ROBERT KUBLIKOWSKI

DEFINITIONS AND THE GROWTH OF KNOWLEDGE:
THE MAIN IDEAS*

Are definitions useful in an empirical knowledge-gaining process? What roles do definitions play in the process of the growth of empirical knowledge? Two attitudes towards definitions can be distinguished in the history of the theory of definitions. According to the first and positive one, definitions have been useful in science. The second attitude has been a critical one.

I try to defend the view about the usefulness of definitions, on the one hand, by application of Hilary Putnam's theory of reference of natural kind terms. On the other hand, Karl Popper's fallibilism is implemented to the theory of definitions, especially to the theory of real definitions.

The structure of this text is as follows: (I) the origin and the development of the theory of definitions, (II) Popperian antidefinitionism, (III) the theory of definitions and the Putnamian theory of meaning and (IV) the theory of stipulative, lexical and persuasive definitions.

I. THE ORIGIN AND THE DEVELOPMENT
OF THE THEORY OF DEFINITIONS

The known reflection on definitions began with Aristotle.[1] He distinguished two types of definitions — of a *thing* and of a *name*. The definition of a thing was acknowledged as the most important one. It was called the *real definition* by *genus* and *differentia* (the *genus-differentia* definition). Its

ROBERT KUBLIKOWSKI, PhD — Assistant Professor, The Department of Methodology of Science, Faculty of Philosophy, The John Paul II Catholic University of Lublin; associate member of the Faculty of Philosophy of TN KUL; address: Al. Racławickie 14, 20–950 Lublin, Poland, e-mail: robertk@kul.lublin.pl

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[1] The ancient, medieval and modern history of the theory of definitions see: KAMIŃSKI 1955-57; 1958a; 1958b; 1992; 1994; 1997. See also BOCHEŃSKI 1961.

goal is to fix the class of objects—so called the *species*-class—in other words, the extension of the term which is being defined (*definiendum*). The definition is built by characterising a large class of objects (the *genus*-class), which consists of the extension of *definiendum* (the *species*-class) and some other *species*-classes. In order to obtain such a definition one needs to distinguish *definiendum* and some other *species*-classes by giving the specific feature, characterising exclusively the objects belonging to *definiendum*. The classical example is: Man is a *rational animal*, where "man" is the name of the *species*-class, "animal" is the name of the *genus*-class and rationality is the *differentia*, that is the important feature which characterises only objects of the *species*-class.

Such a definition was believed to fix the essential qualities of a class of things (Socrates, Plato, Aristotle). Such a standpoint is called the *methodological essentialism*. According to Aristotle, the essential definition can be obtained by the method of *induction* (*epagoge*) and *intellectual intuition*.

The Aristotelian opinion on the role of a real definition in his concept of scientific knowledge can be interpreted in either a radical or a moderate way. The Aristotelian theory of science, strictly speaking, his theory of a scientific knowledge (epistemology) is maximalist. In other words, the goal of the cognitive process is to gain knowledge (*epistéme*) understood—in a maximalist, absolutist way—as *true* and *absolutely certain* beliefs. Such knowledge was believed to be fixed *once and for all*. So, if the scientific beliefs are justified by *true and completely certain premises*, placed in a *formally correct* syllogism, then beliefs—obtained in this way—also belong to knowledge (*epistéme*), so they are *absolutely certain* (*infallible*). According to Aristotle, real definitions by *genus* and *differentia* are premises in such syllogisms.

The Aristotelian epistemology can also be interpreted in a moderate way. According to this interpretation, Aristotle divided knowledge into *doxa* and *epistéme* which can be understood, on the one hand, as *really obtainable* scientific knowledge and on the other hand, as *idealised* scientific knowledge. Perhaps Aristotle believed that such idealised knowledge is not really possible to get, but it is only the *theoretical ideal* which directs our cognitive process.[2]

Apart from a real definition, Aristotle knew also a *nominal definition*. Its goal is to clarify the meaning of a word (see also Euclid).

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[2] KWIATKOWSKI 1969. See also CHARLES 2005.

Ancient thinkers, especially the medieval ones, were more and more conscious that real and nominal definitions were linguistic-cognitive formulas. (But their subjects and goals are different: real definitions characterise classes of objects and nominal definitions characterise the meanings of words.)

Medieval logicians and philosophers generally accepted the Aristotelian view of definitions, but their interest in a nominal definition was gradually increasing. The theory of definition was developed by the explication that a real definition has two forms: a *real essential definition* by *genus* and *differentia* (in the Aristotelian sense) and a *real descriptive definition* (mentioned earlier by Cicero), which was to fix the *non-essential*, but characteristic features of a kind of things.

In modern times some philosophers like Thomas Hobbes and others were critical towards the Aristotelian concept of a real essential definition. Yet, Hobbes' criticism was radical in theory and moderate in practice. Namely, he accepted nominal definitions understood as *abbreviations*, but their form was identical with the form of real definitions. Hobbes enriched the theory of definitions by the notion of a *stipulative definition*, which introduces a new word into a language; a *precising definition*, which clarifies a vague meaning of a word and a *lexical definition* (a *dictionary definition*), which delivers the actual meaning of a word.

Blaise Pascal also preferred a nominal definition to a real definition. For a nominal definition was applied in geometry, which was the ideal for the whole science. Antoine Arnauld and Pierre Nicole accepted the traditional, classical theory of definition. John Locke was not sure whether the cognition of essential features of things was possible and consequently, whether real essential definitions were obtainable. Gottfried Leibniz, Immanuel Kant, Joseph D. Gergonne and John S. Mill began to characterise a real definition not as *true*, *certain* and *full*, but as *fallible*, *partial* and *developing*.

II. POPPERIAN ANTIDEFINITIONISM

Karl R. Popper[3] was an *anti-essentialist* and *anti-definitionalist*. That is why he criticised the cognitive role of Aristotelian real essential definitions and their usefulness in empirical sciences. Aristotle believed that the intellectual intuition justified the *adequacy* of such definitions. Popper called

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[3] POPPER 1979; 1994; 2002a; 2002b; 2002c; 2003a; 2003b.

them *essentialist definitions*. He claimed that intuition was useful only in the process of obtaining and testing *fallible hypotheses*. So he acknowledged only a *heuristic role* of definitions. It seems that there is no possibility to justify the claim that things have essential features. That is why he rather ignored the issue of the existence of the essential features and the usefulness of *essential definitions* in the procedures of *scientific explanation*. This point of view is called the Popperian *methodological anti-essentialism* or the *modified essentialism*.

Nevertheless Popper claimed, that a real definition — but not an essential one — played a useful role as an *abbreviation*. Such a definition allows to use a short name (*definiendum*) instead of a long *description* (*definiens*) of an example representing a group of empirical objects.

This type of a real definition has an identical form as a nominal definition. They differ in their roles. Namely, the role of a real definition is to deliver the verbal characteristics of objects and not only the verbal characteristics of the *meaning of words* as in the case of a nominal definition. But in fact the characteristics of objects and of the meaning of words are interconnected.

III. THE THEORY OF DEFINITIONS
AND THE PUTNAMIAN THEORY OF MEANING

It is useful to apply Hilary Putnam's[4] *theory of reference* to the theory of definition, especially to the theory of a real definition. Namely, the role of its *definiendum* is to designate of something or someone. In other words, *definiendum* is used as an expression which has a *relatively stable reference*.

The Putnamian theory, which is applied here, aims at explaining how it is possible to give meaning to terms, including the scientific ones. This process runs as follows: the first step is that, on the basis of observation, people introduce terms to their languages, including natural kind terms. Such terms designate the observed empirical objects, which belong to natural classes (i.e. to classes in nature, in the world). Such a procedure of designating (a *naming ceremony*) is done in an *introducing event*.

Ostensive definitions and *descriptions* (descriptive definitions) are useful methods in this procedure. The first use of a natural kind term — by pointing out an object — fixes a *causal-historical chain*, which connects the usage of

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[4] PUTNAM 1975; 1979; 1981; 1983; 1987; 1988; 1990; 1994.

the term in the introducing event and all other future uses of that term. That is why according to the presented theory, a natural kind term has a relatively stable reference. The meaning of a term is fixed not only by a causal-historical chain of usage of the term, which refers to its object, in fact, to the class of objects. The component of its meaning is also the *intention* of users of this term (of the first user and of the subsequent ones). Their intention is to talk about the same objects, for example, the samples of a lemon, which belong to the extension of the same natural kind term "lemon."

Empirically obtained descriptions and the theoretical definitions fixed on their basis are only *approximately correct* (*adequate*) and *definite* (*complete*) *descriptions*: some of them are not correct at all, some are less or more correct. Average users of a language can compare their descriptions of objects (descriptive definitions) with the official, standard descriptions (*stereotypes*) delivered by experts. That is why the meaning of natural kind terms like "gold," "water," "acid," "lemon," "tiger" *etc.* is fixed within a community in which there is the *division of linguistic and cognitive work* (*roles*). There are some other components of the meaning of such terms: a *syntactic marker* (mass noun, concrete *etc.*), a *semantic marker* (natural kind) and an *extension*. If these additional components are taken into account then the causal-historical theory of reference becomes the causal-historical-sociolinguistic theory of reference.

The application of the Putnamian theory of reference of natural kind terms explicates the problems of the traditional theory of definition, especially the theory of a real definition. First of all, the traditional theory does not explain how *definiendum* and *definiens*, which contains the description of a class of objects, refer to these objects. But the Putnamian theory helps to solve this problem. Secondly, a real definition is also problematic because the general name, which is introduced in an ostensive way, for example, the natural kind term "lemon" — may be connected with a sample which is not representative for the defined class of objects. Such a case occurs if an unusual, nonstandard sample is taken into consideration. In this situation a definition would not refer to standard, normal lemons, but to abnormal ones.

The Putnamian theory of reference is connected with his essentialism: the essence of a class of things is a feature which is important and useful in science. It is the important feature because all the other features depend on it. Discovering of essential features is useful in the procedure of explaining things (how they react or behave *etc.*). But Putnam distinguished the relative essence of a class of things, the essence which partially depends on the implicit structure of things (*the contribution of the environment*), and partially

on the human, cognitive points of view, needs and interests. It can be noticed that it is not the Aristotelian type of essentialism.

The application of the Putnamian theory of reference of natural kind terms to the theory of definition helps to notice the specifics of the Aristotelian theory of a real essential definition. The Aristotelian name of the *species*-class (*definiendum*) is not the same as the Putnamian natural kind term. Putnam did not write *explicite* about the nesting of the *species*-classes in the nearest *genus*-classes or about the hierarchy of *all* objects divided into *species*-classes belonging to the nearest *genus*-classes. He just mentioned the names of biological species as examples of natural kind terms. But he understood a "natural kind term" in a broad sense, as more general than a "name of a biological species." Namely, the natural kind terms are also names of chemical elements or acids *etc.*

Putnam, like Popper, questioned that the intellectual intuition played the role of justification in the cognition of the empirical objects which are designated by natural kind terms. But Putnam gave a different argument supporting the claim about the existence of essential features and natural kinds. Namely, there are some descriptions (stereotypes) of natural kinds in our languages. Such descriptions (descriptive definitions) are the *obligatory* ways of *conceptualisation* in a linguistic community. If all descriptions or the majority of them were not adequate, then the communication would not occur. But in fact, a relatively successful and fluent communication occurs. So — on the basis of *modus tollendo tollens* — at least some of such descriptions (descriptive definitions) are adequate.

There is another argument for the existence of natural kinds. The growth of science is an unquestionable fact described in the history of science. One of the causes of this growth is the acceptance of the assumption about the existence of natural kinds. Such assumption is useful in the procedure of relatively correct scientific explanation of past facts and also in forecasting the future (Putnam, Richard Boyd,[5] Hilary Kornblith[6]).

A difference can be noticed between the traditional theory of definition and the contemporary one.[7] On the basis of the texts of such contemporary philosophers as Popper, Putnam or Anil Gupta[8] it is possible to form a claim

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[5] BOYD 1991; 2000.

[6] KORNBLITH 1993.

[7] ROBINSON 1950; GORSKY 1981. See also WEINGARTNER 1989; 1991; FETZER, SHATZ, SCHLESINGER 1991; DAVID 1993; WIGGINS 2007.

[8] GUPTA, BELNAP 1993; GUPTA 2006; 2011. See https://plato.stanford.edu/entries/definitions. See also CHAPUIS, GUPTA 2000; KUBLIKOWSKI 2005; 2009; 2016.

that definitions play useful, linguistic and cognitive roles, but they are not real essential infallible (certain) definitions, fixed once and for all. They are fallible definitions which are subject to revision and change in the context of further growth of empirical sciences.

The proposed theory of definition is dependent on the twentieth century fallibilistic philosophy of science (epistemology). The change of the account concerning science has caused the change of the theory of scientific method and knowledge. That is why the theory of a definition has also been changed. According to epistemological fallibilism, beliefs and scientific theories may be revised, changed, modified, or even falsified (refuted). That is why definitions, including real definitions — used in scientific, empirical theories — may also be subject to revision and change. An example of such a process is the revision of the definition of a chemical element[9] or of an acid,[10] described in the history of chemistry. Revisions are caused by the fact that not all information about objects and their features—including the features acknowledged as essential ones—is available in a specific period of the growth of science. That is why new data correct scientific definitions. Definitions are accepted as adequate (true) and useful in the context of the actual state of empirical knowledge. The acceptance of this or that definition is made from the fallibilistic point of view: the previous definitions were formed and accepted because of the previous knowledge. They were subject to revision in the context of a new knowledge. Fallibilism suggests being critical and careful towards the present and future scientific, empirical theories and definitions as they may also be revised and changed. That is why they should not be acknowledged as definite, absolutely certain and unchangeable ones.

In the traditional theory of definition objects like gold, water, lemon, tiger are defined by fixing in a *definiens* a description expressing the features of the objects. So a definition, for example, of a lemon would be like this: A lemon is a fruit with a yellow colour, a thick peel, a sharp taste, a specific DNA (from a biological point of view) *etc.* But Putnam questioned such a description because it was not complete. That is why such a definition cannot be acknowledged as a full definition. It is not fixed once and for all. The *definiens* of such a definition characterises only partially its *definiendum*. The solution of this difficulty is to see this formula as a partial definition[11] under-

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[9] See e.g. https://www.britannica.com/science/chemical-element.

[10] See e.g. https://www.britannica.com/science/acid.

[11] In the case of a partial definition understood in a broad sense its *definiens* characterises its *definiendum* only in a partial way. Such a *definiens* does not describe all, but only some objects belonging to the *definiendum*.

stood in a broad sense. It is adapted to an actual, but changeable state of empirical research.

According to the proposed concept, the scientific, theoretical definitions are not full (complete), but partial in a broad sense. It is caused by the fact that the discovery of the features of empirical objects is a difficult, perhaps unending process. It is not possible to obtain an adequate and *complete* knowledge about empirical reality. In other words, it is not possible to get to know *all* features of the objects of a class. Theories, including definitions, are tested in the context of new research and if it is needed, they are changed — completed, corrected or refused.

IV. THE THEORY OF STIPULATIVE, LEXICAL AND PERSUASIVE DEFINITIONS

The role of a real stipulative definition[12] is to introduce an expression (*definiendum*) into a language. If such a *definiendum* is a general term, strictly speaking a natural kind term, then it has a reference. Such a *definiendum* is also a *notational abbreviation*. It is handy, useful and arbitrary in the aspect of its *graphical form* (shape). The *definiendum* is handy because it is shorter than the *definiens* containing a partial, actual scientific description of a class of objects. (This standpoint was called by Popper as defining "from the right to the left"). The definition understood in this way is cognitively useful because it is the element of a theory which plays an explanatory role in science. The form of such a *definiendum* is arbitrary. Namely, it is up to someone to use a particular graphical form as a *definiendum*. For example, instead of the English term "lemon" to designate objects traditionally called in English "lemons," a different graphical form could be used, let us say, "ABC." But the definition of a natural kind term "lemon," in other words, the description of lemons, is not arbitrary. It is based on experience, on a reliable and actual biological knowledge concerning the class of objects traditionally called "lemons."

If a real stipulative definition is introduced into a language, then it becomes a lexical (dictionary) definition. Its role is to characterise an actual meaning of a word fixed on the basis of actual empirical research (Popper called it defining "from the left to the right"). But it is important to remember that such a real lexical definition — belonging to a scientific empirical

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[12] AJDUKIEWICZ 1958; 1960; 1974; 1984; 1985a; 1985b. See also MATTHEWS 1998.

theory — is fallible, so it may be revised and changed in the context of further empirical research and discoveries.

Natural kind terms are only syntactical, but not semantical abbreviations for the most reliable scientific descriptions. In other words, such definitions are not analytic sentences — in which there is the meaning equivalence between *definiendum* and *definiens*. The introduced natural kind terms (*definiendum*) are not synonyms of scientific descriptions (*definiens*). Such descriptions are only approximately adequate. They are fallible and partial. That is why the full extensions of natural kind terms are not known. Their meanings (extensions) are modified in the course of successive empirical research.

The fact of revisions and changes — modifications or refutations — of real definitions may raise an objection that such definitions are just nominal persuasive definitions which depend on an actual social context: actual cognitive needs or practical interests (Edward Schiappa[13]). But it is important to emphasise that such definitions are formed on the basis of the most reliable and actual empirical knowledge (see Douglas Walton[14]). Revisions of definitions are caused by the factor that human methods and knowledge are fallible according to the fallibilistic philosophy of science.

CONCLUSIONS

To sum up, the main historical and systematic accounts of definitions have been presented, analysed and explicated. A new view of definitions has been also proposed.

In the outline of the history of the theory of definitions I have put in order the standpoints of the philosophers who have accepted the use of definitions and those who have been critical towards definitions.

The Putnamian philosophical semantics of reference has been applied to the theory of definition and in this way I have emphasised the relationship between the theories of meaning (reference) and definition.

I have also explicated and stressed the connection between the theory of definition and the epistemological distinction: *infallible* and *certain* beliefs (*epistéme*) *versus fallible, uncertain* and *probable* beliefs (*doxa*). In the main claim — a *leitmotiv* of this text — I have argued that definitions have played

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[13] SCHIAPPA 2003.
[14] WALTON 2001; 2005; 2008; WALTON, MACAGNO 2008; MACAGNO, WALTON 2008a; 2008b.

useful linguistic and cognitive roles. Nevertheless, such definitions are not real essential *infallible* and *completely certain* definitions, fixed once and for all, but they are *fallible*. They are subject to revision and change in the course of the growth of empirical science which is described in the history of science.

Casimir Ajdukiewicz claimed that the extensions of the expressions "real definition" and "nominal definition" overlapped. The explication of the claim showed that it is impossible to put these definitions in order by means of classification. In this context some relationships between different kinds and types of definitions can be distinguished. Namely, real or nominal definition can be full or partial and they can also be stipulative, lexical or persuasive.

I have worked out the concept of a real stipulative non-arbitrary definition. Its role is to introduce into a language a new expression which has its reference. The result of such a definition is a synthetic sentence. On the other hand, a nominal stipulative arbitrary definition — a meaning postulate — delivers an analytic sentence into a language.

A stipulative definition — after its introduction into a language — becomes a lexical (dictionary) definition, which can be a synthetic sentence (a real lexical definition) or an analytic sentence (a nominal lexical definition).

I have also explicated the distinction: a manipulative definition *versus* a non-manipulative persuasive definition.

The proposed view is the attempt of a contemporary, new look at the traditional theory of definition and it can be helpful for linguists, psychologists, sociologists or philosophers of language and science and also for those who are interested in semiotics, methodology and epistemology.[15]

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[16] An extensive bibliography concerning the topic of definitions see KUBLIKOWSKI 2013.

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