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Psychologism and neopsychologism in philosophy of logic

Master's thesis in philosophy

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Contents

Introduction

My thesis is devoted to the philosophy of logic partially involving philosophy of psychology. Thesis focuses on psychologism – a philosophical theory according to which the ontological and epistemological foundations of logic and mathematics are our mental states. Neopsychologism is a new set of psychologistic ideas that appeared already in the XXth century and are influenced by new psychology including cognitive science and artificial intelligence. Its central idea is that the main problem of the early psychologism in logic criticized by Husserl and Frege (Willard 1980) is resolved in the contemporary neopsychologistic research. The map of the thesis is next. So the beginning of the thesis will introduce the start and the ensuring discussion around psychologism that resulted into it's downfall. The main critical arguments will be considered in the detail. Then the ideas of the neopsychologistic research will be analyzed. It will be explained how exactly the neopsychologism is different from the classical psychologism. The last chapters of the thesis will explain how the neopsychologistic ideas can solve the old problems of the psychologism and lead to the restart of the doctrine.

The philosophy of logic in the part of interpreting the foundations influences the practical research in formal logic essentially. Many new calculuses were introduced due to philosophical reasons. The philosophy here is considering the dynamic changes of the environment.

Philosophy of psychology is introduced as representing the psychologistic basis of the formal systems. It is explained how the changes in this discipline are important for logic.

The topic of the thesis is interesting due to the next reasons. First of all the problem of the foundations of logic and mathematics is one of the most ancient and controversial for philosophy (Colyvan 2001). Psychologism is only one of the views on it. Many philosophers and mathematicians devoted their lives for searching for the clues about the true nature of the formal systems considering it not only a deep philosophical problem but also a valuable cornerstone of knowledge that will influence the general scientific progress of the humankind greatly. Relying so much on mathematics and logic in natural sciences and technology how can we not explore the underlying nature of the phenomenon.

Secondly psychologism itself is historically underestimated idea (Katz, 1981, 75). Recent development of the artificial intelligence and cognitive science shows that being renowned with the help of new empirical data it can become an influential and fruitful doctrine. Psychology made a big influence on the artificial intelligence in the last few

decades when the purely formalistic methods met yet irresolvable difficulties which can be a signal for the logic to reconsider it's foundations in the light of the psychologism. So the topic can have serious implications for the practical sciences.

Third reason is the philosophical nature of the problem itself. Contemporary analytic philosophy is well known for the attempts to base it's epistemology on the existing sciences making psychologism a part of a more wide naturalistic paradigm. This can be seen from the famous work of Quine for example (Quine 1960). And mathematics is the important part of the most of these natural sciences. Finding the foundations of the formal systems will be a great progress for the general philosophical epistemology.

The general context of the contemporary psychologistic discussion is defined by the major progress in psychology and difficulties met by traditional formalistic views in philosophy of mathematics. Psychology today is not the same science as psychology in the days of Wundt when the classical discussion took place. There were several breakthroughs in the theory, changes in the whole paradigm like behavioristic turn for example (Block 1981) and a global recent tendency to rely more on neurophysiology and neuroscience. In the 70ies a whole new interdisciplinary sphere emerged - cognitive science which encompass the ides of psychology, philosophy, neuroscience, artificial intelligence and anthropology. Incorporated into framework of cognitive science psychological data seem to be more promising for the philosophical studies. Philosophy of mind emerged as a special part of philosophy of psychology which is now comparable in number of research with the whole discipline. Old methodological problems are treated in completely different manner. Some ideas like mental representations and computational theories of mind appeared in the field of intersection of philosophy and cognitive science. New views on content of the mental especially it's role in the general ontology would be a great turn for the psychologistic discussion if it will be restarted nowadays.

Formalistic view on the foundations of mathematics was dominant in the beginning of the XX century with the great success of the "Principia Mathematica" and general ideology like that of David Hilbert (Detlefsen 1981). But it's success didn't last for a long time. The big quest of setting the whole logic and mathematics in one formal system with common axioms was impossible to accomplish (Curry 1958). The most famous precedent that gave a start to downfall of the formalists' dream of ideal mathematics is Godel's first incompleteness theorem. The complete philosophical implications of the theorem are debatable but in the field of logic and for the Hilbert's program it's influence is doubtless. Besides that many philosophers and logicians attacked the purely formalistic views during the century resulting in the cooling down of the formalistic ambitions to the end of it. What

was viewed once as the progressive and rational idea comparing to Platonists view is now considered old fashioned and failing to reach all the presumed aims. Philosophy of mathematics which was associated with mainly one dominant view in the beginning of the century came to be the corpus of completely different ideologies with no crucial supremacy in the end of it.

From the other side we have the cooperation of logic and certain areas of mathematics with newly developing computer science. The most famous area in which we can see the products of such cooperation is that of artificial intelligence. In case of using mathematics for simulating the intelligent activity it is very difficult to admit the formalistic view which denies any meaning of the mathematical expressions. How can we for example explain the existence of a more powerful formal systems where the weaker can be analyzed which is a common place in contemporary logic without turning to the contentful view on nature of semantics? In this case even ancient platonic views were more useful for the computer science than formalistic.

The problem of semantics is one of the most important for the contemporary AI research (Bach 1989). It involves not only designing proper truth conditions but also philosophical discussion of the semantic properties of the expressions. There are some scientists like Pylyshyn that consider semantics completely dependent on the right syntax or like Stich who in his early works considered semantics non existing at all. Semantics here is meant not only for formal logic but also for linguistics and representational theory of mind. Though these are completely different spheres thanks to the relevance for cognitive science they intersect with the psychologism in logic greatly. How should we treat tokens in the representational theory of mind? Do they have semantics together with syntax and if yes how both relate to external world? Indirectly psychologism in logics gives a philosophical answer to most of such questions. If the foundation of the logic is mental states and mental states have their semantics we have a case of a common ground. In this case logic and the language of mind can relate as different formal systems second being more powerful.

A part from that according to logical approach in cognitive science mental representations have the structure similar to that of first order predicate logic (Dehaene 2014). Why so? It is the assumption that places the classical logic in correlation with neural mechanisms. Philosophical logics then are just special modules of the general reasoning. In this case any change in the logical semantics especially in it's foundations will influence the general picture of the human mind. From this point of view many theories in philosophy of mind like Fodor's language of thought, mentioned

representational theory of mind and certain aspects of the computational theory are tightly connected to logic and it's foundations.

The topic of the thesis has implications also for certain technical aspects of the artificial intelligence. In the middle of the century two big schools were competing in the field of AI (Russel et al 2010). One was more devoted to tradition searching to find a way to simulate the human intelligence with the help of pure formal systems including logic. They mostly concentrated on the declarative logical representation of knowledge base of an agent. They were called neat. Second one was turning to the biological basis of human consciousness – brain – and it's differences in complexity from the machine. Their methods can be described as more procedural than declarative – they tried to reach the target of simulating brain by all means possible not centering on rigorous formalisms. This school considered these differences between brain and machine crucial and strived to simulate the intelligent activity by copying the complex structures of the brain tissue. They were called scruffy.

Later experiments tried to simulate even human emotions and feelings presuming they also have the role in the general intelligence. In the historical development scruffy overwhelmed neat paradigm for the certain period of time. But with the emergence of the Bayesian networks in the beginning of the XXI century neat became dominant again. The two approaches between dominant in different spheres of the artificial intelligence. Nowadays few people mention this old distinction between schools preferring to synthesize their methods to reach scientific targets.

What is the place of logical psychologism here? Neat is not associated with purely logical formalisms anymore. Reconsidering the foundations of logic we can come to new results in the practical applying of the methods. The mental states as the new foundation for the logic seems like a way to renew the old neat approach especially concerning the problems with semantics. With new semantics based on mental life the neat approach can loose it's procedural minuses and gain new advantages. If the theory of language of thought is true and we will be able to create the formal system that will represent such a language adequately it will enclose us greatly to understanding of the principle of work of a human mind.

The research concerning classical psychologism was conducted mainly by German logicians, philosophers and psychologists in the end of XIX – beginning of the XX century. After the criticism it was down for some years. During the XX century psychologism was considered to be a marginal and unpopular intellectual movement both in logic and general philosophy. The return of the doctrine is connected mostly with the

growing influence of the naturalism in philosophy. In the second part of the XX century some of the most prominent analytical philosophers stated that we should reduce ("naturalize") all the knowledge humankind posses to the data and conceptual architecture of the natural sciences like physics, biology and chemistry (Kim 2003) together with the general ontology. To prove that project of naturalization refers to knowledge as well we can see into classical work of Quine. Mental states seem like good candidates for reducing some of the problematic sciences and complete the project of naturalization.

Mathematics itself is very hard to philosophically reduce and psychology can be the best chance for that. Very few mathematicians of course are ready to admit that their science is just a special chapter of psychology and it can be seen from the criticism of the classical psychologistic doctrine. They refuse it on the level of common sense. But as was previously slightly mentioned for the naturalistic purposes we use a special kind of psychology relying more on empirical data of neuroscience and neurophysiology. We also presume the different role of mental states in the ontology of the world. This changes the picture of psychology and it's relation with formal systems. After establishing a new framework where psychology is viewed differently and the philosophical foundations of transition between psychological and mathematical are more grounded the idea can be much more successful.

New ideas in the foundations of psychologistic logic were brought in from completely different spheres like ethics, anthropology and cognitive science (Jacquette 1997) . They are novel but the general system and unity of the neopsychologistic doctrine is lacking.

What is new in this thesis? Neopsychologistic discussion though narrow and not active already exists. In this work the ideas of the neopsychologism as presented in such a combination to solve the main philosophical problem of the classical psychologism. For the first time they combines in this particular way and analyzed in the light of the old problem. To give more particular examples – some of the classical psychologism critics claim that this doctrine inevitably leads to admitting the role of cognitive constraints for mathematics. The simplest case are big numbers that can never be represented by things in our perceptions. Contemporary cognitive science and psychology made quite a bigger research on physiological constraints of our brains and even some research on the particular connection of these constraints to the mathematics. So the new arguments in favor of psychologism are available which brings the discussion on completely other level. This is just one of the practical examples of how a new science can influence the classical philosophical discussion and how this particular thesis is new.

The work is devoted to the prominent philosophical problem and will have implications for both philosophy and practical sciences.

Psychologism

Psychologism emerged as an idea of reducing logic, mathematics and even general philosophical epistemology to the part of psychology. The hot psychologistic debates in 1870-1914 in Germany are considered to be the part of a more wider so-called foundational discussion in logic that started after Hegel's death in 1831 (George 1997). It was the time when logic was preparing to be reborn. This process was guided both by philosophy and mathematics. In the middle of the century English mathematician Boole wrote his work on mathematical methods in propositional logic while in Europe a wide philosophical discussion of the subject started. It all resulted into Gottlob Frege creating the new logical calculus which was more powerful and effective than a propositional one and soon was named classical or mathematical logic.

Later already in the XXth century mathematical logic was shown to be extremely useful for the mathematics when Kurt Godel proved his famous incompleteness theorem which put certain constraints on the mathematics and especially on the optimism of the David Hilbert's global program. The cooperation of the logic and mathematics became so strong that certain scientists even claimed that logic completely dissolved in different mathematical studies. Partially it is caused by dominating of the formalists and similar views in philosophy of logic. Logic as an independent science facing sort of the dead end is one of the strong reasons to look into it's history and probably reconsider some of it's moments as psychologism is.

Early psychologistic ideas

In the times of Kant classical Aristotelian logic was considered to be closed and complete discipline. This was the best indicator of that logic needed a careful revision. Kant assumes that we need to develop other kinds of sciences with logic as our methodological paradigm (Guyer et al 1998). The state of logic seemed to imply that this is a rare case when the science is fully complete doctrine. Scholastic logic presented nearly 24 syllogisms and considering the syllogistic thinking the true core of the science claimed that this is the logic as it is. Hume's influence on Kant is presumed to contain not only the question of the causal connection but also the idea of logic. In his early writings Kant

attacks the scholastic logic and even states something close to the practical psychologism but later reconsiders and states that the true logic should not contain anything from the empirical psychology. We should emphasize that in the Kant's work the notion of logic gets completely different connotation than in the contemporary scientific discourse. It is the part of his philosophy – epistemological structure of the human mind.

However Hegel was the one who brought the revolution to the philosophy of logic. Though his "Science of Logic" is hardly fitting to the logical science as we used to perceive it nowadays and you probably cannot deduce any formalisms from it his idea of identifying logic and metaphysics provoked a wide discussion of a foundations of formal systems. Though he like Kant tries to incorporate logic into his general philosophy he appeals directly to it as a science and gives it a high place within his doctrine (Beiser 2009). Hegel presents the whole world's history as the process of development of main logical idea. He states that everything that exists is in fact logical and develops in accordance with it's dialectics. It does not coincide with the scholastic picture of this science at all so appealing to logic Hegel also implies that the science should be rebuilt and reformulated. It started the discussion which aimed on reconsidering the scope and the structure of logic as well as it's connection to the classical ontology.

This discussion came to be known as a "Logical Question". The term was coined by Trendelenburg who was the first critic of Hegel attacking his dialectical method and denying the absoluteness of logic (Peckhaus 2006, 99-116). His initial idea was setting logic on more scientific grounds. He is also known for bringing to the public Leibniz's idea of the universal calculus which later became an inspiration for new logicians like Frege and Schroder.

As it is it can be considered to be the first attempt to rebuild logic as the part of the project of naturalizing the philosophy. The idea of naturalization is very popular especially nowadays. The psychology is the only possible candidate for the foundations of logic though this is very debatable. First of all it is the status of psychology itself as a science. To be foundation of something the thing should be more simple and fundamental than this something. Is psychology such a simple construction? The human mind is extremely complex phenomena that requires careful study using the whole arsenal of scientific tools. Some of this tools are from the sciences psychology tries to naturalize. For example it relies a lot on other scientific knowledge and even mathematics – mathematical methods for processing the psychological tests data for example. It creates a loop-like logical paradox which is an often cause of crushing theories in XXth century – we can recount theory of the sets and a verificationalist theory for scientific methodologies.

A critic might say that we speak of new psychology while all the criticism applies to the psychology of the times of Wundt. We would say that it is precisely the point of the argument that psychology changed and it is a serious reason to reconsider the whole discussion.

Secondly the ontological status of logic is also questionable and important for understanding this many-leveled relations between sciences – I mean the mathematical logicism and connected issues. Notion of supervenience now popular in philosophy of mind came from metaethics and was actively used in philosophy of science where it was used to describe the hierarchy of the natural sciences (Kim 1984). Chemistry and biology were reduced to physics this way. But the philosophical analysis of the notion of supervenience showed that conditions this relations requires from both the upper and the lower level are sometimes more complex that just being more simpler for the lower level. The levels should at least share some common ontology. Formalism leads to the certain Platonism or special kind of realism about logic and mathematics. If their laws are so strong and independent from our minds and grounded into the mechanism of the universe itself maybe logic as it is a fundamental scientific discipline which for obvious reasons shouldn't be reduced to something else. We can mention here the theory of logicism – the reducing of the whole mathematics to the logic alone (Rayo 2005).

Though not completely successful this idea was strong at it's time of flourishing. And it supports the theory about logic being completely fundamental discipline. It casts certain doubt on the idea of reducing logic. It can also be a source of one major anti-psychologistic argument. In the many pro-psychologistic texts especially early ones the next thought is applied – psychology is a study of all thoughts and logic is the study of logically correct thoughts so the later applies to the former as a subset to a main set. The obvious counterargument that it is just not so seems implausible because it is evident that logic studies the smaller set of entities than psychology.

More dangerous counterargument is questioning whether these sets are really related in such a way – the simple ordering hierarchy of the main one and a dependent one – just as the relation of supervenience needs it to be. Does psychology really studies all mental states in all their forms? How about relativistic examples of people with psychic disorders? That is a ground of psychiatry. The statement that psychology does not study mental states that refer to logic is arbitrary and methodologically inappropriate. The core of the argument is not this. It is rather that different disicplines connected with mind can study mental states even ontologically the same mental states in different ways and from different perspectives. So for example clinical psychology treats with people with psychic

disorders but psychiatry treats with them differently. Another example is the methodological difference between cognitive science and classical psychology. To sum up the counterargument – it states that mental states can have different forms which should be treated by different disciplines and logic is one of these disciplines. In this case the connection between logic and psychology is not so straightforward as it is presented by followers of psychologism (Block 1981).

Why this is important and this anti-psychologist argument was brought during actually devoted to psychologism work? The thing is it is really hard to answer such an argument in the framework of classical psychologism alone but things change when we turn to the neopsychologism affiliated with empirical data and cognitive science theory. It emphasized the main sense of the whole thesis. Only when we have exact correlates of the internal mental states we can judge about the specificity of the particular mental states and their relation to the exact domain of the sciences that study mind. It was not accessible for the science at time of Wundt.

This is another reason and particular example why neopsychologism changes the whole picture. And as for the logic as being fundamental it is not so hard to admit it if you are externalist as was mentioned before. The laws of logic then are not affiliated with the mental states or the formulas on the paper but rather with some fundamental entities of the world like physical laws but higher. So then these laws defy the universe and all the natural sciences including psychology. This is the core of argumentation of distinguishing of physical and logical laws in the works of Lewis for example. Externalism is hard to attack from the standpoint of the internalism. It will be taking part in the ancient metaphysical debate. The best counterargument will be criticizing the logical laws from the prospect of the logical laws themselves. What exact logic do we think is at the core of the universe? Is it classical mathematical logic? How about intuitionistic logic or the logics of higher order?

Another attack on steady condition of the traditional formal logic is launched by Otto Friedrich Gruppe (1804 – 1876) (Kusch 1995). He was a German philosopher. He thought that we should reemphasize from the careful study of the deduction mechanisms to the creating of the theory of judgments. He even admits to kind of a content factor view on logic saying that judgments about phenomenon should be considered together with the similar judgments of the same class eventually creating the complete unitary system of judgments and their classes. According to him judgments are prior to concepts which opposes the regular opinion about judgments as simple combinations of concepts. Besides that Gruppe considers concepts to be dynamical entities that changes throughout cultural

history of the mankind. In fact Gruppe criticizes both the technical syllogistic logic and some empirical philosophy behind it. The need for restructuring logical syntax at the time was flowing in the air and centering attention on the theory of judgments was a fresh idea.

Partially it will be done in Frege's work (Wright et all 1983) but mostly it is one of the smart ideas of the history of thought that never were realized. The thought about classes of judgments and their mutual relations is purely psychologistic. No other ground for such connection can be found except for associations of our mind. Building the secondary principle of connection of thoughts a part from strict logical hierarchy will be realized in certain artificial intelligence programs. It brought interesting scientific results but did not enclose machine mind to human's enough. But it is still another evidence for psychologism in logic as rich source of ideas for AI sphere and cognitive science.

Gruppe's "judgments before concepts" opposes many traditional ideas in philosophy but especially the empiricist school. Hume and Locke stated ideas or concepts to be the basic material for building mental world (Norton et al 2000). Their methodology was quite efeective and elegant and was attacked mostly from the other side – the side of rationality and aprioristic concepts. The idea of judgments preceding concepts and being completely logical themselves is new and seems to be certain kind of ideology of logicism in psychologism. The relations of logic and psychology a part from considered in this work philosophy of logic and ideas of naturalizing logic are complex and underrepresented in the history of thought. Some attempts were made to study mistakes in judgments of people with psychic disorders from the point of view of mathematical logic.

Logicians try to build calculuses that will represent certain psychological ideas like the idea of unconscious and unconscious reasoning. All these attempts show the great potential of the cooperation of these disciplines and not only in a way of taking ideas and conception of psychology for the purposes of formal systems. Logic can be a should be used for better understanding of human psychology. After all logic and logical thinking together with general rationality are the main criterions for differing between sane and insane people.

The dynamicity of the concepts is another interesting idea. In the contemporary logic it the whole direction of the research – the belief change problem. Humans are very flexible in their worldview – they can change and update their believes according to situations. It makes humans fit for survival in the dynamic environment and also better and more original thinkers than machines are. Logicians try to represent it with the help of the branching time modal logic with set of beliefs updating every next round. But it brings many problems as like however small rounds we make we cannot reflect the perception of

a human adequately. The problematic question asks how much of a human mind we can simulate with the help of mathematics.

Karl von Prantl (1820 – 1872) was a German philosopher and philologist who entered a discussion about the reforming of the logic during approximately the same time. It was the historian of logical science who understood the poor situation of the discipline in contrast with it's true potential. He did not admit to the content factor view directly but did not accept the strict distinction between content and form either. He defended an interesting position of the primacy of language over the reasoning. He also put a lot of faith into dialectical philosophy. According to Prantl language is the synthesize of sound and thought. He considered grammar a tool for analysis of language mistakes together with semantics. Being influenced by English early mathematical logicians like Boole he proposed to mathematize philosophy introducing to it the rigorous methods (Stelzner 2005).

The idea about language as a true grounding for logic is prevailing in the science of the second part of the XXth century. Grounding or foundations are the part of ontology that is a referent of the signs of the formal system and the basis of their meaning. So the psychologism assumes the mental states such a grounding for formal systems.

The recurring interest to the philosophy of language is connected not only to the linguistic turn in the analytic philosophy but rather to the development within logic itself. It is the ideas of Tarski and his followers about the metatheories metalanguges which made situation so (Tarski 1956). The logic is the study of the relations between sentences and other languages and even the notion of the truth is defined within this system. The idea is unusual for our common sense but as for the practical logic it appeared to be very effective. Only relatively recently scientists started to think that some other philosophical doctrines may be useful for the new targets of the logic. The researches started to turn to the old ideas, history of philosophy of logic.

In the light of these ideas of reducing different domains of knowledge we can return to the starting project of naturalization. The idea of naturalization of philosophy so popular nowadays was a product of the intellectual discourse of the 19th century. One of the returning ideas is psychologism itself. It was already mentioned the potential of psychologistic ideas for computer logic especially artificial intelligence. Development of logic mirrors the needs of society presented in the discourse. It happened that the XXth century for logic was the century of mathematics and metamathematical studies which even made some logicians claim that logic completely dissolved in the body of metamathematics. Neopsychologism is developing from the new need for the logic based

on psychology. But the main idea that it is not the same straightforward classical psychologism with all it's pluses and minuses. The whole landscape of the philosophy changed – many ontological premises about the nature of the mind are now different. That's why logical psychologism in the form of contemporary neopsychologism requires serious reconsideration.

Mill's psychologism

The grounding work for the whole psychologistic discussion and it's probable starting point is John Stuart Mill's "System of Logic" (Mill 1843). It was written partially in response to the popular at that time logic book by Whately "Elements of logic". Whately searched for arguments against the modern criticism of scholastic logic. He also stated some protopsychologistic position saying that mental state during the act of reasoning is the sense of that reasoning but if the reasoning is correct it is always the same unitary state for all the syllogisms. His attachment to the psychologistic ideas can be seen from the next passage.

The notion that truths external to the mind may be known by intuition or consciousness, independently of observation and experience, is, I am persuaded, in these times, the great intellectual support of false doctrines and bad institutions. By the aid of this theory, every inveterate belief and every intense feeling, of which the origin is not remembered, is enabled to dispense with the obligation of justifying itself by reason, and is erected into its own all-sufficient voucher and justification. (Mill 1843, 233)

He called logic Grammar of Reasoning and claimed that syllogisms are not just effective argumentation points but the basic nodes to which all the possible argumentation should be reduced. This encloses his views to Prantl but unlike him Whately stated that syllogistic logic does not require any further development which is unusual for later psychologists. Whately rejected induction as the proper part of logic stating only deduction is true science and answered the criticism of scholastic logic by stating that acquiring new knowledge is not a province of this science. That will be one of the main disagreement points with Mill who considered induction on the contrary being the main part of logic.

In his general program Mill seemed to be a psychologist himself but paradoxically he proposed many antipsychologists' arguments (Godden 2005). He distinguished among two types of logic – logic as Art and logic as Science. The Art of logic studies the faculty of reasoning for the purposes of the practical everyday life. It is a prescriptive discipline that should guide our reasoning. And Science is the actual formal study of the syllogisms.

The Art name of the logic comes directly from the scholastic period of it's history when main syllogism were studied as the way to reason correctly. This is the heavy burden of scholastic legacy most of the new psychologistic philosophers will oppose.

According to Mill logic actually is also studying the nature of mental processes. Psychologistic doctrine especially classical one is more affiliated with the Art type. Contemporary researches Pelletier, Elio and Hanson (2008) call the resulting set of early psychologistic ideas for logic Psychological Individualism. As it is Psychological Indivualism is the oldest and simplest psychologistic ideas which directly implies subjectivity of logic and individuals' mental states as the only foundation for logical laws. Mentioned researchers state that since the beginning of the XX century there was at least two other types of psychologism. It is the Psychological Descriptivism – proposed by anthropologists idea that if logic cannot be built from the considerations of the one particular individual it should be built from the observation of the enough large group of people. It solves some of the problems of the Individualism but still is very relativistic doctrine. How should we know that the group of people we observe is enough large to represent the true logic correctly? A part from that some large social groups can also demonstrate deviant behavior like in a case of a totalitarian regime – would they be appropriate candidates for observations in this case?

Mill states that as in the general psychology laws of association of ideas prevail in psychologistic logic (Pelletier et al 2008). That is just another interesting detail pointing on the need of reconsideration of psychologistic doctrine in the light of the changes in psychology itself. In the times of Mill the only true psychology was some unsystematic empirical data, philosophical psychology of Aristotle and new rational psychology like that of David Hume. Later was the most influential. Author's general philosophy made a profound influence on his theory of logic. It was one of the few important disagreements with Whately who was the realist while the author of "System of Logic" was a nominalist. Mill based much of his philosophy on the ideas of the school of empiricists. He criticized the rationalistic idea that there exists "natural light of reason" and claimed that the only thing knowledge can be based upon is empirical data.

All the concept and rules are formed from the nodes of our experience and no such thing as a priori reasoning exists – they are the generalizations of our experience. This is important detail for understanding the relation between philosophical psychology of that time and Mill's ideas. He distinguished knowledge into two types – truths that we know by themselves through intuition or Consciousness and truths that we know through the medium of other truths. The later Mill considered to be the domain of logic which he calls

generally Inference. Such an empirical epistemology not surprisingly admits author to the phenomenalist metaphysics – Mill believes that the only thing our judgments may relate to are the phenomena of the external world (Godden 2005). Unperceived in actuality things are referred by counterfactual judgments – when we speak of the thing which we do not directly perceive but of which existence we know we refer to the permanent possibility of sensation. It was a strong claim in the philosophical world so strongly influenced by Kant. Mill does not admit the ground of the a prori reasoning together with the typical Kantian thing-in-itself. Such a thing is not novel for the one who is the follower of the empirical philosophy but a new thing for the logical discourse. Later it will find it's consequences for Mill's thought about relations between induction and deduction. These two parts of logic are usually considered to represent a priori and a posteriori reasoning.

According to the empiricists' skeptical psychological ideas there is no other thinking process other than a flow of connected ideas which differ only in gradation of vividness and association. Even the concept of "I" is only an illusion created by the habits of our common sense and itself is philosophically not credible idea. Many philosophers criticized this concept throughout the history of thought. But until recently this concept was not applied to logic. We can recall the French poststructuralist and their conception of the death of Author. But more relevant will be the problem of "I" in the contemporary philosophy of mind.

Paradoxically but many representatives of this science-oriented philosophy cast doubt on the unity of "I" or even the existence of such entity. For example Dennett states that consciousness is an illusion and "I" is just a center of a narrative which makes him close to the mentioned ideas of the French philosophers. Metzinger builds his conception of the tunnel of consciousness and turns to the similar idea of the illusionary nature of the "I" (Metzinger 2010). What should it mean for logic? If we view things formally than logic is just the part of the narrative and the mentioned concept together with it's interpretations shouldn't mean much. But everything changes dramatically if we adopt psychologism. It is does not mean that if "I" does not exist than logic is non existing or illusionary entity. It rather means that we should adopt another specific approach to this phenomenon. The notion of "I" changes dramatically if we assume that can create one. Also there is a problem of precisely what intelligent agent can be called having his "I". Formally it was partially realized in the artificial intelligence in the agent-based programming. The intellectual environment in this kind of programs consists of few different thinkers – agents. It is not presumed that any particular agent is intelligent but instead their cooperation creates sentient behavior.

A part from technical pluses of such architecture in brings direct formal advances like ability to reason in incomplete and inconsistent formal systems. Compare this technical architecture to the Dennett's concept of mind as a whiteboard or a common informational space for the group of experts (Dennett 1991).

It is natural to assume that a sense of these connections between the ideas is association – as Hume stated by resemblance or the closeness in space or time. In contemporary psychology associanism the idea that all the psychological processes are composed by association of ideas is just one of the early doctrines that is not so popular and influential nowadays. There is strong experimental data against such a position and many alternative theoretical concepts that are much more influential and strong in modern psychology appeared. For example cognitive science relies more on incorporated into daily thinking logical transitions in the thinking process than on the crude association. It changes the status of philosophical grounding of the psychologism at least in the form presented by Mill. Mill is one of the main targets for later formalistic criticism and the fact that his theoretical foundations should be reconsidered in the light of the advancement of the science means a lot for the whole psychologistic discussion.

Associationism it it's crude form also inevitably leads to the rude relativism. If there are no objective logical rules or concepts or whatsoever and only associations how can we differ between sane and insane persons? This problem was mentioned before as an important detail for status of logic and it is referred by many psychologists. Insane people also produce their fantastic ideas according to some rules and if we analyze their verbal reports we could find some associations between those bizarre ideas. There is no criterion to distinguish between our associations and theirs which by the way brings a big ethical problem besides epistemological. Maybe they have the logic of their own and we have no grounds to consider our logic better than theirs. It is needed to add that logical syllogisms in the body of the narrative of a person does not mean that he is sane either. Some insane persons can produce logically perfect system of fantastic ideas. (Bentall 2003) Mill would have said that the sickness here begins from induction and not deductive process.

But we cannot state that Mill provides the simple reconstruction of logic on the basis of Hume's rational psychology. He no doubt is influenced by it but his position is more complex. As was mentioned before he is more the antipsychologist than psychologist in certain cases. Probably it is because he wrote his main work long before the big psychologistic discussion and he was not a witness of the dichotomy between psychologists and formalists that made the world of philosophy of logic strictly polaric. Mill doesn't know that psychologism automatically presumes many philosophical

constraints and that is why his work is especially interesting and important for understanding the general discourse of psychologism. Through the discussion he presents many arguments that are now the classics of anti-psychologism.

To give an example of Mill's antipsychologism we can see a fragment where he states that relative to the logic as Art everything that psychology can provide is analyzing the mental states of a reasoner during the process of reasoning. In a meanwhile the Art should provide the rules of the right reasoning. Appealing to the Art part of the logic is a usual thing for criticism of psychologism and even wider – logic as Science. Why exactly this fragment is anti-psychologistic? If we analyze the mental states with the means of Art we cannot pretend that we do it scientifically so psychology should withdraw it's claim about the guidance of logic. The distinction of the Art and Science implicitly played it's role for the syllogistic logic and will play long after end of the Mill's debate (Mill 1843).

The Art will always be associated with the old syllogistic logic which cannot bring any new knowledge and is at best a good way to build your arguments. But the contemporary mathematical logic with its complex and completely nontrivial for the common sense theorems is surely the representative of a logic as Science. Can Godel sentence for the first incompleteness theorem be constructed by a man never trained or trained only in scholastic logic? Most probably that no. As well as the implications of this theorem are completely against common sense. Dennett once said that all the scientific theories that have scientific value will go against our expectations and common sense. This thought is especially relevant towards the Art and Science distinction in logic.

What about philosophical logic? Should it be called the Science or the Art? Take for example modal logic created to formalize the notion of necessity and contingency. Are these prescriptive norms? Logic as an Art says so. The status of the necessary truths is the open question in philosophy. But what if the modal logic analyzes the fundamental laws of the universe like physical laws? Should the content of logic influence the status of the norms of the science? What is the status of the modal logic in this light? Despite this content factor considerations we can also speak of the syntax of the modalities.

Modal logic can be built from the propositional but methods used to build it and probe its consistency are mostly mathematical (Kripke 1963). Is it the argument for the modal logic as Science? Why it is important for psychologism? If we see the whole discussion from the standpoint of the mentioned relevance of the distinction of the Art and Science for psychologism we may understand that it is a question about whether psychologism is applicable to the modern philosophical logic. The question may be reformulated in a sense of the consequences which adopting the philosophy of

psychologism brings for non classical logics. The classic discussion concerned and took for examples only propositional and sometimes classical logic.

So is the psychologism useful for philosophical logic or the situation is even worth then with the classical one? We can take modal calculus and its semantics of the possible worlds as the main example. Possible worlds can be interpreted differently but in the most common use it is a mathematical structure which adequately represents modal truths. (Kripke 1980) The psychologistic doctrine can include the modal logic this way only if we admit that mathematical structure of the possible worlds semantics is grounded in psychology. Or we can build the alternative semantics based on the psychology of the individual which will be fully alternative or will include possible worlds as a separate case. The former can be done as a simple statement that possible worlds are actually the mental representations.

The author of this neopsychologistic idea will have to engage with the classical conceptions of the possible worlds like formalism, platonism and radical modal realism probably building a metaphysical doctrine of the modality of his own. This partially answers the question what consequences of the adopting psychologism are – to do it we should provide with new metaphysical grounds. The later variant with the alternative semantics is not so simple. Logician might say that the whole such project is utopian. First of all what does it mean for a semantics of logical calculus or a part of it to be grounded in psychology? Should we refer to the particular mental states or the abstract qualia of the philosophy of mind? If we speak of mental states we need to defy what our metaphysics in a given case is. Simple stating that we should study the mental state to know the sense of the logical operation it correlates with is not enough.

How can we actually study this mental state? This is an important detail of showing how the treating of the notion of mental states in philosophy of mind influences not only this particular notion but also the foundation of formal systems that relate to it. Simple reflexive introspection is not enough and such method is not used even in psychology anymore. Even more novel ways of doing psychology are criticized (Fodor 2000). If it was enough classical psychologists would tell everything about mental states in their time. The best way is to connect the mental states to their physical correlates – neural states and study them.

Here we are entering one of the most complicated discussions of the philosophy of mind. Are the neural correlates of the mental states really enough for proper study of this phenomenon? How should we study them given the complex nature of the correlation? That is why the metaphysics was mentioned in the beginning of the passage. There are

many theories of the mind in analytic philosophy and we should adopt one particular to work with the purposes of the connection of logic and psychology. The best candidate for this task is the representational theory of the mind. Representations are the informational structures of the mind that form the inner space of the human mind (Chalmers 2004). As they are presented in this informational form it is easy to find the cooperation with formal systems. So among all the conceptions of mental state we chose the representational theory of mind and presume that logical operations are connected to the certain class of these representations. Mental representations are the variety referring to different processes in the brain like perception, memory, imagination and they have the different types of content in accordance with that. Logic and logical operations are obviously the part of the representations connected with direct cognizing processes.

The first difficulty arises here as though logic can be classifies as the part of the particular module of the cognitive architecture it is used extensively in many other places with all types of content. We use logical operations when we process the visual perception for example. So we should assume that some of the mental representations can be applied to other kind of the representations and create a more complex structure. This brings in a new special language with the rules of syntax and semantics. Fodor tries to built something similar to this language in his theory of the language of thought. As we started from the psychologistic logic it is crucial for us to understand what are the relations between this existing formal language and the presumed language of mental representations. In a relativistic variant there is no connection – the logic for the mental representations are just a particular type of content and as a language they are built on completely different grounds.

But in a psychologistic version logic has a deep inner relation to this language of mental representations and we can cognize something about the later studying former. This idea is developed beyond the classical psychologism in the contemporary cognitive science studies. According to one of the theories the cognitive architecture of the brain is isomorphic to the predicate logic of the first order (Johnson-Laird 1988). What side to choose in this discussion? The possibility of the language of thought being completely irrelevant for logic is unlikely as than we should pose question about the very foundations of our epistemology. From other point of view we cannot say that the basis of the work of our brain is logic. The only thing we can speak surely about are the common elements between two and the usefulness of the cooperative study of the both. Most probably language of mental representations is more strong as the formal system and has classical logic as it's special case. This is where the precious problematic questions of the

philosophical logic and their connection to the general psychologistic project become important. The formal systems are the particular cases of the great language of mental representations or the language of thought which is a universal tool and the most powerful formal system of all.

We can see the parallels with the Hilbert program in mathematics here. Sense of the Hilbert's program was finding the most powerful mathematical formal systems with most universal axioms and represent the whole mathematical science as being built on these axioms. Could it be that the psychologism in logic can turn to be finished by a similar grand project? Hilbert's program eventually failed because of the overwhelming number of the difficulties including the mentioned Godel's theorem (Detlefsen 1981). This is just an analogy as we can't say that the great unification of formal systems can be done basing on the psychologistic philosophy. Psychologism as a doctrine puts great constraints that make it impossible. The project of unification in such a way is more a metaphysical or epistemological. Doubtful Hilbert or any of his followers-mathematicians would appreciate it.

However it does not stop us from investigating the alternative. Psychologistically united mathematics if it is not the simple statement that the only thing that unites topology and arithmetic is that it happens in our brain should incorporate certain laws of cooperation and transition between formal systems. There are no axioms and no need to unite everything according to the formal rules of the one axiomatic system so the main difficulty is lacking but there are still some constraints on the coexistence of formal systems in the domain of human mind. These constraints would be the syntax of the language of mental representations from which the discussion started. I presume the study of the classical ideas of psychologism, difficulties it faced in it's clash with formalism and the starting of the neopsychologism the stages of the process that inevitably lead to the project of the defining the syntax of mental.

Mill was a starting point in the "Logical Question" and ensuring psychologistic discussion. Many his arguments are still valuable both for psychologism and anti-psychologism.

Mill gives much to those who oppose the psychologism when classifying logic as an Art. To illustrate why it is hard to call Mill complete antipsychologist we would take another passage where he says that rightful understanding of the mental processes behind the logical reasoning is the only basis for creating of rules that guide that reasoning (Mill 1843). Together with that in another place devoted to the Science of logic Mill directly states that it borrows all it's rules from the psychological science. But as was stated in the

previous text it is hard to state what sort of science we have here until we defy what we mean by mental states and the proper way to study them. Could the scientist before even Wundt do something like that? Despite being influenced by philosophical psychology Mill does not go deep into it stating mental states only in the general terms. That is probably first and one of the most important reasons to reconsider discussion in the neopsychologism in the light of the advancement of the cognitive science.

Mill is concerned with a thing which is considered central for the science by majority of logicians – the validity of arguments. It is still the big point for the contemporary logicians psychologistic and formalists and different answers to this questions bring different philosophies of logic as well as different calculuses. According to basics of the logic the inference is valid if all the premises are true. Than it is evident that an inference does not prove anything but that was already assumed in the premises which is an argument against the status of logic as useful science. Whately tried to explain this problem but not successfully according to Mill. This problem can be called a great paradox that fueled Mill's interest to philosophy of logic. However this great paradox have few different resolutions in the contemporary logic (Quine 1986). Mill himself describes the problem in the next passage.

It is universally avowed that a syllogism is vicious [i.e., invalid] if there be anything more in the conclusion than was assumed in the premises. But this is, in fact, to say that nothing ever was, or can be, proved by syllogism, which was not known, or assumed to be known, before. (*Mill* 1943, 183)

The accusation in not bringing the new knowledge is applied mostly to the scholastic tradition of the syllogistic logic. Modern mathematical logic does not need any other arguments except for the theorems it discovers. Mathematical methods together with the theory of sets bring many paradoxical results. Not to mention Godel that was used few times during the discussion we can name Löwenheim — Skolem and Gentzen theorems that are not the things accessible for the common sense alone. The existence of the new knowledge for the mathematical logic is not discussible.

The attack on the syllogisms can be led not only from technical position but also from a more philosophical one. It was an argument presented by Bacon who criticized the traditional logic of Aristotle as not epistemicaly significant (Kitchin 2000). Next Enlightenment's thinkers were very harsh on the scholastic science and logic as the classical part of it was often ridiculed by them. The main argument was that people were rational

and powerful thinkers before Aristotle and during centuries after him without studying his logic.

This discussion has it's continuation in the contemporary discourse as well. It centers around people who did not study logic but evidently use it's rules and concepts in their daily life quite successfully. Thus in the classical history Locke refuted scholastic logic and proposed to use native rustic reasoning or what we call it now common sense. This rationality is interpreted as the sign of uselessness of logic by ones and as the evidence of so called folk logic by others. It is still a powerful source of attack on status of logic as science. However when logic was applied to mathematics the form of the syllogisms became its plus more than a minus. For purposes of the study of the foundations of mathematics rigorism of the classical logic suited better than effectiveness of the common sense reasoning. We cannot say about truth of mathematics that it is so because it most probably seems so but we can say that it is truth because it is driven from the axioms with the help of syllogistic rule. The possibility of using the old propositional logic for analysis of mathematics is proved by "Principia Mathematica" (Whitehead et al 1910). Authors were close to Frege's invention but still used what we previously called scholastic logic.

We also have a kind of a paradox here. We cannot use the power of the "native rustic reasoning" because for mathematical purposes if will be too psychologistical. But we can use scholastic logic for that. But if we are psychologists about logic the grounding of the logic will still be psychological. Does it discredit logic as a foundation of mathematics? As was stated previously the psychologism does not automatically means the end of the formalists' dream about unification of mathematics. The issue depends much on how you defy the psychologsim itself and the principles of unity of formal systems. It was said much about the possible project of the unification of formal system within philosophy of psychologism in the previous passages. So we cannot say that it is argument against the psychological or logical grounding of mathematics.

The later was popular in the beginning of the XXth century and was a kind of the alternative to the Hilbert's formalism. The project of reducing the mathematics to the pure logic was promising and had many followers but eventually failed. The reasons were similar to that of the crash of the formalism. The formal systems just cannot be reduced to dome very basic unitary set of rules or axioms no matter if these are rules of mathematics or pure logic. But by analogy we can speculate about connection of the logicism and the psychologism and the possibility of the revival of the former. Again if the rules of the transition will be provided by the psychologistic philosophical grounds it can refresh the

logicism. As well as in the case of mathematics it should probably be done in the framework of the neopsychologism and the language of mental representations rather than classical psychologism.

On it's part folk logic can be an evidence of the truth of logical science or even the guiding line for the modernization of logic (Smedslund 1988). The roots of the discussion can be found in the early history of modern science including the works of Mill. He was the one who tried to resolve the difficulties in favor of logic and against the heavy and structured criticism presented at that time which earned him a place in history of science. Deduction as we know is completely non-ampliative. So it does not bring any new information or how contemporary logicians would say it is closed.

The contemporary logic centers a lot on the general principles guiding the different formal systems including closed and open. Among these relations we can find many non-trivial laws so as was previously mentioned few times the problem of the new knowledge is not posed to the modern logical science. It is connected to the use of the theory of sets which has a complicated history of discovering the paradoxes and contradictions in the things that seem easily accessible for the common sense. But it is interesting how this actual for the old logic problem was considered and eventually resolved in the process of the development of science and philosophy of logic. And Mill's work is a great example of such an elaboration.

Mill does not take a particular side in this discussion trying to resolve a dilemma by representing a correct relation between inductive and deductive reasoning. This is another point of his disagreement with Whately who as was mentioned before did not admit induction as a part of logic at all. In the contemporary science inductive logic is considered to be the separate sphere. In the understanding of the new logic induction as Mill saw it is more the problem of a content. In artificial intelligence it is a more wider problem of the formulation of the notions. In AI the new notions can be acquired not only through logic but also through other formal systems but the result fir this sphere is the same – it cannot formulate how the formal system acquires new notions in the adequate way (Russell 2010).

Mill's mature theory of deduction was majorly influenced by philosophical psychology of Stewart. It was not the philosophy of mind of nowadays and represented more a kind of philosophical psychology. But is still the historical fact about the impact of the philosophy of psychology on real logical studies. Partially that was these ideas of "mental philosophy" which hinted Mill on the resolving of the great paradox of inferential knowledge he was interested in the beginning. Author never names directly what it was but researches suppose it was Stewart's theory about probative role of general axioms in

demonstrative reasoning. It is the statement that general propositions which axioms are though being applied to the given cases only a posteriori is actually the generalization of these given cases when we have no ground to doubt in the way we should treat them. So the growth of knowledge occurs not when we deduce new theorems from axioms but rather when we establish axioms themselves. This of course can happen only through the experience of particulars which perfectly fits Mill's empiricism. Thus the true basis of logic and the source of real new knowledge is the induction of the starting axioms which of course goes directly against the whole system of philosophy of logic proposed by Whately. The Stewart's idea is indeed very interesting even nowadays. In fact it is even more interesting than it was in the days of the flourishing of the classical psychologism. It directly states that all the knowledge of the formal system consists in it's axioms. New logic as it was mentioned before often deduces unexpected truths from the simple axioms but the epistemological view on knowledge as the set of axioms deserves it's place among great philosophical ideas. It is important because it establishes a relation between different formal systems – the epistemological relation of being different kinds of knowledge. It is another possible philosophical ground for the unification of the formal systems.

Besides that Mill distinguishes real and apparent inferences as well as real and just verbal propositions. Mill proposes to make an analogy between this distinction of his and the distinction of Kant between analytical and synthetic judgments (Guyer 1998). Almost a century later the analysis of the Kantian ideas from the standpoint of logic will become the beginning of the Quine's project of naturalization of philosophy (Quine 1960). So besides axioms there are some epistemically relevant procedures in the deductive part of the logic according to the author. In order to be real an inference should contain something new not stated previously in the premises. Real inferences are ampilative. Verbal propositions just like Kantian analytical judgments are propositions where predicate is the essence of the subject. Real propositions are those where predicate states something not essential to the subject. The analogy with Kant here is relevant but if to think about it is what on which later Quine's criticism is based upon.

The distinction which is presented by Kant is not between a priori and a posteriori creating a deem philosophical antimony but rather the distinction between different types of logical objects. This is important in the light of Mill's mentioning the distinction and general influence of philosophical psychology on philosophy of logic. The rejecting of the a priori is one of the needed foundations for the philosophical naturalization. How can we reduce the whole knowledge to science if we admit the existence of the whole faculty of our mind that exists before any empirical experience and even more than that – influences

and defines the greater part of our knowledge? Together with the big part of the classical metaphysics notion of a priori should be eliminated in order for the naturalization of philosophy to be done.

It also raises an interesting analogy with the contingency discussion in the analytic philosophy. What is the status of non-necessary truths in the post-kantian philosophy and especially philosophy of logic? It seems that according to Mill these contingent truths bring more true knowledge than those necessarial considered a major part of the real science of logic. In the light of the previous discussion of the notion of a priori we may ask do the necessary truths of Kant's philosophy those that are actually a priori hold the Mill's criterion for bringing new knowledge? It seems that in the pure form as defined by Kant himself they should not. But how about the science of mathematics that is a priori according to the author of the "Critique of Pure Reason" (Beiser 2009)? We've already established that in the most of the cases mathematical deduction provides something we should call new knowledge. The whole idea seems like a new possible attack on the Kant's position from the side of the logic.

Mentioned premises bring us to the paradoxical for the Mill's time inferences. Mathematical sciences should bear in them many new propositional individuals or empirical material in order to be considered real sciences. Most of the deductive logic is not a real science. The deduction of classical logic is guided by the principle of the monotonocity which completely excludes the possibility of non-contradictory presence of the real propositions as presented by Mill.

Further in his philosophical development author turns from the Whately's realism and a dictum de omni et nullo principle moving more closely to the pure empiricism and philosophy of logic of his own. For the independent work of Mill presented already in the "System of logic" notion of the ratiocination is important. Ratiocination is the process of the deducing of the general inferences from the general premises. He claimed that all valid syllogisms can be reduced to the four basic forms. These are two affirmative Barbara and Darii and two negative Clarent and Ferio. Though being deductive ratiocinative reasoning is claimed by author to be bringing real knowledge. The reason is that it is composed only of the real propositions. It seems vague and imprecise explanation. Why some of the classical scholastic syllogisms bring new knowledge while all others don't? The definition of the real propositions is not fundamental enough and it brings the difficulties for understanding Mill's thought. The line of a discussion lies in the same ground as the previous discussion of the Quine's criticism of Kant (Quine 1960). What is the particular without any a priori premises? What does the existence of such an object means for

epistemology? It is evident that in this case the world of cognizable will be divided into real and falsified propositions establishing the distinction analogous to the classical Kantian.

Coming closely to the resolving of the great paradox Mill refutes both the position that the syllogisms are useless and Whately's explanation that an aim of logic is a proper explanation of the exact process of reasoning (Whately 2010). He stresses his empirical psychology driven conclusion that axioms being general are just the product of aggregates of particulars. Then he states his resolving of the great paradox – real inference goes only from particular to particular and general axioms as well as the inference laws are just rules according to which such reasoning is processed.

Mill gives psychologistic comments on the role of the syllogisms in the resulting picture of logical science. The inference rules are not the obligatory way we must reason they are more a useful representation of the process of reasoning with the help of which we may analyze and calculate it. In fact this is not the way we must reason but rather the way we may do it. This immediately rises further questions. If the reasoning is really consisting only of particulars what are the general notions and how can we explain their existence? Are they just an illusion or the object that really refers to a certain particular? If this is so why such a phenomenon as illusionary notions exist at all? If we are psychologistits enough we should ask what it means for our mental states and general mental apparatus. Are the mentioned mental representations governed by laws similar to those? In this light the theory of psychologistic logic may help to understand the general structure of the mental representations in mind as was stated before and now it is given a particular practical example. This is the example of how the neopsychologistic conception in the philosophy of logic is connected to the language of mind, mental representations and other elements of the philosophy of mind.

Another important role in Mill's system is played by the mentioned induction. With the great paradox resolved induction is the only true way of acquiring axioms and the basis for any deductive reasoning. Mill bases his philosophy of induction on the interesting philosophical principle he calls uniformity principle (UP). It states that universe is governed by general laws. Induction is done by all humans in the areas other than logic so what is the role of the logicians in the domain which is considered to be most important for the logical science? According to the author logicians should collect and verify the philosophical principles that will guide the real process of the induction for all the involved individuals. Mill here is clearly influenced by the philosophy of Bacon and British empiricists.

Thorough the history of philosophy induction face much of the strong criticism from different schools. One of the classic attacks is that of Hume (Hume 2000). But in the Hume skeptical argument we rather deny the causal link as the ontological entity than an induction as a logical method. The uniformity principle is the philosophical attempt to give the inductive method solid basis. However the most interesting detail in Mill's understanding of the induction is not it – in the general philosophical grounds he keeps to the rich tradition of the discussion. It should be said that problem of the induction including the works of Mill would be more interesting if it was presented in the light of the works of Hempel and his raven paradox (Hempel 1945). The interesting detail is the role Mill gives it in the general logic or it is more appropriate to speak of general epistemology. It was already mentioned that in the artificial intelligence this problematic is presented as a problem of the formulating new notions. But here we can see it more as a philosophical conception. The only way something gets into the scope of our knowledge is through induction which has many preliminary premises. This way for example we should say that even an act of discovering an unusual object is the part of the more complex inductive process of searching for general laws and regularities. Which is actually an interesting conception for the contemporary epistemology. We can say that placing induction in such a place Mill also makes the sort of the early naturalization reducing general philosophical epistemology to the logic and logical methods.

In accordance with the classics of the empirical philosophy Mill sees one of the main inductive principles in causal laws of nature. Author claims that the necessity of existence of a cause of the every fact is the necessity of the human experience.

To furnish all the causal laws Mill proposes a special methodology composed of Bacon-styled methods of work with empirical material. The method of agreement consists in varying the antecedents of the studied event until the perfect correlation is found. Method of difference is also varying the antecedents in a search of the particular feature. Method of residues explores the complex phenomenon with the help of known causal chains. Finally the method of concomitant variations searches for correlation as a sign of causal connection. Interesting detail is that Mill considered mathematics true new knowledge composed of real propositions analyzing the general resemblances between things.

Main points of commenting and disagreement of Mill's work which started the discussion later in Germany can be symbolically seen in the in his discussion with a German logician Whewell (Whewell 1989). This is first of all his empirical philosophy of

the logical terms and secondly the nature of the inductive procedures. But the main criticism was produced much more later.

In conclusion we could say that it is evident that early philosophical psychology has maid a profound influence on the logic and philosophy of logic. In fact philosophical discussion gave start to the refinement of the whole logical science. Besides this it gives another reason for the reconsideration of the psychologists' discussion.

Mature psychologism and Frege's criticism

Why giving exactly the early psychologism of Mill such an attention? It was his "System of Logic" which was addressed later by Frege in his famous criticism of the psychologism. And Frege's arguments are central for the whole discussion. So understanding the precise details of the Mill's psychologistic doctrine is important. Frege especially distinguishes Mill's concept of a number (Frege 1834). Some of the criticism touches even metaphysical questions especially empiric understanding of the status of abstract objects. Other arguments concern the psychologism of the "System of logic" directly. It is directed towards concept of a number mostly and the general criticism against logical psychologism will be analyzed later in the relevant context. To show how much the concept of number and arithmetic plays in the general philosophy of Frege we can take the next passage:

I hope I may claim in the present work to have made it probable that the laws of arithmetic are analytic judgments and consequently a priori. Arithmetic thus becomes simply a development of logic, and every proposition of arithmetic a law of logic, albeit a derivative one. To apply arithmetic in the physical sciences is to bring logic to bear on observed facts; calculation becomes deduction. (Frege 1884, 99)

The view according to which a number is just an analogy with the aggregate of physical things is called naïve. Naïve mathematical concepts according to Frege are always a result of the deep contradiction in the reasoning. To prove that such a concept of a number is inappropriate Frege gives three counterexamples which are: 1) the notion of the identity and distiguishability of the numerical units 2) numbers such as zero and one 3) extremely large numbers. Any of these examples brings difficulties for the scientist who

tries to defy number as a simple analogy with the aggregate of things. The root of all evil in this case according to Frege is psychologism. If everything in the mathematics was just the counting of the certain elements of our mind like perceptions we would never deduce that "1 + 1 = 2". If mathematics was really psychological our cognitive limitations would put constraint on the domain of numbers which is obviously not so.

This powerful attack on precisely one concept of the psychological philosophy of Mill mirrors the Frege and other formalists' position about such ideas. The attack is strong and elegant. But it is precisely the reason why it should be reconsidered in a new light as the neopsychologistic ideas give the decent answer to many points of the classical criticism. Just to give an example – cognitive constraints for mathematics which are put by Frege and Mill in more metaphysical terms are the subject for the precise study in cognitive science and some researches answer the original Frege criticism basing on the direct empirical data.

Ironic in the contemporary logic neither Mill's psychologism nor Frege's sort of Platonism and pure formalism succeeded. Instead a new paradigm introduced formally by Tarski and philosophically by Quine became dominant (Tarski 1934). According to it the domain of logical science is not abstract objects or mental states but the proper logical relations between sentences.

In the time of the publishing of the "System of logic" and some time after Mill psychologism became dominant idea for philosophy of logic which is a strange thing for any contemporary logician. Before him or even more earlier before Hegel logicians didn't think about the ontology of the entities they work with much. Lack of technical advancement had it's correlation in the theoretical grounds.

Up to the beginning of the XXth century greatest enemy for psychologism was not the formalists or any other philosophical foundation of the formal systems but the criticism of those who denied any useful role of the logic at all. These were those who followed Locke in his denying the logic and stating that we should use our native rustic reasoning rather than scholastic syllogisms. This thought was supported by many great thinker of the Enlightment including for example Diderot. The last even wrote that exploring our reasoning with the help of logic or psychological logic is the same as cutting the leg in hope to find a way to walk better. Other kind of technical logicians like Bolzano did not pay much attention to the problem of foundations at all as well as it's psychologistic version.

As was mentioned before the biggest flourishing of the psychologism took place in Germany in the end of the 19th century. It even got the name similar to the earlier "Logical

Question" – "Psychologismus-Streit" (Kusch 1995). Among prominent followers of the conception we can name philosopher and logician Theodore Lipps, Gerardus Heymans, a great empirical psychologist Wilhelm Wundt, Wilhelm Jerusalem, Christoph Sigwart, Theodor Elsenhans and Benno Erdmann. The term "psychologism" itself was coined by Edmann in 1870 to describe the epistemological position of Eduard Beneke. The English mathematician John Boole who wrote a treatise on the mathematization of logic is also unexpectedly a follower of a psychologistic doctrine.

There are at least two versions of psychologism – weak and strong. Weak states that logical laws are the continuation of the laws of the mind and can be uncovered by psychological methods and strong states that logic is literally the branch of psychology.

Beneke was the first major figure in the school (Beneke 2012). He with Fries are known to adopt strong anti-Hegelian position in the general discussion of foundations. He lamented poor state of the contemporary to him German philosophy and searched the cure into establishing a new epistemology basing on the natural science. In the contemporary terms it means to naturalize philosophy and logic. Psychology according to Beneke acquired the status of the real science and we should base logic only on it. But in his main logical book of 1842 actually very little is taken from psychology which another time emphasizes the need to reconsider the foundations of logic in the light of the new psychological knowledge. Beneke engages in the discussion similar to that which concerned Mill about the problem of inferential knowledge. He criticizes Herbart for making syllogistics the core of logic which according to Beneke is the main reason why the illusion of uselessness of logical science appears.

Fries was a Kant's follower who interpreted his grounding of sciences in psychologistic way. He stated that all disciplines like metaphysics and epistemology should be reduced to psychology. To evade problems with such a way of thinking pointed out by Kant himself Fries introduces notion of intuition that makes possible direct knowledge of things as they are. This is a very strange idea for the Kantian more appropriate for a follower of irrational philosophy than critical. Kant's system is putting strict constraints of what there is in human psychology. To what exact faculty of the mind the intuition would relate? Isn't the intuition ruining the whole system of the critical structures? If the intuition is the only thing thanks to which we can cognize the world directly what are the other senses and what is more important to us – what is logic according to Fries? Being a psychologist in logic and a Kantian poses a lot of problems as it ease if we remember the changing in the Kant's relation to this science.

Theodore Lipps is considered to be a typical representative of the psychologism (Lipps 1893). Widely known and influential philosopher at his time he is mostly known nowadays as the main target of the Frege's1 and Husserl's anti-psychologist criticism. As Neokantian Lipps shared the idea of universality of the logical laws for all the individuals of the mankind. The profound study of logic should inevitably lead to the psychology as the foundation for the general epistemology. Lipps waged a strong criticism on the notion of the "third realm" as the ontological basis for abstract objects and which was very popular among formalists and accepted in certain form even by Frege.

In this case philosophical position of Lipps is heavily influenced by Ernst Mach who was a phenomenalist and stated that there are no things apart the phenomenons and our cognition is grounded into the specific details of us as human beings including for example our biology. This branch of theory will be continued in the contemporary philosophy with some researches stating that practical reasoning and even the whole faculty of logical reasoning is grounded into bigger modes of our psychology. So for example practical reasoning is just a mode of empathetic understanding or the embedded into general cognizing apparatus. However Lipps rejected mathematical symbolism in Fregean sense. It tended to produce artificial manipulations with senseless syntactical symbols – the tendency that will fully show itself in Hilbert's formalism (Detlefsen 1989). His disagreement with the Leibnizian idea of thought calculus lies in the understanding of the natural language which according to Lipps are independent culturally defined structures. Leibniz is important here despite his logical ideas were not famous for almost a century after his death because his project of the universal thought calculus was the inspiration for new logicians like Frege and Boole.

He was the first person to state that ordinary scholastic logic does not meet the requirements that are made for it. His dream was of building the calculus that will literally calculate the value of thought which will be the ultimate decision to all philosophical and moral problems of the mankind.

So logic should obviously include the functional relation between thought and linguistic structures that represent these thoughts. Lipps divides domain of logic into first order logic operations like judging and ordering the inner and outer experience and reflexive mind which is actually the same reasoning but on the second level applied to the products of operations of the first level. Author often appeal to the notion of the self-consiousness basing mostly on works of Wundt but never enters the specific discussion of the phenomenology of the experience and it's connection to logic. Lipps does not accept Fregean mathematical functions for the meaning of the logical terms stating that logic is

based on natural language where difference between subject and a predicate is evident (Lipps 1893). He also restores the scholastic conceptions of common names as special abstract objects. Another one difference is the distinction between the proposition and the sentence of the language. The former according to Lipps is the conditional of the first one.

Though basing his theory on the scholastic syllogistic (not symbolic) logic Lipps comes to admitting some of the non classical features of the logic used in the everyday life. So he underlines the non monotonic character of our deduction in these cases as well as the importance of considering all the premises for final inference and indicative pronounces. In opposition to the material implication tradition of Frege he used the implication affiliated with stoics' logical system. He also paid attention to logical fallacies in the ordinary rational reasoning. Lipss' emphasis on the importance of the intentional status of the cognizer is known in contemporary logic as the rhetorical details of the logical discourse and are widely discussed.

Gerardus Heymans was a famous Dutch philosopher and a psychologist (Heymans 1905). His most important theoretical invention was a so-called cube – the three axis gradation of a human character. However he is known also for kind of the radical psychologism in metaphysics. Having conducted experiments on telepathy he stated that underneath all physical processes lies psychical. This idea received the name of psychic monism. It is indeed sort of the inverted classical metaphysical monism. Monists in opposition to dualist state that everything consists only of one sort of thing. Most often monists are physicalists when Heymans considers everything consisting of mental which is quite unusual and exotic especially for classical metaphysics.

Wilhelm Wundt was a pure psychologists considered by many to be a founder of it as independent discipline (Wundt 1880). It makes this case especially interesting as it is the view from outside the philosophy and on psychologism in logic by a professional psychologist. Most of the psychologist do not pay much attention to the logic as a discipline. They use the notions like "logical mistake" without actually referring to real science but rather to a folk logic accessible by everyone. Wundt devotes a big work on logic where states that logic is a science about correct thinking and it's principles are conscious representations themselves. So it is up to psychology to define the genesis of the logical principles as well as interpret the norms of the syllogistic logic. Husserl later chose Wundt's psychologism to be a radical representation of the whole doctrine even calling it "extreme". Paradoxical but Wundt himself his work a rigorous refutation of the psychologism stating that all the details that seem to directly pointing out the contrary are the consequences of the situation every rational thinker faces – you just cannot escape

psychology. Author did not admit the existence of the "third realm" and sided with the strict metaphysical monism.

There is exactly one process we refer to as "thinking". What is unusual about logical laws which makes them laws among all our representations? According to Wundt their normativity is built inside those representations (Wundt 1910). This quite an interesting thought even for contemporary cognitive science. Many scientists that support the theory of mental representations ask whether there is a hierarchy of them and on what principles it is built. So author claims that status of the representation relatively to other such representations is part of this entity which is quite a theory especially for the end of 19th century. Mentioned earlier Lipps presented two levels of judgments that were organized in a special structure in order to represent the ability of mind to reflex on it's actions. In this theory the representations are divided functionally – the second level are judgments about judgments. The conception of levels always bring methodological problems. If levels exist why there are exactly two of them. How about refection about reflection? Where the growth of reflective levels will stop?

The most famous and influential consideration of psychologism in logic and its implications is the criticism of this doctrine by German logician Gottlob Frege and philosopher Edmund Husserl. Frege's criticism falls into three main parts.

He starts from the relation between psychology and logic as sciences. He emphasizes that psychology is fundamentally vague when logic in the contrary is precise. This can be answered by neopsycholgists in a way that now there exist both the imprecise logical calculuses as well as mathematical methods in psychology. The later criticism is against the notion of "idea" as psychologistits use it. Frege then emphasizes the distinction between ideas and their content. This will later become one of the central topics in the classical phenomenology. Numbers according to Frege are simple and objective entities when psychological ideas are subjective and idiosyncratic. This way the any materialistic ground for the distinguishing between a priori and a posteriori is refuted. It should be mentioned that in the cognitive science search for brain defined distinction of such a type is quite a trend and also brings some implications for the problems of classical psychologism.

Frege's attack on the Mill's concept of the number was already mentioned (Frege 1884). His general critical response towards the psychologism of this type may be summed up in the following. Someone who learns to calculate does not gain any new empirical knowledge and no empirical knowledge can justify mathematical statements. There is no general inductive law from which all the mathematical statements will follow. Finally the

aggregates of object do not possess abstract properties and everything that Mill concludes from their existence can be concluded form the analogous abstract entities. Frege understands truth and its connection to the logical laws and thus to the logical particulars in completely other way:

> Being true is different from being taken as true, whether by one or by many or everybody, and in no case is it to be reduced to it. There is no contradiction in something's being true which everybody takes to be false. I understand by 'laws of logic' not psychological laws of takings-to-be-true, but laws of truth. ...If being true is thus independent of being acknowledged by somebody or other, then the laws of truth are not psychological laws: they are boundary stones set in an eternal foundation, which our thought can overflow, but never displace. It is because of this that they have authority for our thought if it would attain truth. They do not bear the relation to thought that the laws of grammar bear to language; they do not make explicit the nature of our human thinking and change as it changes. (Frege 1894, 137)

A apart from the particular entities Frege turns to the notion of the psychological laws. He distinguishes from all the laws between descriptive and prescriptive. So the laws of the physics are purely descriptive. They can be reformulated as the type of the prescriptive laws though. All the prescriptive laws can be called "laws of thought". But only one kind of the descriptive laws is in fact also psychological – descriptive laws of psychology. The point Frege tries to prove here is that the relation between logical and psychological laws is the same as between physical and moral laws. The first are obligatory laws of the universe the second are just human culture prescriptions that can be broken. It is the distinction that got to be known as is-ought problem in philosophy. Frege mentions that the detail about turning the descriptive laws into prescriptive breaks this distinction. He bases his classification of the failed psychologistic logicians on this simple principle – prescriptivists/descriptivists.

Neopsychologism

During the discussion of the old psychologism, neopsychologism and its ideas was mentioned many times in the context of the reconsidering the existing classical problems. Few times to answer the problems psychologism faced modern conceptions of the cognitive science were adopted like in the case with Frege'e attack (Frege 1884) on the Mill's conception of the number. The central idea of the thesis is presenting philosophical problems of the old psychologism and showing how they can be solved in the paradigm of the neopsychologism.

What is the neopsychologism itself? The great psychologistic discussion ended in 1914 and we cannot find something similar in the history of philosophy including the recent. As was mentioned before some like Quine thinks that psychologism will eventually return in the set of naturalization ideas (Quine 1960). Some of the neopsychologistic ideas were brought to public by different philosophers throughout the century. So the neopsychologism is a set of ideas mostly connected to the cognitive science which relates formal systems and mental states in that or this form. As it will be shown it is more wide than the classical psychologism as it does not require the direct reduction of the logical propositions to the mental states and has a reformulated due to empirical data notion of the mental states.

But it did not start as the big program discussion as was in the beginning of the XXth century. Probable reasons are the contemporary sates of psychology, logic and philosophy of mathematics. For all three there is no grand unifying idea like it was in the time of the classical discussion – they are the aggregate of different schools. Psychology doubtful bears a strong resemblance to the discipline of the time of Wundt.

Philosophy of mathematics does not have any great program like Hilbert's and after all the paradoxes and failing of the great doctrine like logicism and formalism it is in the mentioned state of the aggregate of schools. In the recent development philosophers are more interested in indispensability than in the old discussions like realists versus nominalists and psychologistits versus formalists. And today's logic is the living counterargument to the position of its formalistic founders like Frege. Non classical logics develop in different possible directions like the fuzzy logic, paraconsistent, intuitionistic. Most of them start from breaking one of the laws which were considered by Frege and Husserl the cornerstone of our knowledge as well as the foundational laws of the universe. Fuzzy logic provides the vague principle and vague terms for the formal logic thus breaking one of the main arguments of Frege against psychologism.

Later echoes the discussion of the foundations problematic within Vienna Circle. Moritz Schlick (Schlick 1910) stated that Frege's appeal to the vagueness of the psychology is just not right. There are psychological laws that are strict and unbreakable. The easiest example is if you a psychologistis in formal systems than logical laws being psychological laws are strict.

Not all contemporary logicians believe in what Frege and Husserl thought was a law – propositions of logic being "paradigm of necessary truth". It is claimed that logic changed strongly after adopting the Church's thesis and a Turing machine as a tool for deducing new theorems (Jeffrey 1989). The theorem establishes the most strong algorithm

but leaves a place for possible function that cannot be calculated by this machine. This is absolutely impossible for the classical logic in principle. Mathematical and artificial intelligence topics inside the science of logic shifted it's scope. The preserving of classical laws is of second importance after the newly installed notions of computability. The whole discussion of necessity in logic mirrors the Quine's attack on the analytical truths. As we know he comes to a conclusion that the whole distinction is realative.

Views on whether we should adopt psychologism again after all these years differ. Some like Dummett claim the primacy of the philosophy of language over philosophy of mind thus negating the main ideas of the contemporary philosophy of psychology and cognitive science (Dummett 1993). The view like this is both the questioning of the ontological supremacy of disciplines and the appeal to their independence. In fact this position known form the times of irrational philosophy is protecting philosophy as a discipline against the attack of neopositivism. Would the return of the psychologism be the opening of Pandora's box?

The classical psychologistic discussion is studied today as a great representation of sociology of knowledge and the strong influence of the general political and social context on the philosophy. The conflict had not only the philosophical dimension but also had an impact on the structure of the university and the role of the psychology in society. In this sense the context of the contemporary psychologistic discussion changed a lot. No one among the today's researchers consider the reduction of the logical laws to the psychology possible in the unified schema. And no one would adopt associanist psychology for these purposes. Previously mentioned changes in the logic also hold – it is more a study of the formal systems and rules and not the axiomatics as in the definition of times of Frege. No one also carries the philosophical definition of logical entities which are independent eternal and timeless. The study goes on rather logical statements and propositions which are often context dependent.

Many researchers would like to be naturalists in the philosophy of logic but not to include a necessary and strong reduction of the logic to psychology. In 1998 Pascal Engel for example adopted what he called normative naturalism. This form of naturalism was predicted by Husserl in his usteron-proteron argument. In general he claimed that the knowledge cannot be reduced to the naturalistic set of facts because this set being set of scientific facts is itself a part of the body of normative knowledge. A more modern account of the analogous argument can be found in works of Davidson who stated that rationality is itself a knowledge. Another objection comes from the Wittgenstein "rule following"

principle and is similar – we cannot base norms of the psychological facts because the very correctness of these norms depends on these facts which creates a paradox.

The good example of the cooperation of psychology and logic in the contemporary discourse are the studies of Wason and works of Kahnemann and Tversky (Kanhemann et al 1983). They developed experiments to test ordinary unprepared people to complete tasks connected to the classical propositional logic (conditional reasoning) and deductive probability calculus (Bayesian networks). It showed that ordinary people fail even at the simplest tasks of such kind and in a certain sense are not rational. Thagard sums up the possible implications of these experiments (Thagard 2009). First is that people are in majority non rational beings. Second possible answer is that psychological testing is not appropriate for the purposes of logic. And finally logic is fundamentally failed in reflecting the way people reason in their everyday lives. Not a single one of these implications seems to be correct alone or satisfactory. Why is logic not accessible for the psychology? It would mean that a big faculty of our mind connected to the core of the general rationality is out of reach for scientific discourse. Another argument will be the adopting of logic and computer science and practical result that formalizing the human rationality brought for practical science. The fail of the logic as the science seems to reflect the Mill's criticism of scholastic logic. But even then there were people who protected it and now we are talking about science that includes mathematical logic which proved it's effectiveness in opening new unexpected and non trivial truths.

Besides the potential of the cooperation of the disciplines this example also shows that as classical psychologistic discussion was a part of the bigger in scale discussion of the metaphysics of logic today's neopsychologism is grounded into framework of the general discussion of the problem of human rationality. The results of the experiments can be interpreted in the other framework of rationality, the minimum rationality where they can make more sense. The prehistory of the issue is vitally important as the today's discussion though fueled by new empirical material it is still the continuation of the classical discussion which started among NeoKantians and centered around the distinction between transcendental and empirical in mind.

To show how the conceptions of the psychologism can answer the classical psychologism criticism we should classify this criticism and emphasize the main points. Frege's and Husserl's arguments can be divided into two big categories – the ones that relate to Interpersonal Incoherence and the ones that relate to Personal Incoherence.

Interpersonal Incoherence breaks into following points. First admitting psychologism means completely destroying the objective truth. There will be no truths

only different points of view and judgments like "It seems to me that" if the complete reduction to the mental states will be incorporated. This immediately brings the second point of breaking the necessity judgments which will of course affect the communication between the individuals. If there are only points of view with no epistemological ordering of them we will not be able to find any epistemological shared ground which is the foundations of our communication. We have disagreements and discussions as the part of our everyday discourse but even they are possible only if we have some common area of agreement. Thus when discussing nature of a number we agree that there is such thing as a number in that or that form. We can help the psychologists here stating that there are some things that everyone believes and that these things should serve as the common ground. This brings us directly to the next problem. The common agreement about something cannot serve as strong universality especially in the sphere of logic and mathematics.

According to criticism common agreement is not universal enough. This concludes the next problem – the problem within the psychologism itself. If the mental states are producing normativity how can these norms be consistent if according to previous reasons there is not interpersonal normativity – no obligatory "ought" relation. Universality as an agreement remains a completely descriptive thing. If we adopt the psychologistic conception that Mill proposes – admitting that all the formal systems are based on particular atomic propositions it brings the next problem. If it is really so than the content of simple mathematical notions like a number "5" will differ from individual to individual which again makes a rational discussion and mathematics as a science impossible (Frege 1884). This again means that the communication even not scientific but simple everyday communication will be impossible. As a sum result of these problems there can be no disagreement or agreement about anything in the epistemological discourse including especially mathematics.

Personal Incoherence breaks into next problems. The first is similar to the mentioned earlier normativity problems but now applies to an individual mind (Husserl 1900). Any logical law on the individuals' psychologistic grounds will remain a descriptivist thing. It brings all the normativity problems described earlier but also a new one. If the logical law is descriptivist we cannot establish any ought relation even within the individual's mind. We cannot state that mental state A is better than mental state B and that is why the content of the first mental state is a logical law and the content of second is a logical mistake. This also means the lack of any personal necessity – an individual cannot say that at any point of its stream of consciousness there is a mental state that describes the logical law because it can be negated by any other mental state. Which of course can be

called a complete relativism. With all the things described it can be concluded that personal relativism of this form is self-contradicotry because in the space where all the laws are relative it tries to establish itself as a law.

A part of these two big groups of arguments there are some that touch logic and psychology directly as sciences. First of all it is the incompleteness objection – the statement that there are features of the formal systems that are not adequately represented or not represented by mental states at all. Take the notion of completeness or consistency – how can we state that these are the details of our mental states if we reason mostly in incomplete and inconsistent environments and formal systems that have these properties are the relatively rare and separate case. This can be answered that while classical logics indeed possess many features that are not directly analogous to psychological mechanisms 1) there some that are actually analogous 2) there are non classical logics that are built on the purpose of simulating certain psychological features of humans 3) it is not the fact that consistency and other similar features is not a deeply integrated in our cognition mechanism.

The next problem is the exactness objection. According to it the laws of logic and mathematics are exact so they cannot be derived from the inexact laws of psychology. This is of course very debatable in the contemporary logical discourse. As was few times mentioned there are already fuzzy logics built on the inexact principles and some of the spheres of psychology use exact mathematical methods and experiments. Besides that the very statement itself is not quite right. Why do we presume that inexact laws cannot produce exact cases? This is actually the way mathematics and logic were designed from the everyday thinking. The inexact and blurred object usually is bigger in content than an a precise and exact one. It means that you can make an exact object from inexact without loosing content but not the other way round. It logically follows from it that you actually can produce exact logic from inexact psychology – which is proved by new theories both in mathematics and cognitive science.

The next problem concerns the ontology of the psychological logic comparing to formalistic logic. If we take the psychological laws to be prior to the pure logical their implications bring much more premises and existence of certain entities. Every of these entities is in the need of additional justification. Another question is whether the reduction to the mental states in effective in the light of the fact of a more rich ontology – things we need reduce to must be more fundamental which usually means more simple.

However as was claimed before the reduction in its crude sense is a feature of the classical psychologism. Neopsychologists firstly do not strive to complete such a reduction

and secondly the notion of the supervenient relation both between sciences and mind and matter are seen in the different way since those times. It should not be obligatory more fundamental in the sense atoms are more fundamental than the matter. Logical laws can be the modus of the mental state fulfilling the psychologistic doctrine while mental states in general can be more complex and serve to sustain other functions as well.

The next problem also concerns the reduction issues. It is claimed by critics that it is not logic that presupposes psychology but rather psychology as a science presupposes logic. With this view we admit that understanding the psychology already involves some methodological principles that are taken from logic. But this is very wide – logic and its laws applies to numerous objects and relations of the world and if we would take to serious there will be no think in the human epistemology that does not borrow from logic. The issue can be viewed from the other point of view as well – we can assume that there are not exactly sciences of logic and psychology in consideration but rather the domains of them – mental states and logical laws respectively. In the framework of the psychologism it will mean that certain specific mental states with logical laws as their content that define the cognitive function in general and we can speak of the psychological mental states only thanks to those mental states. It has a relation to mentioned previously language of mind theory and its connection to the theory of the mental representations. In this sense the anti-psychologistic argument begins to work against its own doctrine. If logic presupposes psychology than there is special psychology-based language on the level of which we provide our mental operations.

The question of the content of the logic being incorporated into the content of psychology also relates to the so called folk science and folk logic. In the previous paragraphs it was mentioned that folk elements being alternative or being incorporated to the "main" science is a big issue for philosophy of logic. It even makes some researchers claim that logic is just a a part of the more general ability we learn in childhood. So for example it is the part of the language learning and logic is the set of rules incorporated into the grammar of the language.

But nevertheless even without a part of this theory the whole critical argument seems too weak. The supervenience relations between the sciences is a subject for methodology and philosophy of science and there are many researchers in this sphere who will say that reduction of psychology as science to logic as science is possible (Kim 2003). And the assumption with the content leads to many radical implications. We for example would have to re estimate all the sciences and the relations between them.

Next counterargument is historical and similar to the famous Locke's passage about native rustic reasoning. It states that logical reasoning and rationality existed long before logic appeared as a science. It is again the argument about folk logic and the question of its relation to the formal science. If to answer just historically we may say that the whole civilization with all sciences actually appeared not so long ago on the general historical scale. There were some elements of sciences that were used by ancient people and only some time later they formed the particular sciences.

The possibilities of these protosciences were limited nad this changed gradually when the empirical knowledge was finally formed into the framework of the independent science. In this sense logic is many centuries older than psychology which makes the whole critical argument unsound. In general there is nothing that compromise logic in the fact that some sciences were existing as unorganized knowledge and effectively used before emerging as real sciences. A part from that the whole argument seems to be attacking the scholastic logic. It is not to much to say that thanks to Frege the science of logic was reborn into completely new one. As was mentioned earlier the structure and the results of mathematical logic differs greatly from classical set of syllogisms of the scholastic one.

The last problem is again the descriptiveness of the psychology as a science. In the previous paragraphs the notion of description was applied to other person or the particular individual to deny the authority of the normativity provided by them but now it applies to the whole science. Psychology is not authority for the purposes of reduction because of its general descriptive nature. This argument can be questioned in two ways. First of all is psychology really descriptive in a sense relevant for logic? Especially in the framework of cognitive science and modern neopsychologism when mental states have completely new ontological status comparing to the classical psychologism. Secondly the descriptiveness does not automatically mean psychology cannot be foundation of logic. Compare to notion of the natural science which also descripts the facts but can serve as the epistemological foundation for other levels of scientific cognition.

The obvious main weakness of the general argumentation consists in the way critics present their anti-psychologistic argumentation. They seem to point that the logical notions cannot be based on metal state because they are objective and exist in the special third realm. But they never give an explanation or enough strong defense of this platonistic reality of their own theory. The attack on their psychologistic enemy is strong but the backup of their own ideology is weak (Husserl 1910) . In contrast one of the most powerful points of criticism is the charge in the relativism. Radical reduction of the logic to the

mental states makes science seem vague and subjective. First what comes to mind is that the proponents of the psychologism can state that relativism is just as things are and thus is true. All the critical arguments of the Frege and Husserl can be explained in a way that they are growing from the general relativism of the issue. Mill adopts some of the elements of it while theorizing about mathematics.

The expected danger of the relativism is a methodological principle of a philosophical doctrine. In philosophy of logic though it bears some practical implications as the relations between formal systems and their semantics are philosophical questions and philosophical details will have serious technical implications. If at the time of flourishing it was psychologism who won the battle we would have a completely different logic today. Adopting certain kind of the relativism for the psychologism is close to the cognitive architecture theory of the neopsychologistic discourse. The discussion about contingent and necessary truths intersects with the discussion about relation between the conceivability of the thing and its ontological status. Cognitive architecture theory assumes that the structure of our brain has a direct dependence-relation with the empirical data of the outer world. The first thing from the previous discussion that comes to mind in this context is the Frege's attack on Mill's conception of the number (Frege 1884). He states that number cannot base on the aggregate of things as it is impossible to find such aggregates for the very big numbers. This automatically led to the conclusion that mathematics cannot be based on mental states. As was mentioned in this passage neopsychologism can answer this argument on completely new grounds comparing to classical psychologism.

One of the possible answers is the cognitive architecture theory. Cognitive architecture is the theory that sums up the main features of the cognitive psychology of the individual and tries to build a computational model for it using existing machines. The theory presents mental states as the computational states of the machine with all the relevant implications. Cognitive Architecture theory can be teleological. According to this version the mechanism of the mind should be understood in the context of conditionals in which it operates. So the different modules of the brain are aimed at the same goal like social dominance or mating success. For the purposes of the formal systems foundations examination it makes mathematical and logical statements strictly dependent upon the agent's mental status. So the normative power of logic is established because everything in the brain serves one common goal – telos. The theory may differ basing on the nature of the telos. So for example early religious philosophers considered God the ultimate source and aim of all the being and this telos defined the connection between mind and reality in

Descartes' fashion. God is the reason why mathematical and logical ideas of people have the same content. Contemporary theorists though use the idea of evolution instead of the God as the driving reason. Evolutional process made the content of formal systems so the human population can use it and it correlates to the reality.

The theory originates from the artificial intelligence but has it's influence for the cognitive science in general. Using the empirical data and the philosophical theory of cognitive architecture about the conception of mind and the environment neopsychologists may state that mathematical abilitites of a human being influenced by a nature are the adequate representatives of the objective needs of the nature. This can play in support of the classical Mill's view about aggregate of things. Followers of Frege may still disagree giving the infiniteness of the possible numbers as the main argument.

The neopsychologists may answer that the idea that mind can provide only with finite structure is actually old and not argumented and that it's architecture allows to combine elements to build infinities. We can have an analogy with computer science and a computationalist theory of mind here. Turing machine can create the infinite structures and human mind is capable of everything which this machine is capable of (Edelman 2008). According to computationalist theory of mind brain is just a biological machine so it can imitate the Turing machine and so it is capable of creating the infinite structures in question. This is the perfect example of neopsychologistic modern approach being used to solve problems that seemed deadly for the classical psychologism. The neuroscience's data helped to answer one of the important philosophical critical arguments.

It should be emphasized that the main classical criticism is against the psychological individualism – the idea that mental states of the individual are the true basis for logic. As was mentioned there exists also psychological descriptivism – idea that the true basis of logic are the mental states of the group of people. It is based on behaviorism as philosophy of psychology and is proposed by anthropologists. According to this method we observe the actions of the community of the individuals and deduce the relevant mental states. It is obvious that most of the criticism presented above becomes inapplicable. There are some new philosophical problems with this doctrine though. Interpersonal Incoherence for example does not apply anymore as there is a common ground for agreement – mental states of the appropriate majority of the individuals. The main problem of the method is defining this appropriate majority. How can we differ from the normal individual and abnormal? We may say that group of abnormal individuals in society receives a special status – they are put into prisons or jails. But is it really such a strong argument? What

about deviant societies? It is evident that the criterion of normality differs from society to society. So, eventually we will face the intersocial incoherence instead of the interpersonal.

This does not mean the complete defeat of this particulat neopsychologistic conception as well as the neopsychologism in general. It just means that the anthropological criterion is too wide and ambiguous to be the only parameter that defines the required mental states. The most valuable idea of the psychological descriptivism is defining the central notion of the environment which is now a mental representation and not the mental state alone and creating the complete epidemiology if this sort of thing. This is the obvious connection to the representationalist theory of mind again considering representations to be the key to solving problems with psychologism. Mental representations exist both in the brains as the informational structures on which the mind operates and in the environment of our brains.

Another possible application of neopsychologism is using contemporary psychological experiments to solve the mentioned few times problem of folk logic. We can test a group of people on whether there are the common mental states associated with the modus ponens rules or other formal entities. Than we will see whether the distinction between societies analogous to the distinction within persons really holds.

So it is shown how the conceptions and idea of the neopsychologism can be applied to answer the criticism against old psychologism.

Conclusion

As was stated in the introduction the work presents the core of the classical psychologism, the formalists' criticism against it and explains how the contemporary neopsychologistic ideas can help to resolve the classical difficulties. The work is important and interesting due to several reasons.

First of all it employs the neopsychologistic ideas to solve the Frege's critical arguments which was not presented by anyone earlier and thus producing original scientific idea. So the work is novel.

Secondly the importance of psychologism – the central topic of the thesis – is emphasized in connection to the project of the global philosophical naturalization by such scientific titans as Quine. So the thesis relates to the big problems of the contemporary philosophical discourse.

As was stated the revival and reconsideration of the psychologistic doctrine can have serious implications for cognitive science and artificial intelligence. So the work is relevant for the scientific activity in the other disciplines as well as in the interdisciplinary discourse.

How the work should be interpreted and developed? Cognitive science and AI era brings new horizons for logical science. The old problems of the psychologism have mostly metaphysical and methodological character so if we resolve it adequately we can reopen a whole doctrine. This can bring new results first of all in the formal logic itself. New calculuses and new semantics is the natural result of this new philosophy of logic.

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