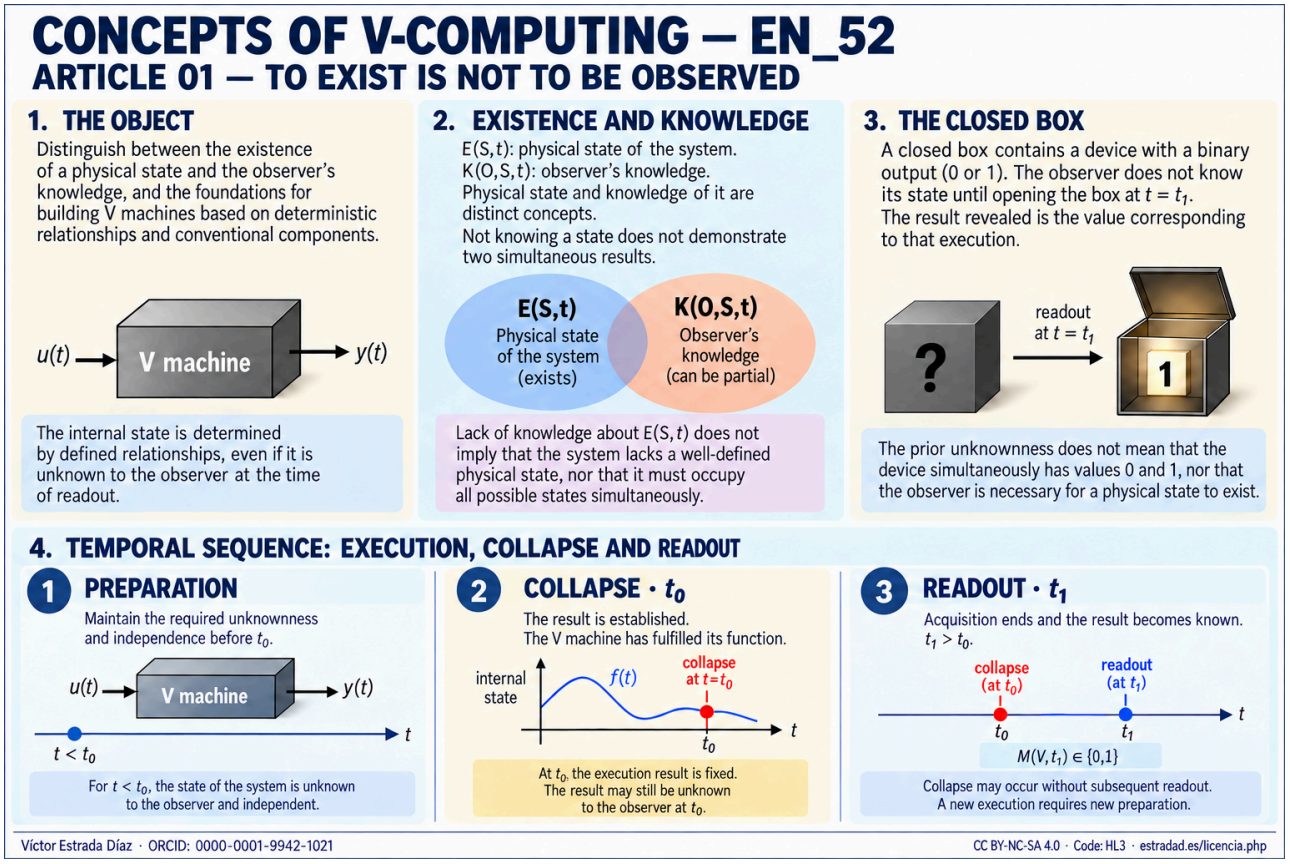
CONCEPTS OF V-COMPUTING — EN_52

ARTICLE 01 — TO EXIST IS NOT TO BE OBSERVED



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1. PURPOSE

This article establishes the fundamental distinction between the existence of a physical state and an observer's knowledge of that state.

V-computing starts from its own definitions and relations, without depending on interpretations of other physical theories.

Its purpose is to establish the foundations for building deterministic machines using conventional electronic or computational components, whose internal states are unknown to the observer until the measurement instant defined by the protocol.

Lack of knowledge of a state does not constitute a physical property of the state itself.

The properties of a V machine must follow from its construction, the relations governing its operation and results that can be checked experimentally.

The demonstrative objective of ES_52 is to build machines using operational concepts associated with qubits without needing quantum mechanics to define their operation.

This is not about simulating quantum amplitudes or artificially reproducing a mathematical description of the Q machine.

It is about building a V machine, subjecting it to specific operations and establishing through tests which operational equivalences exist between the two architectures.

2. EXISTENCE AND KNOWLEDGE

Consider a physical system S and an observer O.

We denote the physical state of the system at time t by E(S,t).

We denote the information available to observer O about system S at that instant by K(O,S,t).

These are distinct concepts.

E(S,t) represents the system's state.

K(O,S,t) represents the observer's knowledge.

The absence of complete knowledge about E(S,t) does not imply that E(S,t) lacks physical definition.

Nor does it imply that the system must simultaneously occupy every state the observer considers possible.

The expression “I do not know the state” describes a limitation of knowledge.

The expression “the system is in several states simultaneously” makes a different physical claim.

The first expression does not prove the second.

In a V machine, the internal state is defined by its construction and deterministic evolution, even though it is unknown to the observer.

The existence of the state does not depend on its observation.

3. THE CLOSED BOX

Imagine a closed box containing a device with a binary output.

At the instant considered, the device has a definite physical value, 0 or 1, determined by its operation.

The observer remains outside the box and has no access to the internal state.

The state is unknown to the observer.

At $t = t_0$, collapse occurs and the execution’s result is established. On completing readout at t_1, the observer learns the value 1.

Readout provides the result established at t_0, even if knowledge of it is completed later.

The earlier lack of knowledge did not mean that the device simultaneously had the values 0 and 1.

Nor was the observer’s intervention necessary for the device to have a physical state.

Measurement allows the observer to know it.

This example represents a V machine and is not, by itself, a demonstration of the internal behavior of a quantum system.

The distinction between a physical state and knowledge of it is the concept we seek to establish.

4. TIME, MEASUREMENT AND COLLAPSE

V-computing explicitly introduces time into the description of the system’s state and internal relations.

Let $f(t)$ be an internal function of the system and let t_0 be the instant of collapse. We denote the instant when acquisition of the result is completed by t_1.

Before t_0, the state to be observed is unknown to the observer, according to the established protocol.

The physical evolution of the V machine is determined by its internal relations.

At $t = t_0$, collapse establishes a binary result. Readout is completed at t_1:

$M(S,t_1) \in \{0,1\}$

Measurement provides a single definite result.

Before t_0, the result of that execution has not been established through collapse.

A distinction must be made between the physical state before observation and the result obtained when observation takes place.

In V-computing, we call the event that establishes the execution's result collapse. That result may remain unknown to whoever will read it until t_1, with $t_1 > t_0$ if readout is completed later.

Measurement encompasses the process needed to acquire the result. Its recipient may be a person or another machine.

The operational readout correspondence between Q_β and Q_v concerns obtaining a definite binary result. Establishing the result must be distinguished from acquiring or consulting it later, as developed in EN_52_04.

This correspondence does not require identical internal physical mechanisms to be attributed to Q_β and Q_v.

Nor does it require interpreting the earlier lack of knowledge as the physical coexistence of mutually exclusive results.

Measurement may interact physically with the system. Its possible effects must be distinguished from the change in the observer's knowledge.

5. INITIAL DEFINITION OF THE V MACHINE

A V machine is a system built using conventional electronic or computational components, whose evolution is determined by defined relations.

Let $x(t)$ be its internal state and $u(t)$ the applied input.

For discrete evolution, we can write:

$x(t + \Delta t) = F(x(t),u(t))$

Its physical output is represented by:

$y(t) = G(x(t))$

F and G are defined by the machine's architecture.

The state x(t) is unknown to the observer before the measurement established by the protocol.

This lack of knowledge does not introduce indeterminacy into the relations F and G.

Collapse at to establishes the result. Readout completed at t_1 makes it possible to know the output corresponding to that execution:

$M(V,t_1) = y(t_0)$

Readout is assumed to be suitable for obtaining that output. If the readout operation physically modifies the system, that effect must be described separately.

The construction does not require storing 2^n states, simulating quantum amplitudes or executing random decisions to determine its evolution.

Any randomness used in preparation must be distinguished from subsequent deterministic operation.

The V architecture may incorporate relations between multiple units, memory and circuit composition.

The possibility of building a complex machine from V units will be addressed in later articles.

6. OPERATIONAL DEFINITION OF Q_β AND Q_v

We will call a binary quantum unit, or qubit, Q_β; its measurement in the computational basis yields one of the results:

$M(Q_\beta,t_1) \in \{0,1\}$

We will call a binary V-computing unit, built through deterministic relations, Q_v; its measurement yields:

$M(Q_v,t_1) \in \{0,1\}$

In the protocol we study, the state corresponding to each unit is unknown to the observer before measurement.

In both cases, a definite binary result is available when acquisition is completed at t_1.

Q_β and Q_v therefore share an initial operational correspondence between unknown state, measurement and observable result.

The conventional mathematical description of Q_β uses quantum amplitudes; the construction of Q_v does not need them.

The initial equivalence between these units concerns the readout event and the set of possible binary results.

This equivalence must not be confused with proof that all circuits built with Q_β and Q_v reproduce the same results.

That requires examining transformations, relations between units, correlations, interference and resources used.

These checks form part of the ES_52 experimental program.

7. THE TIME FUNCTION f(t)

The internal function f(t) allows time to be incorporated into the description of the system's evolution.

The existence of a function, its mathematical definition and the observer's knowledge of its values must be distinguished.

A function may be defined without an observer knowing its value at a particular instant.

In a V machine, internal relations determine the system's physical evolution.

Readout completed at t_1 provides the result established by collapse at t_0.

Distinguishing temporal evolution, physical state and knowledge allows the measurement event to be described without turning lack of knowledge into an additional physical property.

The full mathematical development of f(t), its temporal conditions and its relation to observable states belong to article EN_52_05.

8. DEFINITION, CONSTRUCTION AND DEMONSTRATION

In ES_52, we distinguish three levels:

A. CONCEPTUAL DEFINITION

A physical state and knowledge of that state are different concepts.

Ignorance about a state does not prove the physical coexistence of mutually exclusive values.

B. CONSTRUCTION

The V machine is built using deterministic relations and conventional components.

Its architecture must be described in a concrete and verifiable way.

C. OPERATIONAL DEMONSTRATION

The V machine must be subjected to the same problems and to protocols comparable to those of the corresponding Q machine.

Comparisons will include the operations performed, measurement results, relevant correlations and computational resources.

An isolated agreement does not prove general equivalence.

The conclusion must correspond exactly to the scope of the tests performed.

The aim is not to give priority to a theoretical interpretation, but to establish what the machines built are capable of doing.

9. CONCLUSION

To exist is not to be observed.

The physical state of a V machine is determined by the relations governing its evolution, even though it is unknown to the observer.

Collapse at $t = t_0$ establishes the execution's result; readout completed at t_1 makes it possible to know it.

In V-computing, collapse completes that execution's function, even if the result has not yet been read. A new execution requires repeating preparation and restoring the required unknownness of the inputs.

The operational correspondence between Q_β and Q_v establishes common terms for describing measurement without imposing Q's physical foundations on V.

V-computing aims to build and verify machines that perform operations associated with quantum computing through deterministic relations and conventional technology.

The scope of equivalence between Q and V machines must be established through reproducible constructions and results.

10. RELATION TO THE FOLLOWING ARTICLES

EN_52_02 — The box and Schrödinger's cat.

EN_52_03 — The Q_β bit and the Q_v bit.

EN_52_04 — Collapse at t = to and measurement.

EN_52_05 — The internal function f(t).

EN_52_06 — Relations and superposition.

EN_52_07 — Correlations and Bell.

EN_52_08 — Construction of Q4 and V4.

EN_52_09 — The V4 cryptomachine.

END OF ARTICLE 01