Is your Computer Real?

What is it anyway? rev 2, 9-8-14

by Anthony Rizzi

As you know, there is a radical difference between real things, things that exist in the real world, and purely mental constructs, things that can exist only in your mind. But, though it sounds like something only crazy people would do, nearly everyone does confuse the two in important cases.

To believe something that sounds so outlandish, I'm sure you will want a couple examples. Your computer, in so far as it is a computer, is not real. Your watch, in so far as it is a watch, is not real, but purely mental. How so? Let's start with the watch and then move to the computer. In the process, we will uncover a serious problem with our world view that threatens man's intrinsic dignity.

What do you mean my watch is not real!

When we speak of the watch, in so far as it is a watch, we are speaking about its *function* of telling the time. A *function* is not a thing, but a use we make of a thing. If we try to imagine the function as a really existing thing, we have created something that we can think about but not something that can exist on its own. Hence, the watch in so far as it is a watch, i.e. ***in so far as it is an abstracted function***, is a purely mental thing, not a real thing.

The especially mental nature of the way we think about a watch is even more clearly seen by looking a little more closely at my digital watch. It now has 2:00 on it. We say it is two O'clock, but this is not a two or an O'clock! Those are meanings which we assign to the properties[1] presented to us by our senses. It is not two of anything let alone two O'clock, but the thing that "displays" this is a liquid crystal;[2] one part of the crystal is activated by a field (changing the way it polarizes the light) so that it is darker than the rest, making a certain shape. The shape is not two! Again, we assign that meaning to it. It is an artificial symbol; a symbol we made up. This is clear because other cultures have used different symbols to mean the number two. Symbols exist only in my (or your) mind, not in the thing. The thing on my wrist does not tell time, we do. Again, since symbols obviously only exist in my mind, we see especially clearly now why the watch, in so far as it is a watch, is only in my mind.

Of course, I can also mean, and *confusedly* do often mean, by a "watch" just the thing on my wrist. This brings up a *second* confusion that all of us moderns fall into; this second confusion arises out of the first and manifests our first confusion. We think that thing around my wrist is ***one*** thing, *because we think of it as its function*. Ask someone, ask yourself, is a watch one thing or many things. In fact, it is actually many things that have been put together so that their various powers can work together to do certain things that we then use to tell time.

How so? To go along this part of the trail, we need to stop briefly and pick up a couple simple common sense distinctions that

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[1] We will discuss the meaning of property shortly. There are nine different types of properties. (cf. footnote 3)
[2] It is called an LCD (liquid crystal display).

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we all get through our senses. Note these two principles are, in fact, part of the larger set of first principles that we get through our senses.[3] A substance is something that exists on its own, like a dog or a man or a tree. A property is something that exists in a substance, like red or hard or cold.

So, what is the thing on my arm that I use to tell time? It is not a single substance, as we continually treat it in our conversation and even in our thinking. It is, using our more precise distinctions, many *substances* put together in such a way that it performs the function of a watch. We directly sense the properties of the various substances that make up the watch. Through them, we can figure out that it is many substances. We see, for example, that there is a shiny battery[4] that I can change out that is obviously totally distinct from the rest of the watch. After all, it is only stuffed into a cavity. And, putting a dog in a cage (say to carry on a plane) does not, of course, make the dog and the cage now magically one substance. The powers (a type of property called a quality)[3] of the various substances cause certain changes that work together so that we can assign the meanings described above.

We've said that taking the thing on my wrist as a single substance, rather than recognizing it as many, arises from my treating a function as if it could exist on its own; indeed, we've treated it as if it were the essence of the thing on my arm. In so doing, we even more firmly plant the watch in its purely mental realm, for, in the external world, many substances cannot be one substance.

Why a computer is not real

We are now ready to address the reality of the computer. You guessed it (or figured it out?), the computer is not real either! Not in so far as it is a computer. The same reification of function as an actually existing single substance applies in this case, but, it is a particularly interesting case.

The computer does not really compute at all. Physical changes occur in the computer. We then put these changes in correspondence with certain rules which, in turn, reference some logical operation in our minds which, in turn, reference other symbolic structures such as a written language that finally can reference the real (external) world. In short, there are layers of reference between the basic physical process (things that happen in the electronics and in the mechanical drives) and the things you see on the screen. Let's take this apart in more detail. The next section, where we do this, is very important and should be read. However, because it touches on a few simple technical details, for a first read, some might want to skip to "What does it all mean?" If you do skip it, you *really* should come back to it because, without it, you will not understand the nature of your computer or our confusions.

What is a computer, in more detail?

You may know that the computer (say a windows computer) works by a microprocessor that "processes bits." This processor is

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[3] *See* my *Kid's Introduction to Physics (and Beyond)* which, for the first time at this level, gives these principles and shows where they lead. Note that this kid's book is for everyone, including adults. It is called a kid's book because the principles are those that should be learned as a child and because it is presented at a very simple level. Since none of us were taught the principles in the book, we can say it is for the kid in each of us.

[4] I can begin to see that it is a battery, for example, by noting that the display shows the shaded shapes we interpret as numbers only when it is in place.

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controlled by a processor language which is, in turn, fed by an assembly-level language, which is, in turn, fed by an operating system (another kind of "language"), such as "Windows."[5] The operating system allows one to run even higher level programs such as your email program or even a speech recognition program! One level builds on the next. Ultimately, everything has to be converted to the microprocessor language, also called machine language.

Physical Properties Assigned Base 2 Meaning

The microprocessor is based on the binary system of representing numbers; we'll start here. As you know, ordinary numbers are base ten. Binary numbers are base two. Neither of these is a natural representation that could signify what it means. For example, consider writing the number two; in base ten, we write "2"; in base two, we write "10". A more natural way of writing two is II, as here we *actually* have two shapes. The computer, of course, knows nothing about numbers. It is us men that know numbers[3]--we have abstracted them from physical things.

In base two, we need two symbols, a symbol to represent the one and a symbol to represent the nothing, or zero. In a "place valued" system, where each place is assigned a value, like base ten and base two, each place in the symbol indicates a certain number. In base two, also called binary, the first place is the number of ones, the second place is the number of twos, the third place is the number of fours, the fourth the number of eights and so on.[6] So, 11 means: 1 two and 1 one, which in base ten, we write as "3." And, 101 means: 1 four, 0 twos and 1 one, which in base ten, we write as "5."

How can a physical system represent this? We can pick whatever is convenient. We pick a "voltage," that is, for example, a state of a part of a doped silicon crystal. Our microprocessor is typically a single small crystal of silicon. For the common CMOS transistor circuits, we assign a "0" if the voltage is low, say below 4 volts, and it is assigned "1" if it is high, say above 8 volts.[7] We put together the system so that no voltages in between occur when it is working correctly. These voltages result from accumulations of electrons. It is clear that an accumulation of electrons and the resulting voltages are[8] not a "1". It is still more clear that electrons and voltages are not the nothing represented by "0." Perhaps, though, you begin to see how focusing on a representational number system, with all its complexity, might

[5] For those more familiar with computers, the operating system itself is written in a fairly high level language like C++ (there are potentially much higher languages, such as a standard English interface), and then is converted to the machine language of the processor that you want the operating system to run on. It is converted using an already functioning computer (which already has a working operating system). The conversion process, called compiling, is done by a program that typically, at some point in its genesis, used the assembly level language.

[6] For those who know the notion of power, we can write this in the following revealing way: the first place counts the number of 2^0, the second counts the 2^1, the third counts the 2^2, the n[th] place counts the number 2^{n-1} `s.

[7] For those more familiar with electronics, this is for a 12 volt supply, i.e., V_{DD}=12v. In general, we assign a "0" if the voltage is between 0 and 1/3 V_{DD}, and it is "1" if it is between 2/3 V_{DD} and V_{DD}.

[8] Note we have not even here mentioned that the numbers given here such as "4 volts" are not themselves simply physical things but are the result of a comparison between two physical properties[3]; namely, the strength of the ϕ field on the particular transistor terminal and the standard field strength called one volt. This introduces more distance from the simple physical reality by connecting it, in a somewhat compact and thus hidden way, to something outside of it.

make someone miss the obvious, e.g. that voltages are not shapes like “1” or “0.”

Physical Changes Assigned Rule Meanings

Still, there is more to the computer, which means more to understand but also more that might confuse you by misdirecting your attention. As you know, because you do not see these 1’s and 0’s on the monitor, the computer does not complete its operation here. Perhaps some technician might see the 1’s and 0’s in testing the microprocessor, but these numbers are an intermediate step of the computer’s operation. Instead, the computer, that is the group of substances that I’m using right now, does arithmetic with these ones and zero. There I go again! No! The computer does *not* do arithmetic! Physical processes go on inside the box(es) that hold the parts of the computer. I assign meaning to those processes so that it can ***aid me*** in doing the arithmetic.

We invent an algorithm (that is, a set of rules) for doing binary addition. It’s very much like the rules you learned in grade school about how to “carry the one” to the next place. Physical processes can be made to occur by putting atoms in proximity to each other so they will interact in certain ways. These are called integrated circuits. You can think of them as being wired in a permanent way, but remember they really are parts of a single piece of silicon in this case. These parts interact in such a way that I can, by applying the right series of voltages (another physical process), get them to make high (H) and low voltages (L) that for example count from 0 to 3. That is, I can make the voltages at the output of each of two transistors do the following in succession: LL, LH, HL, HH. This can be written in base ten as: 0, 1, 2, 3. It’s counting. No. It does not know how to count, ***but*** it is undergoing a sequence of physical processes that I can, because of my deliberate use of the physical processes, conveniently assign a meaning of counting.

Similarly, one can make a silicon crystal in such a way that, under the influence of a certain change of a voltage to part of the crystal, it will undergo a process that will allow one to symbolically assign the meaning of addition to the output. For example, part of the crystal can be made so that it has two inputs at each of which I can put a high or a low voltage. It can have two outputs as well, so that when I have, for example, a high voltage at each input, the outputs yield one high voltage and one low. Then, if the outputs are assigned the proper order, I have, in binary: 1+1 = 10, which in base ten is written: 1+1 = 2. I now have set it up so my computer can add. No. You know by now that this is *only* my purposeful and thoughtful assignment of meanings. The physical properties, such as the voltages at a given moment, have been assigned simple meanings, such as numbers, and certain causal changes of properties have been assigned rule meanings.

Now, this may not seem very helpful since I obviously can do “1+1” much faster in my head. However, it is easy to imagine that if I had to add two 64-place numbers, I would rather have the computer execute its processes and I implicitly assign the rule meaning to those processes so that it *effectively* does the addition for me. I now could extend this same reasoning to all of binary arithmetic and other operations, such as memory lookup.

The computer now can, in principle, do anything I can put into a series of rules, as long as I can come up with a series of processes that

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reduces to the rules of arithmetic and a few other related rules.

Hierarchy of Rules and Symbols, One Level Controlling the Next

I can, for example, make up a *higher* set of rules to have the arithmetic do some other process such as appear to move my cursor when I move my mouse. The silicon and other parts are going through a series of changes that, through our interpretation (and that alone), are executing rules in response to voltages transmitted from the mouse.[9] This is a very well choreographed dance. The mouse moves, the cursor "moves." [10] It is so because of the arithmetic rules that are back behind the higher set of rules. Because of the already established assignment of the arithmetic rules and the rules that control them, I can think about what I want to do and then put it into my own rules.

Indeed, at some level, an even "higher level" programming comes about (for example, Java) where I can decide what I want to do and write it down in a way that appears not far from standard English. These shapes I type down[11] result in a sequence of high and low voltage sets being stored (actually associated with electrons) that then can allow or cause a series of processes to begin. When you, for example, run a certain program, this series of processes takes the highs and lows that represent a message to your friend and ultimately leads to causing the inside of a wire to have certain amplitude and frequency radio waves traveling down it. We have, in analogy to physical mail, sent an email message to a friend. Remember, this complex process is, in reality, a series of physical changes. However, it is through man's careful design and *assigning* of meaning to each process (put together for that very purpose) that it has any of the "computing" meaning we can ascribe to it. Because of our connection between the rules (for example the rule of binary arithmetic) and the physical processes, we have a consistent meaning that is assigned from the microprocessor all the way up to the monitor and printer. But for the user, it is the end result that must be able to be assigned meaning. It is clear, however, that *only* if the *whole* system is clearly thought out with the appropriate meanings coherently assigned to physical processes can the end result be given a consistent meaning. Any mistake in the execution might, for example, end in the whole screen turning blue when the email opens.

What does it all mean?

We see the computer is highly symbolic. One layer of symbol is layered onto another. Hence, a computer, in so far as it is a computer, is purely in the mind. Without the mind, it's not a computer, for the physical processes are assigned their meaning by the mind. Of course,

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9 In the case of a wireless mouse, the mouse causes the voltage change through the intermediary of the vaccum---(*see* plana in kid's book referenced in footnote 3)

10 In fact, the cursor does not move. It's only the colors and intensity of the parts of my screen that change; no body moves across my screen through places and at the rate that the cursor appears to. Again, this symbolizes motion for me. It is a much more natural easily recognized symbol; it's so good we might call it a planned optical illusion.

11 No, I don't type them in the first sense of that word. That would imply that I some how physically press the shapes on the page like the old typewriters actually did. In fact, what happens is that my "typing" causes a voltage change that triggers binary high and low voltages that start certain physical processes that end in my screen changing its color or intensity in certain ways. All this can occur because of the power given me by assigning meaning to the physical changes in the state of the parts of the computer such that I can do things such as binary arithmetic.

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if everyone that knew anything about computers and modern languages died, someone else could come along and figure out some layer of meaning that was intended and it would be a computer for him. If he does so, to the degree he does, he *mentally* recreates our assignments. “2,” for instance, still does not *physically* mean the number two.

This problem of confusing symbol with reality is so severe that nearly everyone falls into it. This is because practically no one has been taught these distinctions in any clear way, even computer experts, no, *especially* computer experts.

In case you don’t believe this confusion of symbol and reality is that severe, consider the following. It is confusions of this type that have made it easy for very serious top technical people, in particular computer people, to say “I don’t think the universe exists” and “this [the universe] is just what would happen if you had a big computer and dropped a program into it.” MIT professor Marvin Minsky[12] said precisely those things. Google software engineer, Dr. Ron Garret, said, “We are not made of atoms, we are made of bits [binary numbers][13], we are our thoughts and these thoughts actually reside, if you will forgive stretching a metaphor to the breaking point, we are a simulation running on a quantum computer.”[14]

After all, once you think a computer, defined as an abstracted symbolic function, is real, you have identified reality with purely mental things, so it is only a matter of articulating that thought to get to statements like those of Dr. Minsky and Dr. Garret.

The problem we describe in this paper, including the statements mentioned above, has roots in an even deeper error, the error of not starting clearly with the principles we know through our senses, but instead starting with modern equation-centered science as if it, itself, did not depend on these simple generic principles.[15]

What is the proper way to think about a “computer” and a “watch” so we can avoid living in a purely mental world? We should remember that there is no substance with the essence “computer” or “watch.” This is what we mean when we say that a computer, in so far as it is a computer, is solely in the mind. Instead, we should know that a “computer” is a group of substances set up to interact in such a way that its actions[16] can easily be *interpreted* as solving problems and/or doing tasks such as communication or calculation. This definition focuses on the reality which is *many* substances, such as the LCD in the display, the silicon in the microprocessor and the many

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[12] Said on Book TV CSpan2 dated 9/18/03

[13] “Bit” is the word for the binary place holders in a number written in the binary representation. For example, the binary number 11 (which is 3 written in base 10) has two bits.

[14] *See* youtube video of “Google Tech Talk.” To get the full brunt of this statement, start at 53:26.

[15] Modern science is a wonderful thing and it is absolutely essential to human knowing, but it is not the first thing you know but depends on a whole science that comes before it. This first understanding of the physical world starts with the physical principles given through our senses starting from the time we feel something in utero. See my *Science Before Science*, my *Reintegration of the Modern Mind* given as a plenary talk at the 2006 American Maritain Association conference (published in *Reading the Cosmos: Nature, Science and Wisdom (2011))*(http://www.iapweb.org/articles/Reintegration ModernScienceWeb.pdf), and my *A Kid’s Introduction to Physics (and Beyond)*.

[16] Again, these actions include, most manifestly, the display on the monitor, but also include physical changes all the way down to the level of small parts of the silicon.

substances that make up the hard drive. And, it points out that the changes that the substances undergo are externally real but the "computation" meaning is not itself in the substances or the changes; it is assigned by us.

Similarly, a watch is a group of substances designed externally by us so that the physical changes they undergo can be interpreted as giving us the time of day. It is the nature of the properties we use that make the assignment helpful, but it is still an assignment, not part of the essence of the thing. There is no nature that *is* the function we assign to a thing or set of things; there are only natures that can be *used* for certain functions.

It should be clear now that what we have been talking about is a *complex* type of error, because it is a ***confusion*** between two or more things; it is, in this sense, worse than an error, for it is, as physicist Wolfgang Pauli famously said of an unclear physics paper, "not even wrong." It is not a simple type error of thinking X is true, when it is, in fact, false. This latter would be a clear error that we could articulate, and someone could then say that it is wrong and explain why. With our *confusion* type of error, we can sometimes deny we think it because we don't clearly know that we think it; this is why we say it is a confusion. Again, it is an error of effectively thinking X is true in most of our actions and thinking, but not really clearly knowing that we have framed the proposition X or what it means. In the case of the watch, we have never thought about what a watch is in any clear way.

The whole issue of the watch and the computer may now seem so clear that you feel like there should be and is no real problem. This is often how it feels when this confusion is sorted out, but, despite this, that confusion still stands ready, inside of each of us, to take over again at the merest nudge. These nudges come from inside of us (it's the way we have been taught and live) as well as from others (they also have been so taught and live), and so the confusion will take over again. It will take over; we just might not notice it, which only makes it worse. That is, it will ***if*** we don't meditate on and remember the things we have discussed, habituating the proper distinctions in our everyday thinking.

Indeed, because of an essential deficit in our education with respect to first principles,[15] we often conflate real things, things that exist outside the mind, with things that can only exist in the mind. What should we do with this new revelation of our nascent insanity, our confusion of reality with mere thought?

How do we return to sanity?

We should let these revelations set off an alarm in us. The alarm should make us feel and act on our urgent need to return to the basics that we should have learned through the senses as children, but did not because we were never taught them in a clear way. This means we should read and re-read articles like this, talk to others who have read such articles and spend time and consistent effort to learn ourselves using the resources, for example, in footnote 15 and at www.iapweb.org. We also need to support the only organization that is doing work in this area, the Institute for Advanced Physics. This support can be in the form of prayer and verbal and emotional support, but also needs to include financial contributions, as well as contributions of your time and energy, as you are able. A problem like this that is at the source of all of our thinking is everyone's business. Of course, each person has a role dependent on his vocation. The point is that because the problem attacks the foundation of our culture, unlike the bulk of other things that do not (there is only one foundation), it affects everyone directly and personally, and everyone does have a role. What can we expect if we do nothing?

Well, we moderns are implicitly taught, in many ways, a symbol-first way of thinking and acting. This is powerfully built into us as we use and live with an array of heavily symbol-laden functions. Technical people are even more inculcated with this symbol-first thinking coupled with mental system-building. A technical person's description of a computer might look superficially like the description given above, but it would gloss over and even implicitly confuse the critical distinctions between the physical realities and the symbolic systems that are being built and mentally assigned to those realities. The non-technical person fares no better; indeed, in a technical culture like ours, the technical people lead the rest. What's more, most people, especially those who *appear* to be the most influential among us, such as media personalities and politicians, tend to have no technical education and, in fact, tend to have a kind of math/science phobia. Without the technical knowledge, they cannot know what the most powerful things around us are. In short, practically none of us know what the most powerful things that we use everyday really are. Not knowing what they are, but knowing what they do, makes us, by default, fall more heavily back on taking their function as their reality. That is, what we use a thing for substitutes for its essence. We should not then be surprised that even men are increasingly treated as functions rather than men; we are increasingly human doings rather than human beings! After all, how can someone hope to understand the nature of a man when ***he does not even really see***, let alone understand, the nature of the simple things he uses and refers to everyday?[17]

We will, in fact, increasingly think of man as a mental construct, as a kind of artifact himself; thus, we will develop a mechanical culture that does not respect man's true nature but only his function. Man will be treated as part of a collective, a machine (a function), instead of an individual to be loved and treated with the dignity due a nature with an end which is Truth Himself.

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[17] In fact, people do not even know what a physical thing is; that is, they cannot give a conceptual definition. This is one of the first principles given through our senses upon which everything we know stands (*see* my introductory book referenced in footnote 3).

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A Helpful Example

After writing this article, it occurred to me that an example of how this artifact thinking affects us in the depth of our social thinking would help to bring home how truly erroneous our functional way of thinking is. A good way to underline the seriousness of an error in a functional culture is to show the pernicious consequences of that error.

The functional philosophy, which contains the implicit idea that functions are the essence of things, was first seriously proposed by Jeremy Bentham (1748-1832). He is for this reason considered the father of utilitarianism,[18] the system of thought based on consequence driven activity rather than truth driven activity. In other words, a function, an activity, takes the center stage rather than the nature of things.

Bentham, rightly recognizing where functional centered thinking must logically go, said (in his *Anarchical Falacies*) that "*Natural rights* is [sic] simple nonsense: natural and imprescriptible rights, rhetorical nonsense,—nonsense upon stilts."

Using this principle, he wrote a scathing critique of the Declaration of Independence, the document which best gives the core principles of American government. Bentham says:

> "They are about "to *assume*," as they tell us, "*among the powers of the earth, that equal and separate* (120) *station to which*" — they have lately discovered — "the *laws of Nature, and of Nature's God entitle them*." What difference these acute legislators suppose between the laws of *Nature* and of *Nature's God*, is more than I can take upon me to determine, or even to guess. … What they call self-evident truths. "*All men*," they tell us, "are created equal." This rarity is a new discovery; now, for the first time, we learn, that a child, at the moment of his birth, has the same quantity of *natural* power as the parent, the same quantity of *political* power as the magistrate.
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> The rights of "*life, liberty*, and the *pursuit of happiness*" — by which, if they mean any thing, they must mean the right to *enjoy* life, to *enjoy* liberty, and to *pursue* happiness — they " *hold to be unalienable*." This they "hold to be among *truths self-evident*." At the same time, to secure these rights, they are content that Governments should be instituted. They perceive not, or will not seem to perceive, that nothing which can be called Government ever was, or ever could be, in any instance, exercised, but at the expence of one or other of those rights. — That, consequently, in as many instances as Government is ever exercised, some one or other of these rights, pretended to be unalienable, is actually alienated."

[18] See, for example, Britannica, 2002, micropedia Vol. 2 page109.

Among other important things, Bentham's inability to even properly understand "the right to life and liberty,"[19] reveal very clearly the fundamentally inhuman stance of functional thinking that has invaded our thinking. Again, this comes from its fundamental rejection of nature.

Finally, note that Bentham writes as an Englishman to condemn the ideas at the basis of the new proposed American government. He argues against it from his utilitarian principles. This basically means he is trying to argue that the American system cannot work. Given the huge success of the American "experiment," this is a wonderful icon of the impracticality of "practical" philosophy (i.e. of "usefulness"-based thinking).[20]

[19] He thinks their only meaning can be simply the positive feelings (enjoyment) of life and positive feelings of liberty.

[20] Of course, one cannot really start with usefulness as a base for ones thinking, but when one is unconscious of the ground of thinking in the senses, one can *seemingly* start where one wills.