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# SCRAPING HEAVENS
# On Inconsistencies in Sciences

## 1. Intriguing inconsistencies

The title of this special session "Starry Sky Above Me, Consistency Law Within Me" opens two possible ways of approaching my issue. However, its location under the most impressive radio-astronomical observatory of the Copernicus University strongly directs my thoughts towards the first topic.

Inconsistency is widely believed to be a contingent property of muddy earthly affairs. But certainly, it should not affect the crystal clarity of the heavens. The things taking place within the starry firmament provide the paradigm case for precision, harmony and order. The crystal spheres glide noiselessly past one another forever. And yet, the history of astronomy, too, supplies examples of the important role inconsistency has to play in science.

One such example is the well-known case of Johannes Kepler. He realised the impossibility of comparing the Sun-centered vision of Copernicus with Tycho Brahe's highly accurate observational records of the planet Mars. Kepler's respect for the evidence forced him immediately to give up his theoretical basis. This courageous step made it possible for him to utilize William Gilbert's magnetical philosophy for his famous improvement of astronomical theory. Similar conflicts connected with predictions and subsequent observations of the paths of Uranus, on the one hand, and Mercury, on the other, gave very dissimilar outcomes. While the first tension was solved by postulating (and finding) of a new planet as the source of this conflict, the

second one led to the abandoning of the whole contemporary theory. Mercury also moves in a path that differs from the orbit calculated on the basis of Newtonian mechanics. This time, however, the irregularity could not be explained by the influence of a planet unknown so far, though this strategy was tried. Actually, the perturbation of Mercury's orbit became part of the evidence supporting Einstein's general theory of relativity — the theory that has replaced Newtonian mechanics.

There are later examples of inconsistencies in astronomical theories. Cosmic singularities are always good for various kinds of incoherent features of matter. Unfortunately, my knowledge of recent astronomy is by far insufficient for me to present the topic in detail. So let me turn to more general reflections on how to proceed in view of inconsistencies in scientific theories.

The concept of an inconsistency is by no means a sharp one: besides logical contradictions there are refutations, collisions of thesis and antithesis, inconsistencies, antinomies, contrasts, oppositions, self-defeating assertions, there is "*contradictio-in-adjecto*", paradoxical pronouncement, not to forget oxymorons and a number of other cases.

Some forms of inconsistencies frequently occur in the course of scientific discussion. Discussion is one of the most basic tools for developing science. According to Heisenbergès famous dictum, science emerges from conversation. Naturally, in order to start a discussion, one has to disagree over some problem. So, at least at the outset, any discussion should deal with opinions which conflict each other. Of course, not every disagreement about scientific issues should be treated as an inconsistency. Yet some of these conflicts give rise to formal inconsistencies, as we will see later.

In [2], Dale Jacquette argues that there is no such thing as logically inconsistent belief — it is allegedly impossible to have some belief as well as the opposite one at the very same time. This argument looks not very plausible to me. At least with respect to the following weak version of logically inconsistent belief: A person has inconsistent beliefs at some interval of time, if on request she is ready to confirm any single one of these contradicting beliefs at every arbitrarily chosen moment of this period. In such a case the individual holds (at least) implicitly inconsistent beliefs. That seems to be quite common. An according situation appears e.g. whenever someone, who believes in the supremacy of the welfare state cheats at her tax return.

But there are far more substantial instances. In a recent essay [9] the author distinguishes empirical, weak theoretical complementarity from strong theoretical complementarity. Psychological theory of aggression provides an example for the former case. Its main paradigms, the theories of frustra-

tion, desire and learning, are theoretically compatible as well as empirically complementary. Similar constellations can be found in geography or psychotherapy, in medicine or ethics. More significant from our perspective is strong theoretical complementarity. The standard example is quantum mechanics. This discipline produced an own stimulating notion of (physical) complementarity. Niels Bohr introduced this concept at several places in the interpretation of quantum theory. The knowledge of the momentum of a micro particle is complementary to the knowledge of its velocity. It is impossible to know both of them with high precision. This, however, would be necessary for knowing the state of the particle. There are many more examples of mutually exclusive pictures which complement each other.

> By playing with both pictures, by going from the one picture to the other and back again, we finally get the right impression of the strange kind of reality behind our atomic experiments. [...] Generally the dualism between two different descriptions of the same reality is no longer a difficulty since we know from the mathematical formulation of the theory that contradictions cannot arise. ([1], p. 37 f.)

That much in favor of the Copenhagen interpretation. However, the comfortable feeling vanishes almost immediately if one starts to reflect on what "really" happens in an atomic event.

Heisenberg remarks that the concept of complementarity

> has encouraged the physicists to [...] apply alternatively different classical concepts which would lead to contradictions if used simultaneously. [Moreover, it] is not confined to quantum physics only: we meet it when we reflect about a decision and the motives for our decision or when we have the choice between enjoying music and analyzing its structure. ([1], p. 167)

Sailing this way along the reefs of inconsistency, Heisenberg feels no pricks of conscience when reporting open contradictions at earlier stages of development of the theory:

> [Einstein] was not able to dispute the complete contradiction between this wave picture and the idea of the light quanta; nor did he even attempt to remove the inconsistency of this interpretation. He simply took the contradiction as something which would probably be understood only much later ([1], p. 21)

and

> The strangest experience of those years was that the paradoxes of quantum theory did not disappear during this process of clarification; on

> the contrary, they became even more marked and more exciting. [...] By this time many physicists were convinced that these apparent contradictions belonged to the intrinsic structure of atomic physics. ([1], p. 24)

Similar reports concerning the state of mind of the leading physicists of this period in quantum physics are to be found elsewhere.[1]

From a methodological perspective the principle of complementarity seemingly functions as a tranquilizer which eases to live in peace with all the incompatible descriptions around, at least temporally. (Still another question for philosophically minded scientists should be the acceptability of standard interpretation of quantum mechanics itself.)

In (pure) mathematics such a medication would be inappropriate, perhaps. Inconsistencies in mathematics tend to appear in their most dangerous form: as plain contradictions. Due to the specific inference mechanism employed in mathematical reasoning, contradictions spread out and infect the whole theory, which is thereby made entirely useless.[2] Not so in empirical sciences. In physics, e.g., the tranquilizer may be welcome. And what is more: outside science inconsistent situations are nothing uncommon. It was Heisenberg again, who once revealed: "It would be wrong to say that I am not a Christian. Yet somebody who calls me a Christian would claim too much." Perhaps this nice episode depicts adequately a typical problem of a large realm of human culture: religion.

One of the central issues of medieval European philosophy was the question of how to grasp mentally the concept of God. Augustinus ("If you comprehend God, then it is not God."), Master Eckhart ("You must understand that God is inconceivable."), Thomas of Aquin ("What God really is, will be concealed forever. And this is the highest knowledge we might have: God is beyond all we will think of him.") and, perhaps best known, Nicolaus Cusanus (his principle of "*coincidentia oppositorum*") all express the same basic idea of negative theology: God can be told about only by saying what he is not.[3] The effect of underdetermined basic concepts is not limited to

[1] For instance, Hans Reichenbachès description of contemporary reactions to contradictions uncovered in Niels Bohrès theory. ([7], p. 263 f.)

[2] From the perspective of history of science, though, one should be careful here. The real story of, e.g. the paradoxes in set theory points to much a more complex pattern of dependencies of the several branches of mathematics.

[3] By the way, this essential incomprehensibility based on proclaimed incompatibilities seems to be one of the main psychological attractions of the Sacrum. It reliably produces the impression of some mysterious depth.

Christian religion. The same is true, and even more explicit, for Buddhist thinking. Structurally, this broadly resembles reports about what is going on in physics[4]:

> The easiest questions have no answer at all or have an answer which at first glance resembles more some strange catechism than the concrete claims of physics. If we ask, for instance, whether the position of an electron remains unchanged, then the answer is No. If we ask, whether die electron changes its position in the course of time, then we have to answer No again. If we ask, whether it is in rest, then we answer No as well. And if we finally ask, whether it is in motion, we have to answer again: No. Such answers gave Buddha in those days, when he was questioned about the state of the self after the individualès death. ([6], p. 41)

Of course, underdetermination is not contradiction. Yet in some cases it comes very close to it.

### 1.1. Inconsistencies as presupposition failures

By far not all of inconsistencies should be taken as plain contradictions. The above examples lead to the thought that sometimes incoherence points to a presupposition failure. Let me sketch this idea. Phenomena may have properties which are mutually exclusive. If one property is plainly the negation of the other, then both form a *strongly complementary* pair of properties. Phenomena are strongly complementary, if they have strongly complementary properties. Pairs of propositions which deny properties of an object incompatible with each other are called *contrary* propositions. Now it seems that contrary propositions about strongly complementary phenomena are contradictions. "`This sentence is meaningless`" and "`This sentence is not meaningless`" apparently form an obvious contradiction. Yet, does this schema function in all cases? Let us formulate a small dialogue in analogy to Robert Oppenheimerès remark quoted above. "`Is this number odd?`" "`No!`" "`Well, so it is even.`" "`Not at all!`" Û Should we acknowledge the arisen situation as a contradiction (more precisely: as illustrating or denoting a contradiction)? Let us take one more example: "`Is the moon honest?`" "`No!`" "`Well, then it is dishonest.`" "`No, again!`" This time the solution is obvious: *to be honest* and *to be dishonest* are strongly complementary only with respect to moral beings. As the moon is no such thing, the

[4]Actually, the gateway from physics to more or less exotic religious thought seems appealing for quite a number of physicists. This way the "Tao of physics" and related ideas slip in.

pair of contrary propositions does not bring out a contradiction. Similarly in the first case: even and odd yields strong complementarity only with respect to integers. The assumption that the considered object is an irrational number makes go away the threatening contradiction. The question is how generally this method can be applied. It seems that there are "borderline" predicates, which are strongly complementary with respect to any existent objects (we actually mean: physically existent, instead of taking into account fictional, historical, mathematicial etc. existence). But even physical existence might not be presupposition free. An argument can be found in an very stimulating essay written by Tadeusz Kotarbiński. He claims that (although all truth "is true eternally") not all truth "is true without a beginning":

> [...] there is one part of the future that is depending on us, that is unfinished, undecided; our death is already decided, yet the kind of this death and the moment of its occurrence is not ([3], p. 89).

In other words, my death is already existing as the event terminating my life. But its specific gestalt as a death by, say, the bite of a rattlesnake does not yet exist, this death is still undecided and no part of the "fixed" future. His original argument is not easy to follow. Kotarbiński admits that "thoughts become confused since the language is unsuitable" ([3], p. 87).

However, the basic idea looks fascinating and thus the matter seems worth a try to reformulate it in a precise way. Kotarbinski maintains that existence and non-existence are not presumptionless properties either. Thus they can not be attributed to everything: "X exists" is a presupposition violation for some X! Yet what might be the property which must be presupposed in order to predicate existence or non-existence? If anything, this should be a specific sort of ontological stability, a kind of being which is already decided. Indeed, one clearly feels the lack of appropriate concepts here. (There seems to be some similarity to what Mackie called *fixity*, however there is no factual gateway from one notion to the other.) In order to exist or not to exist, a state of affairs must be in stable being, its ontological status must be decided. Let us call such a state of affairs stable. A state of affairs is *stable* as long as its cause exists or the cause which prevents it from coming-into-existence. Stable states of affairs do or do not exist (i.e., as long as they are stable, outside of the realm of their stability it makes no sense to ask about their existence). It turns out that everything is everywhere and at any time stable or not stable. Thus the *tertium non datur* is universally valid, but on a more fundamental level than on the level of bare existence. Following that line of reasoning, one could read inconsistencies, as far as they are physically real (i.e. describes

an existing physical state), as indicating the ontological instability of the described object — provided that there are no other presuppositions violated. The method should not be applied to non-physical entities, since it outcome could offend pious stirrings A more serious connection links this thought with Kant's remark about contrradictions which mark the outskirts of cognition.[5]

In the long run any remaining inconsistencies should be gradually eliminated from the body of the theory. Short-term, however, this aim might be achievable only at unreasonably high costs or it may be plainly impossible to achieve. Therefore one should know how to handle theories with temporary unavoidable inconsistencies.

## 2. Formal inconsistencies

In order to denote the above considered kind of theories in empirical sciences, a formulation like "theories with inconsistencies" seems preferable to "inconsistent theories" — not even to mention "contradictory theories". In his above mentioned paper, Dale Jacquette calls a thought or thoughts genuinely contradictory only if they

> can be plausibly interpreted as about or semantically directed toward a univocal argument context, a single identifiable question or problem which the thoughts or other elements are supposed to address. ([2] p. 378)

So, a genuine contradiction is just anything what is meant to express one, even if it is not a contradiction in the logic text-book sense. (For reasons which become clear later, we prefer to speak about inconsistencies here, instead of contradictions.) Jacquettès point of view is highly sympathetic to me, since it credits the users of a language with all competence of its usage: they best know when they intend to speak about contradictions, inconsistencies and the like. It is only this attitude what goes together with the intention of applying the results of logical investigation in other disciplines.

Let me briefly explain this. Following the standard way in logical formalization, logicians begin with "cleaning up" the area they intend to formalize. They feel free to decide what the correct usage of the considered part of the language is. Next, they elucidate the rules, how to speak correctly — that means of course: in accordance with the logical rules established previously.

This traditional position is perhaps best represented by the notorious Master teaching at the *Collegium Logicum* as impressively described by

[5] Because of Kant's transcendental unity of apperception this goes together nicely with physical reality considered here.

Goethe in his *Faust*: squeezing his pupils' minds into Spanish boots, frustrating their imagination and invention. Or, in other words (though the above metaphor is obviously unfair to contemporary logic): the traditionalist doubts people's competence in using their own language — he is the only one who can teach them to speak (and to think) correctly. It was this very attitude which brought logic to the brink of disaster, since it led to the opinion that logic is an esoteric discipline, useless and bothersome, having nothing to do with living science. For quite obvious reasons, this is a highly unwelcome and even dangerous image for an academic discipline.

The alternative position could be identified by Martin Luther's attitude, when translating the Bible: he frequented the market place in order to find out first how people do speak. He was perfectly conscious that the success of his translation depends on whether it will be accepted by his fellow citizens or not, i.e. depending on whether they recognized the terminology of the translation as their own language. Unfortunately (or rather fortunately), logic itself has almost no ability to bring its constructions into any spoken language, i.e. to execute obedience to the rules concerning the use of its artificial linguistic creations. Therefore, the upshot of any officious indoctrination performed in the traditional way mentioned above is sometimes a more or less elegant formal calculus which appears to be rather uninteresting for the intended user of the formalization. They simply refuse to accept the proposed construction as an appropriate formal counterpart of the concept to be formalized which is used in their language. In that case, the formalization would be a failure, since the success of the enterprise depends on how closely it fits the real terminology what it pretends to formalize.

In the formal description of a discussion there may occur sentences, one of them being the negation of the other. Whether this is the case or not merely depends on convention — just how to take down the discussion. Obviously, one can easily invent some alternative modus of description in order to avoid the occurrence of $A$ and *non-A* in the formal minutes, e.g. by indexing with the speakers names: $x$ claims $A$ and $y$ claims *non-A*. This would yield $(x; A)$ and $(y;$ *non-A*$)$, what clearly makes the contradiction disappear.

However, nobody can be forced to choose this way (remember that we are to trust the language competence!) What actually appears in the record is thus established by the previously agreed rules of how to take down the discussion. Imagine that some participant in the discussion claims $A$ and some other opposes claiming $A$ *is not true* or *non-A*, for short. Assume furthermore, that the keeper of the minutes is a bit easy-going or in a hurry and on his sheet of paper he writes down nothing else but both $A$ and *non-A*.

In terms of Artificial Intelligence, this illustrates the usual trade-off between a comfortable and precise (and therefore usually very extended) language of formalization on the one hand and limited as well as expensive resources for processing the formalized material on the other hand. Sometimes it may pay off to work with a modest but uncomplicated language which needs little memory and low calculating capacities.

So the emergence of inconsistencies can be brought about by the hard choice between the expressive power of the considered language on the one hand, and the efficiency of the associated metamathematical apparatus on the other hand. I can't see any *a priori* reason to reject neither the possibility of the occurrence of such a situation nor the possibility of its adequate logical formalization. Consequently, logic should investigate this domain. For instance, it should try to answer the question: "How can we encounter incompatible information in practical reasoning?" Let us name "discursive" all approaches within formal logic which aim at an adequate treatment of that problem and of related issues.

### 2.1. The Principle of Contradiction revisited

As it is well known, in formalized theories, explicitly using an extended inference apparatus in order to proceed sentences of a formal language, inconsistencies are in general considered highly unwelcome and even dangerous. The logical background of such an attitude is the honorable principle "*ex contradictione quodlibet*". Formal systems involving that principle and containing some proposition together with its negation happen to explode: the inconsistency of a theory is supposed to entail its overfillness.

We therefore arrived at a dilemma. On the one hand, we need an inconsistency-proof inference device. Such a thing seems to be incompatible with the *ex contradictione quodlibet*, and would therefore exclude it from the class of admissible principles. On the other hand, this very principle take a distinguished position in formal logic at all times. Actually it is considered the very keystone of rationality in our cultural tradition. So it should not be dismissed without serious reason.

Let us therefore take a closer examination on the *ex contradictione quodlibet*. Is it indeed beyond any doubt? This is how Aristotle expresses his opinion on the logical principle of contradiction[6]:

> The principle that two contradictory statements are not both true is the most certain of all. (p. 11)

[6] All quotes are my translations from [5].

Perhaps its reasonable to doubt statements putted forward with that much emphasis. Indeed, Aristotle's conviction was not at all generally shared in antiquity. The most prominent among his opponents was perhaps Heraclitus of Ephesus, but there were others, too. Ever since the idea of possible coexistence of contradictory statements is very much alive. So never mind whether the principle is certain or not, let us rather ask for its truth. That is, what about reasons for the principle of contradiction?

It will be helpful to recall Łukasiewicz's famous paper concerning the Law of Excluded Contradiction (LEC, for short). Łukasiewicz analyzed the reason for assuming LEC in its psychological, ontological, and logical version. A detailed analysis of the psychological version of LEC reveals that it is false or at least very doubtful. (The only evidence Łukasiewicz was able to provide were vague impressions of "dialethic" pious stirrings when reading mediaeval hymns.) What is more, the remaining cases are in a sense identical and not much better founded.

> We cannot claim with entire certainty the existence of consistent constructive objects. And similarly we have no guarantee that there exist consistent material objects. (p. 128)

That means that neither the ontological nor the logical version of LEC is evident. If we are not sure about the truth of LEC, what is our reason to keep it after all? Łukasiewicz argues:

> The laws of geometry are grounded on definitions as well as the law of contradiction is based on definitions. We may doubt their truth when applied to real figures in the very same manner as we may doubt the law of contradiction when applied to the real world. [...] Applying these laws to reality we do not meet with any difficulties. Hence we use them unscrupulously and we will continue to do so as long as possible. (p. 131/2)

Obviously, he agrees that

> The value of the law of contradiction is not of logical nature. (p. 136)

So LEC turns out to need a proof but there is none. However, Łukasiewicz insists that it is an important principle and that its value results from practical-ethical considerations. And what is more, this practical-ethical value is so enormous that the absence of any logical value does not matter at all. He agrees with Aristotle:

> This principle is our only weapon against error and falsehood. (p. 138)

What about the allegedly enormous practical-ethical weight of this principle. There is no weight without gravitation. Therefore the question arises: What is the realm of "practical-ethical gravitation"? Of course, this is not an entirely serious question. Nevertheless it reveals a serious problem. In formal sciences like logic, we don't need any practical-ethical pressure to tell the truth — we have inner-theoretical truth criteria instead. Things are similar in mathematics and in large parts of empirical sciences. Łukasiewicz himself came very close to this conclusion, too:

> If we could confine ourselves to sentences only, which necessarily follow from the definition and are as clear and well proved as the simplest mathematical theorems, then we would not need the law of contradiction. Certainly, we would not be able to show error or falsehood in this case either, but because we would accept only proved sentences, hence the false, which are impossible to prove, would not concern us. (p. 139)

It seems quite obvious, that Łukasiewicz's argumentation is relevant in areas of rational communication lacking objective criteria of truth. However, such areas do not deserve special interest from the point of view of discursive logic: The kind of contexts which are to be formalized in discursive logic possesses its own truth-criteria which are by no means of merely practical-ethical nature. For discursive logic LEC has no practical-ethical weight either.

Given such circumstances the question arises whether there are any reasons at all to keep LEC? Some paraconsistent logicians denies that question. Nevertheless, I don't think that they are right. At least, there are traditional reasons for keeping LEC. We are familiar with this principle, it belongs to the established conventions of rational thinking. So to say, LEC has great aesthetic value. So it comes out, that LEC is neither absolutely true nor especially important, but it is nice. So just for that reason one would like to have it among the basic principles of logical calculi.

Why "paraconsistent logicians" do not like LEC? The crucial point is that everything follows from a contradiction. Given this principle, LEC is necessary to avoid the overcompleteness of the formal system, i.e. the uselessness of this system. Graham Priest uses to define the paraconsistency of a calculus by its lacking the *ex falso quodlibet principle*.

I agree with his definition in letter, but not in spirit. Namely, imagine that you have to take down a discussion. Suddenly, somebody claims $A$ and some other participant opposes claiming $A$ *is not true*, or *non-*$A$ for short. On your sheet of paper you wrote down scrupulous $A$ and *non-*$A$. And now

you observe a remarkable fact: The discussion goes on and may become quite exiting — but no one of the participants panics! None of them feels constrained to accept any claim as true. Both claiming a thesis and then attacking it by claiming its negation are quite popular events in any course of a discussion. This does not cause the discussion to break down because of overcompleteness. It is impossible that both $A$ and *non-A* are true. In the realm of two-valued logic one of them must be false. So (at least) one thesis on your sheet of paper is false. Nevertheless, this fact seems to be not dangerous at all.

Let us now assume — as a second case — that some of the participants claims both $A$ and *non-A* at the same time. This causes a quite different situation! What is the difference? One can precisely describe the conditions under which inconsistent claims may occur in the minutes. Assume that the quarrel goes about $A$. Some of the participants have reason to claim that $A$ is true while the other ones disagree: according to them $A$ is not true. And there is no possibility to persuade one of those groups by logical reasons only to give up their position. As far as there is no new empirical evidence accepted by all participants each of them has a generally used defense: "We are right and the others are wrong!" But now assume that one and the same speaker claims that *A is true* and at the same time he disagrees and claims that *A is not true*. Then there are purely logical reasons which should persuade him to change his mind. One can remind him of the common use of the words *et* and non from which follows that his claim makes no sense. Obviously, the above defense strategy should not be used in this case. Otherwise the speaker would characterize himself as intellectually somewhat embarrassed. That means, if there occurs a contradictory claim in the minutes (not merely claims which are inconsistent with each other) then the person who claimed it either does not use the common language of all of the other participants (and is therefore not a rational *speaker*) or he is mentally puzzled (whence, not a *rational* speaker). In any case it seems the best to exclude him from a rational discussion. The reason is, that at least I would expect just everything from somebody who claims obvious contradictions like *A et non-A*. In this sense it seems quite reasonable to assume that anything follows from *A et non-A* — a rational discussion becomes overcomplete by a contradictory claim. The principle ex contradictione quodlibet is therefore in keep with discursive logic:

From *A et non-A* follows anything.

On the other hand we had observed that from a false claim made in discussion do not follow everything. That means, in the logical framework

appropriate for formalizing the discussion the following *ex falso quodlibet*[7] is not a permissible rule:

From $A$ follows anything or from *non-A* follows anything;

in other words

From $A$ *and non-A* follows anything.

Therefore it seems reasonable to dismiss the *ex falso quodlibet* principle in discursive logic — and insofar I agree with Priest. At the same time, I think that we have good reason not to dismiss the *ex contradictione quodlibet principle*. If there are some dark and slightly mystical areas in paraconsistent logic — and I am quite sure that such areas — then right in between both principles runs the borderline dealing rational paraconsistent logic from the paralogical part.

### 2.2. Parainconsistency

Formal logic has already at hand a large class of inference devices ready to model inconsistency tolerant reasoning. The Polish line of research in this area, so-called non-adjunctive or discussive logic, was invented fifty years ago, by our famous Torunian mathematician. As its name *non-adjunctive logic* indicates, formal contradictions are tamed by restricting the adjunction of propositions.[8] Not always should the adjunction of two formulas accepted for some reason be an accepted formula. In order to achieve that, Jaśkowski worked within a completely modalized language. He created an intentional propositional connectives, among others also a non-classical conjunction with the desired properties. His original calculus $D_2$ was related to Lewisè modal *S5*. Later it turned out that the construction can be based on many other modal calculi as well. By that it gives rise to a large manifold of Jaśkowski-style discussive logics.[9]

[7] I am not sure whether all specialists in history of logic will agree with this term, but I got the permission of some of them. The label seems to express fairly good the content of the rule.

[8] Actually, Jaśkowski's paper starts out a new branch in paraconsistent logic. Another contribution to this tradition is Rescher and Brandom's approach towards a logic of inconsistency ([8]). Also Lewis is suggestive of a non-adjunctive approach to accommodating contradiction ([4]).

[9] More technical details can be found e.g. in [10].

Besides the interesting formal properties of the approach, it is underpinned with a well elaborated philosophical motivation. According to a proposal by Perzanowski, the philosophical background of Jaskowski's system and related calculi should be called "parainconsistency". The main idea is to handle any conflicting information in scientific theories, or databases, or belief sets, or whatever, as merely apparent inconsistencies, as parainconsistencies. This does not mean, however, to ignore or avoid problems by using linguistic tricks. Inconsistencies are interesting and often highly important items in the development of the sciences and should be treated as such. Yet within this approach one is not forced to admit any inherent contradictory nature of reality. That should embank the flood of postmodern as-you-want-ities and protect that kind of logical investigation from philosophical suspicions. Any post-modern talking about fading differences between truth and falsehood sounds more than strange from a logical position. Logic lives on the difference of truth and false in the very same way as ethics depends on difference between good and evil.

Jaśkowski's construction of discussive logic is probably the best-bashed project in the field. There is no room to correct all unfair or objectionable criticism concerning this approach. In my opinion, it is one of the most interesting and promising approaches in inconsistency-tolerant reasoning. Moreover, it has an excellent philosophical motivation. Numerous classical ideas by Leibniz or Kant can be restated within this setting. Discussive logic is evidently motivated by the weak approach to paraconsistency.

The reason for preferring discussive logic as the most promising approach to paraconsistency is not only because of its formal elegance and deep philosophical motivation. Besides, discussive logic represents an ideology that is, to my mind, the most appropriate one for paraconsistency. To put it informally: at the very core of paraconsistency lies not negation, but conjunction. The paradigm for paraconsistency, I take it, is scientific discourse. For any logical formalization, the observer's perspective is the only appropriate one. Hence, when creating a paraconsistent logic we have typically to assume the position of a keeper of the minutes of scientific discussion. Why should we then insinuate that a person who asserts a negated sentence has in mind some exotic kind of negation? Such an assumption could be justified only by referring to the overall consistency of the ongoing discussion. That motive, however, cannot be attributed to the person who made the claim. Writing down her claim in terms of non-classical negation thus means systematically to distort it. We therefore should rather concentrate on conjunction. With respect to inconsistency-tolerating calculi, this connective seems to be the

most important one — at least for those approaches which are directed towards application.

Naturally, parainconsistency does not claim that falsehood and the truth reconcile in the realm of logic. Quite to the contrary: the aim is to obtain a precise, but more sophisticated concept of inconsistency. Not every single inconsistency amounts to a plain contradiction. However, under some circumstances it may be reasonable to treat it as a contradiction (since by that we may gain a simplified formalism or be able to work within a more transparent calculus.) But even then modern logic has the tools to prevent such an inconsistent calculus from explosion.

## References

[1] Heisenberg, W., *Physics and Philosophy*, Penguin Books, London, 1989.

[2] Jaquette, D., *Contradiction*, Phil. Rhet. 25 (1992), no. 4, 365–390.

[3] Kotarbiński, T., "On the question of the existence of the future" (in Polish), Przegląd Filozoficzny 1 (1913), 74–92.

[4] Lewis, D., "Logic for equivocators", Nous 16 (1982), 431–441.

[5] Łukasiewicz, J., "On the principle of contradiction in Aristotle's writing" (in Polish), PWN, Warsaw, 1987.

[6] Oppenheimer, R., *Wissenschaft und allgemeines Denken*, Rowohlt, Hamburg, 1958.

[7] Reichenbach, H., *Atom und Kosmos. Das wissenschaftliche Weltbild der Gegenwart*, Wissenschaftliche Buchgemeinschaft, Berlin, 1930.

[8] Rescher, N., and R. Brandom, *The Logic of Inconsistency. A study in non-standard possible-world semantics and ontology*, Blackwell, Oxford, 1980.

[9] Schurz, G., *Koexistenzweisen rivalisierender Paradigmen. Eine begriffserklärende und problemtypologisierende Studie*, vol. Koexistenz rivalisierender Paradigmen, pp. 1–51, Westdeutscher Verlag, 1998.

[10] Urchs, M., "Handling Inconsistent Information. Towards a Logic of Rational Discourse", in *Perspectives in Analytical Philosophy*, vol. Logik und Mathematik, pp. 269–284, de Gruyter, Berlin, 1995.

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