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Husserl's Transcendentalization of Mathematical Naturalism

Abstract: The paper aims to capture a form of naturalism that can be found "built-in" in phenomenology, namely the idea to take science or mathematics on its own, without postulating extraneous normative "molds" on it. The paper offers a detailed comparison of Penelope Maddy's naturalism about mathematics and Husserl's approach to mathematics in *Formal and Transcendental Logic* (1929). It argues that Maddy's naturalized methodology is similar to the approach in the first part of the book. However, in the second part Husserl enters into a transcendental clarification of the evidences and presuppositions of the mathematicians' work, thus "transcendentalizing" his otherwise naturalist approach to mathematics. The result is a moderately revisionist view that takes the existing mathematical practices seriously, calls for reflection on them, and eventually gives suggestions for revisions if needed.

Keywords: Edmund Husserl, liberal naturalism, mathematical naturalism, Penelope Maddy, transcendental phenomenology

1 Introduction

Transcendental phenomenology grows out from Husserl's criticism of psychologism and naturalism of his time. Thus it is no surprise that phenomenology is typically conceived to be diametrically opposed to, if not altogether contradictory with, the basic naturalistic tenets. This is certainly true insofar as "metaphysical naturalism" (the view that there is nothing but physical entities) or "methodological naturalism" (the view that the scientific method should be used in all areas of inquiry, including philosophy itself) are concerned. However, there are forms of naturalism that are closer to Husserl's spirit, namely those that aim at a realistic description of scientific or mathematical practices. Like researchers in these

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disciplines, the phenomenologist wants to describe the phenomena as they are, not as they should be in accordance to some apriori normative standards.[1]

In what follows I will argue that Penelope Maddy's naturalistic methodology to approach mathematics roughly captures mathematicians' natural theoretical attitude as discussed in the first part of Husserl's *Formal and Transcendental Logic* (1929). In the second part on transcendental logic, Husserl subjects the results of the first part to the transcendental phenomenological method and thereby aims at disclosing the evidences and presuppositions of the mathematicians' theoretical but naive attitude. In other words, Husserl first spells out the mathematical naturalistic view of formal sciences, after which he "transcendentalizes" this view by laying out its conditions of possibility. The two methods are not employed individually, but together so that the transcendental investigations may suggest revisions to the naturalistic goals, concepts, and methods, and *vice versa*, and hence the first part of the book tacitly presupposes the second part. The result is a moderately revisionist view that takes the existing mathematical practices seriously, calls for reflection on them, and eventually gives suggestions for revisions if needed.[2]

In what follows, I will first sort out the terminology regarding various kinds of naturalisms. In the second section, I will argue that Husserl's approach is a so-called "mathematics-first" approach, and for this reason, it can be interestingly compared with mathematical naturalism. In the third section, I will explain Husserl's method as used and explained in *Formal and Transcendental Logic* (1929) so that in the section that follows I will be able to show its affinities with Penelope Maddy's naturalistic methodology. The differences between the two can be found in the extra-mathematical, philosophical questions about the nature of mathematics: while her method leads Maddy's second philosopher to claim that mathematics has "post-metaphysical objectivity," Husserl aims at uncovering the metaphysical commitments of the scientists with his transcendental examination of the mathematicians' practices.

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1 I argue for such a view regarding science in Hartimo (2020).

2 Mark van Atten (2002) has defended a view that Husserl is a weak, but should have been strong, revisionist about mathematics. I agree with him that that the textual evidence supports the former but not the latter view. However, for reasons that should become clear in this paper, I do not think Husserl should have been a strong revisionist. Van Atten's view derives from his different view of constitution (that he identifies with construction in mathematics) and also of foundation that he attributes to Husserl. Husserl's understanding of foundations is here understood as reflective clarification that goes on forever, not in a sense of providing secure foundation for what is erected on the top of it (For more about constitution, see Hartimo 2019).

2 Metaphysical, Methodological, Mathematical, and Liberal Naturalism

In "Philosophy as Rigorous Science" (1911) Husserl famously argues that phenomenology should overcome naturalism. By "naturalism" he means a reductive philosophical attitude according to which "[w]hatever is, is either itself physical, belonging to the unified totality of physical nature, or it is in fact psychical, but then merely as a variable dependent on the physical, at best a secondary 'parallel accompaniment'" (1981, p. 169). On this view, consciousness, ideas, ideals and norms, are naturalized, which in Husserl's view results in relativism and skepticism (ibid.), along the lines of his earlier argument against psychologism in logic put forward in *Prolegomena to the Logical Investigations* (1900). The kind of naturalism Husserl here criticizes is nowadays called "metaphysical naturalism" or "scientific naturalism" (cf. De Caro and Macarthur 2010). For Husserl metaphysical naturalism is connected to methodological naturalism. In his view the naturalist "believes that through natural science and through a philosophy based on the same science the goal [that which is genuinely true, beautiful, or good] has for the most part been attained, and with all the enthusiasm that such a consciousness gives, he has installed himself as teacher and practical reformer in regard to the true, the good, and the beautiful, from the standpoint of natural science" (1965, p. 169). It is important to note that Husserl's argument is not directed against natural sciences, but rather towards philosophers who think philosophy should adopt naturalist methodologies and reductionist ontology.[3]

In this article I am *not* claiming that Husserl agrees with either of these kinds of naturalism. On the contrary, he vehemently opposes these forms of naturalism until the end of his life. But, I want to claim that there is a sense of the term 'naturalism' that is in a way "built-in" in Husserl's approach. While Husserl's primary objections are pointed at the reductionistic naturalistic views, he also holds that the natural sciences are nevertheless naïve about their own starting point, and thus in need of philosophical complementation. For this reason, Husserl proposes to engage in a study of the givenness of the world of the natural sciences. Natural sciences are thus not dismissed – rather the other way around: to

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3 Accordingly, he writes, "[o]bviously we are not directing our critical analysis toward the more popular reflections of philosophizing natural scientists. Rather we are concerned with the learned philosophy that presents itself in a really scientific dress" (Husserl 1911, p. 171).

be genuinely scientific, the natural sciences should be looked at as they are and complemented with philosophical reflection.

Husserl presupposes a kind of naturalism by relying on an extensive analysis of the world of the natural attitude, which in the phenomenological reduction is brought into the focus of transcendental phenomenological investigation (cf., esp. Luft 1998). In *Ideas I*, Husserl accordingly examines the correlation of the world given by natural attitude, and its givenness to transcendental consciousness. In *Ideas II*, he identifies all kinds of other attitudes, such as a practical attitude and a personalistic attitude in addition to natural and naturalistic attitudes. Within the phenomenological attitude the different attitudes can be examined, their differences spelled out, and the various worlds revealed by these attitudes are seen as divergent restricted stances of one unified world, as argued by e.g., Andrea Staiti (2014, esp. pp. 83–108). None of these attitudes is reduced to anything more foundational, but in phenomenology they, and the worlds given in them, are examined "on their own" as such (for more detail, see Hartimo 2021, esp. section 1.5). This kind of approach comes close to what De Caro and Macarthur call liberal naturalism. De Caro and Macarthur describe liberal naturalism as a view "that wants to do justice to the range and diversity of the sciences, including the social and human sciences (freed of positivist misconceptions), and to the plurality of forms of understanding, including the possibility of nonscientific nonsupernatural forms of understanding (whether or not these also count as forms of knowledge)" (De Caro and Macarthur 2010, p. 9). These different kinds of forms of understanding are different kinds of attitudes. The virtue of transcendental phenomenology is that it offers a standpoint from which these attitudes can be individuated, related to each other, and reflected upon systematically.

In what follows I will restrict myself to one such attitude, namely natural mathematical attitude. Like the other scientific disciplines, mathematics as such is, in Husserl's view, naïve and in need of phenomenological completion. In phenomenology of mathematics, the natural, straightforward, yet theoretical attitude of mathematicians is subjected to philosophical reflection. I will here argue that Husserlian natural theoretical view of mathematics uses a naturalized methodology similar to the one used by Penelope Maddy's second philosopher. The mathematical naturalist is not reductionist about abstract objects but believes that whatever mathematicians using the mathematical methods are committed to, exists. To be sure, the mathematical naturalist thinks that the reductionistic, scientific, or metaphysical naturalistic view of mathematics cannot do justice to mathematicians' attitude to pure mathematics, which is an independent discipline

that studies objectively existing, acausal, and non-spatiotemporal abstract objects (e.g., Maddy 2011, p. 62).[4] For the mathematical naturalist, the philosophical views about the existence of the objects of mathematics do not determine the used methods (as for intuitionists or constructivists), but the other way around, the mathematical practice comes first. Thus, mathematical naturalism entails an anti-revisionist attitude towards mathematics that can be termed "mathematics-first" and in its extreme "philosophy-last-if-at-all" (Shapiro 1997, p. 7) approach. The view is that it is not philosophers' task to criticize, restrict, or revise mathematics on philosophical grounds, instead mathematicians should be taken to be the best authorities about their own subject matter. Mathematical naturalism can thus be contrasted with "philosophy-first" views, such as the constructivist view of mathematics, in which the realm of justified mathematics is limited to what can be constructively proven.

Husserl's approach is not an extreme form of "mathematics-first" view. On the contrary, Husserl holds that the natural mathematical view should be subjected to transcendental phenomenological criticism. This makes his view moderately revisionist, but so that it takes the existing mathematical practice seriously, calls for reflection on it, and eventually gives suggestions for pertinent revisions. This is where Husserl clearly departs from straightforward naturalists. Yet, the critique he promotes is *inner* criticism of the basic concepts, presuppositions, and evidences in operation in mathematics. Along the lines of "mathematics-first" views, Husserl does not want to restrict or truncate mathematics on philosophical grounds, but he seeks to clarify various kinds of evidence with which mathematical facts can be given. Thus Husserl's approach takes mathematical practice as it is and allows for a pluralistic view of mathematics. But it also subjects mathematical practice to explicit philosophical examination. For Husserl, philosophical reflection is needed ultimately for the sake of science: "*only a science clarified and justified transcendentally (in the phenomenological sense) can be an ultimate science*; …" (1969, p. 16), he writes in the introduction to *Formal and Transcendenta Logic*.

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4 Maddy (2014) classifies her view as a variant of "methodological naturalism", specifying this by explaining that "my Second Philosopher investigates the world beginning form her ordinary perceptual beliefs gradually developing more sophisticated observational and experimental techniques and correctives, eventually ascending to theory formation and confirmation, all in the sorts of empirical ways usually labeled 'scientific'"(p. 2). Since her method does not use empirical methods like empirical experimentation, data gathering or interviews, I find it misleading to call it "empirical." Maddy does not offer any explanation for her usage of the term, but only refers to the way the second philosopher proceeds, "counting the reader to get a rough idea of what I'm after" (2014, p. 2n). I will discuss the nature of her method in more detail below.

3 Husserl and "Mathematics-First"

In this section, I will display some general expressions of a "mathematics-first" view in Husserl's writings throughout his life. First, in his *Logical Investigations* (1900–1901) Husserl's "mathematics first" attitude can be read off from the division of labor between philosophers and mathematicians that Husserl established at the end of the *Prolegomena to Logical Investigations*:

> The construction of theories, the strict methodical solution of all formal problems, will always remain the home domain of the mathematician. … No one can debar mathematicians from staking claims to all that can be treated in terms of mathematical form and method (Prolegomena §71, Husserl 1900, 1913, 1975).

The passage shows that Husserl is not inclined to constrain mathematics from its being freely developed. Husserl's subsequent description of the philosophers' task is to understand the essence of mathematics - not to declare what is allowed and what is not permitted.

In *Ideas I*, Husserl's description of mathematics in the natural attitude is very short, but nevertheless "mathematics first":

> The world of numbers is likewise there for me precisely as the Object-field of arithmetical busiedness; during such busiedness single numbers of numerical formations will be at the focus of my regard, surrounded by a partly determinate, partly indeterminate arithmetical horizon; … (Ideas I, §28, Husserl 1913, 1976).

Here Husserl describes the attitude of someone engaging in arithmetic. This (natural) attitude is described to be the innocent, naïve attitude that is prior to any philosophical reflection about the activity. Again, the starting point is "mathematics-first", an attempt at characterizing the mathematicians' attitude towards her subject matter while she works.

As a final example of mathematics-first attitude I wish to reproduce a text from 1931. Husserl writes as follows:

> Should one, in one's judgement of mathematics, the total sense of which depends entirely on these [foundational] concepts, follow a Hilbert, a Brouwer, or whom else? Can we be so sure, although exactly that is *communis opinio* today, that classical mathematics and likewise physics was not better advised? But we will do no better there. It was never finished but itself becoming, and so the problem repeats itself, the impossibility of a definite choice that determines the norm for us.
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> Meanwhile it quickly becomes apparent that actually it is not that important to make such a choice by deciding in favor of some camp or some leading researcher. Everyone who has studied mathematics knows the general phenomenon called mathematics—mathematics as this exact science, which is becoming at any time and through all time, in which it was and

still is, the one in becoming that has become at every present, from present to present all the same unitary in its continuing development, in spite of all the discrepancies that always exist between the researchers and between the conceptual, the theoretical formations they have produced (Translation from van Atten 2007, pp. 64–65).

While Husserl's description of the nature of mathematics is not altogether clear in this passage, it obviously agrees with the "mathematics first" view of the mathematical naturalists. In the first passage he points out that a choice between intuitionists, formalists, or classical mathematics putatively determines the norm that guides the mathematical practice. This choice, he holds, is impossible – the ongoing practice of mathematics is independent of such choices. In the second passage, he writes that such choice is not that important either. Mathematics develops independently of such "philosophy-first" choices.

I hope these passages suffice to show Husserl's general approach to be "mathematics first". In the next section, I will discuss Husserl's most detailed and mature discussion on mathematics and how it shows the "mathematics first" approach in particular.

4 Husserl's Method in *Formal and Transcendental Logic*

In accordance to his mathematics-first approach, Husserl formulates a method with which mathematics can be approached "on its own terms". He does it in *Formal and Transcendental Logic* (1929) (hereafter FTL), the work that, according to his own estimation, managed to give a "definitive clarification of the sense of pure formal mathematics" (1969, p. 11).[5] In its introduction Husserl defines his method as *Besinnung*, which he claims is empathetic reflection on mathematicians and logicians' work to find out the intended goals of their work. After having explained that we experience sciences and logic as cultural formations produced by the practice of the scientists and generations of scientists, he defines *Besinnung* as a method with which to explicate the implicit goals that the generations of scientists have striven for. It is thus a method to clarify the mathematicians' historically shaped goals. Husserl writes that *Besinnung* requires entering in "a community of empathy with the scientists" [Mit den Wissenschaftlern in Einfühlungsgemeinschaft stehend oder tretend] (1974/1969, p. 13/9). The scientists' goals are thus

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5 Husserl also remained satisfied with his results, writing in a letter to Grimme in 1937 that he thinks FTL is his "most mature" work, even if "too concentrated" (Schuhmann 1977, pp. 484–485).

found in an empathetic engagement with them; it is thus "science-first" in taking the scientists' and mathematicians' activities as they are.

However, Husserl was not only interested in a descriptive approach of discerning the goals of sciences, but he also aimed at the evaluation of these goals. This takes place by what he terms 'radical *Besinnung*.'

> Radical *Besinnung*, as such, is at the same time criticism for the sake of original clarification. Here original clarification means shaping the sense anew, not merely filling in a delineation that is already determinate and structurally articulated beforehand" … "original sense-investigation [Besinnung] signifies a combination of determining more precisely the vague indeterminate predelineation, distinguishing the prejudices that derive from associational overlappings, and cancelling those prejudices that conflict with the clear sense-fulfilment – in a word, then: critical discrimination between the genuine and the spurious (1974/1969, p. 14/10).

Radical *Besinnung* not only seeks to clarify the scientists' goals, but it also seeks to reveal the *genuine* goals of the activity. Note that Husserl does not say that it seeks to find out whether the scientists have a correct set of goals, such as truth, but whether their goals are *genuine* [echt]. The genuine goals are the ones found in the practices. They are thus the ones that are in accordance with the final sense(s) of the practices – not according to some external, "philosophy-first" originated standards.

In FTL, the radicality of *Besinnung* is achieved through transcendental phenomenology, that is, in transcendental logic. Transcendental logic studies the way in which formal logic and mathematics are constituted: it examines the presuppositions and ultimately the evidences striven at in formal sciences. It does *not* add anything *transcendent* to the analysis, but it seeks to clarify the held presuppositions and the kinds of evidence sought for in the exact sciences. This examination may reveal conceptual confusions. The clarified and purified kinds of evidence are ultimately taken as revised norms for the activity (1974/1969, §69). Husserl thus seeks to clarify the norms found in mathematical practice; he does not make a priori claims about which norms mathematicians should adopt.

Having explained the radicality of *Besinnung*, in the next paragraph Husserl concludes:

> So much by way of a most general characterization of the aim attempted and the method followed in this work. It is, accordingly, an intentional explication of the proper sense of formal logic (1969, p. 10). [Dies zur allgemeinsten Charakteristik der in dieser Schrift versuchten Zielstellung und befolgten Methode. Es ist also eine intentionale Explikation des eigentlichen Sinnes der formalen Logik (1974, p. 14)].

It thus should be clear that this is the method used in FTL. Its use can be divided into two "directions." In the first part on formal logic Husserl discusses the historically given logic and mathematics in terms of the goals towards which the logicians and the mathematicians are aiming in these disciplines. Both are formal and apriori disciplines, hence they are difficult to tell apart. Ultimately Husserl distinguishes them in terms of researchers' intentions: what the mathematicians are aiming at differs from what logicians aim at. While mathematicians develop freely non-contradictory theories, logicians seek truth and applicability to the world. These goals are in turn associated with different kinds of evidence. The second part on transcendental logic discusses logic in another "direction," to which I will turn in section 7 below.

5 Maddy's Naturalized Methodology

In her *Naturalism in Mathematics* (OUP, 1997), Penelope Maddy characterizes the fundamental spirit of all naturalism as

> the conviction that a successful enterprise, be it science or mathematics, should be understood and evaluated on its own terms, that such an enterprise should not be subject to criticism from, and does not stand in need of support from, some external, supposedly higher point of view (1997, p. 185).

The resemblance to Husserl's attitude towards mathematics as discussed above is immediate. Referring to the histories of nineteenth-century mathematics that show how mathematics gradually separated itself from physical sciences and undertook pursuits of its own, Maddy then distinguishes her view from Quinean naturalism (1997, pp. 183–184). Her view is "mathematics-first," not "science first" nor "philosophy first". In her subsequent book *Second Philosophy* (2007) she termed her approach, as the title has it, "Second Philosophy," to distinguish her view from other "naturalisms" on the market. In *Defending the Axioms: On the Philosophical Foundations of Set Theory* (2011) she distinguishes between two groups of questions the second philosopher is concerned. The first group is methodological, to it belong questions such as "what are the proper grounds on which to introduce sets, to justify set-theoretic practices, or to adopt set-theoretic axioms?" The second group is more philosophical: "what sort of activity is set theory? What are sets and how do we come to know about them?" (2011, p. 41). For the argument of the present paper, the methodological questions are more pertinent, and the claim is that with respect to them Maddy's naturalist's and Husserl's views converge. Their views diverge on the second set of questions so that whereas Maddy opts for "empirical" metareflection, Husserl thinks our reflection should be

transcendental. This results in different kinds of views of what mathematics is about, which I will briefly discuss in the end of this paper.

The methodological questions draw on the naturalized methodology that Maddy introduced in her *Naturalism in Mathematics* (1997). The naturalized model of practice is informed by a study of historical cases that give both negative and positive counsel. The negative counsel shows that certain typically philosophical questions are ultimately irrelevant to the practice of mathematics. The positive counsel shows a pattern about which considerations are relevant and decisive. In particular,

> the positive counsel of history is to frame a defense or critique of a given method in two parts: first, identify a goal (or goals) of the relevant practice, and second, argue that the method in question either is or isn't an effective means toward that goal. In detail, we should expect that some goals will take the shape of means toward higher goals, and that goals at various levels may conflict, requiring a subtle assessment of weights and balances. But the simple counsel remains: identify the goals and evaluate the methods by their relations to those goals (Maddy 1997, p. 194).

Like Husserl's, Maddy's approach is historical. Maddy's naturalized methodology starts with a study of historical cases that are examined in light of contemporary discussion. The practice is then "purified" by "highlighting the goals that remain behind and by elaborating means-ends defenses or criticisms of particular methodological decisions." This produces "a naturalized model of the practice." This model is then held to reflect the

> underlying justificatory structure of the practice, that is, that the material excised is truly irrelevant, that the goals identified are among the actual goals of the practice (and that the various goals interact as portrayed), and that the means-ends reasoning employed is sound. If these claims are true, then the practice, in so far it approximates the naturalist's model, is rational (1997, pp. 196–197).

Like Husserl's *Besinnung* Maddy's naturalized method thus aims at description of the mathematicians' theoretical goals. Like Husserl's view of teleological, intentional history, Maddy thinks the practices are goal-directed. As Husserl puts it above, both methods are attempts to explicate what is typically only "vaguely floating before us". Like for Husserl, the crucial element of Maddy's method is to identify, or as she says, *purify,* the goals mathematicians are aiming at. Husserl, however, would add that his subsequent transcendental reflections would help in the task of identifying and purifying the mathematician's goals.[6]

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6 Thus he claims that in isolating the sense of pure mathematics he was guided by the problem of evidence (examined in transcendental logic), and that "the evidence of truths comprised in formal mathematics (and also of truths comprised in syllogistics) is entirely different from that of other apriori truths, …" (FTL, p. 12).

According to Maddy, the naturalistic method gives both negative and positive council. The negative council shows that philosophical choices are irrelevant for the development of mathematics. This is what Husserl claimed in a passage cited and discussed above in Section 3. The positive council relates to the possibility of criticizing the practice. Maddy's naturalist may find two kinds of errors in mathematical practice: first, she may realize that the practitioner may be mistaken about her goals, paying only lip service to them. Or, she may be mistaken in her means-ends reasoning, i.e., whether her methods will actually realize the chosen goal (Maddy 1997, pp. 194, 198). Likewise, in Husserl's *Besinnung*, the goals are identified, the conflicting and conflated goals are sorted out, and the used methods are evaluated in terms of whether they actually help to realize the goals in question (this is what Husserl means by *genuineness* [echt] of these goals). In this way, both methods aim at inner criticism of the practice in question.

Maddy's oeuvre is rich with examples. Obviously so, for it is not a "philosophy first" approach. She examines the development of each discipline in terms of the goals that the mathematical discipline in question seeks to achieve. For example, to answer the question whether mathematicians should search for axioms with which to settle the continuum hypothesis, she analyzes the goals of set theory as opposed to those of group theory and geometry (Maddy 2007, pp. 351–358). Maddy identifies, for example, Zermelo's leading goal in developing set theory to serve as a part of the Hilbertian foundational project (Maddy 2011, pp. 45–47). This goal gives set theorists grounds to seek for a single axiom system that would be as decisive as possible, and hence one that could also decide the continuum hypothesis. This would justify adding Gödel's axiom of constructibility ($V = L$), which however conflicts with the other foundational goal that set theory should be as general as possible (Maddy 2007, pp. 358–359). So, the naturalist has to "assess the weights and balances" of the conflicting goals. In other words, the naturalist does not criticize the practice by referring to e.g., metaphysical claims about set theoretical reality, but she tries to determine the ultimate goals of set theory.

This is exactly what Husserl claims his *Besinnung* of mathematics is about, and what he accordingly engages in, in the first part of FTL. This is also how Husserl approached mathematics already in *Prolegomena* (1900). In it, Husserl discusses the theory of theories as the goal-sense that Husserl thought was shared by mathematicians as diverse as Riemann, Lie, Grassmann, Hamilton, and Cantor. The theory of theories aims to be as general as possible. The difference to Maddy is that Husserl lumps together the goals of set theory, geometry, and group theory, whereas Maddy is more detailed and thinks that set theory differs from the others in its aim to provide the foundations for mathematics. Generally, Husserl's method produces a more "algebraic" view of mathematics than what Maddy's does. Given his repeated emphasis on definiteness of the axiom systems, Husserl seems to

think that mathematics is ultimately about abstract structures and their relationships with each other (Husserl would agree with Stewart Shapiro in thinking that the mathematicians typically share an understanding that arithmetic, real analysis, and complex analysis deal with a single structure and that they communicate about these structures to each other (Shapiro 1985)).

Maddy then practices naturalized methodology – *Besinnung* – everywhere, starting with all kinds of philosophical projects and continuing to logic and mathematics. And so does Husserl: in *Formal and Transcendental Logic* Husserl investigates the senses of logic and mathematics by seeking to capture the sense of these disciplines from the way they have been practiced since antiquity. In *Crisis*, for example, he applies the method of *Besinnung* to transcendental philosophy itself and to modern scientific rationality.

Both, Husserl and Maddy intend to formulate a method rather than a thesis. Their respective methods aim at understanding different practices in terms of the goals they are aiming at. For both, Maddy and Husserl, the method is "mathematics-first" description of the goals aimed at in mathematics. For neither, this results in scientism, which would be a "first-philosophical" view. Maddy points out that "our inquirer [the Second Philosopher] doesn't believe as she does because 'science says so', as some naturalists would have it, but on perfectly ordinary grounds – this experiment, that well-confirmed theory" (Maddy 2011, p. 39).[7] Consequently, philosophy comes "second." The second philosopher's views about reality arise from the scientific practices, from within. Similarly, for Husserl, science does not have any *special* authority for the person in the natural attitude, but she bases her opinions on observation and cogent arguments; it is often reasonable to rely on science. This is the reason for why, in *Crisis*, Husserl believes scientific attitude saves us from the relativism of the life-worlds (cf. Hartimo 2018b).

6 Maddy's Post-Metaphysical Objectivity

The crucial difference between Maddy's naturalism and Husserl's approach lies in the external "meta" questions that are not strictly mathematical (Maddy) and that

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7 For example, Maddy argues against Burgess and Rosen's (1997, p. 65) characterization of 'naturalism', according to which: "The naturalists' commitment is at most to the comparatively modest proposition that when science speaks with a firm and unified voice, the philosopher is either obliged to accept its conclusions or to offer what are recognizably scientific reasons for resisting them" (cited from Maddy 2011, p. 39). Maddy explains that contrary to Burgess and Rosen, she does not have faith in *science*, but she relies on evidence (Maddy 2011, p. 39). According to her, a second philosopher "doesn't decide to place her faith in something called 'science'; she is simply one of those speaking with a firm voice, on the basis of the evidence" (Maddy 2011, p. 39n).

concern the nature and essence of mathematics (Husserl). Maddy's second philosopher eventually is a "post-metaphysical" objectivist who holds that fruitful theories track objective facts of mathematical depth, instead of truths about reality. Maddy construes two positions, thin realism and thin arealism. According to the former, sets are what set theory describes them to be (Maddy 2011, p. 63), the latter position in turn does not assume that the sets exist but is guided by various concrete set-theoretic norms, goals, and values (Maddy 2011, p. 99). From the second philosopher's standpoint these turn out to be equally accurate descriptions of facts of mathematical depth (Maddy 2011, p. 112). This shows that the second philosophical objectivism does not depend on the existence or non-existence of mathematical objects or the truth or the rejection of mathematical statements, hence it is "post-metaphysical." For this form of objectivity, mathematical fruitfulness, rather than any sense of ontology, is the actual constraint experienced by mathematicians (Maddy 2011, p. 116).

Husserl deviates from Maddy in wanting to capture also mathematicians' intentions in their practices. To Husserl realism would be a more "natural" depiction of mathematicians' metaphysical commitments than the more artificial arealism. In fact, Maddy would not disagree with this – she explicitly holds that the arealist disagrees with what the mathematicians say. Or to put it precisely, "The Arealist doesn't disagree with what mathematicians say *qua* mathematicians, but when they branch out into questions of truth and existence external to mathematics proper – what is the nature of human mathematical activity? what is its subject matter and how do we come to know about it? and so on – then she reserves her right to differ" (Maddy 2011, p. 103). Maddy thus does not trust the mathematician in her view about the nature of her subject matter, but thinks that this should be left to the "empirical" second philosopher. Husserl in contrast, wants to capture the mathematician's naïve theoretical attitude towards his subject matter, and to him the mathematicians are realists rather than arealists. As Husserl puts it in *Ideas I*:

> The truth is that all human beings see 'ideas,' 'essences.' And see them, so to speak, continuously, they operate with them in their thinking, they also make eidetic judgments – except that from their epistemological standpoint they interpret them away (Ideas 1, §22).

"Arealism," would be to Husserl, a species of a *philosophy-first* approach, something that an empiricists' epistemological standpoint might persuade one into. While he thinks that we naturally posit existence of abstract entities, yet, his realism is thin in the sense that it is based on his view of the ontological commitments found in the practice of science. While Maddy phrases the second philosophical quest to be to give the simplest hypothesis about the ontology that accords with the data, i.e., the practice, Husserl does not *posit* any ontology, he

does not hypothesize about ontological questions – but he tries to clarify the mathematicians' ontological commitments in their practices. For this he needs the transcendental approach, to which I will turn next.

7 Transcendentalization of Naturalism

In FTL turning to transcendental philosophy takes place in a piecemeal fashion, over the course of Husserl's quest for *radical Besinnung*. "Radicality" refers here, as it does elsewhere in Husserl's writings, to the quest of explicating and consequently questioning the presuppositions assumed in experiences.

The transcendental logic is directed to what Husserl calls the subjective side of logic, i.e., to what are the conditions of possibility of formal logic. Whereas formal logic thematized logicians' naïve actions, transcendental logician now turns to reflect on it:

> Turning reflectively from the only themes given straightforwardly (which may become importantly shifted) to the activity of constituting them with its aiming and fulfilment – the activity that is hidden (or, as we may also say, 'anonymous') throughout the naïve doing and only now becomes a theme in its own right – we examine that activity after the fact. That is to say *we examine the evidence* awakened by our reflection, *we ask it what it was aiming at and what it acquired*; and, in the evidence belonging to a higher level, we identify and fix, or we trace, the possible variations owing to vacillations of theme that had previously gone unnoticed, and distinguish the corresponding aimings and actualizations, – in other words, the shifting processes of forming concepts that pertain to logic (Husserl 1969, p. 177).

The transcendental logic is Husserl's metareflection about the mathematicians' and scientists' practices. It aims to reveal the evidences and presuppositions of the mathematical practice. It does not postulate metaphysical claims, but it tries to uncover the mathematicians' metaphysical and normative commitments. Such examination is needed so that the correct range for the fundamental concepts and principles of logic can be fixed (Husserl 1974/1969, §80).

Before proceeding further, Husserl points out that this does not mean that he thinks logic is psychological:

> The judgments of which logic speaks in its laws are not the mental judgment-processes (the judgings); the truths are not the mental evidence-processes; the proofs are not the subjective-psychic provings; and so forth. The theory of cardinal numbers (which, as we know, is itself a part of logic) has to do, not with mental processes of collecting and counting, but with numbers; the theory of ordered sets and ordinal numbers has to do, not with mental processes of ordering, but with ordered sets themselves and their forms; and, in like manner, syllogistics does not have to do with the psychic processes of judging and inferring (1969, §56).

The psychological acts, such as acts of judging or constructing are real psychic processes of human beings and hence temporally outside one another. But in them numerically the same judgment can be made (1974/1969, §57b). This leads Husserl to a description of what mathematical practice seems to be about: These judgments are about ideal (i.e., abstract) objects, that can be directly "seen," like the objects of experience in usual sense. Yet, even in this evidence, we may be deceived, and another evidence may later replace it ("Even ostensibly apodictic evidence can become disclosed as deception and, in that event, presupposes a similar evidence by which it is 'shattered'", Husserl writes (1974/1969, §58)). In these evidences, ideal objects of logic, like physical objects, are given as "transcendent," as outside of our consciousness (1974/1969, §61). In Maddy's terminology, they are experienced as something that constrain our practice.

The latter part of FTL on transcendental logic thus begins by examining the various kinds of evidence that are operative and sought for in the formal sciences. Husserl isolates three kinds of evidence: the evidence related to grammatical correctness, distinctness related to non-contradiction, and clarity related to truth. These kinds of evidence indicate how the "ideal formations" are given to us. Furthermore, Husserl's method is open to any new discoveries in mathematics and to new kinds of evidence with which they might be given. For example, what Husserl's calls "constructional infinities" give a rise to a need to examine how these "new sorts of formations" are evident (§74).

The examination of the evidences brings to the fore various kinds of presuppositions that typically go unnoticed in logic, such as an assumption of the ideal identity of the formations of logic and that they can be reidentified time and again; reiteration, that "one can always again", and the law of the excluded middle and other logical principles. These display mathematicians' metaphysical commitments. For example, the mathematicians' presupposition that "*Every contradictory judgment is 'excluded' by the judgment that it contradicts*" is about mathematical "existence" and non-existence (§75). In Husserl's view, the principle of non-contradiction assumed by the mathematician, displays the commitment to mathematical existence (which in Maddy's view is irrelevant for the practice of mathematics).

By examining the idealizing presuppositions of formal logic, the transcendental logic thus *reveals* the normative ideals and ontological presuppositions of the (exact) scientists – it does not *posit* the metaphysics to suit the case. Transcendental logic provides an extramathematical, but not external, point of view with which to examine and revise the assumed goals and concepts. It relates these to each other, and to our life-world, aiming to examine and critically evaluate the role of mathematics and science in our lives. Husserl is primarily describing a

method, a way to go about for understanding our activities – he does not argue for the existence of this or that.

Husserl's transcendental phenomenology does not provide us with the unmovable Archimedean point that Descartes dreamed of, or an incorrigible foundation from which one would be able to offer indubitable criticism. This is because transcendental phenomenology offers nothing more than another point of view, from which we may examine what is given through *Besinnung* in our practices. The virtue of transcendental phenomenology is that it gives us a point of view from which we may systematically examine our presuppositions and potentially notice at least some of them to be misguided. The examination of evidences can also serve as heuristic for the mathematical practice, it seems.[8] It enables us to look at them *from outside of the natural attitude*, hence in relation to other goals, to evidences, and to the life-world needs, but without fabricating an artificial external measure of objectivity. Phenomenological approach to mathematics thus takes a naturalist view of it and complements it with an extra-mathematical level of reflection, which exploits the findings of the transcendental investigations, but does not assume any non-naturalist external standards.

Maddy rejects the usefulness of transcendental philosophy (in a Kantian form) for evaluation of mathematical practice and, on the contrary, seeks to naturalize Kant's, and more recently, also Wittgenstein's approaches (cf. Maddy 2014). However, what I want to suggest is that the naturalist might benefit from a transcendental point of view, without thus committing herself to the existence of anything more substantial than what the scientific practice already commits herself into. It enables moderate criticism of the mathematical practice, which in Husserl's view makes science genuinely scientific – a goal that naturalist should not have any quarrel with.[9]

8 Conclusion

Husserl's discussion of logic and mathematics shows how he uses the phenomenological method for examination of the kinds of evidence operating as a network of norms for logic and mathematics. This view is reliant on a form of mathematical naturalism, a form that comes very close to the naturalist method as Maddy describes it. As such it aims at approaching the mathematicians' activities in their own terms by identifying and evaluating the goals the mathematicians seek to

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8 It is tempting to think that this is the reason why Zermelo, too, refers to evidence as a *source* for the discovery of Axiom of Choice, cf. Maddy (2011, p. 46n).

9 For a more detailed defense of this view, see Hartimo (2021).

realize in their theories. This is the starting point for Husserl's phenomenological criticism. Husserl then proposes a transcendental examination of the evidences and presuppositions of the practicing mathematicians in order to provide a moderately revisionist approach towards these practices.

Generalizing from Husserl's attitude towards mathematical naturalism, one can conceptualize phenomenology in general to be reliant on some sort of naturalism – a non-reductive kind that demands description of intentional activities as they are. It seeks to spell out the goals, norms and values guiding the intentional activities and examine the constitution of such normative structures, or worlds – as Husserl would say – and the way in which they relate to each other and to our lifeworld. While his views in ontological matters come close to liberal naturalism, he importantly seeks to transcendentalize his naturalism, that is, he examines the conditions of possibility of such views, and ultimately aims at immanent criticism of various rational projects.

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