THE REASONER

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GUEST EDITORIAL

Dear readers,

I am delighted to present you with the new edition of The Reasoner, featuring an interview with my colleague and friend Miloš Kovačević. Miloš is a Ph.D. student and a teaching assistant at the University of Belgrade, Faculty of Philosophy. His field of study is political philosophy and apart from his academic work, Miloš is also a prominent LGBT activist in Serbia and one of the organizers of Belgrade Pride Week.

A relationship between political philosophy and activism tends to be a dynamic and fruitful one. Many social movements have originated from a single philosophical idea, while, on the other hand, working in a community has always endowed theoretical insights as well. While as researchers we tend to keep our work as independent of our private lives as possible, I often wonder how much all the different parts of our identities, sexual orientation being one of them, really influence our interests and the way we are treated in the scientific community.

The history of philosophy is full of significant authors who happened to have been gay or bisexual - from many ancient Greek philosophers having had homosexual relationships up to Wittgenstein. Despite that, I have noticed that the topic of same-sex relationships is not as present in political philosophy as one would expect it to be. Given that the available data from countries where mass surveys were conducted, notably the UK (2018) and the US (2020) show some 2-6% of populations indentifying themselves as members of LGBT community, I believe that a broader represention is needed.

With love and respect, I dedicate this issue to all the LGBT students, scholars, and researchers out there, especially those among them who have suffered any kind of discrimination based on their sexual orientation. I am thankful and proud of being able to work on this project. I hope you will find enjoyment and encouragement in Miloš Kovačević's story about his work in both philosophy and activism.

ALEKSANDRA VUČKOVIĆ
University of Belgrade

FEATURES

Interview with Miloš Kovačević

ALEKSANDRA VUČKOVIĆ: You enrolled in the Faculty of Philosophy at the University of Belgrade in 2011. Have you come out as gay by that time?

MILOŠ KOVAČEVIĆ: No, not really, since by "coming out", I mean coming out to your parents. And my parents didn't know

about it at the time.

AV: You are originally from Novi Sad, so enrolling in this University meant you would also have to move to Belgrade. At the time, did you think of yourself as a young man moving into a new city or did you think of yourself as a *gay* young man moving into a new city?

MK: Well, I have had previous gay experiences back in my high school, while I still lived in Novi Sad, so I think that even at that time I had fully realized that I was gay. When I was young, I thought of myself as a straight man, then in middle school, I thought I was bisexual, but by the end of high school, I have realized that I'm a gay man. So, I came to Belgrade knowing who I was. As to whether I have truly come out to people around me, it's a matter of question. I have outed myself pretty quickly to *some* of the colleagues, but not to all of them.

AV: What did your first coming out to colleagues look like? Did you have "the official talk" or did it pop out more spontaneously during casual conversations?

MK: I remember meeting the first of my new friends – a straight girl and another gay boy, for whom at the time I didn't know was gay. I remember constantly listening to other people in order to try to learn more about their opinions – whether they were homophobic or gay-friendly. And it was not an easy task, since you have to talk to another person a lot and on many different topics. It's not a topic that pops out in conversations too frequently, so I had to try and detect their opinions on the LGBT population based on their other views.

AV: What were those *other* views that hinted at you that someone was gay-friendly?

MK: People tend to have a cluster of views that are intertwined. For instance, if you notice that someone is not too religious, it may be a first hint that said person might not be homophobic since many people embrace homophobia due to some religious dogma. And if you notice that the person in question does not hold nationalistic sentiments, it is another good sign. If you also realize they support feminism, "the door" for your coming out is pretty open by then. Some people openly show their support for LGBT Pride and others talk about their gay friends without any judgment or stigma attached to it. Then you know that someone is safe. And I quickly came to realize that my first new friend, a straight girl, is gay-friendly, so I came out to her. After that, the other friend, also a gay man, came out as well, although I previously thought of him as straight. I don't remember how I came out to you since we started hanging out a bit later.

AV: It's a funny story since it was *me* who came out as bisexual first and then you said "Oh really? Well, I'm gay!" So, your first time coming out was a pretty pleasant experience, but what happened after? Have you encountered some not-so-gay-friendly colleagues or even straight-forwardly homophobic ones? And did you, or do you even now, have to work with such people as well?

MK: Well, I can't say I have too many colleagues right now at my doctoral studies, since the current focus is much more on independent research and working in small groups instead of attending lectures with seventy other people. But, at the time before I got my Bachelor's degree, I had feared some of the colleagues – especially those masculine ones. In my head, macho men were always a potential threat, because they fit that stereotypical image of how a homophobic guy looks and acts. But most of them didn't turn out homophobic at all. I can't say I encountered any discrimination based on my sexual orientation and I became pretty open about it as time went by. Only those who hadn't asked didn't learn about my orientation. AV: But how often do people get asked about their sexual orientation?

MK: Yes, it's a question that's currently bugging me as well. What does being out as gay *really* mean? Does it mean you have to go to your mentor and say something like: "Hello professor, I just came here to tell you that I'm gay"? Just as we don't walk around telling everyone about our political or religious beliefs, we probably don't talk about our sexual orientation as well. So it may happen that such a topic never arises in communication with our mentors. While some people tend to be closer with their mentors and discuss even parts of their private lives with them, some of us, myself included, tend to be at a greater distance. And I don't see it as a necessarily bad thing.

AV: Since you mentioned the relationships with mentors, have you ever noticed someone of your superiors, a professor or a teaching assistant, for instance, making inappropriate jokes or comments regarding the LGBT population? Or have you ever felt like you've been treated differently than your colleagues who are straight or presumed straight?

MK: No, I cannot say that such a situation ever occurred. But, since I followed the media, I knew that some of the teachers were, to a greater or lesser degree, homophobic, at least according to my standards. One professor published an article in a scientific journal in which he stated that same-sex couples ought to get a right to be in a civil partnership, but not marriage. This is something that homophobes nowadays say - "You can be together, but not married", but he published that article ten years ago. So, I am not even sure whether it could be classified as homophobic, keeping in mind different standards at the time. The law regarding same-sex civil partnerships we accept to pass in Serbia *now*, in 2021, so at the time he was writing that article, it was rather a progressive view. I read this article during my master studies and I remember trying to figure out not just my colleagues', but professors' views regarding the LGBT population as well. And I remember the classes in applied ethics where teaching assistant would play movies to students and those movies would be on the same old topics such as abortion, euthanasia, etc. One time we were watching the documentary about surrogacy in which gay couples appeared as well. I'm not sure, but I think some of the guys in the classroom started giggling when gays were shown on screen, but the TA kept a straight face. And I was pretty certain that she wouldn't pick such a movie for our class unless she was gay-friendly. So when the time came for us students to pick a topic on which we would like to write a paper, I came to her with a proposal of writing an article titled "Moral justification of the same-sex marriages". The topic was approved and later I got a good grade, so there were no problems at all, zero homophobia. And although in that paper I criticized the article of the aforementioned professor who didn't approve of same-sex marriage, his TA awarded me the maximum number of points.

AV: And how did you feel about that professor's article you have criticized?

MK: Back in 2016 when I first read it, I remember thinking how conservative it was. And it still is. However, it is still far

more progressive than mainstream opinions in our region. But one of the other TAs was a whole different story. I don't recall him being homophobic during the classes, but he published an article in one of the daily newspapers in which he compared same-sex romantic relationships to zoophilia. It was a 'slippery slope' kind of argument - "if we legally recognize the same-sex relationships, what is going to be next and what is going to be after that" and he concluded that we would end up legally and morally accepting zoophilia as well. And that was genuinely homophobic. I don't know if he holds the same belief today, maybe he changed his opinion, but at the time it was as unfair as it gets.

AV: So far, we have talked about your student life, but you've grown since then and today you have become a TA yourself. What is your relationship with students? Are you known as "that gay teacher"?

MK: I don't think that students spend too much of their time thinking about me, I think they see me as some "boring figure", so to say. (he laughs) I think they do realize I'm not some conservative right-wing supporter. I believe they see me as a liberal who approves of left politics as well. And I tend to challenge their conservative beliefs - I usually ask them further questions to elaborate and justify those views.

AV: And what happens if someone expresses a more liberal or left-leaning stance?

MK: Of course, I do like to ask further questions in those cases as well. The students should always practice to reevaluate and properly justify their beliefs, instead of just accepting them at face value. It's intellectually stimulating and I think all of us philosophers are used to playing the devil's advocate. It's a part of your job, you always have to be fair to your opponent and do not ignore his arguments. But naturally, it is always easier to challenge views you disagree with.

AV: What course are you teaching?

MK: My course is Introduction to Politics and I work with first years that are studying philosophy, psychology, a lot of future psychologists, and sometimes history as well. I teach them basic concepts of political philosophy, such as legality, legitimacy, etc. and we often discuss the hierarchy of the legal order. One of the first things I teach them is that lower-order legal acts have to be in accordance with higher-level legal acts - the highest of them being the constitution. I ask them then if they could name one of the lower-order legal acts which would not align with higher ones. And they often use the example of same-sex marriages that ought to be considered illegal, since the constitution of the Republic of Serbia defines marriage as a partnership between a woman and a man.

AV: So, how do you respond to that?

MK: I tell them that they are right because they *are* right and they do understand the concept of hierarchy, which was the point of the lecture. But in the end, I do add that our constitution has an article which states that every law in Serbia has to be in alliance with the European Court of Human Rights which is officially accepted and recognized as the authority. And according to the European Court of Human Rights every country, including Serbia, has to have a law regarding same-sex partnerships. However, this is not just about legality, but the legitimacy of laws as well, which students also need to understand. According to the Anglo-Saxon conception, one order is legitimate if and only if it respects human rights. But, if we deny LGBT people the right to get married or to adopt a child, we deny them the human rights that everyone else has. So even when

the law regarding same-sex partnerships passes, the question will remain whether we respect the human right of gay people, let alone the trans community, since trans people still cannot legally change their name.

AV: Apart from teaching at the university, you are also an LGBT activist and you work for an organization that fights against hate crimes. So, since you have experience in both philosophy and activism, do you think that the topic of the LGBT community and the challenges it faces is adequately represented in education? Do you feel we need more perspective from LGBT authors in philosophy?

MK: Well, not really, I don't think LGBT authors are excluded *per se*. We know that some authors we study also happen to be gay, such as Wittgenstein. But, you see, his homosexuality has never been mentioned, although professors often tend to include facts from the private lives of philosophers. But I don't see it as a big problem, since philosophy is not really about anyone's personal life, but about universal topics and questions.

AV: But in philosophy, we do discuss war, pollution and other contemporary issues, right?

MK: There is a book on sexual ethics, by Serbian author Igor Primorac. And actually, it is a part of the curriculum for doctoral studies, so I could have picked the topic of same-sex relationships. It's not particularly a popular one, but I think we had the liberty to write about it. However, I do believe that we need fresher topics than the same old corporal punishment and abortion. I think those things are passé, so the discussion about LGBT rights could be a refreshment. But, on the other hand, I don't think that the number of students who also happen to be LGBT accounts for the relevance of the issue itself. I think that philosophers should start writing about it and then and only then think about the curriculum.

AV: As far as I can notice and correct me if I am wrong, but I've come to a conclusion that your experience as a researcher and LGBT activist has mostly been a positive one. Do you think that such openness can be found on other faculties as well or is the Faculty of Philosophy an exception due to students there being generally more broad-minded?

MK: I think you're right. There is certain open-mindedness in social science and art that can't always be found in other branches of science. But I believe it's only natural. Philosophy makes you question everything and think about human existence in all of its forms and variations. Human relationships are a big part of social studies, so we do tend to develop a "special sensitivity" for the LGBT community. But I don't think that other branches should be excluded from this discussion, quite the opposite, I think everyone should have a say in it.

Abstraction and Idealization: Mutually Exclusive or Not?

In his recent article, Arnon Levy (2018: 'Idealization and abstraction: refining the distinction', Synthese, 13(1):1–18) provides a detailed account of the distinction between abstraction and idealization. With regard to abstraction, Levy's view can be summed up as follows: A process of abstraction ends up with an abstract representation, but this doesn't mean that all abstract representations are produced by the process of abstraction. We can identify an abstract representation without knowing whether it is an end-product of a process of abstraction or not.

The idea is straightforward: first, compare two or more representations of the same subject matter and then identify the one which contains fewer details than the others. For instance, a representation that states the exact mass of an object (e.g. 5 kg) is more detailed than the representation that states the approximate mass of the same object (e.g. between a range of 1 kg and 10 kg). Accordingly, the latter representation is more abstract than the former. Notice that there is no need to consult the process abstraction here –a simple comparison of two representations (two products) is sufficient to identify abstractness.

Process/product distinction is crucial for Levy because it allows him to reject the standard view that the category of abstraction and the category of idealization are mutually exclusive. Martin R. Jones (2005: 'Idealization and abstraction: A framework', Idealization XII: Correcting the model. Idealization and abstraction in the sciences in M. R. Jones & N. Cartwright (eds.) Vol. 86, 173–217), is one of the proponents of the standard view and Peter Godfrey-Smith's (2009: Abstractions, Idealizations, and Evolutionary Biology, Mapping the future of biology: Evolving concepts and theories in A. Barberousse, M. Morange & T. Pradeu (eds.), 47-55) views are also akin to those of Jones'. They argue that, with respect to a single property, a representation can contain idealization, or abstraction, but it cannot contain both. In other words, while constructing the model of a system, we can either omit a property of the system without misrepresenting it (abstraction) or misrepresent a property of the same system (idealization), but not both. According to Levy, this need not be the case because a representation can be both abstract and idealized. He provides a counterexample to support his view and asks us to consider the two following statements:

(a) the speed of light in a vacuum is several hundred meters per second

(b) the speed of light in a vacuum is 300 m/s

where (a) and (b) are both representations of the same subject matter or single property i.e. the speed of light. The former is more abstract than the latter. Furthermore, the two statements are both false – more specifically they are both misrepresentations because the speed of light in a vacuum is 299,792,458 m/s. Therefore, the counterexample shows that a particular representation can be both abstract and idealized.

Levy argues –and I agree with him- that a representation can be more abstract than its less abstract counterpart. As he states, relative abstractness of two representations can only be indicated by the comparison of two or more abstract products. So, we should understand abstractness via abstract products -not in terms of the process of abstraction. But does this argument adequately address the standard view's claim? A closer look will reveal that the answer is negative. It is because Jones explicitly describes his understanding of the concepts as follows:

> "[W]hen we say that a model M is an idealization, or is idealized, we mean just that it contains one or more idealizations . . . and talk of idealization as a process or activity may simply denote the process or activity of constructing an idealized model in this simple sense [emphasis added]. . . The same holds, mutatis mutandis, for the terms 'abstraction' and 'abstract' " (2005: 192).

What Jones has in mind here includes the process/product approach and its implication for the distinction between the abstract product and the process of abstraction (and also for the

distinction between idealized product and the process of idealization). Accordingly, let me present Jones' argument more charitably. Consider a version of inclined plane models. We might, purposefully, misrepresent the plane's friction by setting its value to zero, at the level of model construction. Furthermore, we might omit plane's color by not mentioning about it. Given the standard view, the former denotes the process of idealization; while the latter denotes to the process of abstraction. As it is seen, their subject matters are different –one idealizes away the friction, and the other abstracts away the color of the plane. When all the processes are done, we obtain a model of inclined plane including a large number of statements that each represents a single property. The model is both abstract and idealized. Indeed, the standard view does not deny this possibility. What it denies, however, is somewhat different.

According to the standard view, once an abstraction process is applied for a given property, it is no more possible to idealize away that given property. For instance, when we abstract away the color of the inclined plane, we implicitly state at the outset that the color is of no importance for our purposes. Is it possible to think of the inclined plane as colorless? Yes. Is it possible to think of the inclined plane as blue, yellow or any other color we want? Again, yes. But the situation becomes different when it comes to the process of idealization. Is it possible to think of the inclined plane as frictionless? Yes. Is it possible to think of the inclined plane has a friction coefficient of 0.5, 0.7 or any value somewhere in the range of 0.1 to 1? No. The reason is that each different value of surface friction will produce different outcomes than the other. However, different colors of the plane would not have different implications for the model –at best, we would have different redundant representations of the plane. The upshot seems to be that, abstraction can be achieved with either specifying or not specifying the input property, whereas idealization requires an explicit specification.

One final note: from what I have said so far, one cannot draw a conclusion about whether idealization and abstraction are mutually exclusive or not. So, I remain neutral between two positions. What I want to underline is that the argument of the standard view under discussion is not properly addressed by Levy.

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Resilient Creative Thought Processes: Reconciling Imagination and Reasoning

Creativity and/or creative thought processes seem to incorporate a component of imagination and it also must have a well-reasoned argument or basis of judgment. But, these two mental acts: imagination and reasoning are apparently contradictory in nature and functioning. This feature espouses an evolutionarily interactive interplay between these two acts and processes.

Let us fathom out apparently two different kinds of mental acts: imagination and reasoning. It is of our concern how non-rational imagination transforms into rational imagination leading to intellectual imagination and/or creativity. So, how does a creative act or thought process gets the parity or optimality between the two differently stated mental acts? How does a conscious agent balance out between the two? What is the nature of the *content* of these acts: is it representational or non-

representational? In other words, does the agent, brain, system (even artificially intelligent system) process and access the *content* with some representations of the world or state of affairs or there may be a non-representational account.

To decipher it systematically, we should assess how one accesses or enquires into the known/unknown environment. Resolution to Meno's paradox (logical impossibility of inquiry and discovery) suggests a plausible way to come out from an inactive and sluggard attitude and quest for inquiring and discovering. The nature of an inquiry showcases the plausible conflict and an uneasy link between reasoning and imagination. Consider these two attributions: "X is reasonable enough, but X lacks imagination" and "X is quite imaginative, but X has to be a little more rational." There seems to be an epistemic clash between the two It portrays that we consider reasoning and imagining as two different mental acts where a person good at one may/should eschew the other. Sometimes reasoning and imagining are cast not only as aliens to each other but as opponents too. One's imagination may impede the reasoning employed whereas one's reasoning may tether the power of imagery with constraints. But, why is it that reasoning and imagination are envisaged as two incommensurable propensities or proclivities, which could not be easily integrated? Can reasoning hinge on the power of imagery or vice-versa? Imagination, visualization, or mental imagery implies the counterfactual scenario with an unruly method, in other words, unreasonable. Imagination seems to have a connotation that it veers away from reality, but "imagination, as the basis of all creative activity, is an important component of absolutely all aspects of cultural life, enabling artistic, scientific, and technical creation" Vygotsky, L. S. (2004: Imagination and creativity in childhood, *Journal of Russian & East European Psychology*, *42*(1), 7-97). Whereas reasoning signifies a realistic approach to language, thought, reality, and is mainly a rule-based activity, that apparently must be accounted as unimaginative. But do we make mistakes while rendering such judgments about their demarcation? Can't the power of imagination/imagery appropriately be dealt with sound reasoning, and vice-versa? How do the evolution and development of imagination and reasoning coincide to form a possibility of reconciliation and creativity? Can it not be argued that imagination and rationality benefit not only each other but also the whole growth of knowledge? Perhaps it can be; we now know how the debates between deterministic attitude and indeterministic approach incorporate the element of chance and order? Also, how the notion of indeterminacy, inconsistency, incompleteness, ignorance, and mistakes are no more vices, rather they are significant criteria for epistemic growth. It will be fruitful to see the boundaries of this rivalry getting blurred and if something meaningful could emerge out.

The power of imagination/imagery implies plausible sequences of action or possibilities to arrive at well-reasoned conclusions. Reasoning/rationality also requires the creative hold of imagination with caution. Platonic insight about the 'tie of the cause', to the otherwise *running away* opinions (*doxa*), renders a significant approach to this amalgamation. In other words, we need to fasten the imagery or opinions with the chain of explanation or reasoning. This reconciliation could be assessed in at least below mentioned four methods:

1. Rational Imagination or Rational Imagery (RI)

2. Non-rational Imagination (nRI) or Imagination without Reasoning

3. Rational Non-Imagination (RnI) or Reasoning without an element of Imagination

4. Non-rational Non-Imagination (nRnI): for instance, infants' condition or of a zombie

So, can X now be imaginatively reasonable or reasonably imaginative? How one progresses from 'nRnI' to 'RI'? Could there be involved a pattern of growth in the interplay of the evolution of reasoning and evolution of imagination where the connection between pure reasoning 'RnI' and pure imagination 'nRI' and then even 'RI' is possible? Could there be some mechanism for the 'RI' approach, or it is a coincidental 'emergent phenomenon'? Through Meno's slave, we get the demonstration of spontaneous recovery of geometric knowledge without the formal training of it. The mental imagery or visualization was judiciously guided by repeated questioning in the right spirit. Hence, the reasoning and imagination resulted in significant growth of knowledge. RI is not a grand overarching formulation rather it claims to have a modest approach to accommodate both the viewpoints and explicate a comprehensive approach. For instance, the mathematical, diagrammatic reasoning, scientific modeling, informal reasoning, judicious dialectic argumentation stands in defense for such coupled RI. The coupling of imagination, mental imagery, visualization with the probity of reasoning seems a difficult task but certain disciplines adhere to such methodological approach either implicitly or explicitly. We routinely observe and acknowledge the need for the creative imagination not only in all arena of life but also in the well-reasoned formulas.

The aspects of cognition in all life forms surprise us to find the role of visual mental images to reason out well in the world. Visuospatial and cross-modal studies (Molyneux's problem, synesthesia, etc.) tell us about the pieces of evidence in support of this. Even Platonic insights, with the connection of imageries to memory, and the Aristotelian concept of '*phantasma*' or mental image/representation showcase the explicit central role of imagery in the cognition and cognitive theory. The historical and philosophical viewpoint of science considers creative imagery as one of the crucial developmental factors for scientific inquiry and discovery. Creative cognition and imagery invoke the elements of 'surprise' 'awe' and 'wonder' along with theories of rationality as well. It also asks for '*seeing* the unseen' or otherwise unseeable. Seeing certain novel connections in the unequivocal or unambiguous phenomenon changes the aspect of seeing or imagining, and hence the reasoning involved also gets redefined. It could be observed through the duck-rabbit example. When one looks at the picture, identifying it as a duck, or as a rabbit, the picture in Figure 1 remains the same, but our way (sense) of looking at it changes.

Summarily, a tripartite logical connection between language thought, and reality allows 'thinking in pictures' at a sub-rational or ratiomorphic level with vicarious explorations of the anticipatory world. Evolutionary epistemological viewpoints offer an explanation for the prior origins of mental imagery, visualizing or 'thinking in pictures' than 'thinking in words.' "We need to stretch our imaginations even to discern the radical exercise of imagination that everyday reasoning demands" Perkins, D. N. (1985: Reasoning as imagination, https://psycnet.apa.org/record/1986-08225-001, *Interchange*, *16*(1), 14-26). The architecture of hierarchical cognitive complexities allows a RADAR or SONAR like exo-
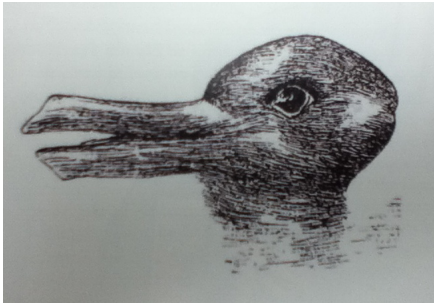
Figure 1: Interpreted by L. Wittgenstein (1953), Philosophical Investigations, Pt. II, Sec. XI

somatic vicarious mental exploration. Such interplay not only helps in avoiding dangers and predicting the world but also aid in creatively employing reasoning (artificial intelligence) and explicating sound reasoning out of mental imagery (a thought experiment, scientific modeling). Thus, the perception-action-cognition model has a coupled interactive interplay between imagination and reasoning under the evolutionary point of view.

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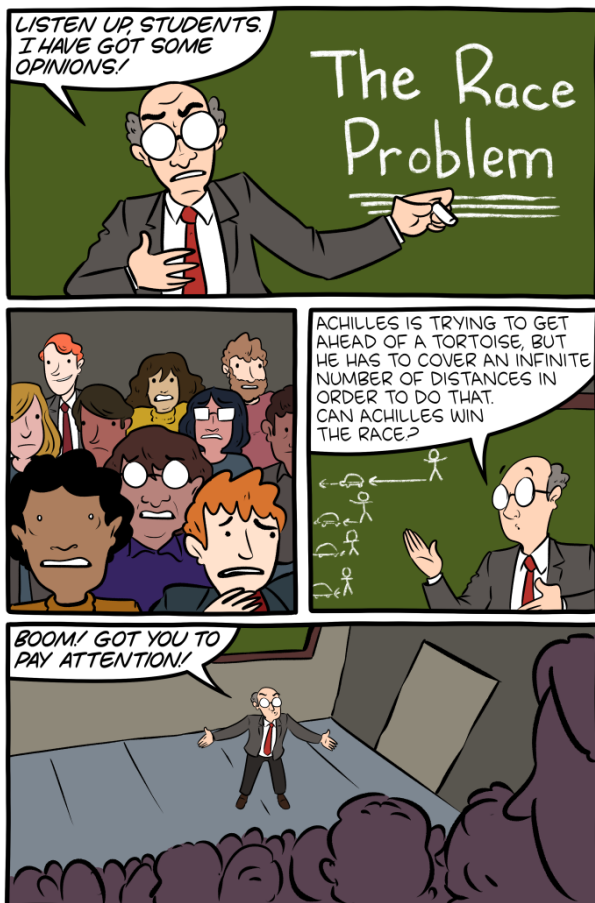
Calls for Papers

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CLASSIC METHODOLOGIES IN THE PHILOSOPHY OF SCIENCE: special issue of *Journal for General Philosophy of Science*, deadline 30 April.

WHAT'S HOT IN . . .

Science Policy

In the context of the Covid-19 pandemic, it becomes increasingly important to address the public health emergency while respecting people's freedom. The ethical dimension of the measures against Covid-19 requires cooperation among researchers from different fields and politicians. This calls for an interdisciplinary approach in science. For instance, psychologists can give us insightful information on how science should be communicated with the general public.

An example of the importance of the interdisciplinary approach in public vaccination policy comes from the recent Ebola outbreak in Congo. Maxmen (2019) reported about a vaccinated person being killed by his frightened neighbors who believed that the vaccine made him infectious. To address such risks, the researchers changed their vaccination approach: instead of vaccinating people close to their homes, they directed interested people to vaccination sides in neighboring cities Maxmen (2019 Nature Sep; 573(7773):178-183). This solution required an understanding of the local beliefs and showed how valuable the insights from social sciences are.

In the case of Covid-19 vaccination campaigns, one important aspect is the coherent and uniform presentation of the results. Opposite recommendations regarding different types of vaccines (and even the same vaccine) create confusion in the public and could undermine the trust in the safety of vaccines in general. Trust in science is a cross-national issue as the virus does not respect borders.

On the micro-level, trust in science is mainly achieved through communication with the closest experts on the field – local doctors. To properly educate the general public about research in life sciences, communication with the local doctors is, therefore, of crucial importance. They can amplify the message and are for many patients the most trustworthy source of information. Moreover, trust between scientists and the general public is something that has to be built through addressing all the questions and potential worries of the public.

Science cannot be blindly trusted and all research results need to be properly justified. This is an important lesson from history and philosophy of science which taught us that different ideas and approaches should be pursued to reach the most reliable conclusion. The difference in opinions is important for

the scientific pursuit, however, it creates tension regarding science communication. For the general public it is frequently hard to differentiate between mainstream scientific beliefs, concerns of a minority of researchers, and people who pursue a non-scientific agenda and only pretend to identify flaws in the mainstream views.

The starting point of successful science communication should be the assumption that there might be reasons for mistrust in a particular scientific result and an effort should be put in identifying and addressing them. These reasons might have something to do with personal and collective experiences, exposure to certain information, etc. When the trust is once broken, it takes effort to restore it. Furthermore, it is important to listen to questions and concerns, as scientists should not take knowledge for granted – some truths are not as obvious as they believe, especially for people from different backgrounds. To gain a deeper understanding of the beliefs of people, and later intervene appropriately, an open-minded and interdisciplinary approach should be practiced.

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Evidence-Based Medicine

We would like to continue today our series on the COVID-19 pandemic and its relationship to EBM(+). While our latest contribution in the *Reasoner* was about how the most recent researches on the new SARS-CoV-2 pandemic show the fruitfulness of an EBM+ approach, today's column is devoted to the relationship between epidemiological *models* of the COVID-19 pandemic and EBM(+).

Whilst EBM is a medical methodology relying on the best evidence available, which is, traditionally, a statistical correlation between a disease and its cause established through association studies - where the *gold standard* is a clinical RCT confirmed through systematic review and meta-analysis - (plus the evidence of a linking mechanism for EBM+), an epidemiological model is a specific intentional scientific representation: e.g., a mathematical representation of the spread of the coronavirus infection (cf. Cepelewicz, "The Hard Lessons of Modelling the Coronavirus Pandemic", 2021, *Quanta Magazine*), or an agent-based representation of the COVID-19 pandemic (cf. Maziarz, & Zach, "Agent-Based Modelling for SARS-CoV-2 epidemic prediction and intervention assessment: A Methodological Appraisal", 2020, *Journal of Evaluation in Clinical Practice* 26: 1352-1360). Beyond their purely scientific purpose, epidemiological models are generally meant to guide public health policies.

An interesting issue coming, first, to mind when thinking about the relationship between epidemiological models of the COVID-19 pandemic and EBM(+) is the following one: given time and data limitations in the case of this pandemic, can EBM(+) be strictly followed, and, if not, how can EBM(+) adapt to this pandemic?

A very recent paper of Carley and colleagues (Carley,

Horner, Body, & Mackway-Jones, 2020, "Evidence-Based Medicine and COVID-19: What to Believe and When to Change", *Emergency Medicine Journal* 37: 572-575) tackles this issue.

In this paper, the authors concede that, in the case of the SARS-CoV-2 pandemic, decisions that are both "*time critical and information light*" (p. 572; emphasis original) cannot be made by the use of traditional EBM (or even EBM+), for getting thorough scientific knowledge about the COVID-19 by the use of association studies like RCTs - even by directly enrolling patients suffering from the COVID-19 in a trial like the RECOVERY trial in the UK (Welcome — RECOVERY Trial) – (or even the use of mechanistic reasoning) would take several years.

However, the authors eventually and shyly suggest that, in the case of a pandemic, EBM should adapt with respect to the *level* of evidence reachable: the best evidence available seems to come, in this case, more from *observational* studies (e.g. the construction of computational models based on raw and anonymized data) than from clinical ones.

Instead of using this conclusion as a claim for an EBM+ approach, we would like to interrogate ourselves about the different levels of evidence available in the SARS-CoV-2 pandemic and their relationship to epidemiological modelling.

The hierarchy of evidence for EBM is generally drawn as the following pyramid (from "Hierarchy of Evidence", *Physiopedia*):

With those different levels of evidence, we may wonder whether EBM is a medical methodology stating that medical evidence should be *ideally* based on mere clinical RCTs confirmed through systematic review (as the gold standard), or whether EBM is not to be taken, rather, as a more flexible medical methodology allowing different sorts of evidence depending on the context and the purpose – but *without* judging those sorts of evidence as less reliable than the gold standard.

Indeed, generally speaking, scientific models can be more or less *idealized*, that is to say, containing false assumptions (for the sake of the model's representative purpose), and/or more or less *abstract*, that is to say, leaving aside features deemed irrelevant for the model's purpose (cf. Weisberg, *Simulation and Similarity: Using Models to Understand the World*, 2013); the presence of idealizations and abstractions in a scientific model is regulated by the modeler's representational intention, that is to say, whether the model is intended to have, generally, *descriptive*, *predictive* or *explanatory* power.

On this basis, epidemiological models are built differently depending on their modeler's intention. Thus, to build such models – all with their own *legitimate* purpose -, scientists shall rely on different sorts of evidence. From this, we can

finally suggest that the level of evidence on which EBM relies depends upon what scientists intend to do with this evidence, that is to say, the modelling purpose; time and data limitations during a pandemic like the COVID-19 restrain, of course, the kind of models modelers are able to build, but it does not imply that EBM is itself restricted or cannot be correctly used even in those circumstances, for EBM adapts to epidemiological models.

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Mathematical Philosophy

What roles, if any, do alethic modalities play in mathematics? According to received wisdom, the answer is simple. All mathematical truths are necessarily true. All mathematical falsehoods are necessarily false. And we know this on a priori grounds.

Recent work, however, has begun to enrich and complicate this picture. In my last What's Hot column (*The Reasoner* 15:1, January-February 2021), I discussed counterfactual approaches to mathematical explanation, which assume that we can make sense of and reason profitably about mathematical impossibilities. This time I want to describe some projects that, in various ways, offer a fresh look at the very idea that mathematics is necessary.

Let me start with Yli-Vakkuri and Hawthorne's "The Necessity of Mathematics" (2020, *Noûs* 54: 549-577) and Leitgeb's "Why Pure Mathematical Truths Are Metaphysically Necessary: A Set-Theoretic Explanation" (2020, *Synthese* 197, 3113-3120). Both papers pose two questions: "Is it true that mathematics is metaphysically necessary? If so, how do we know this?" Both start from the shakiness of traditional justifications for affirming necessity. And both, in the end, defend the necessity of mathematics, albeit in very different ways.

Leitgeb, Yli-Vakkuri and Hawthorne agree that there are no obvious slam-dunk reasons for thinking mathematics is necessary. If logicism had succeeded and mathematical truths had turned out to be reducible to logical truths, then mathematics would arguably have been analytic and the necessity claim would plausibly have followed. But the traditional logicist program failed, neologicism is controversial at best, and the notion of analyticity is viewed with suspicion by many. There are other possible routes to the necessity claim, but most rely on tendentious assumptions about epistemology or the nature of mathematics. Can't we do any better?

On Yli-Vakkuri and Hawthorne's view, we need look no further than the practice of mathematics to find compelling evidence for the necessity claim. Mathematicians themselves take mathematics to be necessary. Absent some good reason to think the experts are wrong, we'd be wise to follow their lead.

As it turns out, mathematical counterfactuals also play a starring role in Yli-Vakkuri and Hawthorne's argument. Mathematicians, they argue, commonly employ such conditionals in a way that commits them to a principle called Counterfactual Deduction. This is the rule that if $\Gamma, A \vdash B$, then $\Gamma \vdash A \square\rightarrow B$, where $\square\rightarrow$ is the counterfactual conditional. (Counterfactual Deduction is arguably at work, for instance, in reductio proofs. Given the axioms of number theory and the assumption that there's a largest prime number, we can prove that the successor of the product of all the primes is both prime and composite. This reasoning seems to license a counterfactual: "Given the axioms, if there had been a largest prime, then the successor of the product of the primes would have been both prime and composite".) Together with a few other standard logical principles, Counterfactual Deduction allows one to prove $\vdash A \rightarrow \square A$. This says that not just that every mathematical truth is necessary, but that this is *provably* so. Mathematics, Yli-Vakkuri and Hawthorne conclude, is in a position to demonstrate its own necessity.

Leitgeb's completely different argument is based on the rigidity of set membership: the claim that for any pure set Y, if $x \in Y$, then necessarily $x \in Y$. The reasoning is as follows. Suppose that P is a true mathematical claim. Then P has a translation Q in the language of pure set theory such that $\square(P \leftrightarrow Q)$. By the weak modal logic **K**, which Leitgeb accepts, it follows that $\square Q \rightarrow \square P$: if P's set-theoretic translation is necessary then so is P itself. By the rigidity of set membership, we have $Q \rightarrow \square Q$. These two conditionals together tell us that $Q \rightarrow \square P$. Since P is true by assumption, so is Q. Finally, the truth of Q and the last conditional imply $\square P$. Of course, P was an arbitrary mathematical truth, so this means that all mathematical truths are necessary.

A virtue of this account, on Leitgeb's view, is that it not only demonstrates the necessity of mathematics but also tells us where this necessity comes from. Leitgeb endorses a kind of explanatory foundationalism about set theory, according to which facts about sets explain all other mathematical facts. So the necessity of ordinary mathematics is due to the necessity of set theory plus the explanatory priority of set theory. (Yli-Vakkuri and Hawthorne's account offers no such story. It tells us that mathematicians are committed to the necessity claim, but not why they are or whether this commitment is justified.)

I think both of these arguments are extremely interesting. Neither is beyond criticism, though. Samuel Elgin's "Counterfactual Logic and the Necessity of Mathematics" (2021, *Journal of Philosophical Logic* 50: 97-115) takes on Yli-Vakkuri and Hawthorne. Elgin shows that the Counterfactual Deduction principle together with the authors' other commitments entails the collapse of the counterfactual conditional into the material conditional, so that $A \rightarrow B$ holds in mathematics just in case $A\square\rightarrow B$ holds. This in turn leads to the validity of Counterfactual Strengthening, the problematic and widely shunned principle that if $A\square\rightarrow B$ then $(A \wedge C)\square\rightarrow B$. Counterfactual Strengthening implies, for instance, that from the seemingly true counterfactual "If 6 were prime, then it wouldn't be divisible by 3", we can derive the seemingly false counterfactual "If 6 were prime and equal to 3, then it wouldn't be divisible by 3". This isn't an encouraging result.

My own past work has also argued at length against Leitgeb's style of explanatory foundationalism about set theory (D'Alessandro, "Arithmetic, Set Theory, Reduction and Explanation", 2018, *Synthese* 195: 5059-5089). In a nutshell, I've tried to show that all the most popular reasons for thinking that set theory explains arithmetic are bad ones, while there are good reasons for thinking the opposite. Of course, even if I'm right about this, Leitgeb's argument for the necessity of mathematics wouldn't be affected—only his claim to have explained

this necessity would suffer.

There's more to say about the role of modality in mathematics. I would have liked to talk, for example, about Linnebo and Shapiro's fascinating "Actual and Potential Infinity" (2019, *Noûs* 53: 160-191), which explores the use of modal tools to capture the notion of potential infinity (and the ensuing logical consequences). Maybe next time. But why wait two months when you can just go read it yourself?

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WILLIAM D'ALESSANDRO
MCMP, Munich

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EVENTS

MAY

NEN: The Nature of Epistemic Normativity, online, 13–14 May.
VIS: Values in Science, Stockholm, 17–18 May.

JUNE

PaMM: Philosophy and Methodology of Medicine, online, 1–3 June.
LoC: The Logic of Conceivability, online, 7–9 June.
AAL: Australasian Association for Logic, online, 23–25 June.

JULY

D-M&ER: Difference-Making and Explanatory Relevance, online, 12–16 July.
LoSy: Panhellenic Logic Symposium, Volos, Greece, 14–18 July.

SEPTEMBER

Progic: Combining Probability and Logic, Munich, Germany, 1–3 September.
CSPS: Congress of the Society for the Philosophy of Science, University of Mons, Belgium, 8–10 September.
VoAS: The Varieties of Anti-Skepticism, Pamplona, Spain, 15–17 September.
SPoI: Science and Philosophy of Imagination Conference, University of Bristol, 16–17 September.
ECSQARU: European Conference on Symbolic and Quantitative Approaches to Reasoning with Uncertainty, Prague, 21–24 September.

COURSES AND PROGRAMMES

Courses

Programmes

MA IN REASONING, ANALYSIS AND MODELLING: University of Milan, Italy.
APhil: MA/PhD in Analytic Philosophy, University of Barcelona.
MASTER PROGRAMME: MA in Pure and Applied Logic, University of Barcelona.
DOCTORAL PROGRAMME IN PHILOSOPHY: Language, Mind and Practice, Department of Philosophy, University of Zurich, Switzerland.

DOCTORAL PROGRAMME IN PHILOSOPHY: Department of Philosophy, University of Milan, Italy.
LogiCS: Joint doctoral program on Logical Methods in Computer Science, TU Wien, TU Graz, and JKU Linz, Austria.
HPSM: MA in the History and Philosophy of Science and Medicine, Durham University.
MASTER PROGRAMME: in Statistics, University College Dublin.
LoPhiSC: Master in Logic, Philosophy of Science and Epistemology, Pantheon-Sorbonne University (Paris 1) and Paris-Sorbonne University (Paris 4).
MASTER PROGRAMME: in Artificial Intelligence, Radboud University Nijmegen, the Netherlands.
MASTER PROGRAMME: Philosophy and Economics, Institute of Philosophy, University of Bayreuth.
MA IN COGNITIVE SCIENCE: School of Politics, International Studies and Philosophy, Queen's University Belfast.
MA IN LOGIC AND THE PHILOSOPHY OF MATHEMATICS: Department of Philosophy, University of Bristol.
MA PROGRAMMES: in Philosophy of Science, University of Leeds.
MA IN LOGIC AND PHILOSOPHY OF SCIENCE: Faculty of Philosophy, Philosophy of Science and Study of Religion, LMU Munich.
MA IN LOGIC AND THEORY OF SCIENCE: Department of Logic of the Eotvos Lorand University, Budapest, Hungary.
MA IN METAPHYSICS, LANGUAGE, AND MIND: Department of Philosophy, University of Liverpool.
MA IN MIND, BRAIN AND LEARNING: Westminster Institute of Education, Oxford Brookes University.
MA IN PHILOSOPHY: by research, Tilburg University.
MA IN PHILOSOPHY, SCIENCE AND SOCIETY: TiLPS, Tilburg University.
MA IN PHILOSOPHY OF BIOLOGICAL AND COGNITIVE SCIENCES: Department of Philosophy, University of Bristol.
MA IN RHETORIC: School of Journalism, Media and Communication, University of Central Lancashire.
MA PROGRAMMES: in Philosophy of Language and Linguistics, and Philosophy of Mind and Psychology, University of Birmingham.
MRES IN METHODS AND PRACTICES OF PHILOSOPHICAL RESEARCH: Northern Institute of Philosophy, University of Aberdeen.
MSc IN APPLIED STATISTICS: Department of Economics, Mathematics and Statistics, Birkbeck, University of London.
MSc IN APPLIED STATISTICS AND DATAMINING: School of Mathematics and Statistics, University of St Andrews.
MSc IN ARTIFICIAL INTELLIGENCE: Faculty of Engineering, University of Leeds.
MSc IN COGNITIVE & DECISION SCIENCES: Psychology, University College London.
MSc IN COGNITIVE SYSTEMS: Language, Learning, and Reasoning, University of Potsdam.
MSc IN COGNITIVE SCIENCE: University of Osnabrück, Germany.
MSc IN COGNITIVE PSYCHOLOGY/NEUROPSYCHOLOGY: School of Psychology, University of Kent.
MSc IN LOGIC: Institute for Logic, Language and Computation, University of Amsterdam.
MSc IN MIND, LANGUAGE & EMBODIED COGNITION: School of Philosophy, Psychology and Language Sciences, University of Edinburgh.
MSc IN PHILOSOPHY OF SCIENCE, TECHNOLOGY AND SOCIETY: University of Twente, The Netherlands.
MRES IN COGNITIVE SCIENCE AND HUMANITIES: LANGUAGE, COMMUNICATION AND ORGANIZATION: Institute for Logic, Cognition,

Language, and Information, University of the Basque Country (Donostia San Sebastián).

OPEN MIND: International School of Advanced Studies in Cognitive Sciences, University of Bucharest.

RESEARCH MASTER IN PHILOSOPHY AND ECONOMICS: Erasmus University Rotterdam, The Netherlands.

JOBS AND STUDENTSHIPS

Studentships

DOCTORAL PROGRAMME IN PHILOSOPHY: Language, Mind and Practice, Department of Philosophy, University of Zurich, Switzerland.

LogiCS: Joint doctoral program on Logical Methods in Computer Science, TU Wien, TU Graz, and JKU Linz, Austria.

Jobs

RESEARCH SCIENTIST: in Causal Inference and Machine Learning, DeepMind London, open until filled.

ASSISTANT PROFESSOR: in Philosophy of Science, Stockholm University, deadline 3 May.

PROFESSOR: in Philosophy of Science, University of Leeds, deadline 24 May.