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The Role of the Notion of a Proper Answer in the Logic of Questions: Methodological Remarks and Postulates

Rola pojęcia odpowiedzi właściwej w logice pytań. Uwagi i postulaty metodologiczne

Abstract

The remarks in this article mainly concern the role of the concept of the so-called "proper answer" in the logic of questions. The purpose of these remarks is to justify the postulate of basing any logic of questions on a conception of the structure of questions and answers, in which the notion of a proper answer is strictly defined. This postulate is addressed to any logic of questions, although it is mainly supported and illustrated by analyses and comparative remarks referring to conceptions based on Ajdukiewicz's theory of questions and to recent presentations of Inferential Erotetic Logic (IEL). The analyses confirm that the concept of proper answer is fundamental in theories of questions, as it is assumed in the definitions of almost all concepts relating to questions and answers. In Ajdukiewicz's conception, it is used explicitly, for example, in the definitions of the conditions of proper questioning and of complete and exhaustive answers. In IEL, it appears explicitly in the definitions of the sound question, the notion of the presupposition of a question (and its

variations), the relations of evoking a question (by a set of declarative sentences) and implying a question (by another question), etc. This basic concept should therefore be well defined. This postulate applies especially to such theories of questions in which claims concerning questions and answers are proved in symbolic language – as is the case in IEL, which, however, lacks a strict definition of the concept of proper answer (there are only vague, pragmatic definitions formulated in natural language). There is, however, the idea – adopted by Ajdukiewicz as well as in the conceptions referring to him – that is closer to a good definition of the proper answer, namely that a proper answer is one the structure of which is determined by the scheme of the question structure. However, this idea should be complemented by an accurate and general conception of structure of questions, which is lacking in the existing theories. In order to confirm the validity of the formulated postulate, references are also made to some new results achieved in the theory of questions, in which Ajdukiewicz's ideas are developed and supplemented by a full account of the structure of questions and the notion of proper answer defined in a general and strict way.

Abstrakt

Zawarte w artykule uwagi dotyczą głównie roli pojęcia tzw. odpowiedzi właściwej w logice pytań. Celem tych uwag jest uzasadnienie postulatu oparcia jakiejkolwiek logiki pytań na takiej koncepcji struktury pytań i odpowiedzi, w której pojęcie odpowiedzi właściwej jest ściśle określone. Postulat ten jest adresowany do każdej logiki pytań, choć jest on poparty i zilustrowany głównie analizami i uwagami porównawczymi odnoszącymi się do koncepcji opartych na teorii pytań Ajdukiewicza oraz do najnowszych ujęć inferencyjnej logiki erotetycznej (IEL). Analizy potwierdzają, że pojęcie odpowiedzi właściwej jest podstawowe w teoriach pytań, jest bowiem zakładane w definicjach niemalże wszystkich pojęć odnoszących się do pytań i odpowiedzi. W koncepcji Ajdukiewicza jest użyte wprost na przykład w definicjach warunków właściwego postawienia pytania oraz odpowiedzi całkowitych i odpowiedzi wyczerpujących. W IEL występuje wprost w definicjach: pytania trafnego, pojęcia założenia pytania (i jego odmian), relacji ewokowania pytania (przez zbiór zdań oznajmiających) i implikowania pytania (przez inne pytanie) itd.

Dlatego to podstawowe pojęcie powinno być dobrze zdefiniowane. Postulat ten dotyczy zwłaszcza takich teorii pytań, w których w języku symbolicznym dowodzi się twierdzeń dotyczących pytań i odpowiedzi – jak jest w IEL, w której jednak brak ścisłej definicji pojęcia odpowiedzi właściwej (są tylko ogólnikowe, pragmatyczne określenia sformułowane w języku naturalnym).

W stronę dobrej definicji pojęcia odpowiedzi właściwej idzie określenie – przyjmowane przez Ajdukiewicza i w koncepcjach doń nawiązujących – że odpowiedź właściwa to taka, której budowa jest określona przez schemat struktury pytania. Określenie to powinno być jednak uzupełnione o trafną i ogólną koncepcję struktury pytań, której w zastanych koncepcjach brak. Dla potwierdzenia słuszności sformułowanego postulatu, w artykule zaproponowano nowe wyniki osiągnięte w teorii pytań, w której idee Ajdukiewicza są rozwinięte i uzupełnione o pełne ujęcie struktury pytań i dobrze zdefiniowane, tj. w sposób ogólny i ścisły, pojęcie odpowiedzi właściwej.

Słowa klucze: odpowiedź właściwa, struktura pytań, logika pytań, Ajdukiewicza teoria pytań, inferencyjna logika pytań

1. It can be stated that the concept of a proper answer is present in every logical theory of questions. In any "theory", because this statement does not concern solutions to individual erotetic problems, but conceptions that include: types of questions, conditions for good questioning (especially the accuracy of questions), types of answers and the requirements for answers. And it is "present", as this concept is usually not defined directly, often only used, while in more complex concepts indirectly assumed.

Various terms are used in question theories to denote proper answers, for example, "conclusive answer", "principal possible answer", "sufficient" and "just-sufficient answer", "congruent", "exhaustive", "complete", and "direct answer".[1] This concept (ignoring differences in terminology) is used directly, and it is often also assumed without naming, e.g. when it comes to answers to a given question, when any verbal responses to the given question are distinguished from the expected responses. In informal question theories it is taken explicitly in many definitions; and in formal theories, definitions refer to this concept – usually through symbolic notations used in the definitions of successive, more and more complex concepts. To illustrate the various uses and meanings of this

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1   See e.g. [16, pp. 14–15], where there are references to the works from which these different terms come. The opposition *proper answer* vs. *improper answer* used is distinguished from other oppositions: direct (immediate) answer/ indirect (mediate) answer; on-topic answer/off-topic answer (pointless answer); complete answer/incomplete answer; minimal complete answer (not too complete answer)/not-minimal complete answer, adequate answer/inadequate answer [12, pp. 175–246]. [Uwaga redakcji: liczby w nawiasach kwadratowych odsyłają do poszczególnych pozycji bibliograficznych zamieszczonych w Bibliografii na końcu artykułu].

concept, I will point out a few examples taken from Ajdukiewicz's conception of questions and from Inferential Erotetic Logic (IEL).[2]

1.1 In concepts referring to Ajdukiewicz, the concept of the proper answer is clearly visible in the postulates on good questioning and when it comes to the kinds of answers and the conditions answers should meet.   In this approach and the terminology employed we are talking about questions posed properly/improperly. The necessary and sufficient condition for proper questioning is the truthfulness of its so-called positive assumptions (**PA**) and negative assumptions (**NA**): **PA** states that among the proper answers to a given question there is (at least one) a true answer, and **NA** – that there is a false answer among them.[3]

In turn, when it comes to answer distinctions and postulates, the concept of a proper answer appears when: (i) complete answers (called "full" [całkowite]) are divided by Ajdukiewicz into direct and indirect answers: direct complete answers are equated with proper answers, and indirect complete answers are defined as not being proper, but implying the proper answer to the question; and when (ii) so-called exhaustive answers are defined as true sentences from which each true proper answer follows.[4]

1.2 Compared to Ajdukiewicz's conception of questions, IEL is a much more complex and structured theory. Questions and answers formulated in natural language and the regularities observed in the practice of asking questions and answering are reconstructed in a deliberately constructed, symbolic language, the concepts and theorems of this theory being related in terms of definition and proofs. In IEL the concept of a proper answer is most often deemed "direct answer", with the terms "principal possible answer" and "just-sufficient answer" also employed. These terms (one of them) are already visible in relatively simple concepts (definitions), such as the concept of question soundness and question presupposition. By resigning from terms formulated exclusively in the symbolic language of IEL, it can be stated that a question *Q* is sound if,

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2   Since the purpose of this analysis is neither a historical one nor that of furnishing a review of existing literature, references will be limited to Ajdukiewicz's original conception (albeit that it has been employed by many Polish semioticians) and to recent presentations of IFL in [16], [17] and [18], omitting earlier versions of the latter and other theories of questions. Such limited references are only meant to show the role of the concept of a proper answer, and to confirm the accuracy of the postulate of giving a strict definition of this concept in the context of theories of questions.

3   [3, pp. 88–89] – notable in the work quoted is the concept of questions published in [2], the basics of which were published and discussed in the 1920s.

4   [3, p. 90].

and only if at least one direct answer to Q is true;[5] and the presupposition of the question Q is this and only the sentence that follows logically from each direct answer to Q.[6] The concept of a proper answer ("direct") is also assumed in defining the so-called prospective presupposition of the question Q: it is such an presupposition of the question, the truth of which is a necessary and sufficient condition for the soundness of the question Q.[7]

The concept of a proper answer is also a component of more complex concepts, namely the evocation of a question and the erotetic implication. Still resigning from the definitions written in IEL, it can be stated that a question is evoked by a set X of declarative sentences if and only if the truthfulness of each set sentence guarantees that the question Q is sound, but from the set X no specific proper answer logically follows. In other words – if and only if the truthfulness of the sentences of the set X guarantees that the question has a true proper answer, but does not indicate (does not imply) any specific proper answer.[8]

As for the erotetic implication, the question Q' is implied by the question Q in the context of the set X of declarative sentences if and only if the truthfulness of the sentences of the set X and the soundness of Q ensure that the question Q' is also sound, i.e. has a true proper answer; and that each proper answer to the implied question Q' narrows the set of proper answers to the implying question (on the basis of the set of sentences X), i.e. it indicates such a proper subset of proper answers to question Q, in which there is at least one true proper answer.[9] The concept of a proper

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5   See: [16, p. 37, Definition 4.1], [17, p. 35, Definition 11], [18, p. 300, comments to D6]. Wiśniewski indicates 16, p. 37] the work [5, p. 146] as the source of this definition, but this definition was proposed much earlier by Ajdukiewicz as a component condition (**PA**) of correct questioning.

6   See: [16, p. 39, Definition 4.7], [17, p 37, Definition 14).

7   See: [16, p. 40, Definition 4.8], [AW 17, p 37, Definition 15].

8   See: [16, pp. 59–60, Definition 6.1], [17, p. 45, Definition 28], [18, p. 300, Definition 6]. The conditions of the evocation of questions are equivalents of the above mentioned **PA** and **NA**. The first of the conditions defining the evocation relation, i.e. $X \Vdash_{\mathscr{L}} \mathbf{d}Q$, can be considered a translation of **PA** into the language of IEL This condition, developed according to the definition ($\Vdash_{\mathscr{L}}$) and worded in a way that facilitates comparison, states that on the basis of recognized knowledge – i.e. if X is a subset of all the sentences Tp assumed to be true – there is a true "direct" answer $A \in \mathbf{d}Q$, i.e. that (in Ajdukiewicz's terminology) some (at least one) of the proper answers to Q is true. On the other hand, the second condition, namely ($\wedge A \in \mathbf{d}Q$) $X \not\Vdash_{\mathscr{L}} \{A\}$, is a counterpart of the requirement **NA**.

9   See: [16, p. 67, Definition 7.1], [17, p. 47, Definition 29], [18, p. 300–301, Definition 7].

answer is also a component of the definitions of specific kinds of erotetic implications, such as regular, strong and pure erotetic implications.[10]

In the symbolic language used in IEL, the concept of a proper answer is referred to by **d**Q, denoting the set of proper answers to the question Q.[11] The symbol **d**Q appears directly not only in the strict (in formal language) definitions of the above-mentioned concepts, but in almost every directly formulated (and numbered) definition accepted in IEL, except for the definitions of auxiliary concepts. Therefore, it is reasonable to expect that this notion is defined in a strict manner and in the same language as this entire structure.

2.1 However, there is no such definition. Proper ("direct") answers to the question Q are defined in IEL as those of the possible answers which:

„[…] provide neither less nor more information than it is requested by Q. Being true is not a prerequisite for being a direct answer."[12]

Answers called "direct" in [18] are in [17] and [16] referred to as *Principal Possible Answers* (*PPA*):

[A *PPA*] is a possible answer that is "optimal" in the sense that it provides information of the required kind and, at the same time, provides neither more nor less information than it is requested by the question"; [13]

[…] direct answers/ppa's are supposed to be the possible just-sufficient answers, where "just-suffient" means "satisfies the request of a question by providing neither less nor more information than it is requested".[14]

The definitions of the proper answer (variously termed) proposed in other theories of questions are similar to the above cited. In [4], apart from the "informative" characteristics adopted in IEL, there is a requirement to refer to the question in a direct and precise manner; in [8] it is postulated "an answer which would satisfy the questioner if it were true and if he were in a position to trust the answer. By a conclusive answer, I mean a reply which does not require further backing to satisfy the questioner."; in [13], proper answers are understood as sentences that anyone who understands a question should consider as acceptable answers to a given question, and at the same time "the simplest, most natural ..."; and according to [7] the "direct" answer provides exactly what the question demands, and directness means both "logical sufficiency and immediacy". These definitions – quoted in IEL to explain and support

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10   See: [16, pp. 76–77, Definitions: 7.4.1, 7.4.2, 7.4.3], [18, p. 301, Definition 8].

11   See: [16, p. 37], [16, p. 35], [18, p. 297].

12   See [18, p. 297].

13   See [17, p. 4].

14   See [16, p. 18].

the adopted characteristics of proper answers[15] – also do not go beyond the "intuitive" level. The notion of a proper answer is defined in them by pragmatic concepts: understanding a question, satisfaction with the answer, trust in the respondent, recognition of the answer as admissible and natural, no need for further justification, the obligation to consider a sentence as an answer to a given question, etc – are pragmatic ones. The requirement for any given answer to provide exactly ("neither less nor more") the required information, if it has not been made precise, also becomes a pragmatic condition; the conditions of logical sufficiency, directness, accuracy and maximal simplicity ("the simplest") of answers also require semantic or syntactic precision.[16]

The need for precision is already visible on the "intuitive" level. For example, to possible answers to the question

(Q) Who discovered America?
undoubtedly belong:
(i) *Columbus* (ii) *Christopher Columbus* (iii) *America was discovered by Columbus* (iv) *America was discovered by Christopher Columbus* (v) *America was discovered by the son of Domenico Colombo, a Genoese weaver and merchant, born in 1451* (vi) *Vespucci* (vii) *Amerigo Vespucci* (viii) *Columbus in 1492*; etc.

There are doubts, however, as to which of these and many other possible answers satisfy the condition of providing exactly as much information as is required by the question (Q). For example, the answers (i) – (v) are syntactically different, but all indicate the same person. So if the condition "neither less nor more information" were to be met for question (Q) always and only when exactly one person is indicated among all the possible explorers, then each of the answers (i) – (iv) is an element of $\mathbf{d}(Q)$. The same is true for answers (vi) and (vii) for as direct answers these may not be true. However, comparing these answers in the context of the requirement that an answer should not provide too much information, certainly results in the elimination of the answer (viii) from $\mathbf{d}(Q)$ determined in this way; and may also lead to the assessment that this requirement is not met in sentence (iv), indicating Columbus through information about his father – and it is easy to formulate even more complex descriptions, yet ones unequivocally signifying Columbus. In turn, the recognition that for this reason (v) $\notin \mathbf{d}(Q)$ casts a shadow of doubt on the answers (iii) and (iv): do they not provide too

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15   See e. g. [16, pp. 14–15], [17, resp.: p. 16, OA_4; p. 10, A_2; p. 14, A_3; pp. 4–5, A_1].

16   Wiśniewski [16, p. 25] also points to the ambiguity of the concept of a proper ("direct") answer, defined in such pragmatic terms.

much, since they contain information known from the question that it is about the discoverer of America? This information is not (directly) in the answers (i) and (ii), but maybe the information about the first name of the discoverer makes the answer (ii) "redundant"? If so, then only the statement (i) or its full sentence equivalent (iii) is an element of the set of "direct" answers, which – according to the assumption adopted in IEL – is uniquely determined by questions (Q). In turn, the rejection of the answer (v), and the inclusion in **d**(Q) of the answers (i), and (ii) – or (iii) and (iv), (vi) and (vii) – suggests that the condition "neither less nor more" must be understood to mean that it is permissible to use different, but equal-range individual names (*Columbus* and *Christopher Columbus*), but it is not permissible to use a general name in the answer, even if denoting the same.[17]

2.2 In conceptions based on Ajdukiewicz, the concept of a proper answer is better defined. Apart from pragmatic definitions, a method of characterizing answers that refers to the schemas of questions is employed. Proper answers are defined as sentences that are obtained when, in the answer pattern set by the question (known as *datum quaestionis*), the variable contained is replaced by a constant from the scope of the variable, i.e. from the range of the so-called unknown of the question.[18]

However, such definitions are satisfactory only if it is accompanied by well-defined schemas for any questions. In [3] only the scheme for so-called *questions to be completed* "consisting of a question particle and a fragment of a declarative sentence" are described in more detail, while for the *questions to be completed* "[...] which have the entire sentence under the question particle" there is only one example, for the *questions to be decided* it is only a general hint on building answer patterns, and for *questions to be explained*, the pattern is omitted.[19] The lack of question

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17 I agree with the comment that an effective way to make the 'right answer' more precise is to include expectations about the answer in the question sentence itself, for example replacing question (Q) with *What is the full name of the discoverer of America?*

18 [3, p. 87].

19 [3, p. 87–88]. Interrogative sentences and questions called in Polish semiotics: "questions to be decided" [pytania do rozstrzygnięcia] or "decisive questions" [pytania rozstrzygnięcia] (in Polish there is the "Czy" particle) are referred to in these analyzes as Y/N-questions; called "questions to be completed" [pytania do uzupełnienia] or "completion questions" [pytania uzupełnienia] will here be generally designated as W-questions, and among them "simple questions to be completed" [pytania do uzupełnienia proste] (in Polish with the pronouns "Kto" [Who], "Gdzie" [Where], "Kiedy" [When] etc.) are Wh-questions; and "problem questions to be completed" [pytania do uzupełnienia problemowe], also called "questions to be explained [pytania do wyjaśnienia] (with "dlaczego" [why] in Polish) will be called Why-questions (W-questions = Wh-questions + Why questions).

schemas is also visible in Ajdukiewicz's analyzes of properly asked questions. Namely Ajdukiewicz indicates how the assumptions **PA** and **NA** – or better to say the postulates as to the appropriate questioning – should be specified for particular types of questions and on this basis to decide whether a given question is properly asked. Namely, **PA** is fulfilled if and only if the alternative of the proper answers is true, and **NA** – if the alternative of the negations of the proper answers is true. [20] However, a study of an appropriate questioning in accordance with these ideas is possible only if the concept of the proper answer is well defined, which in turn requires arrangements as to the structure of the questions and answers of any kind.[21]

3. In [12], questions are distinguished from interrogative sentences with possible sources of ambiguity specific to interrogatives exhaustively covered.[22] Sources of ambiguity specific for interrogative sentences – i.e. independent of ambiguity, which may affect any expressions of a given language, including interrogatives – are: (i) the indeterminacy of what is questioned and what is given (this type of ambiguity applies to interrogative sentences for Wh- and Why-questions) (ii) the interrogative sentence quantification, i.e. a requirement, refined in a given asking situation, as to the number of objects from the so-called universe of questions that must be indicated in the answer (concerns W-questions, i.e. Wh- and Why-questions); (iii) the possibility of causal or purposive interpretation of interrogative Why-sentences.[23]

3.1 The general scheme of any question structure is given by the formula:

(*) ? x^* *in* U^*: $C^*(x^*)$.

In this scheme, "x^* *in* U^*" indicates the subject of the question, that is, its unknown and universe, C^* is the condition predicated about objects from the universe of the question; and the generally described proper answer to the questions has the form $C^*(x^*)$, and it must be that x^* *in* U^*.

In [1] is proposed a general approach to the structure of Wh-questions (and answers to Wh-questions), namely the formula ? x $P(x)$ (I owe this information to Prof. A. Brożek).

20 See [3, pp. 88–89].

21 This gap in Ajdukiewicz's conception has been filled in [14], [13], [15], [9], [18], [6] and [12], among others.

22 Questions are interpreted interrogative sentences, i.e. sentences taken in one of their possible meanings and this distinction is indicated by writing interrogative sentences in plain print, and writing questions based on them in italics (as used in these analyzes). The ambiguity of interrogative sentences is also analyzed in [10].

23 These interpretations are indicated by the subscripts "c" or "p", respectively: Why_c-questione, Why_p-questions.

The symbol *in* is a variable for which, in less general schemes, one can substitute the symbol of the relationship appropriate for the unknown $x^\star$ and the universe $U^\star$, i.e. $\in$ or $\subset$ (equality included). For specific questions or kinds of questions, the notation "$x^\star$ *in* $U^\star$" is detailed according to the subject of the question /kind of question, and the possible quantification of the question can be taken into account. The question condition $C^\star$ is also properly concretized – up to the concretization appropriate for a given question – and it is possible to take into account the ambiguity of the interrogative sentence, i.e. indicate with the schema exactly this question that expresses one of the meanings of the interrogative sentence being uttered, the appropriate one for a given situation.[24]

3.2 For example, the interrogative sentence:

1) Who studies philosophy?

if addressed to a specific group of P people, it can be ambiguous only because of ambiguity as to the quantification, i.e. how many people need to be indicated. The scheme for (1) that does not take into account any quantification is the formula:

? $x \in P$: $C(x)$

and for questions with the quantification of $n = 1$, $n = 2$, $n = k$ and the quantification of "all", the following schemas are appropriate:

? $\{x\} \subset P$: $C(x)$;
? $\{x_1, x_2\} \subset P$: $C(\{x_1, x_2\})$
? $\{x_1, x_2, …, x_k\} \subset P$: $C(\{x_1, x_2, …, x_k\})$,
? $A \subset P$: $A = \{x \in P$: $C(x)\}$,

where strings like $C(\{x_1, x_2, …, x_k\})$ are conjunction abbreviations: $C(x_1) \wedge C(x_1) \wedge … \wedge C(x_k)$. In each of these schemas there is the same universe P of people whose names are substituted for the variable x, and the same condition C = *studies philosophy* visible in the scheme of proper answers (after the colon).

There are, however, Wh-questions whose universe is not the same as the scope of the unknown. This is the case in questions with more than one interrogative pronoun.

2) Who is studying what?

If there is a specific set P of people and a set D of disciplines of study that come into play, then also this interrogative sentence may be ambiguous only due to undefined quantification. On the other hand, the subject of questions is different than for (1), visible in the above formulas obtained from (2), because in the scope of the unknown of these

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24 An analysis of the question structure, supported by many specific interrogative sentence reconstructions, is also in [12].

questions there are ordered pairs taken from the universe $(P \times D)$. Here are the schemas for questions based on (2) – unquantified and quantified in the same way as (1):

? $<x, y> \in (P \times D)$: $C(<x, y>)$,

? $\{<x, y>\} \subset (P \times D)$: $C(<x, y>)$,

? $\{<x, y>_1, <x, y>_2\} \subset (P \times D)$: $C(<x, y>_1, <x, y>_2)$,

? $\{<x, y>_1, <x, y>_2, …, <x, y>_k\} \subset (P \times D)$: $C(<x, y>_1, <x, y>_2, …, <x, y>_k)$;

? $A \subset (P \times D)$: $A = \{<x, y> \in (P \times D)$: $C(<x, y>)\}$;

In these formulas, strings of the type $<x, y>_k$ oraz $C(<x, y>_1, <x, y>_2, …, <x, y>_k)$ are abbreviations for $<x_k, y_k>$ and $C(<x, y>_1) \wedge C(<x, y>_2)$, $\wedge, …, C(<x, y>_k)$, the condition $C = is\ studying$, and the form of the proper answers is visible after the colon.

In a similar way, it is possible to construct a schema for Wh-questions based on interrogative sentences with more than two pronouns – unquantified or with quantifications such as $n = …$ or "all". On the other hand, questions that are quantified differently, e. g. "at least one", "more than three", "$2 \leq n \leq 5$", etc., must be approached differently. In the question schema, one need to add a condition specifying the number $\|A\|$ of the elements of set A in accordance with the quantification required in the question. For example, the shape of the question obtained from (2) for the quantification "not less than k, not more than n" is:

? $A \subset (P \times D)$: $<x, y> \in A \Rightarrow C(<x, y>) \wedge k \leq \|A\| \leq n$.

It is also possible to grasp which component of the declarative sentence p is concerned by a particular W-question "derived" from p – which in the context of question situations will be called the question matrix p. The corresponding schema indicates exactly what is the universe U, and thus – what is the condition C assumed in a given question, adjudicated in the proper answer about objects from the universe U. For example, if $p = Peter\ studies\ philosophy$, then the question sentence

(1) Who studies philosophy?

refers to the first component of the sentence p, and the interrogatives:

(1a) What is the relationship (relation) between Peter and philosophy?

(1b) What does Peter study?

(1c) Where does Peter study philosophy?

refer, respectively, to the second, the third component and to the whole sentence p.

Having adopted appropriate notational convention, one can express this difference by the following:

? $A_1 \subset U_1$: $A_1 = \{x \in U_1$: $C_1(x)\} \wedge \| A_1 \| …$

? $A_2 \subset U_2$: $A_2 = \{x \in U_2$: $C_2(x)\} \wedge \| A_2 \| …$

? $A_3 \subset U_3$: $A_3 = \{x \in U_3$: $C_3(x)\} \wedge \| A_3 \| …$

? $A_p \subset U_p$: $A_p = \{x \in U_p: C_p = p(x)\} \wedge \|A_p\| \dots$.

Expressions (1a) – (1c) are also written in a way that indicates they are interrogative sentences, because, just like (1), they can give rise to variously quantified questions, which in turn can be given by specifying the number $\|A\|$ in the above schemas, and thus in the proper answer schemas. The subscripts indicate that the universe, and hence the condition of the question, is changing. The universes are the specified sets: $U_1 = P$ of persons, $U_2 = R$ of possible relations binding Peter and philosophy (studying, teaching, interest, etc.), $U_3 = D$ of fields of study, $U_p = M$ possible places where Peter studies philosophy; accordingly, $C_1 = studies$ $philosophy$, $C_2 = Peter\ is\ connected\ with\ philosophy$, $C_3 = Peter\ studies$, $C_p = p = Peter\ studies\ philosophy\ (in)$[25].

3.3 What is common to Why-questions and Wh-questions of the form ? $A_p \subset U_p$: $A_p = \dots$ is that the question segment refers to the whole matrix, i.e. to the sentence p[26], and that the same quantification can appear in them as in W-questions. However, what distinguishes them is, first, the ambiguity of the question segment *Why* itself. Such questions require an explanation of what is announced in the sentence p, but because *Why* can be understood as a question about cause or as a question about purpose, so in the structure schemata for the generally understood why-question – as well as in the proper answer schemata – the phrase "... because ..." appears, and in the versions for the causal and purposive interpretations, respectively: "the reason that ... was that ..." and "the purpose that ... was that ..." .[27]

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25 In [12, pp. 61–73], a generalization $(*)_U$? $A \subset U^{\{\dots\}}$: $A \subset \{x \in U^{\{\dots\}}: C^{\{\dots\}'}(x)\}$ of these schemes, and other ways, consistent with the one sketched here, of representing the structure of any Wh-questions are also proposed.

26 This, I suppose, explains why Ajdukiewicz places both Wh-questions and Why-questions in the broader category of W-questions. The dichotomous separation of Y/N-questions solely on the basis of the syntactic criterion, i.e. whether the participle *Czy* is used in the (Polish) question sentence, is not correct: if it is used (at least once) the question is in the Y/N category, if it is not used the question belongs to W-questions [3, p. 88]. Namely, among the sentences in which this participle is used more than once, pleonastic question sentences with the patterns "Is p or not p?" [Czy p, czy nie p?] and compound question sentences, which can be equivalently formulated as a conjunction of simple Y/N-questions, can be classified in the Y/N category. In contrast, question sentences such as "America was discovered by Magelan or Columbus? – unless understood as a conjunction of simple Y/N-questions concerning Magellan and Columbus separately – do not fall into the Y/N category, but give rise to Wh-questions with the universe indicated in the question sentence – in this example, $U = \{$Magellan, Columbus$\}$.

27 The counterparts to these propositional formulations are phrases in fully nominal ("the reason ... was ...", and "the purpose ... was ...") or mixed stylization [12, pp. 58–61, 71–73, 85–89, 94–95, 107].

Second, a new source of ambiguity appears in Why-question sentences, namely, a possible ambiguity about what is being questioned in the matrix of a given question, i.e. what the question is about and what the condition assumed in it is. To illustrate this ambiguity, let us assume that p = *Peter studies philosophy*. The question sentence

(3) Why does Peter study philosophy?

is usually understood as

(3a) *Why p*?

However, there are question situations in which the sentence (3) is uttered in order to obtain an explanation about certain parts/components of the matrix p.[28]

For example:[29]

(3b) *Peter studies* [why] *philosophy*?

(3c) *Peter philosophy* [why] *studies* ?

(3d) *Philosophy studies* [why] *Peter*?

(3e) *Studies* [why] *Peter philosophy*?[30]

Accounting for such ambiguities requires unambiguously indicating in question schemata what exactly is in a given question within the scope of its question segment (is questioned), and thus – what is in the question given. Assuming the agreement that the matrix constituents questioned are denoted by {...} and the data constituents, i.e. the rest of its constituents by {...}’, one can conclude that in the question sentences formulated above the questioned/data division is as follows:

{3} = *philosophy*	{3}’ = *Peter studies*
{2} = *studies*	{2}’ = *Peter philosophy*
{1} = *Peter*	{1}’ = *studies philosophy*
{1, 3} = *Peter philosophy*	{1, 3}’ = *studies*.

The condition C, corresponding to the unquestioned components, is for questions (3b)-(3e) denoted in a way that indicates this, i.e.

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28 The components of the matrix p which are the subject of the question will be preceded in the case of Why-questions by the question segment, by the pronoun *why* in square brackets. The sign [why] is also supposed to indicate that the requirements of a certain grammar – irrelevant in the general analysis – are omitted. (In Polish, it is syntactically correct to place the pronoun *Why* [*Dlaczego*] before the sentence p and before any of its constituents). In the reconstruction of Y/N-questions the sign [Y/N] will be used for the same purposes.

29 The combinations assembled from the three components of this matrix are eight; in question situations, seven may appear, because the 0-element combination, i.e. the situation when all the components of the matrix are given (none are questioned), corresponds to the statement p.

30 Writing (3a)-(3e) as questions (indicated by italics) is the result of omitting the quantification that can accompany these expressions; without this simplifying assumption, (3a)-(3e) should be written as question sentences.

as $C^{\{3\}'}$ = *Peter studies*, $C^{\{2\}'}$= *Peter philosophy*, $C^{\{1\}'}$= *studies philosophy*, $C^{\{1, 3\}'}$= *studies*. Using these denotations, the sentence *p* can be represented as an ascription:

$C^{\{3\}'}(\{3\})$; $C^{\{2\}'}(\{2\})$; $C^{\{1\}'}(\{1\})$; $C^{\{1, 3\}'}(\{1, 3\})$.

Each one stands for the sentence *p*, but in these notations it is clear what the explanation is supposed to be about, and what is unquestioned in the question.

Consistent with the comments and agreements above, the schemata for questions (3b)-(3e), and within them the schemata for proper answers, look thus:

(3b) $? x \in U^{\{3\}}$: $C^{\{3\}'}(\{3\})$ *because* (*x*);
(3c) $? x \in U^{\{2\}}$: $C^{\{2\}'}(\{2\})$ *because* (*x*);
(3d) $? x \in U^{\{1\}}$: $C^{\{1\}'}(\{1\})$ *because* (*x*);
(3e) $? x \in U^{\{1, 3\}}$: $C^{\{1, 3\}'}(\{1, 3\})$ *because* (*x*).

In turn, the question scheme obtained from (3) when interpreting this sentence according to *Why p*? is:

(3a)' $? x \in U^{\{1,2, 3\}}$: $C^{\{1, 2, 3\}'}(\{1, 2, 3\})$ *because* (*x*).

And since $\{1, 2, 3\} = p$, this scheme can be simplified:

(3a) $? x \in U^{p}$: *p because* (*x*).[31]

In a way relativizing to the particular questions, their universes are also labeled in these schemata. There are answers explaining: that philosophy is studied by Peter – e.g. the answer *Why, so that after graduation he can teach philosophy*; that Peter is connected with philosophy by studying (e.g. *Because he is no longer satisfied with studying philosophy on his own*); that it is Peter who studies philosophy (*Because Andrew has decided to study physics*); and answering (3e) one has to explain both that Peter … and that … philosophy, e.g. *Because he has earned money for his studies and has always been interested in philosophy*. The universes of questions (3a)-(3e) are different, but not disjointed. Indeed, it is worth noting that the answers to questions (3b)-(3e), i.e. questions with universes $U^{\{3\}}$, $U^{\{2\}}$, $U^{\{1\}}$ and $U^{\{1, 3\}}$ are also the answers to question (3a), the answers to (3b) and (3d) are the answers to (3e) – that is, in general: answers to a question in which a given component of the matrix *p* is being questioned are also answers to any other question based on that matrix in which the given component is also questioned. The completeness of a particular answer is a separate matter.

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31 In the "universe" $\{1, 2, 3\}$ empty is both the set $\{1, 2, 3\}'$ and the condition $C^{\{1, 2, 3\}'}$, meaning the whole matrix *p* is questioned.

The formulas for questions (3a)-(3e) fall under the general scheme of Why-questions structure:

$(*)_W$? *x in* $U^{\{...\}}$: $C^{\{...\}'}(\{...\})$ *because* (*x*)

or under its causal or purposive variant:

$(*)_{W_c}$? *x in* $U^{\{...\}}$: *The reason for* $C^{\{...\}'}(\{...\})$ *was that* (*x*)

$(*)_{W_p}$? *x in* $U^{\{...\}}$: *The purpose of* $C^{\{...\}'}(\{...\})$ *was that* (*x*).

In the question schemas, the variable *in* is replaced by the symbol $\in$ or $\subset$, the symbol for the set *A* may also appear, and a condition specifying the number $\|A\|$ may be added – depending on whether and how the particular question is quantified, i.e. how many explanations the questioner expects. Schemata for questions simultaneously determine schemes for proper answers.

3.4 The ambiguity, the source of which is the demarcation between what is questioned and what is given (the question condition), becomes even more evident in the case of Y/N-question sentences. Semiotic analyses of Y/N-questions show that the question segment in a question sentence of the type "Is it so that *p*?" does not always refer to the whole matrix *p*, which is a source of potential ambiguity not only for the question itself, but also for a negative answer to such a question.[32] A full analysis of Y/N-question sentences must therefore take into account that in questions – that is, question sentences posed in concrete situations – not only are single components of the matrix *p* questioned, but also their pairs, triplets, etc., up to the questioning of all components, that is, the whole matrix *p*.

The result of applying the above way of analyzing the matrix and distinguishing possible meanings of a question sentence to Y/N-interrogatives is a schema where the symbol {...} denotes, as in schemas for questions of other types, the part of the matrix *p* – from its individual components up to the whole sentence *p* – that is questioned in a given question from among those obtained from the question sentence "Is it so that *p*?":

$(*)_{Y/N}$? $x \in \{\{...\}, non\{...\}\}$: $C^{\{...\}'}(x)$.[33]

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32   See, for example: [13, pp. 48–51], [6, pp. 143–144], [16, pp. 9–10]. In Polish, the participle "Czy" suffices in the question segment of any Y/N-questions, both when the entire matrix *p* is being questioned and in questions concerning any of its parts.

33   [13, pp. 49–51) took into account only the possibility of questioning the individual, single components of the matrix *p* of the question sentence "Is it so that *p*?" and proposed a scheme for the structure of such questions, which, in the part concerning what I call the object of the question, is consistent with $(*)_{Y/N}$. However, the "negative" component of the universe of Y/N-questions, i.e. *non*{...}, has to be understood differently than in [13]: inscriptions such as "non-Columbus", "non-America", i.e. falling under the formula *non*{...}, have to be understood not as name expressions, but sentence

Accordingly, the universe of each Y/N-question is two-element, the affirmative proper answer follows the formula $C^{\{...\}'}(\{...\})$ and is always equivalent to sentence p. In contrast, the negative proper answer, with the scheme $C^{\{...\}'}(non\{...\})$ may not be unambiguous, or more precisely, it is rarely unambiguous. This is because behind $C^{\{...\}'}(non\{...\})$ are hidden unambiguous and complete answers, each of which corresponds to one of the possibilities for negating the segment $\{...\}$, and from each such unambiguous answer it follows that $C^{\{...\}'}(non\{...\})$.[34]

To facilitate the comparison of schemata, the formula $(*)_{Y/N}$ is applied below to the question sentence corresponding to (3), i.e.

(4) Does Peter study philosophy?

and to only those of its seven possible interpretations that have counterparts in the above questions and formulas (3a)-(2e):[35]

(4b)   *Peter studies* [Y/N] *philosophy*?
(4c)   *Peter philosophy* [Y/N] *studies*?
(4d)   *Philosophy studies* [Y/N] *Peter*?
(4e)   *Studies* [Y/N] *Peter philosophy*?
(4a)   [Y/N] *Peter studies philosophy*?

For easier reading, the components of the matrix p = *Peter studies philosophy* are indicated by abbreviations: *Peter* =1 = P, *studies* = 2 = s, *philosophy* = 3 = F.

(4b)   ? $x \in \{\{F\}, non\{F\}\}$: $C^{\{F\}'}(x)$.
(4c)   ? $x \in \{\{s\}, non\{s\}\}$: $C^{\{s\}'}(x)$.
(4d)   ? $x \in \{\{P\}, non\{P\}\}$: $C^{\{P\}'}(x)$.
(4e)   ? $x \in \{\{P, F\}, non\{P, F\}\}$: $C^{\{P, F\}'}(x)$.
(4a)   ? $x \in \{\{P, s, F\}, non\{P, s, F\}\}$: $C^{\{P, s, F\}'}(x)$.

The conditions in the schemas of these questions are in the order: $C^{\{F\}'}$ = *Peter studies*, $C^{\{s\}'}$ = *Peter philosophy*, $C^{\{P\}'}$ = *studies philosophy*, $C^{\{P, F\}'}$ = studies. Since the condition $C^{\{P, s, F\}'}$ of question (4a) is empty – because all the components of the matrix p = {P, s, F} are questioned – so the last

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expressions, interpreted in the context of the question (cf. ibid., p. 49). A wrong understanding of this component and the negative answer to Y/N-questions also leads to wrong evaluations: of the logical value of presuppositions and the accuracy of Y/N-questions as well as evaluations of answer completeness.

34 In [12], the notion of generalized negation *non* and the schemes for Y/N-questions and for answers to such questions – here only briefly discussed – are thoroughly analyzed and illustrated. These analyses show that – contrary to Ajdukiewicz's conviction [3, p. 89] – not every Y/N-question is properly posed, and not every such question is sound (the necessary condition of soundness is the truth of the condition $C^{\{...\}'}$).

35 The use of [Y/N] is set out in footnote 28.

scheme simplifies to ? $x \in \{p, non(p)\}$; and since it is possible to show that $non(p) \Leftrightarrow \sim p$, it simplifies to:

(4a)' $x \in \{p, \sim p\}$.[36]

The affirmative proper answer to each of these questions is the sentence p = *Peter studies philosophy*; in the schemata of this answer given to the subsequent questions, however, it is apparent what the question is about, or more precisely, which components of matrix p are being questioned. In contrast, the negative proper answer is more often ambiguous than it is unambiguous. Ambiguity increases with the number of matrix components questioned: negative proper answers are unambiguous only when the question concerns one matrix component, and most ambiguous when it concerns the whole matrix p.[37] For example, behind the negative answer to question (4e), i.e.: $C^{\{P, F\}'}(non\{P, F\})$ are hidden three unambiguous full answers (the symbol *non* is abbreviated by *n*, and $C^{\{P, F\}'}$ is replaced by *studies*):

studies $(\{nP, F\})$, *studies* $\{P, nF\})$, *studies* $(\{ns, nF\})$;

and the negative proper answer to (4a) follows logically from each of the complete answers (but not vice versa):

$\{nP, s, F\}$, $\{P, ns, F\}$, $\{P, s, nF\}$, $\{nP, ns, F\}$, $\{nP, s, nF\}$, $\{P, ns, nF\}$, $\{nP, ns, nF\}$.[38]

4. A good, i.e. precise and general, definition of the proper answer is possible on the basis of a conception which can provide a schema for the structure of any question. Question structure schema determines the structure of proper answers to the question. Only then is the identification of the proper answer, as a sentence that falls under the schema of the question's structure, general and accurate.

4.1 It is consistent with the above to build a theory of questions in the following order: question sentence – question – proper answer – etc. In adopting this construction way, it is necessary first to propose a conception of possible ambiguities of the question sentence, then a general conception of the structure of questions (interpreted question sentences), and on the basis of this conception to define the proper answer. A good definition of the concept of the proper answer provides a solid basis for

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36   See [12, pp. 44–58, W3, W5].

37   To be more precise, and not evident in the analyzed example, they are unambiguous if and only if the question concerns a single and simple matrix component, and not such as "philosophy and mathematics", "philosophy and/or mathematics", "philosophy or mathematics", etc. See [12, pp. 76–82, 192–202].

38   Not every proper answer is therefore complete: the set of complete answers intersects with the set of proper answers to Y/N-questions, which distinguishes them from answers to questions of other kinds, which, if proper, are complete.

defining more complex concepts and justifying claims about questions and answers. It is necessary, for example, when the presuppositions of a question are defined as sentences that follow logically from each proper answer; a so-called direct presupposition as the logically strongest of the presuppositions of a question; an accurate question as having a true and false proper answer, and so on. On a well-defined concept of the proper answer it is also possible to firmly ground analyses concerning the conditions of accuracy and the relationship between the accuracy of a question and the logical value of its presuppositions, as well as distinctions concerning the kinds of answers and the relationship between them.[39]

On the other hand, the initial adoption of the reverse order at the starting point: proper answer – question – question sentence, accompanied by a defective (unclear, vague) definition of the proper answer results in this defect being transferred to the theory. This order of analysis is in IEL[40], in which questions are then represented by sets of proper answers:

$? \{A_1, \ldots, A_n\}.$

In this formula (the so-called e-formula) A_1, ..., A_n are the declarative sentences (which are syntactically distinct in pairs) that are the proper answers ("PPA") to the question.[41]

When the reconstruction of questions is based on the notion of a proper answer, one not made precise in the language in which the logical theory of questions is built, then all the definitions and theorems in which this notion is presupposed, for example, the notions basic in IEL, already indicated above, of: the presupposition of a question (and the particularizations of this notion), the soundness of a question (and related notions), the notion of evocation and the variants of erotetic implication, as well as theorems concerning these relations, are deprived of a strict basis.

4.2 The representation of questions with answers is prompted by the assumptions made in IEL, derived from the Hamblin postulate:

"[… Hamblin postulate:]

H$_2$: *Knowing what counts as an answer is equivalent to knowing the question.*

splits into:

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39   See [12: p. 116, D4; p. 119, D5.a, D5.b; p. 121, W6; pp. 113–173; pp. 175–246].

40   In IEL symbolism and terminology: a set dQ of proper answers – a question Q (reconstructed in the form of a so-called e-formula, which is its meta-language, theoretical equivalent) – and a NLQ, i.e. a question formulated in natural language.

41   See [16, p. 17].

H$_{2_1}$: *Knowing a NLQ is equivalent to knowing the e-formula that represents it.*

H$_{2_2}$: *Knowing the e-formula is equivalent to knowing what counts as ppa's to it.*

Thus "knowing a question" often yields a disambiguation."[42]

Only if the assumption **H2** were true for any question could it justify representing questions by answers. It is certainly not the case that a single answer points unambiguously to a question. Let us suppose, that the sentence counted as an answer is "Socrates discovered America". This sentence is undoubtedly one of the proper answers to *Who discovered America*? – but not only. It is also included in the set of proper answers to other questions, for example: *Socrates discovered America or was he an eminent philosopher*? *Who among – Socrates, Aristotle, Columbus, Magelan – discovered America*?, "What is Socrates known for?", and can also be considered as an abbreviation of the proper answer to "Why is Socrates a famous historical figure?" and as an expansion of the proper answer in the affirmative to "Did Socrates discover America?"[43] Premise **H$_2$** is defensible only if by "knowing what counts as an answer" is meant the necessary and sufficient conditions for any declarative sentence to be decidable as the proper answer to a given question. This, however, requires knowledge of the answer schema (as determined by the question structure schema), which determines the set of proper answers **d**Q.[44]

That assumption **H$_{2_1}$** is not true is demonstrated clearly by the fact that knowledge of NLQ's does not lead unambiguously to the formula representing them and that there is no consensus on this in question theories. Assumption **H$_{2_2}$**, on the other hand, can be acknowledged, but again: as long as there is an elaborate scheme for the structure of any questions in a given conception. In IEL there is no reconstruction of the structure of questions, because questions are represented (in e-formulas) by sets of answers; in the language of this theory, therefore, "knowing a question" has not been achieved.

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42 See [16, p. 16].

43 Italics are used for questions, i.e. unambiguous question sentences, normal font for question sentences, which can be quantified in various ways (Why-question sentences) or interpreted depending on what is being questioned/data (the last sentence).

44 The scheme of the question and answer structure is necessary because the enumeration of all proper answers does not uniquely indicate the question, i.e. there are different questions with the same sets of proper answers (understood as in IEL), as for example the questions: *Paul likes [Yes/No] Anna or Sophia?* and *Who among {Anna, Sophia} does Paul like?*

4.3 A postulate that logic of questions should be based on a concept of question structure (taking into account the ambiguity of question sentences) but is, however, confronted with the fact that not only has no theory of questions been agreed upon, but also no structure conception itself. This fact fosters doubts as to whether an accurate and general question structure conception is possible at all; and – how to prove its accuracy and generality. These requirements and related doubts apply, of course, also to the question structure conception outlined above. For example, how can it be verified that any question, i.e. any of the possible meanings of any question sentence formulated in a given natural language (not to mention any natural language), can be subsumed into the question patterns according to (*), i.e., $(*)_U$, $(*)_W$ and $(*)_{Y/N}$ and their further specifications. Proving that for any given natural language question it is the case that it falls under one of these schemes, and thus also under (*), is not possible. On the other hand, empirical verification – i.e. corroborating the results of a logical theory of questions with facts drawn from the practice of posing and answering questions – encounters otherwise known limitations. Confirming the thesis of the generality of these schemata involves effectively pressing further, specific questions into them. A better way than random questions testing is to test such questions, which previous erotetic analyses have pointed out as difficult to reconstruct and classify, i.e. to show that the anomalies of other question theories disappear. It is also valuable to show that other categorizations can be reduced to the one obtained on the basis of the proposed schemes that "inter-theoretical reduction" is possible. Indeed, selected other classifications can be reduced to schemes based on (*), which confirms that the division of the universe of questions into two categories, i.e. Y/N-questions and others (W-questions), among which there are Wh-questions and Why-questions, originating from K. Ajdukiewicz, is correct.[45]

4.4 Related to the above is another methodological postulate: the logic of questions should firstly be pragmatic, and then formal. This postulate allows one to stop – as with Ajdukiewicz – at pragmatics and formulate the concept of questions in natural language enriched with a few methodological terms; however, it is supposed to protect against developing a formal logic of questions without confronting it with the empirical base drawn from the practice of asking and answering. The assumptions made in the formal logic of questions – both at the starting point and

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45 In [12, pp. 55– 69] the question considered difficult are checked and the classifications adopted in [7] and [16, pp. 74–84] are reduced to the proposed schemes.

for proving the theorems intended therein – must not be incompatible with this practice. Only then can the results obtained in the formal logic of questions in turn provide a basis for explaining, normalizing and improving this practice.

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