

# On Will

Do you have a choice?

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*Puzzled, the spectator is looking at a random event.*

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### Abstract

This article attempts to shed light on existential questions like “*Does free will exist?*”, “*Do you have a choice?*”, and “*If you can exercise will, how can that affect the reality we perceive?*” The article also looks at the relation between free will and quantum mechanics.

# 1 Do you really have a choice?

On the subject of choice, there are two options: Either you really have a choice, or the appearance that you may choose is simply an illusion.

By *choice* is meant the possibility of *will* being exercised. Thus, the subject of choice is strongly related to the subject of free will. Do you really possess free will?

Since there are many situations where people seemingly cannot choose what they want, we will refer to free will as meaning potential free will.

You either have potential free will or no free will. In the latter case, it should not even be called will as everything is then simply a series of events with no will involved.

Let us explore the possibility of no free will: You have no choices; it is all predetermined. Everything is simply a series of events. There is no will involved and everything is determined by the laws of the physical universe. This assertion we label a *Physical Theory* or an *Objective Theory*.

Determinism is a common view among natural scientists and is gaining ground in the general population. In the book *A Brief History of Time*<sup>1</sup>, the astrophysicist Steven Hawking explains it very well: If you know the state of the universe at any given time and all the laws that govern it, you can calculate all consecutive events. You can determine every single motion in the universe at any time. The brilliant French scientist Pierre-Simon Laplace formulated this idea in a paper published in 1814<sup>2</sup>. Although it has been proven that such a thought experiment is impossible<sup>3</sup>, that proof still does not disprove the universe as causally deterministic.

Many physicists disagree with Laplace in that they assert the possibility of randomness in the universe. Random events would break the prospect of calculating the future. However, such being the case still wouldn't necessarily leave room for any will or real choices.

We see that there are two Objective Theories: the Deterministic Model and the model that allows for random events, the Random Model.

The Objective Theories are attractive in that they present complete systems within the boundaries of the physical universe without any external influence. The beauty of such a system lies in what it can prove – anything physical can be proven in and by the physical universe.

The Objective Theories also make the science of physics the ultimate profound science able to explain it all.

In the Objective Theories, there is no will that can cause anything. Everything is an effect of an earlier effect or is simply a random event. With no will there is never any purpose behind why something happens.

If the worldview of no free will is the truth, it has ramifications into most fields of human endeavor. It most obviously disrupts the field of religion as religions in the main build on the notion of free will and the possibility of choices. But it also disturbs the fields of philosophy, ethics and law. With the removal of the concept of will comes the subtraction of responsibility.

Aristotle outlined the essence of responsibility – a definition that remains the basis for accountability in our judicial systems<sup>4</sup>:

*“Aristotle’s discussion is devoted to spelling out the conditions under which it is appropriate to hold a moral agent blameworthy or praiseworthy for some particular action or trait. His general proposal is that one is an apt candidate for praise or blame if and only if the action and/or disposition is voluntary. According to Aristotle, a voluntary action or trait has two distinctive features. First, there is a control condition: the action or trait must have its origin in the agent. That is, it must be up to the agent whether to perform that action or possess the trait – it cannot be compelled externally. Second, Aristotle proposes an epistemic condition: the agent must be aware of what it is she is doing or bringing about.”*

<sup>1</sup> *A Brief History of Time*: [http://en.wikipedia.org/wiki/A\\_Brief\\_History\\_of\\_Time](http://en.wikipedia.org/wiki/A_Brief_History_of_Time)

<sup>2</sup> *A Philosophical Essay on Probabilities* (eng. 1902): <http://www.archive.org/details/philosophicaless00lapliala>

<sup>3</sup> P.-M. Binder, “Theories of almost everything”, *Nature*, 455 (2008), 884-885

<sup>4</sup> “Moral Responsibility” by Andrew Eshleman: <http://plato.stanford.edu/entries/moral-responsibility/>

There is no accountability for actions if there is no will behind them. There is no one to be held responsible if the person had no choice. Thus, the human systems of law and order are merely illusions – as is the apparent drive for happiness or attaining one's goals. All such pursuits are appearances that are bound to happen or that happen by chance. The appearance of choice is an illusion. There is no reason for living.

The nullification of responsibility may seem glum to some and a relief to others. But it hardly matters as it either seems that way due to chance, or it was bound to happen.

There is no wrongness or rightness in the Objective Theories. There is only *isness*.

In the Objective Theories, there is no real difference between a human, an animal and a well-crafted robot. Artificial intelligence is within reach.

The physical universe is composed of space, energy, matter and time. Everything within it is governed by its laws, whether the laws allow for random events or not. Therefore, in order for free will to exist, it cannot be governed by the laws of the physical universe.

The power of choice must at least in part be separate from the physical universe in some way. And only if it can potentially be completely separate can it potentially be fully free. Free implies free from space, energy, matter and time. It does not suggest that free will is somehow physically located outside the universe as that would still subject the will to physical laws and hence it would not be free.

Let's explore a theory of free will: You can choose. It is up to you. You can change the course of events. You are accountable for your actions and are ultimately responsible. This assertion can be labelled a *Metaphysical Theory* or a *Subjective Theory*.

Again, this may seem glum to some and a relief to others.

Free will imposes changes on the physical universe if only on a very small level, perhaps much like the *butterfly effect*<sup>5</sup>.

Free will introduces the *observer* into the universe, an element that seems to fit well with quantum mechanics. Lee Smolin, in the book *The Trouble with Physics*, lists the five great problems facing the science of physics today. The second problem reads: “*Resolve the problems in the foundation of quantum mechanics, either by making sense of the theory as it stands or by inventing a new theory that does make sense*”<sup>6</sup>. The external observer possessed with free will seems to resolve the problems in the foundation of quantum mechanics, as will be explored later in the article.

As free will lies outside the realm and laws of the physical universe and acts as an external influence, it cannot be directly proven or disproved in and by the physical universe. Any proof can only be circumstantial. For that reason, the weakness of this theory is that it cannot be proven to those who will accept only direct physical proof of a phenomena.

As free will is exterior to the laws of the physical universe, it supersedes time. Hence, it was never created and will never be destroyed. It may or may not be the cause of the physical universe but it was not caused by it. In fact, free will cannot be caused by the physical universe as nothing can beget something outside its realm of influence. Or in a simpler form: *Nothing can beget something with greater potential than its own*. This would rule out the possibility of creating real artificial intelligence. AI may certainly mimic free will and thus create the illusion of a computer possessing free will; however, it cannot transcend the laws of the universe in which it exists.

Even though free will is exterior to the physical universe, it is influenced by it to a varying degree. It loses its potential in ratio to its identification with the physical universe. This may explain the varying degree of apparent free will.

If a Subjective Theory is true, it poses the question of whether a belief in an Objective Theory would be a self-fulfilling prophecy. On the other hand, if an Objective Theory is true, a belief in a Subjective Theory would merely be a belief in an illusion for which the person bears no responsibility. Another question that can be posed is, who would be relieved by which theory? The answer to these questions are subjects for other articles.

It is worth noting that in this discussion of free will, one could simply reduce it to a discussion of whether *will* exists at all. If the answer is *yes*, reality cannot be purely deterministic and/or random. *Will* is that other factor beyond determinism and quantum randomness.

<sup>5</sup>The butterfly effect: [http://en.wikipedia.org/wiki/Butterfly\\_effect](http://en.wikipedia.org/wiki/Butterfly_effect)

<sup>6</sup>Lee Smolin, 2006, *The Trouble with Physics*, Houghton Mifflin Harcourt, p. 8

Whether you choose to believe in an Objective or Subjective Theory may not really be a question at all. If an Objective Theory is true, your belief is not your choice to make. If a Subjective Theory is true, it is either you choosing to see the truth or your choice to disregard the truth and thereby possibly make yourself even more subject to physical laws.

The choice may or may not be yours.

## 2 Can the universe be deterministic?

As noted earlier, determinists believe the universe is fully governed by causal laws resulting in only one possible state at any point in time. But can the universe actually be causally deterministic? Let's see:

1. For a system to be deterministic, its underlying rules must be consistent.
2. For a system to be deterministic, its underlying rules must be complete.
3. No system of rules can be both complete and consistent per Gödel's Incompleteness Theorems <sup>7</sup>.
4. Thus, no system can be deterministic.

This would rule out Laplace's idea of the universe being causally deterministic. What is left, then, of the Objective Theories is the Random Model, allowing for either the incompleteness or the inconsistency made inevitable by Gödel's Incompleteness Theorems.

In addition to being the basis of proof that no system can be deterministic, Gödel's Incompleteness Theorems show that it is impossible to prove either Physical Theory in and of itself.

No consistent universe is ever complete. There would always be another factor or axiom that would explain it further. Thus, the physical universe cannot be everything there is if it is to remain consistent. There must be some other factor beyond it that gives it meaning.

The full and complete reassurance, the comforting certainty about why things happen, seems more elusive than ever. But the absolution from all responsibility may still be feasible through the Random Model.

In the section "Cause and Effect", we will explore what a Subjective Theory could entail.

## 3 Extrapolating Free Will

If there exists potential free will, free of any physical restrictions, that free will cannot have been created as time is a physical property. Thus, free will supersedes the physical universe, or has always co-existed with the physical universe if the universe has no beginning. The latter could be challenged by such questions as "Can anything physical exist that wasn't created?" and "Can any effect exist that wasn't caused?"

As free will causes changes in the physical universe, it represents the *cause*; and space, energy and time are the *effect* of free will acting.

The physical universe is truly *effect* and is not capable of causing anything – it has no will of its own. Free will, on the other hand, cannot be affected by anything except by its own choice, as it is by its nature potentially free from the laws of the physical universe. That potential is alloyed solely by the individual's own considerations. Therefore, anything that free will experiences is by its own volition. By choosing otherwise, free will experiences otherwise.

While the physical universe is total effect, free will is cause. Although free will makes choices by its own volition, its choice may be swayed by its experiences, which are the result of its choices.

A feedback mechanism is then seen as free will chooses its own experiences and is then affected by them. This may lead to free will apparently losing control of its will by association with the physical universe and believing it has less free will. It will then act less free, less *cause*. To change this feedback mechanism, free will can be persuaded, perhaps by another free will, to believe it is more *cause* and less *effect* and thereby bring the situation under the power of will once again.

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<sup>7</sup>Gödel's Incompleteness Theorems: [http://en.wikipedia.org/wiki/G%C3%B6del%27s\\_incompleteness\\_theorems](http://en.wikipedia.org/wiki/G%C3%B6del%27s_incompleteness_theorems)

Any persuasion masked as a solution will do as long as free will believes the solution presented will work and as long as the solution aligns with physical universe laws to the degree that the individual believes in those laws. This may explain how many people are helped by a wide plethora of practices aimed at bettering the individual. It may also explain the placebo effect.

## 4 Cause and Effect

A realist believes in the RWOT (the Real World Out There)<sup>8</sup>, the universe existing wholly independent of its harboring observers. This branch of thinking is called “philosophical realism”.

An alternative view is that of the RWIH (the Real World In Here)<sup>9</sup>, the universe being a consensus reality of the wills involved in creating it.

Suppose potential free will is capable of creating a complete reality on its own – like what most people experience when they are dreaming. While there is enjoyment in playing a variety of solitaire-type games, there can be more enjoyment in playing games where other wills are involved as this creates a balance of cause and effect for oneself. Hence the creation of a consensus reality.

The physical universe may be seen as a common “playing ground”, where each participant contributes his own visions and realities but where everyone agrees on a set of rules, including the laws of physics.

If a potential free will is only affected by its own considerations, how can it then know about other potential free wills? One explanation could be that there exists a Potential for cause and free wills emerge from this Potential Cause. With a common source, separate free wills would inherently be linked.

Think of the Potential Cause as a blank piece of paper. From this paper arise points (separate cause points) that decide to BE (able to draw on the paper). Each point draws its own small picture (its own universe). As two points interact with their drawings, they start creating a common reality. As additional points interact with their drawings, a broader consensus reality emerges. Wikipedia is an example of such a co-created reality, as is the virtual world of Second Life.

Individuals emerging from a Potential Cause parallel what is seen in particle physics, where the potential of space gives rise to pairs of particle-antiparticle.

The Cause is pure potential. From this Cause then come decisions *to BE*, with each individual having its own reality or universe through its own considerations. Each such individual basically *is* his own universe with all its considerations. Individuals have the power of limitless consideration.

Each individual has the potential to cause effects through considerations. Nothing exists beyond what is considered. Anything existing is due to considerations.

A consideration is a decision. And every consideration creates an effect, as it is motivated by the ability to cause. Each represents a desire for something and, to a certain degree, puts that desire into effect, giving rise to new considerations that move one closer to the desired something.

For every consideration, there is cause creating effect, making for the fractal structure of universes. As considerations are added, layer upon layer, the very basic considerations, the “trunk” of the “tree of considerations”, grows more elusive as “branches” and “leaves” cover the view of it.

To create the consensus reality we know as the physical universe, it requires a massive quantity of considerations – all the way from the basic laws of physics up through the way these laws allow for combinations of basic forms into structures, and further up to how each individual interacts with the physical universe through a body – and even further up to creating a life within the consensus reality. With an enormous number of individuals participating, each with a vast quantity of considerations, the complexity of the physical universe can be rather staggering.

To be part of a common *playing ground*, individuals must obey the rules of the consensus reality it consists of.

It is much like any other game, like soccer, for example – to participate one must abide by the rules. As the individual participates in the consensus reality (the physical universe), he takes on a massive amount of agreement with those rules. An individual is bound by the agreements of the physical universe. Hence, he ordinarily cannot

<sup>8</sup>Lee Smolin, 2006, *The Trouble with Physics*, Houghton Mifflin Harcourt, p. 7

<sup>9</sup>RWIH (Real World In Here): Coined by the author

simply lift an object by pure consideration unless he solicits agreement by all individuals in the consensus reality – or unless it is somehow allowed by the rules. This may explain the lack of commonly displayed psychic abilities. It may also explain magic (i.e. someone found a buried allowance for certain magic to be displayed, or a loophole in the rules).

If such a Subjective Theory is true, then one would expect to see, from time to time, a variety of phenomena such as OBE (out-of-body experience) and remote viewing. Most realists would have abandoned this article well before this paragraph, perhaps by preconceptions or emotional stands. A Subjective Theory would, however, offer explanations for phenomena that an Objective Theory cannot satisfactorily explain or which it unscientifically dismisses altogether. But to be complete, a Subjective Theory will have to offer further testable predictions as well as possibilities for falsification.

An individual existing within the consensus reality is very much at apparent effect simply because of his agreement to the rules. He may apparently become even more effect by agreeing further to others' considerations – by taking them on as his own. Layers upon layers of considerations result in lower levels being masked by higher levels. The lower-level considerations can then be referred to as *unconscious considerations*.

There is a gradient scale of free will that shows how much an individual is in agreement. For an individual to rise on this scale, a solution must be presented matching the individual's level of agreement. A heavy drug addict, heavily into agreement with physical universe laws and others' considerations (basically the same thing), needs a very physical solution in order for him to accept its workability. An individual high on the scale needs the simplest of solutions – like what is described by the British philosopher Alan Watts when he relates why any practice of individual improvement can work. He says that the only reason an Eastern guru would ask someone to go through a regimen of mental and physical exercises is that they cannot simply “*get off it*” – they need to feel they deserve the insights before they attain them<sup>10</sup>.

As an individual is only bound by his own considerations and can only be hurt or become effect by his own considerations, resolving his own considerations is essentially the only solution there is. This may, then, explain why placebos work – an effect medical societies should embrace wholeheartedly. Any solution works only to the degree that it can entice the individual into considering that it will work. This is why any religion can work, as can psychotherapy, or psychiatry, faith healing, meditation, or simply anything, as long as the individual considers it will work. With this understanding comes tolerance of others' realities, of others' religions and views.

Some techniques reach the level of agreement of more people than other techniques. Workability is further enhanced by the individual's perception of the value of the solution. If the solution includes much suffering, monetary cost, secrecy or scarcity, it will often be seen as more valuable and hence has a better potential of getting some individuals to accept it as workable.

As any solution can work and will work best if it strikes at the level of free will exercised by the individual, there is a scale of solutions from the most physical to the very light. Starting at the most physical levels, we have solutions such as band aids, surgery, medicine, vitamins and on up through various therapies and rituals to tackling the effects of the individual's most intimate considerations. But above all of this would be addressing the individual's considerations directly.

Instead of addressing the individual's perceived problem, one could address his considerations about it, to release his free will. His considerations are, after all, the only things anchoring him to the problem. Having him simply look at his own considerations layer after layer should bring him to whatever level he would like.

There is evidence in physics supporting such a Subjective Theory as the one outlined above. QM (quantum mechanics) hints at the observer being an active ingredient in creating the reality we see.

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<sup>10</sup> Alan Watts' video: <http://www.youtube.com/watch?v=fCSsiF3BQoQ>



## 5 A Subjective Collapse Theory

What makes the quantum mechanics wave function collapse?

This has been one of the great questions giving work to physicists ever since Erwin Schrödinger came up with his mathematical explanation for wave-particle duality. In the aftermath of the mathematics came philosophical questions: Is the universe objective? Does it exist if we are not observing it? Are there many universes? Coexisting?

Particles are waves and waves are particles. Simultaneously. Apparently they are both until they are measured. Then they settle to become a particle or a wave. The famous double-slit experiment <sup>11</sup> shows what is known as a *wave function collapse*: the wave function describing the probability of the particle's location collapses to one of its two possible states. The experiment suggests that the collapse is related to measurement by a conscious observer.

This concept was taken further by the late John Wheeler in his *delayed-choice* thought experiment. It postulated that measurements here and now can influence and causatively determine the path that a photon has been travelling for billions of years <sup>12</sup>. Such perplexing ideas go back to Erwin Schrödinger's thought experiment devised to show the absurdity of some interpretations of QM. But when Schrödinger put forth his *Schrödinger's cat* as an attempt at a *reductio ad absurdum*, he only sparked a flurry of interesting interpretations.

Schrödinger's cat describes a closed quantum system – a box with a cat inside. The cat's life depends on whether a vial of poison gas is broken by a hammer linked to a Geiger counter that may be triggered by a possible radioactive emission from a small piece of uranium. The possibility of the uranium having emitting a particle is what makes the system undecided until someone opens the sealed box, observes and thereby collapses the quantum system. The eminent physicist Eugene Paul Wigner extended the conundrum by asking when the system is decided from the next person's perspective: when his friend (the person in the laboratory) opens the box or when he is told whether his friend found a dead cat inside. This extension is known as *Wigner's friend*. It probes the philosophical boundaries to Schrödinger's cat.

The interpretations of QM range from the strict deterministic, like some Objective Collapse Theories claiming that all seemingly random events were decided at the Big Bang, to theories accepting an inherent, unpredictable randomness in the Universe, to the theory known as Consciousness Causes Collapse. The latter is a version of Wheeler's Participatory Anthropic Principle <sup>13</sup> and claims that an observer is the active agent deciding the state of a quantum system by observing and collapsing it.

Further, in 2007, Wheeler's delayed-choice thought experiment was confirmed. An implementation of it suggests that the act of observation ultimately determines whether the photon will behave as a particle or wave <sup>14</sup>.

This moves the conundrum to the philosophical debate about the nature of consciousness.

Most criticisms of the idea of Consciousness Causes Collapse go along these lines:

*“Was the wave function waiting to jump for thousands of millions of years until a single-celled living creature appeared? Or did it have to wait a little longer for some highly qualified measurer – with a PhD?”<sup>15</sup>*

Such criticism suffers from a logical fallacy in that it carries a hidden assumption: that consciousness must be physical, evolved in and contained within the domain known as the physical universe. While it may seem obvious to some that consciousness can only be in the domain of physics, it is nevertheless a hidden assumption.

Steven Weinberg wrote an article published in *Physics Today*, November 2005, titled “Einstein's Mistakes” <sup>16</sup>. He makes what seems like a good argument for why QM can indeed be treated deterministically:

*“The Copenhagen interpretation describes what happens when an observer makes a measurement, but the observer and the act of measurement are themselves treated classically. This is surely wrong:*

<sup>11</sup> Double-slit experiment: <http://physics.about.com/od/lightoptics/a/doubleslit.htm>

<sup>12</sup> John Wheeler's delayed-choice thought experiment: <http://discovermagazine.com/2002/jun/featuruniverse>

<sup>13</sup> Wheeler's Participatory Anthropic Principle: <http://www.abc.net.au/rn/scienceshow/stories/2006/1572643.htm>

<sup>14</sup> Delayed-choice experiment: [http://en.wikipedia.org/wiki/Wheeler's\\_delayed\\_choice\\_experiment](http://en.wikipedia.org/wiki/Wheeler's_delayed_choice_experiment)

<sup>15</sup> Bell, J.S., 1981, “Quantum Mechanics for Cosmologists”. In C.J. Isham, R. Penrose and D.W. Sciama (eds.), *Quantum Gravity 2: A Second Oxford Symposium*. Oxford: Clarendon Press, p.611.

<sup>16</sup> “Einstein's Mistakes”: [http://scitation.aip.org/journals/doc/PHTOAD-ft/vol\\_58/iss\\_11/31\\_1.shtml?bypassSSO=1](http://scitation.aip.org/journals/doc/PHTOAD-ft/vol_58/iss_11/31_1.shtml?bypassSSO=1)



*Physicists and their apparatus must be governed by the same quantum mechanical rules that govern everything else in the universe. But these rules are expressed in terms of a wavefunction (or, more precisely, a state vector) that evolves in a perfectly deterministic way."*

Unfortunately, Weinberg's argument suffers from the same logical fallacy as noted above. His hidden assumption is quite visible when it starts with *"This is surely wrong..."* Weinberg's argument is only true if the observer is in fact wholly within the domain of the laws governing quantum mechanics.

If consciousness exists independent of the physical universe (or indeed any physical universe), it may be the missing element in the reason for wave function collapse. This now introduces the *subject* (that which thinks, feels, perceives, intends) in a Subjective Collapse Theory. This is the observer, the individual mentioned earlier.

Before one dismisses the Subjective Collapse Theory on emotional grounds, it should be noted that no theory is complete without having explored all possible weaknesses and hidden assumptions. The possibility of an external subject causing collapse should warrant investigation.

If free will exists, it must exist outside the physical domain and as such is indeed an external observer of the quantum system known as the physical universe. Even so, if a subject observing an event exists separate from the physical universe, this does not necessarily imply that it possesses free will. However, the case for free will has been argued earlier in this article.

Let's outline a Subjective Collapse Theory as a very simple HYPERLIST<sup>S</sup> <sup>17</sup>. Note: the line in green describes the conditions under consideration, and the word "OR" indicates that indented below it are the possible situations.

["Schrödinger's Cat" = True & "Subject needed for collapse" = True]

OR:

- Quantum system undecided for you
  - Particle possibly emitted
  - Particle possibly interacting with solid matter
  - System observed by cat
- Quantum system decided for you
  - Event observed by you as the subject
- Each subject has its own reality
- A common reality is created by interacting subjects

As you can see, this logical breakdown treats the Schrödinger Cat's thought experiment as true and not merely a *reductio ad absurdum*. Granting that the experiment is true and the outcome is determined by a subject observing the event, it follows that every subject has its own reality and what is viewed as *objective reality* is then caused by subjects interacting.

Perhaps the quantum randomness we observe is really the result of subjects possessing free will creating a consensus reality through their considerations. With an enormous number of "players" in the game, and with every particle up for debate, whether a certain particle goes left or right may seem completely random, while in fact it could be the result of consensus considerations.

This is not an attempt at logically proving this Subjective Collapse Theory but merely to propose it as a possible interpretation of quantum mechanics <sup>18</sup>.

<sup>17</sup>HYPERLIST<sup>S</sup> <http://isene.com/hyperlist.pdf>

<sup>18</sup>[http://en.wikipedia.org/wiki/Interpretation\\_of\\_quantum\\_mechanics](http://en.wikipedia.org/wiki/Interpretation_of_quantum_mechanics)

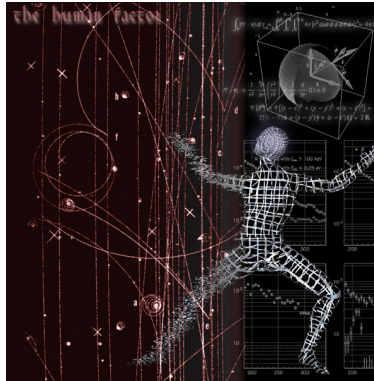
## 6 A final note: Unification

The search for unification in physics has been a holy grail for centuries. A Subjective Theory, including the Subjective Collapse Theory, would introduce a unification of an order higher than that of physics. It would unify the natural and social sciences; it would unify physics, psychology and philosophy and their siblings.

It would also bring the notion of responsibility into every social science.

The question of unification in physics may boil down to the simplest of ideas: that reality is reality by consideration only and that the laws of physics do not constitute the most senior concept describing our universe. The consideration that those laws exist would be the most senior concept. Beyond that, there would be only Potential Cause, and this Potential Cause causes effects simply because it can, and not as the effect of some other cause. In that, one may speculate about multiverses<sup>19</sup> as a possible logical result of pure Potential Cause.

This article does in no way comprise a complete theory. It simply outlines some ideas for a theory, perhaps enough to spark some interest in looking at reality as consensus considerations.



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<sup>19</sup><http://www.daviddarling.info/encyclopedia/M/multiverse.html>

## Notes

<sup>1</sup>A *Brief History of Time*: [http://en.wikipedia.org/wiki/A\\_Brief\\_History\\_of\\_Time](http://en.wikipedia.org/wiki/A_Brief_History_of_Time)

<sup>2</sup>A *Philosophical Essay on Probabilities* (eng. 1902): <http://www.archive.org/details/philosophicaless00lapliala>

<sup>3</sup>P.-M. Binder, “Theories of almost everything”, *Nature*, 455 (2008), 884-885

<sup>4</sup>“Moral Responsibility” by Andrew Eshleman: <http://plato.stanford.edu/entries/moral-responsibility/>

<sup>5</sup>The butterfly effect: [http://en.wikipedia.org/wiki/Butterfly\\_effect](http://en.wikipedia.org/wiki/Butterfly_effect)

<sup>6</sup>Lee Smolin, 2006, *The Trouble with Physics*, Houghton Mifflin Harcourt, p. 8

<sup>7</sup>Gödel's Incompleteness Theorems: [http://en.wikipedia.org/wiki/G%C3%B6del%27s\\_incompleteness\\_theorems](http://en.wikipedia.org/wiki/G%C3%B6del%27s_incompleteness_theorems)

<sup>8</sup>Lee Smolin, 2006, *The Trouble with Physics*, Houghton Mifflin Harcourt, p. 7

<sup>9</sup>RWIH (Real World In Here): Coined by the author

<sup>10</sup>Alan Watts' video: <http://www.youtube.com/watch?v=fCSsif3BQoQ>

<sup>11</sup>Double-slit experiment: <http://physics.about.com/od/lightoptics/a/doubleslit.htm>

<sup>12</sup>John Wheeler's delayed-choice thought experiment: <http://discovermagazine.com/2002/jun/featuniverse>

<sup>13</sup>Wheeler's Participatory Anthropic Principle: <http://www.abc.net.au/rn/scienceshow/stories/2006/1572643.htm>

<sup>14</sup>Delayed-choice experiment: [http://en.wikipedia.org/wiki/Wheeler's\\_delayed\\_choice\\_experiment](http://en.wikipedia.org/wiki/Wheeler's_delayed_choice_experiment)

<sup>15</sup>Bell, J.S., 1981, “Quantum Mechanics for Cosmologists”. In C.J. Isham, R. Penrose and D.W. Sciama (eds.), *Quantum Gravity 2: A Second Oxford Symposium*. Oxford: Clarendon Press, p.611.

<sup>16</sup>“Einstein's Mistakes”: [http://scitation.aip.org/journals/doc/PHTOAD-ft/vol\\_58/iss\\_11/31\\_1.shtml?bypassSSO=1](http://scitation.aip.org/journals/doc/PHTOAD-ft/vol_58/iss_11/31_1.shtml?bypassSSO=1)

<sup>17</sup>HYPERLIST<sup>S</sup> <http://isene.com/hyperlist.pdf>

<sup>18</sup>[http://en.wikipedia.org/wiki/Interpretation\\_of\\_quantum\\_mechanics](http://en.wikipedia.org/wiki/Interpretation_of_quantum_mechanics)

<sup>19</sup><http://www.daviddarling.info/encyclopedia/M/multiverse.html>