

Contextuality: A Philosophical Paradigm, with Applications to Philosophy of Cognitive Science

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Abstract

We develop on the idea that everything is related, inside, and therefore determined by a context. This stance, which at first might seem obvious, has several important consequences. This paper first presents ideas on Contextuality, for then applying them to problems in philosophy of cognitive science. Because of space limitations, for the second part we will assume that the reader is familiar with the literature of philosophy of cognitive science, but if this is not the case, it would not be a limitation for understanding the main ideas of this paper. We do not argue that Contextuality is a panaceic answer for explaining everything, but we do argue that everything is inside a context. And because this is always, we sometimes ignore it, but we believe that many problems are dissolved with a contextual approach, noticing things we ignore because of their obviousness. We first give a notion of context. We present the idea that errors are just incongruencies inside a context. We also present previous ideas of absolute being, relative being, and less-incompleteness. We state that all logics, and also truth judgements, are context-dependant, and we develop a “Context-dependant Logic”. We apply ideas of Contextuality to problems in semantics, the problem of “where is the mind”, and the study of consciousness.

1. Introduction

How do we decide if something is “right” or “wrong”? This seems at first hand a strange question, since we make such decisions every day, without putting much attention into it nor noticing anything unusual. But since these decisions are such an important part of our lives, we should study them thoroughly. Let’s begin with an example: Do parallel lines intersect? Well, a couple of centuries ago, any mathematician would have said: “no, of course not! What a silly question...”, following Euclides teachings in geometry. But in the last century we have learned that we can give an affirmative answer, if we are using, for example, geometries defined by Lobachevski or Riemann. What makes the difference for giving an answer is the geometry we are using. Since they have different axioms, in some cases parallel lines intersect, in some others they do not. We will argue that in order to make a decision, it must be related to a *context*. This might sound obvious, but perhaps it is so obvious that we ignore it, and the

possibility of failing to notice our mistakes is increased. We are always <speaking in | in>¹ a context. Perhaps this is why we fail to notice it so easily.

We can see that there are many questions that will have different answers depending on their contexts. Another example: Is the “morning star” the same as the “evening star”? Well, it depends on our context, and the answer can be yes, no, or yes and no depending on our context. If we are in an astrophysical context, both evening star and morning star are Venus (not even a star, though). But in a contemplative context, they are different, precisely because one can be seen in the morning and another in the evening (in different subcontexts). If our context contains the both mentioned above, we can just say ‘yes and no’.

But what do we mean by “context”?

2. Contexts

We are not able to give a definition of context, because usually definitions castrate the flexibility of concepts by making their boundaries sharp. This sharpness is necessary in some cases, especially in formal languages (Heylighen, 1999), but we will have to take the risk of being misunderstood preferring not to take any flexibility from the concept of “context”. Therefore, we will just attempt to give a *notion* of what do we mean by “context”.

A **context** consists of the set of circumstances and conditions which surround and determine an idea, theory, proposition, or concept. These circumstances and conditions can be spatial, temporal, situational, personal, social, cultural, ecological, etc. Notice that we are giving a relative notion, but it should serve our purposes, because in an open system², contexts cannot be **completely** described (Gershenson, 2002). We can see that in nature contexts are dynamic, since the relations of the system inside the context with the rest of its world are changing constantly, therefore changing the context. But the *relevant*³ changes might be *considered* to occur sporadically.

For example, the concept ‘cat’ will be determined by the context in which it is used. It can be a context of veterinary medicine, naughty pets, violent cartoons, cute animals, Broadway musicals, etc. The way we refer to ‘cat’ will change considerably depending on the specific context that we are using. Moreover, it seems that we cannot find a definition of ‘cat’ which would be fully explanatory in all possible contexts, nor a property shared by the concepts of ‘cat’ in all possible contexts more than the property of being a cat itself; even when *most* ‘cats’ (used in different contexts) have four legs, two eyes (not the ones with accidents or mutations... which would be cats anyway), fur (not some breeds), whiskers (if naughty children haven’t cut them), are mammals (not a wooden cat), etc. But anyone fluent in English language understands when someone says “hey, look! A cat!”, and that anyone is able to understand *what does that someone means*. This is because *they share a context*, or the necessary parts of a

¹We use the notation <A | B> to mean A and B at the same time.

²Consider that all natural systems are open, *i.e.* they are related to other parts of the universe.

³The relevant features of a context are decided by an observer, *i.e.* they are *relative* to the observer’s context.

context for the understanding to take place. Therefore, any use of a concept *needs* a context to be used in. *Concepts are determined (in part) by the context they are used in.* This context can be very narrow (e.g. in a private conversation, for example), or very broad (e.g. in a formal description), or of some degree in between (e.g. in a written text) (Heylighen, 1999). But formal concepts are as context-dependant as any other, the only thing is that they depend on a broader context. Another example can be seen with the concept of birds (feathers, fly, etc.). We cannot find any property common to all birds in all possible contexts.

Contexts are also necessary because they make information implicit. We cannot make explicit all the properties of any object, since they are infinite. We need to refer only to the ones relevant to our <situation | context | use of them>.

We can identify contexts inside contexts. Most contexts can be subcontexts or supercontexts, it just depends on the relative context we are using. Contexts are recursive. For example, the context ‘9:40 pm, September 15th, 2002, the mind of Víctor Gershenson, thinking about his cat Ginebra’ determining the concept of ‘cat’, can be a subcontext of ‘the mind of Víctor Gershenson, thinking about his cat Ginebra’, which can be subcontext of ‘the mind of Víctor Gershenson’, which can be subcontext of ‘the people in México City’, which can be subcontext of ‘the people in México’, which can be subcontext of ‘the people in the world’, which can be subcontext of ‘all people who have lived on this planet’, which can be subcontext of something abstract enough not to have much practical relevance. We can see that ‘cat’ will be more defined in subcontexts than in supercontexts. Supercontexts contain more “instantiations” of ‘cat’ (more things can be considered to be a ‘cat’), than subcontexts, where concepts are more specific. In other words, more “objects” will be identified with a concept (or category) in supercontexts. For example, the context ‘the mind of Víctor Gershenson, thinking about his cat Ginebra’ probably will only consider as ‘cats’ those females with black fur and white paws, while the context ‘the mind of Víctor Gershenson’ will consider as ‘cats’ males, striped, gray, white, etc.

We can refer to our <physiological | psychological | philosophical> context with the word **Seelenzustande**⁴. This would be to make a distinction between a personal context, and other types of contexts (the context of a frog, the context of Viking invasions, the context of subliminal propaganda, the context of planet Mars, the context of Euclidean geometry, etc.). Each person has her or his own Seelenzustande, even when most parts of all Seelenzustandes seem to be very similar. A common social context can be seen as the intersection of different Seelenzustandes inside a society.

Before developing Contextuality any further, we need to briefly introduce some of our previous philosophical ideas.

3. Absolute Being and Relative Being

We have defined two types of being: absolute (a-being) and relative (re-being) (Gershenson, 2001; 2002). The a-being is the being which is independent from the observer, and is for and in the whole universe. Therefore, it is infinite and uncomprehensible, although

⁴German for “soul state”.

we can approximate it *as much as we want to*. The re-being is the being which is for ourselves, and it is different for each individual, and therefore dependent from the observer. It is relative because it depends on the *context* where each individual is, *i.e.* Seelenzustande. This Seelenzustande is different for all individuals, and even the Seelenzustande of an individual is changing constantly, with his or her representations of what *re-is*. The re-being depends on experience, reason, and beliefs, which in turn depend on each other. The being would be the conjunction of a-being and re-being.

Everything re-is a generalization of what a-is. This is because things a-have an infinitude number of properties, but can re-have only a finitude of them, no matter how huge. Therefore, we need to ignore most of these properties (*e.g.* the spins of the electrons of a table), making a generalization of what things a-are. However, it seems that most of the properties contemplated by different re-beings are the most relevant for their contexts, and there is not much inconvenience in ignoring many of the properties. But we need to be aware that we will never have a *complete* description of what things a-are, because it would have to be infinite.

We continue developing ideas related to Contextuality.

4. Errors and Mistakes

With the aid of our ontological distinction between a-being and re-being, we can restate the initial phrases of the *Tractatus Logicus-Philosophicus* (Wittgenstein, 1918): what *re-is* the case?

People <determine|define> what **re-is** the case (*i.e.* it is context-dependant). Our world is everything that re-is the case for us. We cannot speak about what a-is the case without falling into imprudence. Once we mention it, it is relative, relative of our contexts. But we can agree that something re-is the case for all of us.

Experience helps us in agreeing what re-is the case by expanding and making compatible our contexts. While experiencing we can test incongruencies of our context. When they are detected, we call them an error or mistake. There a-are no errors or mistakes, because we believe that things follow the laws of nature at all times. Only when our experience does not match our expectations, we say “there was an error”. But there only re-was an error, in the sense that a system did not do what we expected or wanted to do. All errors are dependent of an observer.

For example, when I am programming, I type the code following the laws that control the mechanisms of my brain and body, whichever they a-are. When I make an error, it is not that the mechanisms “went wrong”, but that the mechanisms did not do what I expected or wanted. We say that errors occur in a system when the context of the system is unable to contain *as much as we do* (if there re-is such error, but our context does not contain it, we cannot detect it). Errors are relative to the context from where they are judged (something re-is an error from one context, but re-is not from another...). An **error** is given when an inconsistency is detected *inside a context* (otherwise we do not detect any error).

The fact that our context cannot contain what a-is the case leads us to say that there will always be potential errors to be found, when the enlarging parts of our contexts become incongruent with the previous ones. Natural contexts are constantly changing, developing, and

evolving. And formal or defined contexts cannot ignore natural contexts if they want to have any relation with “reality”.

For example, when I am programming, I have a different Seelenzustande before and after I detect an error, because the experience of detecting an error (*i.e.* incongruence with my Seelenzustande) expands my Seelenzustande, and part of my previous Seelenzustande stops being consistent with my actual Seelenzustande because the results were not the ones I expected. Only *then*, I can say that I had a mistake. If my experience would give the expected results, it would also expand my Seelenzustande, but there would have been no incongruence, and therefore no error. We can learn not only from mistakes. Any experience expands our Seelenzustandes. But anything we *forget*, reduces our Seelenzustandes. All experience carries learning, even just to be less unsure of our Seelenzustande. For example, the experiences of blue skies on days without clouds reinforce my idea that “skies are blue”, *every* time I see the sky blue. This does not *prove* that I will never see a green sky, but if I “*always*” have seen blue skies (not counting twilight), I will **believe** that skies a-are blue, when blueness is a property we ascribe to the skies (Gershenson, 2001) (the skies just a-are...).

This view leads us to say that *all ideas are valid in the context they were created* (Gershenson, 2001; 2002). This is because when ideas are generated, there cannot be errors inside the context they are generated, since they are generated according to their actual context. It is when the context is enlarged (in a few seconds or in two thousand years...) that inconsistencies of the previous context can be detected, but *from a new context*.

We can see that we cannot get rid of all possible mistakes because our contexts are incomplete. But we can make them *as less-incomplete as we want to* (Gershenson, 2001; 2002).

5. Less-incompleteness

All ideas and theories a-are incomplete. They can only **re-be** complete *inside a context*, if they are consistent with it. If we want to approach more to the a-being, we should make our contexts as less-incomplete as possible. For this, we should contain as many contexts as possible inside our contexts. But if we try to do this, some of these contexts very probably will be contradictory. We reach a divergence point: either we restrict ourselves to non-contradictory contexts, making our context more incomplete, or we leave all hope of non-contradiction behind. We can see that contradictions are just a problem in a limited context, which expels from the beginning any possibility for contradiction. But if we reconsider our prejudices⁵, and admit contradictions, we are able to understand them (Gershenson, 1998; 1999), and the “problem” vanishes. Therefore, we choose to leave all hope of non-contradiction behind, accept contradictions as they are, and to enlarge our contexts as much as we can, containing as many contexts as we can. We have called this approach “metacontextuality” (Gershenson, 2001).

An example can be seen withing entomology: are the egg, caterpillar, cocoon, and butterfly the same thing? At a restricted level, speaking about properties, they are different,

⁵One of the **axioms** of Aristotelean logic is: something can be only true or false, but not both, nor something else.

but at an organismic level, they are the same, even when their properties change considerably. With this we could have a contradictory situation only if our context is not flexible and wide enough to consider both situations. But if we do, we will have no problems in answering to the question “are the egg, caterpillar, cocoon, and butterfly the same thing?” with a “yes AND no... it depends on the context”.

So if we expand our contexts, how far can we go? Could we contain everything? Even when in theory, we can define an absolute context, containing all possible contexts, first of all, it would suffer from something similar to Russell’s paradox⁶: if it contains all possible contexts, then it has also to contain itself. Second, this would be something very similar to the a-being: infinite, and unreachable, even when we can approximate it as much as we want to. Therefore, we need to be always aware that our contexts are limited, and that *there is no context in practice which never changes*. All our “truths” are tied to a context, therefore *relative* to it, and no matter how general this context is, truths inside it are not absolute and universal. We believe that there re-is no such thing as an absolute truth: if there a-are, there cannot re-be contained in limited context, and if there a-are not, well, they also cannot re-be contained in a limited context. So in practice it does not matter if there a-are or not absolute truths: we cannot contain them anyway.

Notice that formal contexts (e.g. mathematics, formal logic) might seem to be consistent. Well, first of all, they are also incomplete (Gödel, 1931; Turing, 1936; Chaitin, 1990), and second, they are so “well-formed” because we define them. We cannot say that mathematics a-are universal, because we can *define* an infinitude of mathematics with different axioms, and any “silly theorems” will hold inside those mathematics. But we can say that mathematics **re-are** universal, inside *our* contexts, since we all agree on them. And it is very convenient to do so.

Contextuality does not lead to radical relativism. That everything is dependant of a context by no way means that “anything goes”. This is because we share most parts of our Seelenzustandes, precisely because most parts of them are learned socially. It is because we have many parts in common in our Seelenzustandes that we can communicate, and attempt to agree on what we perceive and do in our world. We would describe the paradigm we propose as a *contextual relativism grounded on experience*. This is because even when everything is dependent of a context, Seelenzustandes are developed and shaped though experience. And since we share similar environments, our experiences will be similar, and therefore our Seelenzustandes will also be similar. Experience limits the possibilities of our contexts.

Since we defend that all truths are dependant of a context, we develop briefly a formalism for tying logics to a context.

⁶A “respectable set” is defined as a set which does not has itself as one of its elements. Let A be the set of all respectable sets. Is A a respectable set? Yes and no: if A is respectable, then A contains itself, since it contains all respectable sets, so it is not respectable; but if A is not respectable, since it contains only respectable sets, then it does not contain itself, so it is respectable.

6. Context-dependant Logic

*“About a fact there are as many truths as there are sets in the universe...
and lies, much more...”*

There have been a wide variety of formal logics developed: Aristotelean, boolean, of Lukaciewicz, fuzzy (Zadeh, 1965), paraconsistent (Priest and Tanaka, 1996), multidimensional (Gershenson, 1998; 1999), neutrosophic (Smarandache, 1995), just to mention some. We defend that there is no “better” or “true” logic. They are all more or less suitable for a specific context. For example, boolean logic is appropriate for designing digital computers, and multidimensional logic can be used to model emotions, since it handles contradictions (Gershenson, 1999). Boolean logic cannot handle contradictions. Multidimensional logic can be used for designing digital computers, but for this case it would be too redundant, and therefore boolean logic would be “cheaper”. Each logic is more appropriate for a different context.

But, when we speak about **truth** or **falsity**, we are also tied to a context. Because of this, we define Context-dependent Logic (CDL).

Every proposition P can only have a truth value (or vector) **in dependence** of a context C. This truth value is **relative to** the context C. Propositions have only sense⁷ in a context(s). Propositions have no sense without a context. In many cases this context is implicit, but it is still a requirement for the sense of propositions. Therefore, CDL can contain propositions and syllogisms of any defined logic, as long as they specify their context; and manipulate propositions from different contexts and/or different logics.

For example, let us suppose we want to find a truth value or vector for the proposition “the king of France wears a wig”. Is this true, false, both, none? Well, it depends on the context. Using multidimensional logic, we can say that in the “XXth century” context, this proposition is ‘nor true nor false’, because there was no king in France during the XXth century. But in the context “5 p.m., day of the coronation of Louis XIV” the proposition would be ‘true and not false’.

Also, we can see that propositions can have different truth values if in our context we use a different logic. For example, the proposition “this phrase is false” will be ‘true and false’ in a multidimensional context, ‘0.5’ in a Lukaciewicz context, ‘?’ in an Aristotelean context, and ‘true, false, and indeterminate’ in a neutrosophic context.

We can see that we might run into something similar to the “silly theorem problem”⁸ (Gershenson, 2002). We can call this the “silly proposition problem” (SPP): for any silly proposition P_s there exists at least one context C_s where P_s is true. How to determine a context C is silly or not? As with the STP, experience might help to identify “silly contexts”, even when

⁷In the Fregean (1892) sense of “sense”.

⁸The STP can be formulated as: “For any silly theorem T_s , we can find at least one set of axioms such that T_s is consistent with the system defined by the axioms. How do we know a theorem is not silly?”. The partial answer given in Gershenson (2002) concludes that only through experience we **agree** in which theorems re-are silly and which ones re-are not.

‘silliness’ depends on another context. We could say that evolution helps “useful” contexts to persist more than silly ones.

Syllogisms inside one context have no problem because each proposition is consistent with the context C . When a proposition is not consistent, the context may be enlarged to contain it, or the proposition may be declared invalid, be ignored, or in other words thrown under the carpet. If we need to use in a syllogism propositions from different contexts, they will hold in the context of their union $C_u = C_1 \cup C_2 \cup \dots \cup C_n$, but then the syllogism may or may not hold in the contexts of each proposition. If the contexts are contradictory, C_u will be called a paraconsistent (or contradictory) context. We would require a logic which accepts contradictions (*e.g.* paraconsistent, multidimensional, neutrosophic). Consistent logics (*e.g.* Aristotelean, boolean, fuzzy), cannot manipulate contradictory premises because they banish them from their contexts. Each logic is tied to a context. All logics are context-dependant.

Contexts might be more or less incomplete. If $C_j \subset C_i$, we can say that C_i is less incomplete than C_j . But less-incomplete contexts are not always optimal for all problems. But problems are also context-dependent. We re-are context-dependent.

But we should note that the contexts are given *before* we can judge a truth value or vector, therefore, we cannot judge the truth of a context, if it is not from another context.

Logics can be consistent only inside a context, therefore they are limited, and we cannot have a “general purpose” logic. No matter how much we enlarge our contexts, there will be things left outside them, which potentially will lead to the modification and adaptation of our contexts. Of course, for praxis inside a specific context, this has no factual consequences.

With CDL we try to show that logics cannot provide absolute truths, since all logics, and formal systems are based in axioms or beliefs, and therefore, incomplete (Gödel, 1931; Turing, 1936; Chaitin, 1990; Gershenson, 2001).

CDL is less-incomplete (Gershenson, 2001; 2002), since it tries to contain all possible logics, even logics which might deny it, but it is incomplete nevertheless... and context-dependent. Any logic is a CDL. It could be seen as a “metallogic”, but for example neutrosophic and multidimensional are also metalogics (they contain other logics).

A logic (and everything else) is useful only inside its context. Logics are just tools. They do not determine reality, nor what things a-are. *Objects are independent of the <representations we have |abstractions we make> of them.*

7. Contextuality and Meaning⁹

We begin to apply ideas from Contextuality to philosophy of cognitive science.

Information and meaning re-are only in a context. They a-are not a property of things. Observers (men, animals, systems) *give* meaning to things. Things do not have a meaning by themselves.

⁹The ideas presented in this section were developed after reading Dretske (1990), and from discussions with colleagues at Sussex University.

Everything *can* a-be (represent) information. Something re-is (represents) information only for the one who understands it, *i.e.* the re-being is related to the context of the understander.

Representation is also context-dependant. Information might be misrepresented outside the context of the observer (*e.g.* a frog “misrepresenting” small objects for flies, when frogs do not have the same concept we have of a fly (Lettvin *et. al.*, 1959)). If we grow the context enough, there will be no misrepresentation. There is no misrepresentation in the context of the understander. Frogs do not misrepresent a fly because they do not have the concept of ‘fly’. *For them*, there is no error. Their sensorimotor mechanism works perfectly when they trigger their tongue in presence of ‘small dark moving objects’. Misrepresentations are judged from the outside.

Information and meaning can only be true or false *only relative to a context*. But if for some context A is false, it does not mean that it cannot be true (or something else) for other context.

We define contexts and contexts define us.

7.1. Contextuality and Semantics

All semantic theories have problems, because they try to formalize or abstract natural language, which is not completely formalizable. With this we do not intend to say that they are not useful. But we will say that the less-incomplete a semantics is, the less problems it will have.

Contextuality is not like possible world semantics, first because it is not only a semantic theory, but a philosophical one. But as Putnam (1981) showed, possible world semantics suffers from something similar to the “silly theorem problem” (Gershenson, 2002), when he showed that meaning is a function of theory (we would say theorems are a function of axioms). But we believe that though experience you can contrast (Popper, 1934) ideas and contexts, therefore restricting the possible meanings. In this way, Contextuality salves this problem of possible world semantics. It seems that a semantic theory could be successfully be built from the ideas of Contextuality.

8. Contextuality and Mind

There has been a wide debate in philosophy of cognitive science on the question “where is the mind?”. Apart from people whose context leads them to say that the question is malformed (*i.e.* people that restrict the word “where” to physical places), the literature has been divided mainly into two streams: people defending that the mind is only in the brain (individualists, *e.g.* Butler, 1998; Adams and Aizawa, 2001), and people defending that the mind is in the brain, body, and world (active externalists, *e.g.* Varela, 1994; Clark, 1997; Clark and Chalmers, 1998; Haugeland, 1998). We would explain the arid debate because, broadly, the people of each band are in different contexts. The main difference between them, is their concept of mind.

If, according to our context, we understand that the mind includes only logical reasoning, higher order processing of information, deliberation, etc., then very probably we would agree with the individualists. If, according to our context, the mind involves also

sensorimotor coordination, active perception, enaction, etc., then we would agree with the active externalists. If our context contains both contexts and we do not have any prejudice for contradictions, we would agree with both.

Therefore, the problem of “where is the mind” can be reduced to a difference of context. If people understand both contexts, then in some conditions they can speak about the mind in one sense, in other conditions in another sense. And the problem just evaporates.

9. Contextuality and Consciousness

The study of consciousness has also been a plentiful source of debates. Perhaps it is because the experience of consciousness is extremely Seelenzustande-dependant that people have different concepts of consciousness. It is almost a necessity that there will be problems if people think they are talking about the same thing, just because they use the same word to denote it.

There have been several, supposedly contradictory (*i.e.* contradictory in a limited context), approaches for studying consciousness (Velmans, 2000). We can mention dualism, reductionism, and reflexive monism. If we contain all three inside a context, there is no problem with any of them, they just visualize things from different perspectives. About dualism, we can say that *res cogitans* emerges from *res extensa*, so there is no problem on their relationship. Mind therefore could potentially (but not completely computationally, though) be described <in terms|as an emergent property> of matter, therefore, there is no problem with reductionism. In reflexive monism (Velmans, 2000), both mind re-determines matter and matter re-determines mind, both part of “the thing itself” (~a-being). There is no problem with any theory *in their context*.

Other theories of consciousness are also valid in their context (*e.g.* Varela, 1994; O’Regan and Noë, 2001), but will have conflicts with people with incompatible contexts. We believe that we should try to contain their contexts, in order to have a less-incomplete view of consciousness, studying from many different contexts. Moreover if we cannot agree on what consciousness is...

10. Conclusions

Our philosophical ideas have been developed in the last few years noticing the importance of contexts. This importance has also been noticed by other people from different perspectives (*e.g.* Wittgenstein (1982), Smarandache (1995), Heylighen (1999), Gärdenfors (2000), Gabora and Aerts (2002)), and our ideas are compatible with them. We believe that the ideas of Contextuality can be applied to and be enriched from other areas of philosophy and in particular philosophy of cognitive science.

We are aware that these ideas are not fully developed, but we believe the ideas are promising and worth pursuing. Only with further work and feedback these ideas will be shaped more accurately.

We should mention that our ideas also have consequences into ethics: if we cannot prove completely that any context is better than other, we should be *tolerant* with other

contexts, and realize that *our* context is just another one, no matter how “good” or “bad” it is, how incomplete or less-incomplete it is. No context can be completely right or wrong; only relatively, but relative to another context.

11. Acknowledgements

I would like to thank Francis Heylighen, Andy Clark, Nadia Gershenson, the E-Intentionality group and the students of Philosophy of Cognitive Science at Sussex University, for their valuable comments and suggestions. I also give thanks to Kasia Bazlova for providing very useful inspiration.

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