoS ONE* **9**(1): e85733.
doi: 10.1371/journal.pone.0085733

Linus Vepstas, (2018) Sheaves: A topological Approach to Big Data. *OpenCog Foundation Technical Report*.

Linus Vepstas, (2018) Gradient Descent vs. Graphical Models. *Hanson Robotics Technical Report*.

Linus Vepstas, (2018) On the Beta Transformation. *arXiv: 1812.10593v3*.
doi: 10.48550/arXiv.1812.10593

Linus Vepstas, (2020) Graphs, Metagraphs, RAM, CPU. *OpenCog Foundation Technical Report*.

Linus Vepstas, (2023) Purely Symbolic Induction of Structure. *International Conference on Artificial General Intelligence AGI 2022: Artificial General Intelligence* pp 134-144.
doi: 10.1007/978-3-031-19907-3_13

Linus Vepstas, (2023) Grammar Induction - Experimental Results. *International Conference on Artificial General Intelligence AGI 2022: Artificial General Intelligence* pp 413-423.
doi: 10.1007/978-3-031-19907-3_40