

Consciousness from AI to Noosphere – PJW, RETIRED

It ain't what you don't know
that gets you into trouble. It's
what you know for sure that
just ain't so. *Mark Twain*

- Machine consciousness **can be built**. Some of us now know how, based on “telos” mathematics applicable to neurons, circuits and spirit, and QED
- See www.werbos.com for links to details

“It can’t be done” is such a boring old lie

- Heavier-than-air flying machines are impossible – Lord Kelvin, 1895
- A rocket will never be able to leave the Earth’s atmosphere — New York Times, 1936
- I think there is a world market for maybe five computers - Thomas Watson, IBM chairman, 1943
- There is not the slightest indication that nuclear energy will ever be obtainable – A. Einstein, 1932
- .. my imagination refuses to see any sort of submarine doing anything but suffocating its crew and floundering at sea — HG Wells, 1901
- Minsky and Papert, Perceptrons, 1969

Is consciousness a substance?

Another boring type of category error

- Heat once viewed as a substance (phlogiston) – refuted by Giobert, 1792
- Life once viewed as a substance: “Some vitalists.. proposed testable hypotheses ...but these experiments failed to provide support for vitalism. Biologists now consider vitalism in this sense to have been refuted by empirical evidence, and hence regard it as a superseded scientific theory.”
- All known minds are complex systems, like life



The new AI based on deep learning is remaking the world here and now. We need to jump to CNN and RNN, the next big thing.

- **Deep learning** = backprop + convolutional neural network (+bottleneck nets) + tricks
- CNN = cellular neural network (Chua/Roska)
- RNN: huge symposium in Barcelona December 2016
- New evidence that the brain is an “artificial neural network” (Frontiers in Systems Neuroscience)
- Huge choices here and now in where humanity goes next -- huge new risks, new technology options

www.weforum.org

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- Sergey Brin, the co-founder of Google and one of the most successful Silicon Valley entrepreneurs, says he did not foresee the artificial intelligence revolution that has transformed the tech industry.
- “I didn’t pay attention to it at all, to be perfectly honest,” he said [in a session](#) at the World Economic Forum’s Annual Meeting in Davos. “Having been trained as a computer scientist in the 90s, everybody knew that AI didn’t work. People tried it, they tried neural nets and none of it worked. (Deep Mind like D-Wave known, not enough.)”

5 Grand Challenges for Adaptive and Intelligent Systems

– General-purpose massively parallel designs to learn...



$$\frac{\Pr(A|B)}{\Pr(A)} = \frac{\Pr(B|A)}{\Pr(B)}$$

COPN

Important future applications



Space



Sustainability



Human Potential



Prediction

Memory

...

Clustering

Optimization

$$J(t) = \text{Max} \langle J(t+1) + U \rangle$$

$$\frac{\partial^+ z_n}{\partial z_i} = \frac{\partial z_n}{\partial z_i} + \sum_{j=i+1}^{n-1} \frac{\partial^+ z_n}{\partial z_j} \frac{\partial z_j}{\partial z_i}$$



New Performance Breakthroughs in Prediction/Recognition by Ng&LeCun

Audio

TIMIT Phone classification	Accuracy
Prior art (Clarkson et al., 1999)	79.6%
Stanford Feature learning	80.3%

TIMIT Speaker identification	Accuracy
Prior art (Reynolds, 1995)	99.7%
Stanford Feature learning	100.0%

Images

CIFAR Object classification	Accuracy
Prior art (Yu and Zhang, 2010)	74.5%
Stanford Feature learning	75.5%

NORB Object classification	Accuracy
Prior art (Ranzato et al., 2009)	94.4%
Stanford Feature learning	96.2%

Video

UCF activity classification	Accuracy
Prior art (Kaiser et al., 2008)	86%
Stanford Feature learning	87%

Hollywood2 classification	Accuracy
Prior art (Laptev, 2004)	47%
Stanford Feature learning	52%

Multimodal (audio/video)

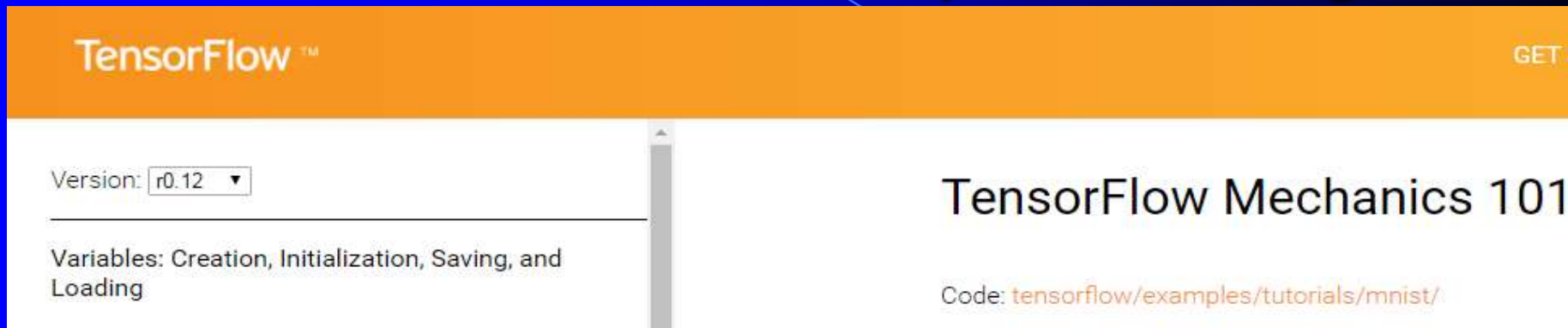
AVLetters Lip reading	Accuracy
Prior art (Zhao et al., 2009)	58.9%
Stanford Feature learning	63.1%

Other unsupervised feature learning records:
Different phone recognition (Geoff Hinton)
PASCAL VOC object detection (Kai Yu)

Andrew Ng

New world records (under NSF COPN) using relatively simple neural networks with a symmetry addition...

Goggle Tensor Board: Use of Gradients at the Core of Deep Learning



TensorFlow™ GET:

Version:

Variables: Creation, Initialization, Saving, and Loading

TensorFlow Mechanics 101

Code: [tensorflow/examples/tutorials/mnist/](https://www.tensorflow.org/examples/tutorials/mnist/)

Training

The `training()` function adds the operations needed to minimize the loss via [Gradient Descent](#).

Firstly, it takes the loss tensor from the `loss()` function and hands it to a `tf.scalar_summary`, an op for generating summary values into the events file when used with a `SummaryWriter` (see below). In this case, it will emit the snapshot value of the loss every time the summaries are written out.

```
tf.scalar_summary(loss.op.name, loss)
```

Next, we instantiate a `tf.train.GradientDescentOptimizer` responsible for applying gradients with the requested learning rate.

```
optimizer = tf.train.GradientDescentOptimizer(learning_rate)
```

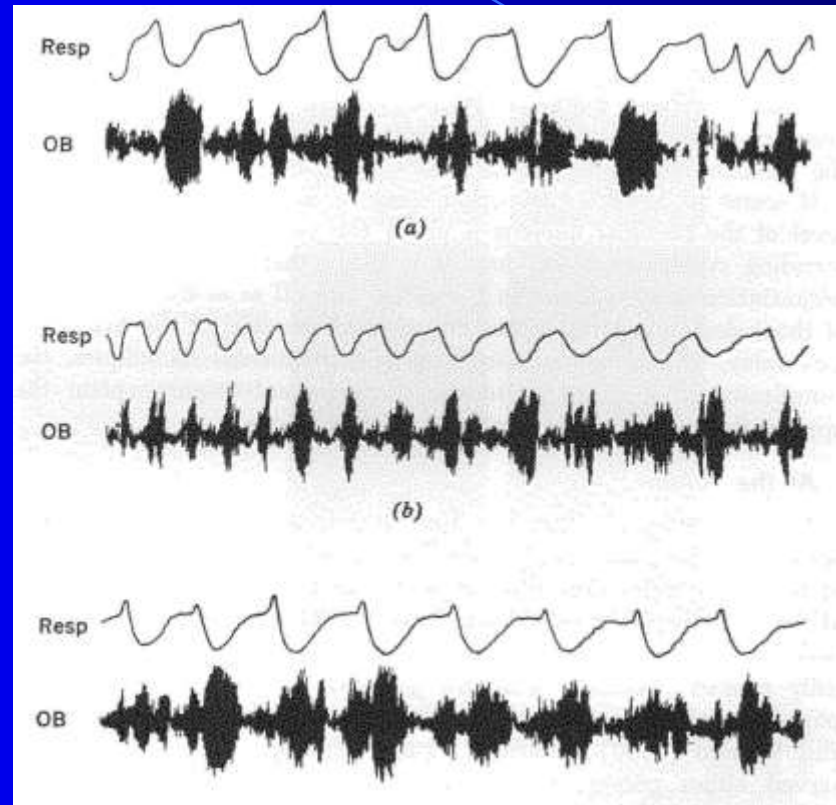

Neural nets became heresy in 1960's because no one could train them even to solve simple XOR problem.

“time”	X_1	X_2	Y
1	0	0	0
2	0	1	1
3	1	0	1
4	1	1	0

Minimizing square error was considered and rejected for two reasons:

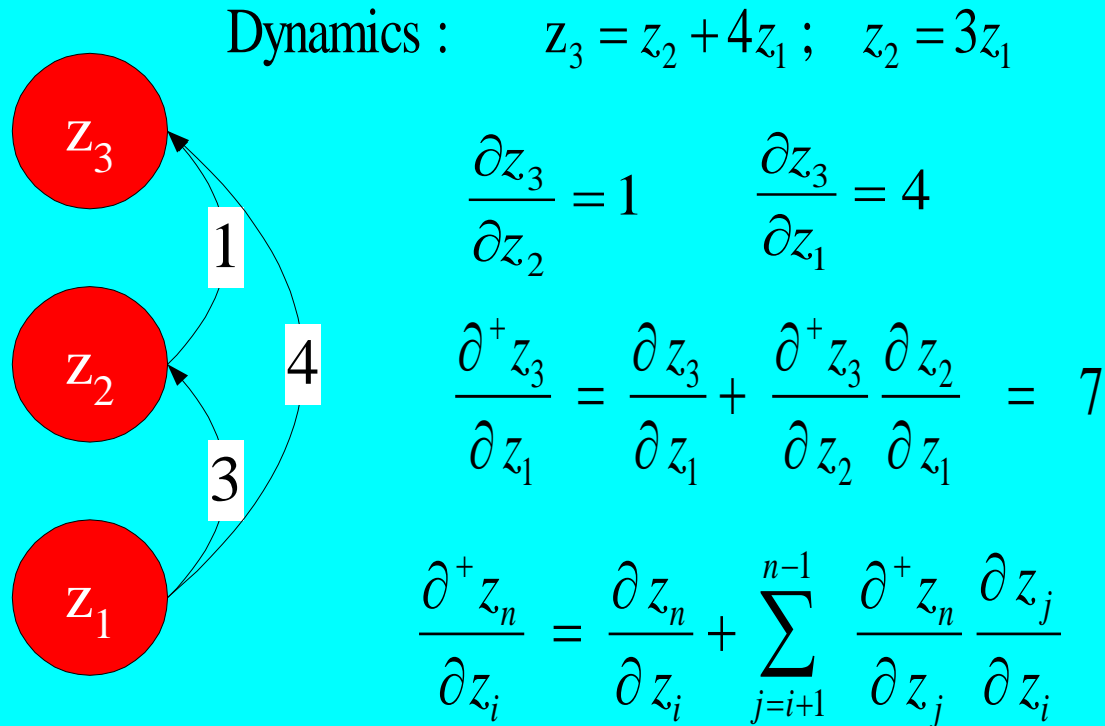
- (1) No one knew how to calculate derivatives efficiently, locally;
- (2) The TLU “spiking type” neuron model was nondifferentiable.

Offer to Minsky to Coauthor BP/MLP (see Talking Nets) with new neuron model



Real neurons are not 1/0 asynchronous binary digits!
Every ≈ 100 ms, a “volley” or “burst” of continuous intensity. Clocks, Richmond, Llinas, Bear/Connors

How calculate the derivatives?



A Chain Rule For Ordered Derivatives

1974 thesis: example of application of BP through time (BTT) to general time-series systems in general econometric package (AD 2004)

Roadmap for Cognitive Prediction

Reward direct
simplicity

Reward symmetry

1. AT&T winning ZIP code recognizer and new COPN work

3. Mouse



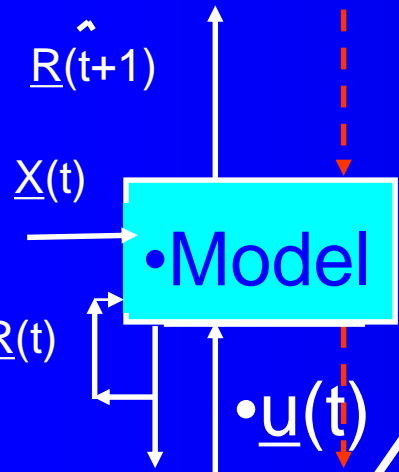
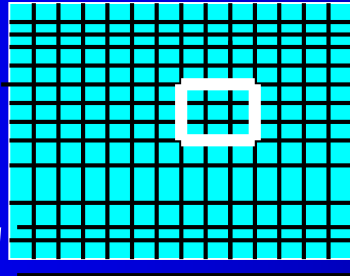
Space-like cognitive map
of the space of **Possibilities**,
to support higher creativity

2. reptile



Predicts What
Will Happen
Over Multiple
Time Intervals
Harmonized

Networks for inputs
with more spatial
complexity using
symmetry – CSRN,
ObjectNets,

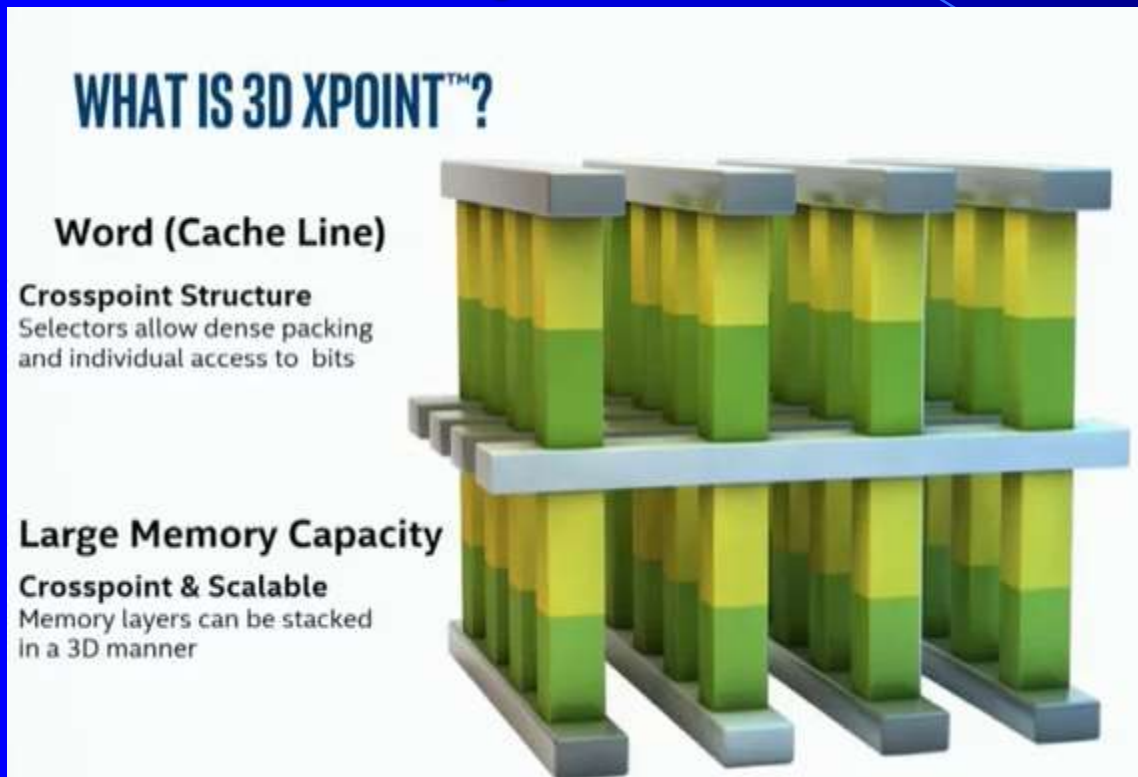


0. Vector Prediction (robustified SRN/TLRN)
HIC Chapter 10 on web.

To see how you could do better than even them, and break the world records again... or to see the research needs to fulfill gthis roadmap... see

www.werbos.com/Erdos.pdf

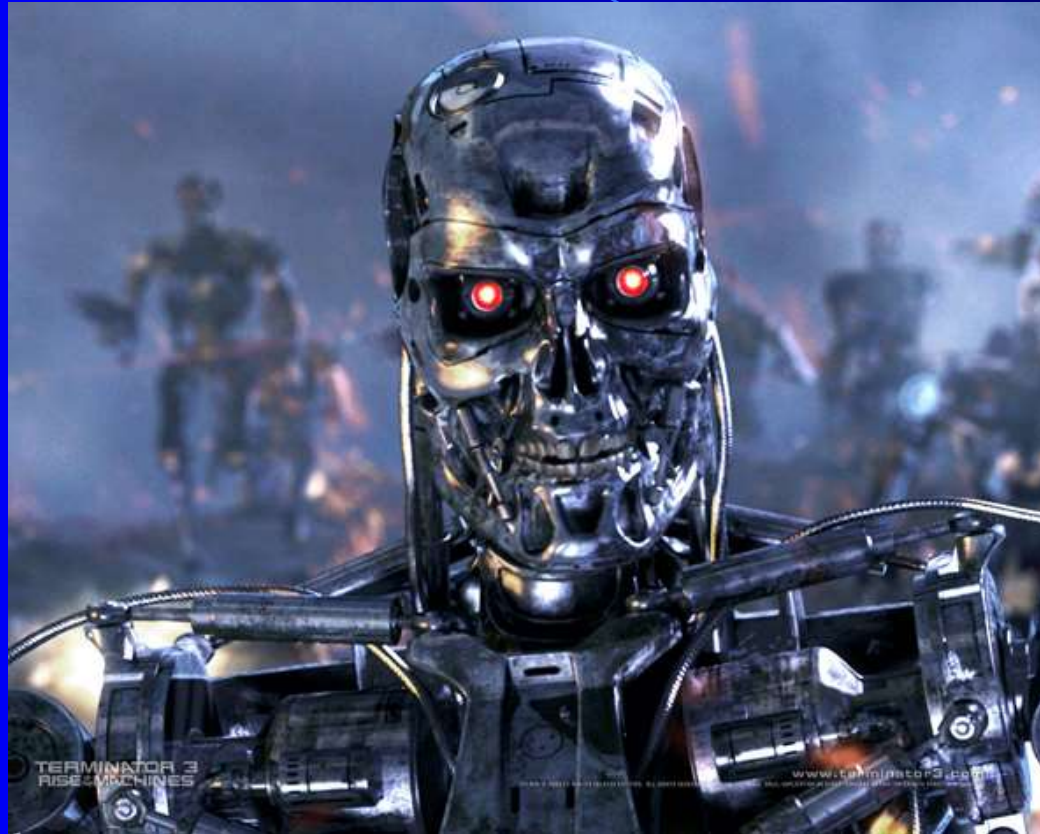
CNN: From Chua (Memristor) to HP rediscovery to a massive new flood



- Image credit: Intel, open for noncommercial use
- Analysis source: Burr, Shenoy.. IBM 2014

- First product is memory, but offers huge performance for neural networks as well. In Kozma book, Memristors for More than Just Memory

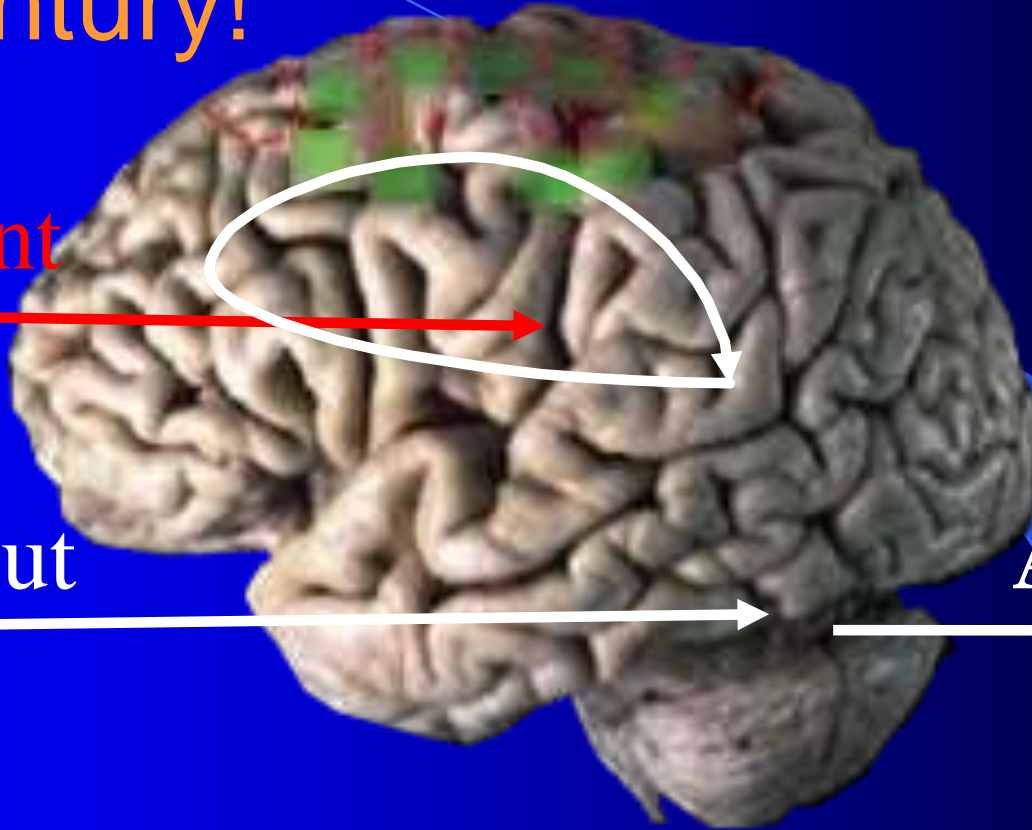
ANNs, IOT etc tomorrow: risks and opportunities
both **much bigger** than people realize!



See www.werbos.com/IT_big_picture.pdf for
6 slide overview with lots of links to details
on the web

Never forget the grand challenge
for this century!

Reinforcement



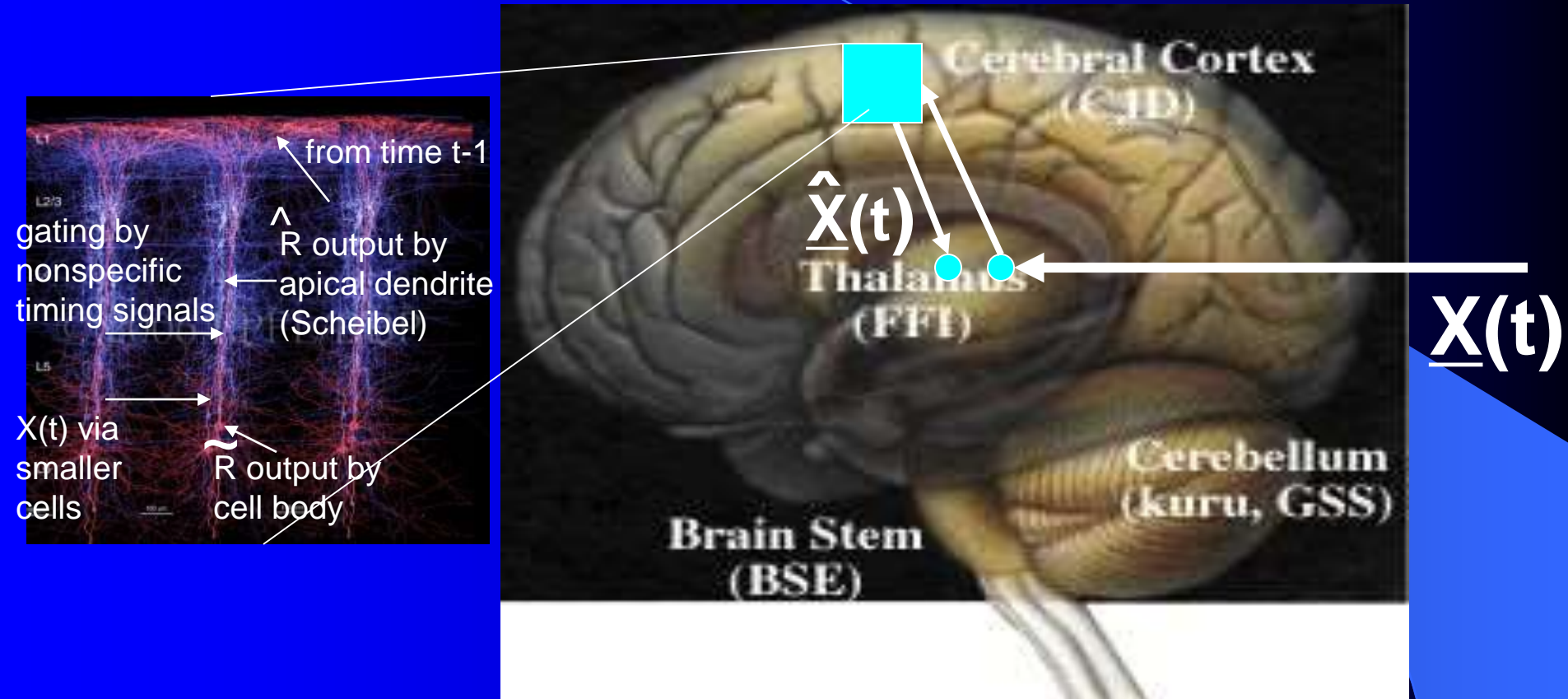
Sensory Input

Action

Brain As Whole System Is an Intelligent Controller

- Mouse maximize probability of survival among other things
 - Lots of animal behavior research
- Lots of recent motor control research (UCSD...)

Ability to learn to “Predict Anything” Found in the Brain (Nicolelis, Chapin)



Goldman-Rakic, Baars: Consciousness, working memory due to recurrent nets!!

Richmond: “ $t+1$ ” – t is .12 seconds. Each cycle has a forwards pass to predict, and a backwards pass to adapt, from multichannel unit data. NEW PAPER VERIFIES !

But Nicolelis statement also needs verification beyond rat whiskers, few words.

(Bliss, Spruston): found “reverse nMDA” synapse and backpropagation along dendrites

Regular Cycles of Forward and Backward Signal Propagation in Prefrontal Cortex and in Consciousness

Paul Werbos and Joshua Davis

Frontiers in Systems Neuroscience

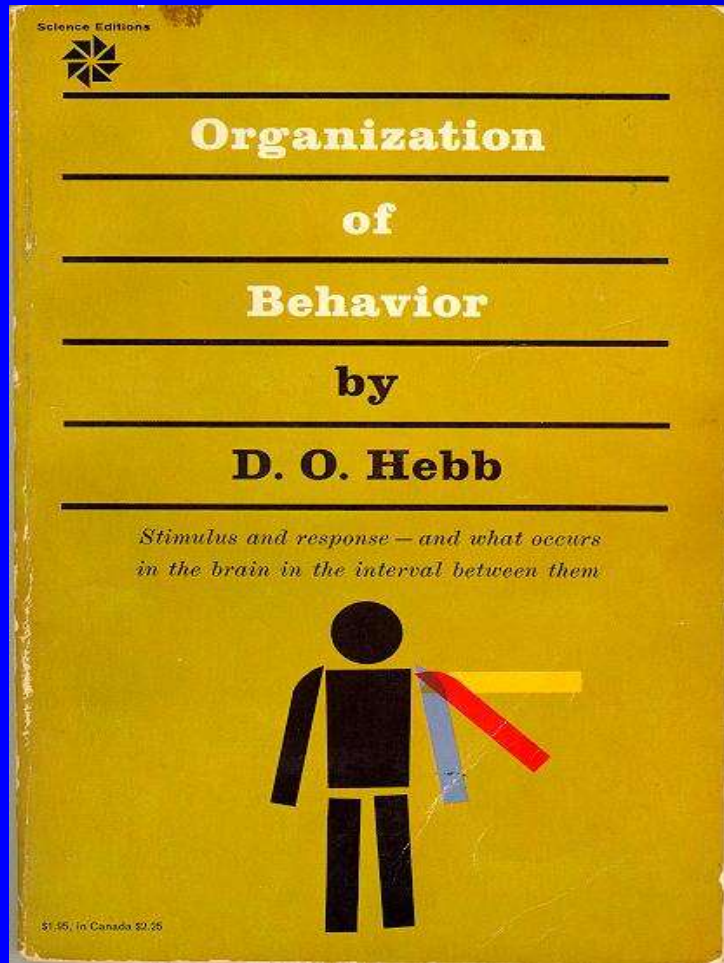
November 28, 2016

Open access, link posted at
www.werbos.com/Mind.htm

Is the brain “an artificial neural network?”

- Best available data: Buzsaki lab, 128 channels, 24 Khz raw data, burst versus spike sorting
- From many measures, clock time of 153.4 ms in rat for which best data available (only one we probed).
- Clock lets us sort brain cycle into “AM” and “PM,” as essential to brain data as seasonal adjustment to monthly sales data.
- Compared two main hypotheses:
 - Repetition: $(Pr(\text{burst}(t,k)|\{<t\}))$ in PM same as in AM
 - Mirror (BP): $(Pr(\text{burst}...))$ in PM time-reverse of AM
- Inversion number statistic shows 40% less error with mirror hypothesis versus repetition

Hebb 1949: Intelligence As An Emergent Phenomenon or Learning



$$\Pr(\text{Theory}|\text{Experience}) = \frac{\Pr(\text{Experience}|\text{Theory}) \cdot \Pr(\text{Theory})}{Z}$$

Theory: Spiritual or Paranormal experience is “real”

Beyond the Mundane Brain

- Human history has many stories of life which do not fit the model of individual brain as the only intelligence. But they seem impossible in a simple model.
- Personal experience forced me to become open-minded in March 1967: I remembered and quoted a speech of Mao Tse Tung the day before it was given! (See Greeley 1969: 70% of PhDs have had personal experience they do not discuss.) BUY GOLEMAN, **CONSCIOUSNESS!!!**
- Two intense new directions:
 - Scour literature from “schools” all over the earth for ways to expand my first person database, because more and richer experience is needed to explain all this. Also use neural network model to guide this.
 - Re-examine basic physics and what is really possible, with the smallest possible change in physics from what we already know.

It's Not Just Me!

- Schrodinger, Heisenberg, De Broglie, Dyson
- Best survey data available (Greeley&McCready, in Goleman, *Consciousness*, Harper and Row 1979): **70% of elite PhDs say yes** to “Have you ever had the feeling of being very close to a spiritual force that seemed to lift you out of yourself?” But most respond with fear, conservatism, regression!!
- Soul is to most serious people today what sex was to Victorians!

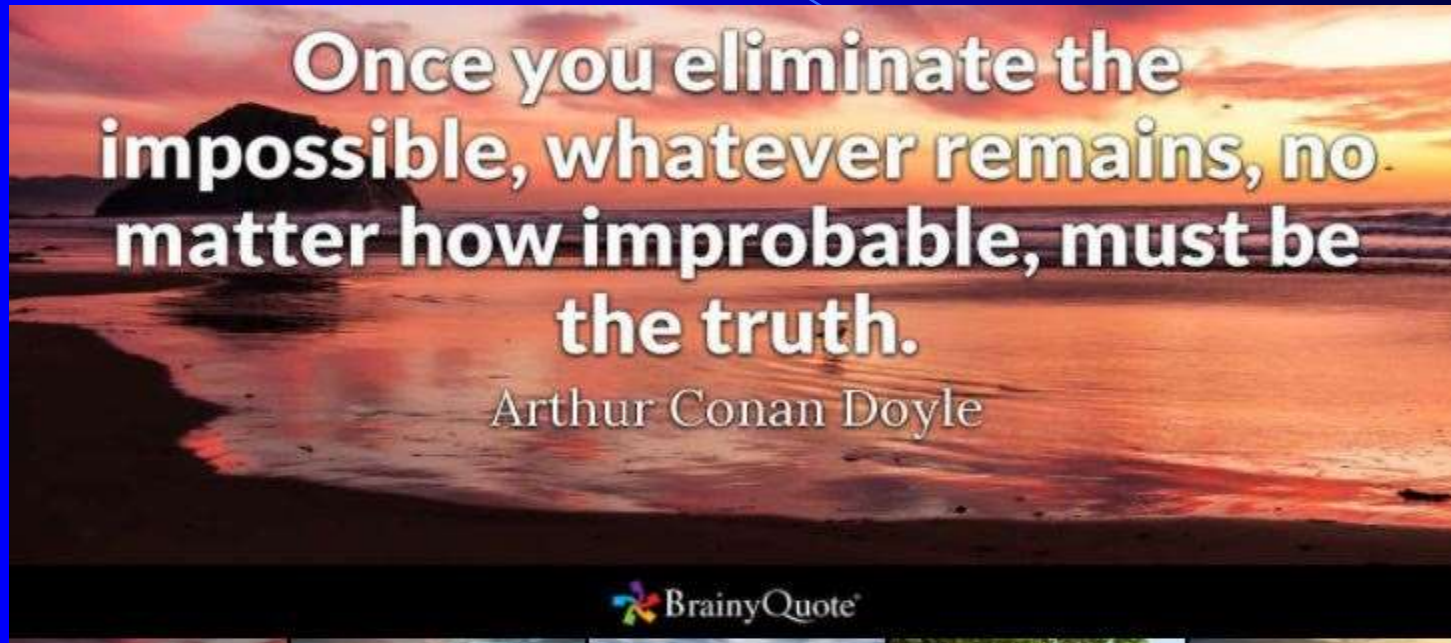
The Big Question Here.....

- *If* we believe paranormal effects are real
- *And if* we believe that everything is ruled by mathematical laws of nature (“physics”)
- *Then* what do we do about it? How can we improve our understanding?

QED → REMOTE VIEWING

- ☯ Quantum effects Are Not Enough
- ☯ Additional Force Fields?
- ☯ But if so, where is signal processing(SP) ?
- ☯ A radical chasm -- extreme choices; give up remote viewing totally or else:
 - ☯ “cables” & SP in the universe
 - ☯ esoteric biology or “soul,” symbiotic biology and intelligence
 - ☯ but either way, what about genetics?

The Noosphere Species Theory (cites at www.Werbos.com/Mind.htm)

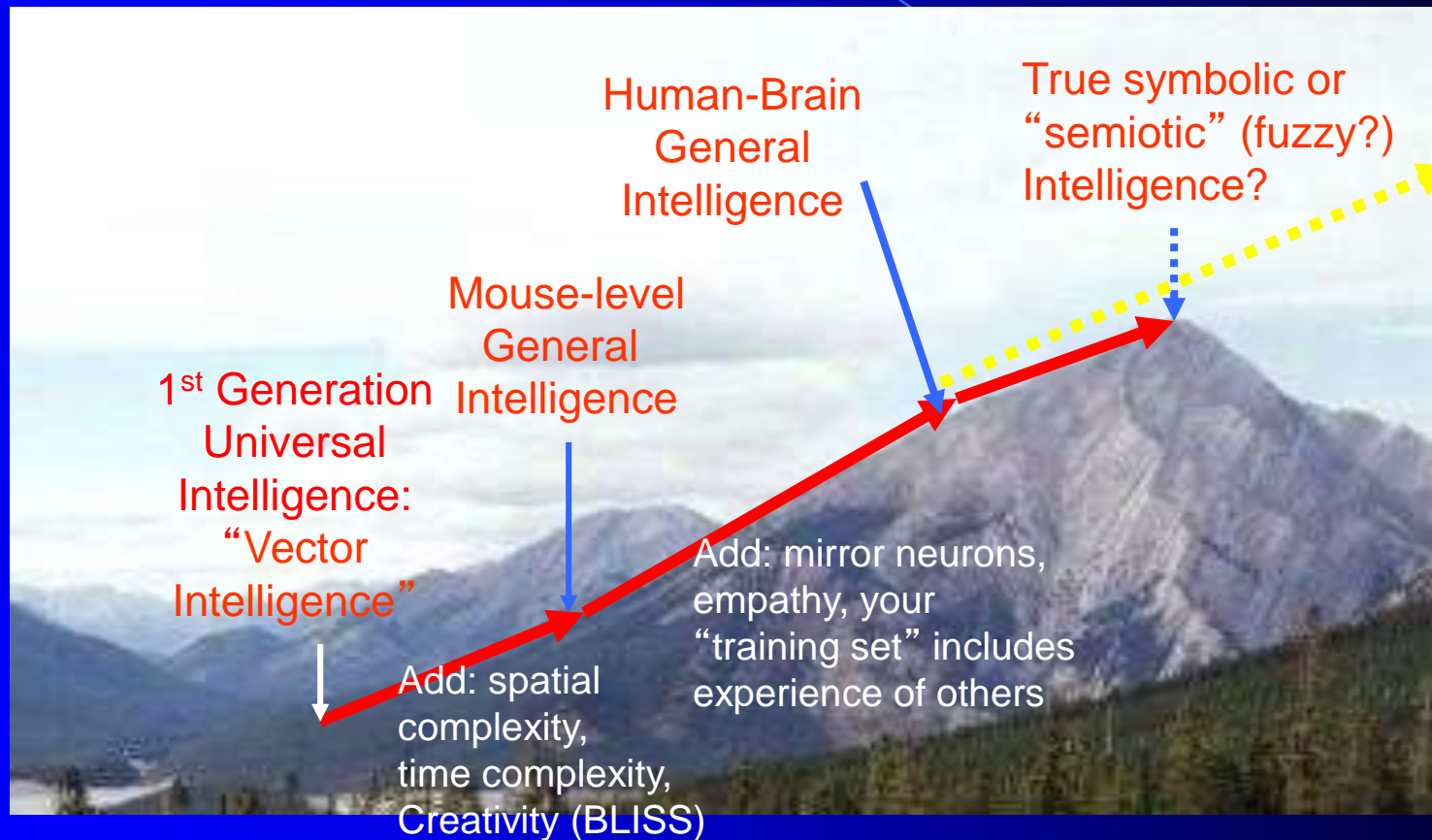


- Like noosphere theory deChardin/Verdansky but:
 - Origin in evolution of noospheres in cosmos is necessary for logical completeness as a scientific theory
 - Fits how our solar/earth noosphere “is a baby” (Terry not Gaia)

The Biggest Picture

- Is the dark cosmos a dark forest or an ocean of life?
- Is the primitive village earth surrounded only by hungry tigers or by an ancient civilization like China 1500AD?
- Who of us will respect our true ancestors and pass the serious examinations?

From Brain to Mind: What Can We Learn Of Use Beyond the Level of the Mouse Brain?



www.werbos.com/pi/Confucius_talk.pdf

And Neural Networks 2012; arxiv MLCI

Beyond the Individual Human Brain – A Few Quick Thoughts Based on What I Have Seen

- $\partial J / \partial R_i$, a backpropagation signal, represents “how much an increase in R_i makes to happier. It represents the value of R_i to you. It fits Freud’s idea of “psychic energy.” Backpropagation of J derivatives represents a kind of flow of emotional energy in the brain. It drives the learning of all that we do.
- Collective intelligence requires similar flows of derivative information between people and connecting to the larger world. Is “ki” or “tao” (or “tama”) really just a flow of the same kind of derivative signals in our larger Mind, driving the larger course of our culture and society and world? Is it governed by the same mathematics, the chain rule for ordered derivatives?

The Force be With You!!!

How Can A Simple Neural Network (10-100 Neurons)

Outperform a Brain With Billions of Neurons?

Answer: It Pays Attention!



- IJCNN94: John Deere Fund \approx \$1b reports earning 6% over Dow per month for years, using a simple neural network



A leading
psychologist
discusses
the principles
and practice of
modern
scientific
hypnosis

Hypnotism

by G.H.

Estabrooks

D38 A Dutton

Paperback : \$2.95

\$3.50 in Canada

Can **we** learn to pay more attention and be far more effective? What is the barrier? Claim: we can; the main barrier is the gap between symbolic & subsymbolic thought.

KQED: THE SECOND QUANTIZATION (I)

(Feynman, Schrodinger, Toko..., 50's)

$$\psi = \psi_0 \oplus \psi_1 \oplus \psi_2 \oplus \dots = \psi(FS)$$

$$\psi_1(x_1, s_1)$$

$$\psi_2(x_1, x_2, s_1, s_2)$$

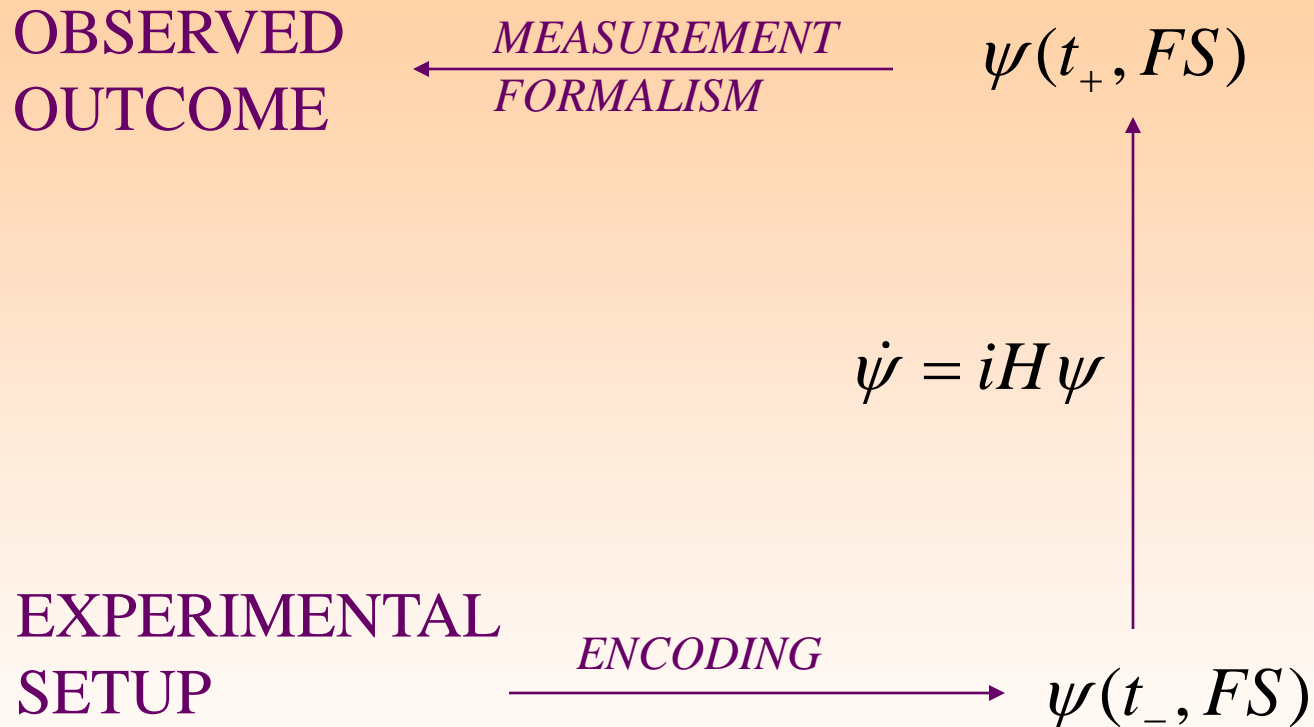
$$\dot{\psi} = iH\psi = i(H_0 + H_I)\psi$$

H_0 : like old Schrodinger (no V)

H_I : creation and annihilation

Normal Product Maxwell-Dirac Hamiltonian

THE SECOND QUANTIZATION (II): From WRONG Copenhagen to KQED



Here Ψ is a vector in FH, H a “matrix” (operator). But empirical quantum optics, condensed matter physics, quantum computing shows that this does not work! For correct prediction, encode knowledge into a full “density matrix” ρ over FH, and use “master equations” for its dynamics through “reservoirs.” IJTP08.

From KQED to Modified KQED (MQED): EXPERIMENT 2 To DEMONSTRATE FTL

