

Empirical Pictures of Time

Richard Shoup

Boundary Institute
Saratoga, California, USA

rshoup@boundary.org

Copyright © 2008 - All Rights Reserved

Obsessed with Time

MSNBC Home World News Popular Politics

Obsessed with 'time'? Word is most used noun
 'Year', 'day', and 'week' also in Oxford dictionary's list of most used nouns

World News
 Intl Terrorism
 Conflict in Iraq
 Africa
 Americas
 Asia-Pacific
 Europe
 Mideast/N. Africa
 South/Central Asia

Video
 U.S. News
 World News
 Business
 Sports
 Entertainment
 Tech / Science
 Health

AP Associated Press
 Updated: 5:50 a.m. PT June 22, 2006

LONDON - For those who think the world is obsessed with "time," an Oxford dictionary added support to the theory Thursday in announcing that the word is the most often used noun in the English language.

"The" is the most commonly used word overall, followed by "be," "to," "of," and, "a," "in," "that," "have," and "I," according to the "Concise Oxford English Dictionary."

On the list of top 25 nouns, time is followed by other movement indicators with "year" in third place, "day" in fifth and "week" at No. 17.

R. Shoup - Utrecht II, Oct '08

Boundary Institute

True or False?

- ⊘ Time is a 4th dimension, like Space
- ⊘ Time "passes" or "flows" continuously
- ⊘ Time flows in one direction only
- ⊘ Time passes equally for all observers
- ⊘ Time had a beginning in our Universe
- ⊘ Time is well-understood in physics
- ⊘ *The notion of time has to be introduced if only to distinguish cause from effect: Cause must always precede effect.* -- Gerard 't Hooft, physicist

R. Shoup - Utrecht II, Oct '08

Boundary Institute

PERIMETER PI INSTITUTE FOR THEORETICAL PHYSICS

Home Scientific Outreach What's New About Contact Careers

Home Scientific Conferences Past 2008 The Clock and the Quantum

The Clock and the Quantum: Time in Quantum Foundations
 September 28 - October 2, 2008
 Perimeter Institute

Does anything *happen*?
 Are events fixed in a *block universe*?
 Can causal influence go backwards?
 Where do Time and Space come from?

R. Shoup - Utrecht II, Oct '08

Boundary Institute

87th ANNUAL MEETING
UNIVERSITY of SAN DIEGO
San Diego, CA
June 18 - 22, 2006

SYMPOSIA

Frontiers of Time: Retrocausation - Experiment and Theory

Organized by Daniel P. Sheehan, Dept of Physics, USD
Tue -Thu, June 20-22, 2006

Tangled Concepts

- Time, change
- Causality
- Randomness
- QMeasurement
- QEntanglement
- Consciousness
- Free Will, Determinism
- Gödel theorems
- Artificial Intelligence



"Tangle", Martina Nehrling

Key Anomaly: Psi

- Traditional taxonomy inappropriate, misleading
 - Telepathy, Clairvoyance, Precognition, Psychokinesis - different aspects of the same natural phenomenon
- Important properties (*hints*), from the *evidence*
 - ➔ Time/order independence (clairvoyance vs precognition)
 - Complexity independence (goal orientation)
 - Selectivity problem (resonance, "tuning in")
 - Experimenter effect (attitude, audience)
 - Effect small (in principle?), unavailable to evolution
- Real physical phenomena, poorly understood
 - Not poor technique or analysis, fraud, hallucination, etc.
 - Analogy to electromagnetism

Psi and Physics

"Your belief system is shot."



"Needless to say, [paranormal phenomena such as precognition] would be just as upsetting in quantum mechanics as in classical physics; If genuine, they would require a complete revamping of the laws of nature as we know them."

-- Murray Gell-Mann, The Quark and the Jaguar

Psi and Physics

Option 1: There is a physical effect not yet recognized by physicists, allowing information to be transmitted in novel ways.

What kind of effect could this possibly be? It has to be so weak that it went unnoticed in all physics experiments. These experiments are tremendously more sensitive than brain tissue and the like. Deviations from the Standard Model can only be expected in extremely high-energy particles or extremely weak interaction phenomena. The first cannot be emitted by brain tissue, the latter cannot be detected by brain cells. But there are many other reasons why this option can never work. The purported signal(s) should not only be able to move backward in time, over unlimited distances, from dead bodies, etc., but also carry information in a form that brains can encode and decode without any practice (unlike the ordinary senses). All these features are completely uncharacteristic for all physical phenomena, so it will be extremely difficult to keep this option up.

A Theoretical Physicist's View [of the "paranormal"] – Gerard 't Hooft
<http://www.phys.uu.nl/~thoof/paraplue.html> University of Utrecht

R. Shoup – Utrecht II, Oct '08

Boundary Institute

Why the Physics Emphasis?

- Theory to guide experimentation
 - otherwise just wandering around
- Acceptance in science community
 - collaboration, publication, support
- Potential of a huge contribution
 - *revolution* in science and society at large

"Time is nature's way of keeping everything from happening at once. Space is what prevents everything from happening to me." -- (attributed to) John A. Wheeler

R. Shoup – Utrecht II, Oct '08

Boundary Institute

Time Symmetry

Classical

$$E = \frac{1}{2}mv^2 = \frac{1}{2m}p^2$$

substituting $E \rightarrow i\hbar \frac{\partial}{\partial t}$ and $p \rightarrow i\hbar \frac{\partial}{\partial x}$ gives

Quantum

$$i\hbar \frac{\partial \Psi(x,t)}{\partial t} = -\frac{\hbar^2}{2m} \frac{\partial^2 \Psi(x,t)}{\partial x^2}$$

A solution for +t is also a solution for -t.

R. Shoup – Utrecht II, Oct '08

Boundary Institute

About Causality

- Common sense - cause *before* effect, unidirectionally
- Experiments *cause* their results, not the other way around
- But the laws of physics are time-symmetric
 - So... precognition should be commonplace?
 - Exception?: random "collapse" of the wavefunction

"All philosophers imagine that causation is one of the fundamental axioms of science, yet oddly enough, in advanced sciences ... the world 'cause' never occurs.... The law of causality, I believe, ... is a relic of a bygone age, surviving, like the monarchy, only because it is erroneously supposed to do no harm."

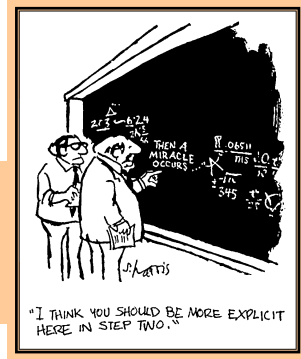
-- Bertrand Russell, 1913

R. Shoup – Utrecht II, Oct '08

Boundary Institute

Quantum Dynamics

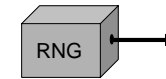
1. **Unitary evolution**
(Schrödinger equation)
 - linear, unitary, conservative, reversible, deterministic
2. **Measurement** (“collapse” of the wavefunction)
 - non-linear, non-unitary, non-conservative, irreversible, random, unpredictable



R. Shoup – Utrecht II, Oct '08

Boundary Institute

REG/RNG: Uninfluenceable, Unpredictable



- No inputs
- No memory

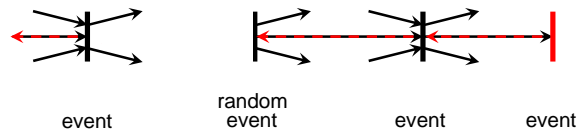


Tests: Diehard, NIST, Comscire, etc.

R. Shoup – Utrecht II, Oct '08

Boundary Institute

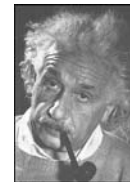
Randomness vs. Backward Influence



R. Shoup – Utrecht II, Oct '08

Boundary Institute

Is Nature Probabilistic?

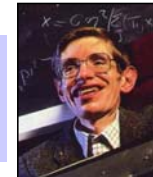


“[QM] yields much, but it hardly brings us closer to the Old One's secrets. I, in any case, am convinced that He does not play dice.”

– A. Einstein, letter to Max Born, 1924

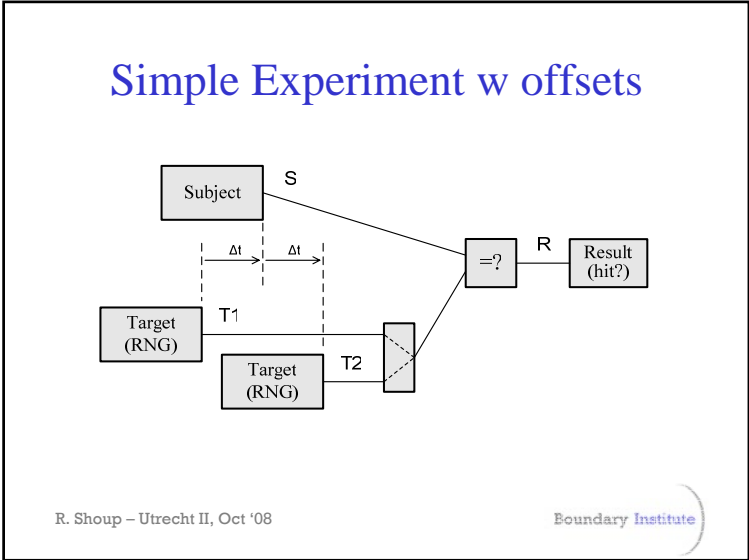
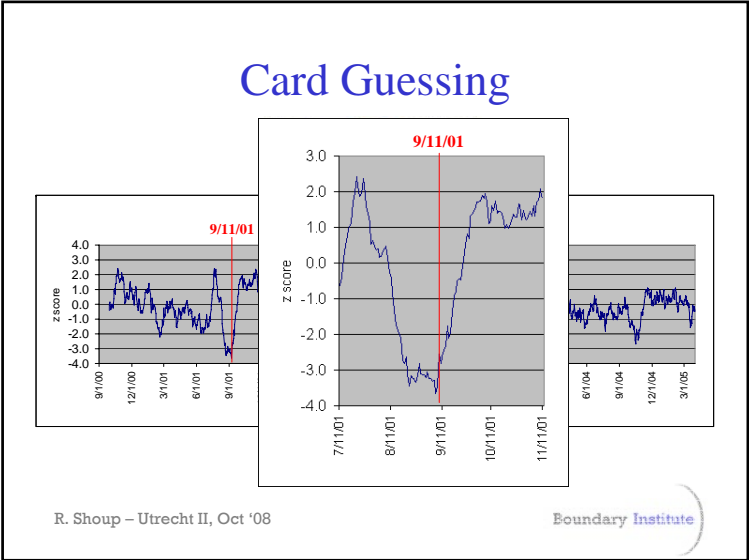
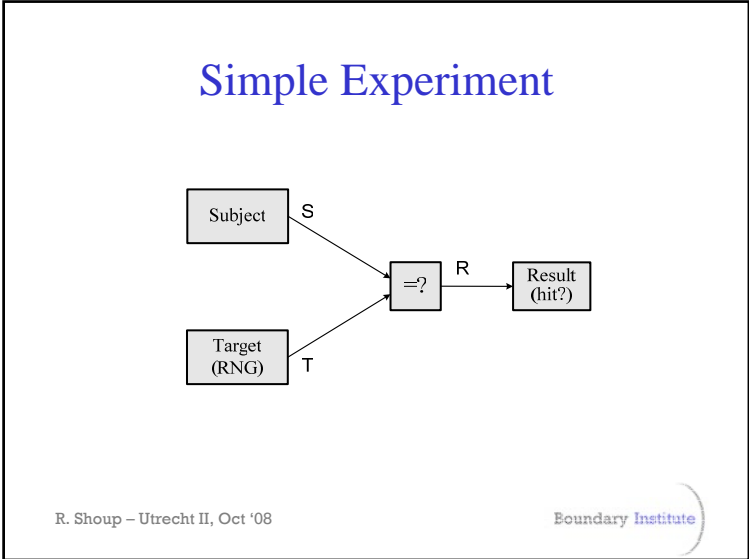
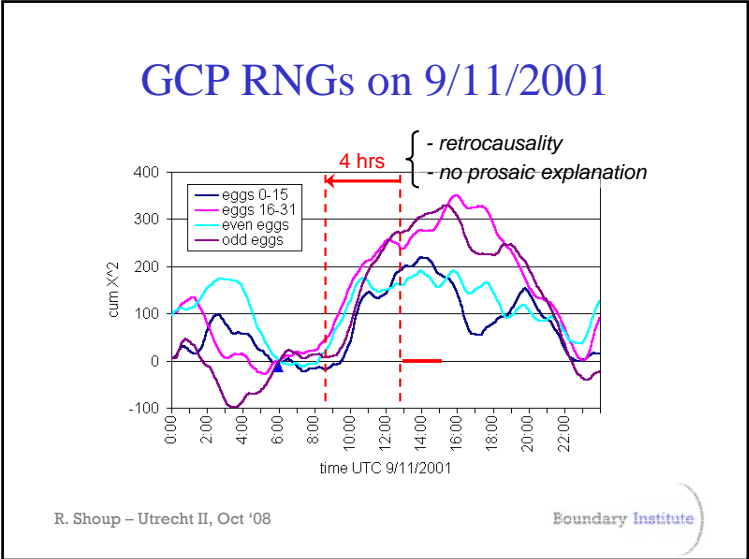
“Not only does God definitely play dice, but He sometimes confuses us by throwing them where they can't be seen.”

– S. Hawking, 1995

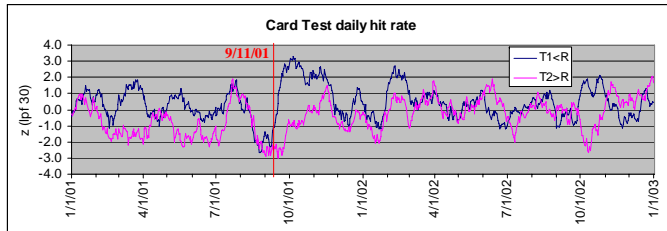


R. Shoup – Utrecht II, Oct '08

Boundary Institute



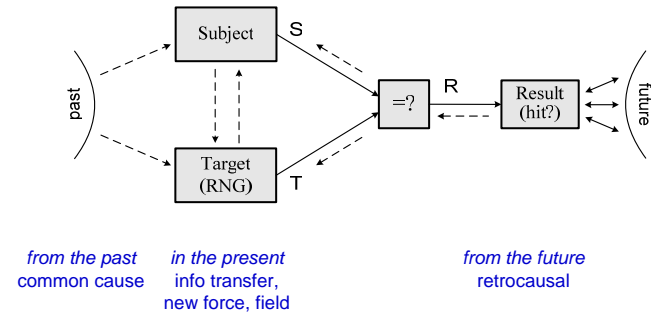
Card Guessing - T1 vs T2



R. Shoup – Utrecht II, Oct '08

Boundary Institute

Correlation Path



R. Shoup – Utrecht II, Oct '08

Boundary Institute

Explanatory Theory

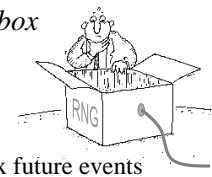
- Unitary bidirectional causality/influence
 - Modest changes to quantum theory formalism, simpler
- Good agreement/explanation for psi properties (hints)
 - Time/order independence (clairvoyance vs precognition)
 - Complexity independence (goal orientation)
 - Selectivity problem (sensing & affecting)
 - Experimenter effect (belief, audience)
 - Effect small (in principle?), unavailable to evolution, etc
 - and more...

R. Shoup – Utrecht II, Oct '08

Boundary Institute

Origin of Randomness?

- RNG is best thought of as an *empty box*
 - Not a generator, but a *receiver*
 - Reflection of *output* (dependencies)
 - No such thing as causeless action
 - Output *appears* random due to complex future events
- Effects can be understood *without injury* to physics
 - QMeasurement is *unitary* -- no “collapse”
 - Causal influence forward and backward (*relational*)
 - Events are connected through *past* or *future* interactions



R. Shoup – Utrecht II, Oct '08

Boundary Institute

Summary FAQ

- Q: Is Quantum Measurement unitary & reversible?
A: Yes, if the environment is included.
- Q: Does the wavefunction really “collapse”?
A: No. It's all unitary evolution.
- Q: Are RNG outputs really random & causeless?
A: No. They are influenced by future events.
- Q: Can Future events influence the Present?
A: Yes! But usually only in small ways.
- Q: Does God play dice?
A: No! Nothing is fundamentally “random”.

R. Shoup – Utrecht II, Oct '08

Boundary Institute

Summary FAQ - II

- Q: Does psi require rewriting physics?
A: No, just a modest change to QM formalism.
- Q: Can “random” processes be influenced?
A: Yes. The evidence is strong & theory predicts it.
- Q: Can these effects be made large & controllable?
A: Yes, but it requires manipulating many particles.
- Q: Why isn't there more psi?
A: Because we're on a steep entropy slope.
- Q: Do we have “free will”?
A: Literally, no. Experientially, practically, yes.

R. Shoup – Utrecht II, Oct '08

Boundary Institute

Directions: Experiment

- Analysis of prior experiments and databases (especially large ones such as the GCP, GotPsi, others) for retrocausal effects on RNGs and on subjects
- Analysis of prior experiments in other scientific fields for retrocausal or other psi effects
- Experiments carefully controlling and manipulating the size and complexity of future dependencies to a stream of random events, including the experimenter(s)
- Experiments involving known physical variables such as local sidereal time, lunar phase, local geomagnetic parameters, etc

R. Shoup – Utrecht II, Oct '08

Boundary Institute

Directions: Theory

- Examine further implications of unitary measurement, degree of backwards influence
- Entanglement due to *future* interactions
- Double-boundary conditions, Markov chains
- Models and predictions for real experiments
 - discrete combinatorics (Link Theory)

R. Shoup – Utrecht II, Oct '08

Boundary Institute

Acceptance: Perfect Storm

- Phenomena are *small, elusive, difficult to replicate, strange*
 - Uncontrolled variables, experimenter effect, etc.
- Phenomena *appear to violate physical laws* ***
 - Not true!
- *Noise level* in the field is quite high
 - Nonsense, true believers, true dis-believers, etc.
- Phenomena investigated mostly in the realm of *psychology*
 - *Parapsychology, paranormal, negative definitions*



...But the significance and benefits are (will be) very large!

R. Shoup – Utrecht II, Oct '08

Boundary Institute

Directions: Acceptance

- Fundamentally a *physics* problem
- *Deeper* physical theory that connects
 - Consistent, plus corroborating evidence
- Define phenomena, terms, *positively*
 - As anomalies *within* physics, not outside
 - No vague “consciousness”, “energy”, etc.
- Outreach, collaborations, publication, etc.

R. Shoup – Utrecht II, Oct '08

Boundary Institute

Big Picture

- Deeper connection between Science and human experience -

Functional/unidirectional cause-and-effect

⇒ *usage, control, manipulation, consumption*

OR

Relational/bidirectional cause/influence

⇒ *co-existence, cooperation, symbiosis*

Which of these is a better model for Science in the 21st Century?

R. Shoup – Utrecht II, Oct '08

Boundary Institute



Time's Up!

www.boundary.org

rshoup@boundary.org

R. Shoup – Utrecht II, Oct '08

Boundary Institute