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Tadeusz Ciecierski

Assistant Editor

Krystyna Komorowska

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Studia Semiotyczne (Semiotic Studies) is a journal founded in 1970 by Jerzy Pelc, who was its Editor-in-Chief up until 2015. Between 1970 and 2015 *Studia Semiotyczne* was published non-periodically. In December 2015 *Studia Semiotyczne* was formally transformed into a six-monthly publication simultaneously in print and on the Internet. The journal publishes papers that fall on the borderline between philosophy and semiotics and in particular, in the fields of analytic philosophy of language, general theory of signs, applications of semantic methods in philosophy, philosophical aspects of linguistics and psycholinguistics, semiotic aspects of philosophy of mind, philosophical consequences of metalogic and the theory of formal languages, analysis of the language of philosophy and the philosophical argumentation, and history of ideas in semiotics and logic. *Studia Semiotyczne* is published by *The Polish Semiotic Society*. The guidelines for submitting manuscripts, the legal and ethical aspects of the publication and the review procedure are described in the "For Authors" section of the website:

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The Danuta and Henryk Hiż Prize

The Danuta and Henryk Hiż Prize is a cash prize awarded to an individual winner of a contest for the best work dedicated to the philosophy of language or other sign systems, that is, problems pertaining to theoretical semiotics understood as the study of cognition and communication. Danuta and Henryk Hiż were students and friends of Tadeusz Kotarbiński before 1939. Both fought in the Warsaw Uprising. Following the defeat of the Uprising, they were imprisoned in a German POW camp. After liberation by American forces, they remained in the West, first in Belgium and later in the United States, where they obtained professorships and lectured, mainly in Philadelphia. The Hiż's remained in constant contact with their Polish friends and repeatedly visited Poland. During these visits, Henryk Hiż gave guest lectures on the philosophy of language at Polish universities, predominantly at the University of Warsaw and for the Polish Semiotic Society.

The Prize was funded from money donated by the Hiż's to one of their Polish friends and his wife who transferred it to the Polish Semiotic Society after the death of Henryk Hiż. Their aim was to create an award that would facilitate the development of philosophy. The Polish Semiotic Society announced the first edition of the Prize, with an award in the amount of 5,000 PLN, on the fiftieth anniversary of the University of Warsaw Semiotic Seminar, the fortieth anniversary of "Studia Semiotyczne" (Semiotic Studies) and the twentieth anniversary of the Library of Semiotic Thought series. The theme was *Semiotics and Cognitive Science*.

Five essays were submitted for the Prize. The jury composed of Prof. Joanna Jurewicz (Head of the Jury), Prof. Joanna Odrowąż-Sypniewska, Prof. Anna Wójtowicz, Prof. Jerzy Bobryk and Dr Justyna Grudzińska (Secretary of the Jury) convened on October 25, 2013. Following a discussion (during which a letter from an absent member of the jury – Prof. Jerzy Pelc – was read), the jury decided:

1. To award the Danuta and Henryk Hiż Prize in the amount of 5,000 PLN to Paweł Grabarczyk for his essay *Problems with seeing: On the*

philosophically significant uses of the expression ‘to see’;

2. To award an honourable mention and to recommend for publication in “*Studia Semiotyczne*” Przemysław Zonik’s essay *The similarity between primary and derived mental structures as the basis for communication: A neuro–anthropological perspective.*

The award ceremony included a lecture by the winner of the contest’s first edition, Mr. Paweł Grabarczyk. It took place on November 15, 2013 at the Kazimierz Ajdukiewicz Room in the Institute of Philosophy of the University of Warsaw.

Paweł Grabarczyk¹

Problems with Seeing: On the Philosophically Significant Uses of the Expression ‘To See’

Abstract The aim of the paper is to distinguish two common notions of the expression “to see” – objective and subjective without attributing beliefs to the observer. Thus, the main aim can be characterized as extensional explication. This gives us the ability to describe visual perception without assuming anything about higher cognitive abilities of the agent. Subsequent addition of the notion of belief enables me to characterize more visual categories present in the literature of the subject.

Keywords perception, seeing, nonconceptual perception

1.

It surely need not be emphasized that the verb “to see” is part of the vernacular nontechnical language we use every day. However, it turns out that even its ordinary daily use provokes philosophically significant questions and difficult cognitive puzzles. The task I set myself in this article is to explore the ways in which this expression is used and to introduce certain conceptual restrictions that should help solve these puzzles.

Let us begin by exploring the difficulties alluded to above. Let us imagine that we witness the following exchange:

A: I saw a red mug here yesterday.

B: You couldn’t have seen a red mug because I don’t have one.

¹ Institute of Philosophy, University of Łódź
E-mail: pagrab@gmail.com

A: I surely know better what I saw – unless it was an illusion.

Which interlocutor is right? One may say that the dispute concerns the question of whose perspective should be considered privileged in describing perception: that of the subject of perception or that of a third person (who may, for example, be in possession of additional information). I will argue that the most convenient solution is to assume that here we are dealing with two senses of the expression “to see”: the objective sense (employed by interlocutor B) and the subjective sense (employed by interlocutor A). Before we clearly demarcate these two senses, I would like to indicate several more problematic examples of the use of the expression in question.

The most readily recognizable phenomena which lead to misunderstandings of the type cited in the above dialog are hallucinations and illusions. Does a hallucinating person who utters the sentence “I see a black dog” utter a false sentence or perhaps an ambiguous one since he or she does see the dog in some sense of the word “to see”? Does the type of hallucination this person is having impact the truth conditions of the sentence? For instance: will the situation differ depending on whether the hallucination is a typical one or one experienced while the subject’s eyes are closed? And what about the relatively similar, at least *prima facie*, situation of dreaming: when I say that I saw a dog in a dream, do I use the expression “to see” in a way that is significantly different from the case of hallucination? Perhaps this is its metaphorical use?

Equal difficulties are caused by illusions and their subset: ordinary misperceptions that may nonetheless be quite awkward to describe. Let us illustrate this with an example. Let us say that I am at a club and I notice a person I associate with a friend I have not seen for a long time. Importantly, I am not under the impression that I see my friend – I believe that I see someone else who merely resembles him. After a while I bump into my friend and find out that he really was at that club that day around the same time I was. It is therefore highly likely that the person who triggered my association was none other than my friend². How should I describe the situation now, *ex post*? Should I simply say that I saw my friend, or should I use a formulation like this one: I saw him then but I saw him as someone else? Perhaps, as some would prefer it, every act of visual perception is an act of “seeing as” (Strawson 1979)? Does seeing an object “as a postman” differ radically from “believing that one sees a postman”?

This situation points to yet another problem related to the description

² I owe this example to Michał Zawadzki.

of sensory perception. I have in mind the relation between sentences of the form “O sees that φ ” (let us call this version “propositional”) and those of the form “O sees f ” where f is a name created from φ (let us call this version “nominal”)³. The possibility of describing a perceptual act in these two ways raises the following questions: Is this a merely stylistic difference with no significant philosophical consequences? Does each perceptual act allow this dual description? Is describing a given perceptual act using the propositional form equivalent to ascribing a belief to the subject of perception?

To understand why belief ascription in the context of perception is philosophically significant, one must realize the specificity of sensory perception. A common though rarely explicitly articulated intuition regarding perception is that it is, if I may say so, conceptually innocent. Even if I can describe, in more than one way, what I saw or heard, the experience itself is independent of the description. This intuition has repeatedly manifested itself in philosophy, from the belief about the existence of pure sense data (resulting from equally conceptually pure perceptual acts) to protocol sentences to the division between knowledge by description and knowledge by acquaintance. The identification of perception with the possession of some kind of a belief significantly complicates this picture since beliefs seem not to be independent from their description. There is no doubt that “John’s belief that his dog is black” differs from “John’s belief that his dog is the colour of coal” since John could possess the first without possessing the latter. It would be difficult to find anything equally obvious in the case of visual sensations: is the sensation of a black dog definitely different from the sensation of a “coaly” dog?

This question becomes even trickier to answer in the context of the perception of creatures that we would rather not, for one reason or another, imbue with the capacity to form beliefs (Stich 1978; Glock 2000).⁴ As is not too hard to guess, at issue are infants and animals whose capacity to form beliefs, according to most philosophers, is rather limited.⁵ Sensory perception seems to be an absolutely basic cognitive function shared across many cognitive systems – the same cannot be said about the capacity to

³ This can be done in many ways, which is not significant for my analysis. For example, the nominal equivalent of the sentence “John sees that the dog is black” can have the form “John sees a black dog” or “John sees the dog’s being black,” or “John sees a dog that is black.”

⁴ Or a capacity to form beliefs characterized by a specific (for example sufficiently complex) kind of content.

⁵ This problem also pertains, for obvious reasons, to philosophers who do not want to ascribe any propositions to these creatures, or perhaps to anyone at all.

form and to hold beliefs. The view that perception should depend on the possession of beliefs thus appears to be entirely counterintuitive.

2.

Let us now distinguish the particular senses in which the expression “to see” is used and whose conflation or insufficient differentiation entangles us in the difficulties mentioned above. Let us begin with the metaphorical sense which I will not analyze in detail in this article. We occasionally say that we “see” or “saw” something, by which we really mean that we understand or understood it. When I say that “I see a solution,” I mean that the solution has become evident or clear to me.⁶ Metaphors like this one emphasize the absence of inferential reasoning – to see that p is simply to come to believe that p without the help of inference. This metaphorical use is an expression of the belief in the direct nature of sensory perception, the belief that, as McDowell (1994a) put it, perception is “openness to the world.”

The first literal sense I would like to distinguish in this article seems to be the exact opposite of the metaphorical sense touched on above. Here I mean cases where the object of perception is not literally perceived but putative, or where its existence is deduced from another (implicit) perceptual act. Let us call this sense indirect.⁷ Despite this slightly convoluted description, it is a rather frequent phenomenon likely well known to the reader. Let us illustrate it with an example. Let us assume that someone tells us she saw that there was nobody in the basement. On closer examination, we learn that what that person actually saw was a door locked with a padlock. The sentence “ O sees that ψ ” should therefore be interpreted as shorthand for the conjunction: “ O sees that φ and O believes that if φ then ψ .” As can easily be observed, this leads to two difficulties. First of all, the first operand of the conjunction features the expression “to see” that we are seeking to explain. Secondly, the latter operand settles the issue we would like to explore by ascribing to the subject a belief.⁸ For this reason, I will not take this sense into consideration in further analysis but will assume that it is parasitic on direct use. Luckily, the contexts where the predicate “to see” is used indirectly are easy to recognize. One striking feature of the indirect

⁶ Both these adjectives are obviously mere confirmations of this visual metaphor.

⁷ This category corresponds to what Dretske (2000) calls “epistemic seeing.”

⁸ This sense can be associated with the doxastic sense introduced by Dretske (1996). I do not have enough room in this article to indicate the differences between Dretske’s proposition and mine.

sense is that it forces a propositional context. Let us cite our example again. Could I, in the situation described above, substitute the sentence “I saw that there was nobody in the basement” with the sentence “I saw there being nobody in the basement”? Certainly not, since the latter sentence suggests that I looked into the basement. Let us note that this is not the case when the word “to see” is used directly: we do not feel the same resistance when substituting the sentence “I saw that the padlock was locked” with “I saw a locked padlock” or “I saw the padlock locked.”

Is the impossibility to change the propositional context into the nominal one invariably due to the direct use of the expression “to see”? Unfortunately, I cannot answer this question definitively, although I have not been able to find an example to the contrary. Therefore, I will adopt the hypothesis that in the case of the direct sense of the expression “to see” the difference between the nominal and the propositional formulation is purely stylistic. Accordingly, I will treat every sentence of the form “*O* sees that φ ” as equivalent to the appropriate nominal form “*O* sees *f*.”

Let us now turn to the analysis of the two most significant literal senses of the expression “to see” we referred to as objective and subjective in the context of the introductory dialog. Let us say that the observer *O* utters the sentence:

(S) I see a postman.

At first glance, it may seem that the difference between the objective and the subjective sense of the expression “to see” boils down to the fact that in the case of the objective sense we require that it be true that:

(1) There is a postman in *O*’s field of vision.⁹

As can easily be noticed, (1) is the necessary condition, although not a sufficient one, of the truth of sentence S understood objectively.¹⁰ Let us now consider the following example found in Grice (1961: 142). Let us imagine that, through some surgical or pharmacological intervention, we can induce in an observer the impression that he sees a clock on the shelf. Let us

⁹ Robinson (1994) calls this intuition the phenomenal principle – if it seems to the subject of cognition that a certain object possesses a certain sense property, then there exists something this subject is conscious of and this something possesses this property.

¹⁰ By talking about sentence S understood objectively or subjectively I clearly mean a sentence where the expression “to see” is used in the objective or the subjective sense, respectively.

additionally assume that it so happens, by sheer accident, that there is actually an appropriately looking clock on some shelf in front of the observer. Would we say that this person sees a clock? Probably not, despite the fact that (1) is satisfied. A natural supplement to this condition should thus be a reference to the causal relation. Our stimulated observer does not see the clock because it was not the clock that induced in him the visual reaction. This solution is accepted, after Grice, by Searle, according to whom the following restriction should be added in addition to the presence of the seen object in the given situation: the observed object is not only in the observer's field of vision but it also induces the visual experience.

Unfortunately, I am worried that this restriction does not provide much. The following modification to Grice's thought experiment is sufficient to withstand it: Let us assume that a surgeon induces in my brain a reaction identical with the one I would be having if I opened my eyes – I would see a surgeon manipulating some apparatus. Here, we have a situation where the object (the surgeon) induces in me a visual experience but I would hesitate to conclude that I see the surgeon. In order to realize how inadequate Searle's objection is, however, we do not even need to rely on such atypical scenarios. As I press my closed eye, my finger induces in me a visual experience. However, we do not claim that the effect brought about by the pressing is a "view of the finger," although the visual experience has been caused by it. This kind of skepticism is usually responded to by noting that the difference between a visual experience brought about by a viewed finger and one brought about by a pressing finger lies in the fact that the first impression is somehow similar to the view of the finger (this is what "being an image" is supposed to mean; Crane 1995: 14). However, the details of this postulated relation of resemblance remain shrouded in mist. Luckily, we need not stop at this explanation. I think that the intuition behind distinguishing the pressing of the eye and the reflection of light reaching it is precisely that seeing – even if it were to produce an image most dissimilar from the represented object – should be mediated by this and no other physiological mechanism. The point is not just that the observed object should induce in us the visual experience but that it should induce it in a way appropriate to the given sensory modality. Luckily, we are after all in a very comfortable situation here: we do not need to introduce any technical terminology to render Searle's restriction more precise since the vernacular already contains an appropriate expression indicating the particular narrowly understood causal relation. It is the relation "*x* is looking at *y*." That *O* is looking at a postman means that the postman is reflecting light which then affects *O*'s

eyes in a causally relevant way.

This condition may seem too restrictive to the reader. Moreover, does looking at something truly ensure the obtaining of the right causal relation anyway? In order to find out, let us consider the following thought experiment. Let us imagine that I am looking at a postman through a pair of glasses. Let us also assume that at the last moment the glasses block the light reflected off of the postman that hereby does not reach my eyes, although everything else is the same. Should we still say that I am looking at the postman? I am looking “in the direction of the postman” at best but this is an entirely different relation than “looking at” him. This allows us to extend the condition which must be satisfied if S is interpreted objectively.

(1a) *O* is looking at a postman who is in *O*'s field of vision.

The difference between the objective and the subjective sense would thus be that in the latter case condition (1a) does not have to be satisfied in order that sentence S be true.

That said, someone might raise an absolutely fundamental question here: do we really have to distinguish the objective and the subjective sense of the expression “to see”? Perhaps we should assume that only the first is appropriate and each time condition (1a) is not satisfied the expression “to see” is used deviously: *O* did not see a postman in any sense but merely had the impression of seeing one. Could we not stop at this reductive interpretation?

The problem is that this way we risk identifying a mistake due to flawed perception with one due to erroneous belief. After all, *O* could falsely think that he sees a postman because he possessed erroneous beliefs as to what a postman should look like. Let us illustrate it with an example. Let us assume that I am observing a session of the university senate and am trying to find my dean. Although I barely know her, I have a chance since I know that on a day like this she will be the only one wearing a brown toga. Let us now assume that I see a person in a brown toga and assume that I have seen the dean. The two situations that we would like to distinguish and that are conflated under the reductive interpretation are the following: (A) perhaps the dean is not present in the room and I have fallen prey to a misperception in that a toga looks brown to me even though it is not brown; and (B) my belief that the dean will be wearing a brown toga is false and I have seen someone else since someone wearing a brown toga is actually there. We are under the impression that a misperception is something completely different

than being misled by an error and we would like to be able to somehow express this difference.¹¹

Another example of a situation where the reductive interpretation fails is describing illusions we have already unmasked. If I am under the illusion described by Mario Ponzo (1911) and know what it consists in, then I risk a misunderstanding by saying “I nonetheless have the impression that one of the lines is longer.” Namely, this utterance can be interpreted such that it will entail the sentence “I nonetheless believe that one line is longer,” which is not what I wanted to say. In order to avoid the misunderstanding, I should say “One line still looks longer” or “I still see one line as longer.”

Another phenomenon whose description benefits from the opposition between the subjective and the objective sense is our ability to notice or ignore (depending on our needs) such phenomena as a difference in size resulting from perspective or a difference in colour resulting from different lighting (Cohen 2010). Observing two mutually spaced rods we may say that in some sense we see that they are equal and in some sense, that one is longer than the other.

Yet another instance where we clearly use the expression “to see” in the subjective sense is when we describe our hallucinations (or illusions) knowing that we are experiencing them. If I wanted to inform my doctor about some strange side effect of a drug I am taking, I would say that “I see red patches after taking it” rather than that “I have the impression that I see red patches after taking it.” The latter formulation has a meaning different from the subjective use of the expression “to see” since it informs the interlocutor that I am not sure about the content of my hallucination. We use the subjective sense when we merely wish to report what visual impression we experience without settling the issue of whether anything actually corresponds to our perception, that is, when we want to utter S without suggesting that condition (1a) is satisfied.

The main culprit in this confusion is the risky step from the formulation “I have an impression. . .” to “I have the impression that. . .” This step is erroneous insofar as the term “impression” used in the first formulation is shorthand for “visual impression” (this is what we are after). It is erroneous because there is no such thing as “the visual impression that. . .”

¹¹ A similar example is described by Anscombe (1981b: 45).

3.

The above discussion implies that a relatively safe paraphrase of sentence S in the subjective sense is the sentence:

(S') I have the visual impression of a postman.

However, reference to impressions leads us into a miry terrain as we hereby introduce a non-extensional context (Anscombe 1981a).¹² Let us cite, once more, the example used at the beginning: Is “the impression of a black dog”¹³ the same as “the impression of a coaly dog” or are they two different impressions? Does everyone who has the first also have the latter? Let us imagine that Caesar was once intently staring at a piece of red fabric. Am I allowed to say that Caesar then had the impression of the colour of my shirt?

Reference to impressions also leads to many grave difficulties in the description of animal and infant perception. Can I, uttering the sentence “The dog sees ten cats,” assume that there is such a thing as “the impression of ten cats” or do I silently presume that the dog can count to ten? The equivalent of sentence S does not fare much better. Let us assume I say that “The dog sees a postman.” The aforementioned difficulty stemming from imbuing animals with beliefs aside (the point is certainly not that the dog sees something of which it knows that it is a postman), we still face the following dilemmas. First of all, we should consider whether there is anything like “the impression of a postman” in the first place. Perhaps there is some kind of a gestalt quality suitable to serve as such a visual impression. Or perhaps not – perhaps “the impression of a postman” is something highly specific, like a bag, a hat, or the colour of a piece of clothing? Regardless of whether we could reach a consensus on this issue, it is rather beyond doubt that to speculate as to what “the impression of a postman” might be in the case of a creature that cannot be asked about it and one we do not wish to imbue with too much knowledge regarding postal workers seems to be an utterly sterile activity.

A seemingly attractive solution is to refer to some version of Locke’s division into simple and complex ideas. Perhaps we can ascribe “the impression of a postman” to a dog as shorthand for something like “the impression

¹² Some confusion may arise as Anscombe uses the expression “intentional” in reference to the phenomenon of intensionality (which she justifies on philological grounds).

¹³ “The impression of a black dog” is clearly an amphiboly. It can refer to an impression had by some black dog or an impression had by some observer (who might incidentally be a black dog). Throughout this article only the latter sense is implied.

of a so and so coloured shape.” This solution, however, is inadequate for at least two reasons. First of all, difficulties related to reducing predicates such as “to be a postman” to a conjunction of “to be red” and the like carry over to the analogous reduction from “to be the impression of a postman” to “to be the impression of red.” Secondly – and this is particularly clear in the case of animal perception – there is no way to establish the degree of detail required for simple ideas. At some point the whole charm of their simplicity vanishes: Is “the impression of red” simple or do we need an impression of a shade of red, for example “the impression of crimson”? Is “the impression of crimson” simply “the impression of red” for those who are not familiar with the relevant palette of shades (small children could serve as an example here)? Let us note that if we go even further down the ladder of detail, we will reach differences in shade which, although given in perception, are not distinguishable conceptually (we could at best distinguish them artificially using expressions such as “red₂₉”).¹⁴ Given that we want to talk about perception in other species as well, we should allow the distinction of differences that are beyond our grasp not only conceptually but also perceptually.

This is why it would be advantageous if we could explicate the notion of a visual impression in a way free from this kind of trouble. I think that this can be managed if we begin with a certain observation commonly shared by philosophers. Even though we can understand sentence S in the subjective sense, we do not have access to someone else’s impressions. In order to know what our hypothetical observer *O* is talking about I must understand his words in roughly the following way: *O* is in a specific state in which *O* is when looking at a postman. Let us develop this intuition. We again assume that *O* utters sentence S but this time that he uses the word “to see” in the subjective sense. We have already noted that this sense means that sentence S does not entail (1a). It does seem, however, that it entails the following two sentences:

- (2) At the time of uttering the sentence S, *O* is in a particular state *P*.
- (3) Every time *O* is looking at a postman, *O* is in the state *P*.

I intentionally do not precisely determine the kind of a state featuring in sentence (2). It may be *O*’s brain state, the state of a larger part of his

¹⁴This example has not been chosen at random. The problem of the perceptual grain seemingly exceeding the conceptual grain not only in the case of animals and infants but also in the case of adult and competent users of language has been intensively discussed in the literature (McDowell 1994b; Peacocke 1998; McDowell 1998). This example has been used, among others.

body (for example the brain plus the stimulated receptors) or the state of his mind (P may for example be a *quale*).¹⁵ Let us also note that (3) is an implication and not an equivalence. We do not exclude the possibility that O can be in the state P due to causes other than seeing a postman (including hallucinating).

Can sentences 2 and 3 be viewed as an explication of the notion of “the impression of a postman”? Unfortunately, this characterization is still too modest and thus susceptible to the following counterexample. Let us imagine that O is always nervous in the company of a postman. Nervousness will satisfy conditions (2) and (3) but we will probably not say that this is what seeing in the subjective sense is about. This is why instead of “the state P ” we should speak of “the state of visual perception P .” This qualification should be read in the following way: the states we are in can be divided into various subsets such as emotional, audial or visual perceptual states. Let us note that I do not determine here whether this classification is made based on introspection or knowledge of physiology. There is no need for this since we are able to make this classification (however imperfectly) using both methods. Even if we had difficulty defining such categories, there is no doubt that we employ them very skillfully – we do not mistake visual impressions for audial ones or for an emotion.¹⁶ The corrected conditions will look like this:

- (2a) At the time of uttering sentence S , O is in a particular state of visual perception P .
- (3a) Every time O is looking at a postman, O is in the state of visual perception P .

Condition (3a) leads to a consequence which is hard to accept. Both conditions are satisfied when the implication (3a) is emptily satisfied. Let us show this based on an example, by assuming that our observer O is looking at a wall and is in a certain state of visual perception. The unwanted consequence of (2a) and (3a) is that this state is also automatically the state in which the observer always is when looking at dragons (since he has never looked

¹⁵ Let us note that the condition thus formulated fits conceptions that construe impressions as intentional (for instance, Dretske 1969; Tye 1995) as well as those that treat them as a kind of “mental paint” (see e.g. Block 2003).

¹⁶ A complication, which I have no room to analyze here, is introduced by the phenomenon of synesthesia as well as by properties such as “good” or “formidable” which some would like to classify as specific visual impressions (Tye 2006).

at any and never will). In order to bar this consequence, we must rework the relevant condition once more:

- (3b) There is a time such that O is looking at a postman at this time and every time O is looking at a postman, O is in the state of visual perception P .¹⁷

Condition (3b) may seem too restrictive at first glance but it means merely that one cannot have an impression of something one has never seen, and in particular of something that cannot be seen – this is highly likely. If there are no dragons, then no one knows what they look like and thus also which impression might be “the impression of them.” If there is anything problematic, it is the dragon and not condition (3b).

Another striking feature of the notion of “the impression of a postman” thus explicated is that it is purely functional. The possibility is allowed that the state P_1 I am in every time I am looking at a postman is the same as the state P_2 my interlocutor is in every time she is looking at a police officer.¹⁸ Perhaps this consequence should be considered a flaw in the context of a theory of perception. However, I am interested in the use of the expression “to see” and in this case the consequence is advantageous since the skepticism evoked here is part and parcel of this usage. Precisely this is why inverted spectrum thought experiments are so suggestive. They show that we could have very different impressions without noticing the fact since language, including the expression “to see,” would function the same. “The impression of a postman” is what people have when they are looking at postal workers even if the relevant state is not identical across all people. From the perspective of the semantics of the expression “to see,” impressions are very much like the Wittgensteinian beetle in the box.¹⁹

The above characterization of the internal sense of the expression “to see” allows us to clarify an ambivalence mentioned earlier. I was considering whether we may say that Caesar had the impression of the colour of my shirt.

¹⁷ For the sake of simplification, I skip another complication here: condition (3b) should be supplemented with the restriction that the circumstances in which O is looking at a postman are “normal” or “typical.” By “circumstances” I mean both the state of O ’s surroundings and of O ’s perceptual apparatus. “Normalcy” should thus be defined in the following way: normal circumstances are circumstances that accompanied the acquisition by O of the disposition to enter the state P at the sight of a postman.

¹⁸ For the sake of this argumentation I rather generously assume that internal states of different observers can somehow be compared.

¹⁹ This distinguishes my explication from an analogous proposition by Susan Haack (1993: 80).

As can be seen, we do not have to ponder Caesar's beliefs – whether he had the right impression depends on whether he had ever had the opportunity to look at anything of the colour of my shirt and whether he then acquired the state of visual perception he is always in when looking at things of that colour. We may not know the answer to this question but it ceases to trouble us nonetheless.

To summarize, the expression “to see” is used in sentence S in the subjective sense if it's a matter of the satisfaction of conditions (2a) and (3b), while it is used in the external sense if it's a matter of satisfying condition (1a). This corresponds to the following popular intuition: in one sense of the expression “to see” we are only interested in the object that affected our perceptual apparatus, while in the other sense we are interested in the perceptual state we were in.

4.

The advantage of the fact that we have so far managed not to refer to the observer's beliefs is that we can now add this factor and use the thus construed conceptual apparatus to describe various kinds of seeing, especially those frequently discussed by cognitive scientists and philosophers of mind. In order to do that, we must introduce one more distinction: between “believing in the broad sense” and “believing in the narrow sense.” By “narrowly believing that p ” I mean the disposition to affirm the sentence p (or its utterances). By “broadly believing that p ” I mean the disposition to the kind of behaviour I, as an observer, find the most convenient to describe by reference to the possession of the belief that p .²⁰ It is the broad sense that we often employ while describing the behaviour of animals and infants. Colloquially speaking, we then mean that the given animal behaves as if it thought that p . From now on I will mark this broad sense of “believing” with an asterisk.²¹ Let us now introduce the following additional conditions, the satisfaction of which will be taken into account in further analysis:

(4) O believes that (1a).

(5) O believes* that (1a).

²⁰ Which I can also do using many other synonymous sentences such as “ x thinks that p ” or “ x is of the opinion that p ” etc.

²¹ The ascription to animals of beliefs even in this broad sense is obviously problematic (Bermudez 2003, in particular Chapter 5).

(6) *O* believes that (2a).

(7) *O* believes that (3b).

Let us begin with the situation where all the above conditions are satisfied: (1a), (2a), (3b), (4), (5), (6), and (7). This will be our model noncontroversial example of correct visual perception.²² The observer has a particular impression correlated with postal workers and believes that he has it. In addition, he is actually looking at a postman, who is in his field of vision, and is rightly convinced of this. The result of denying condition (1a) will be that instead of the model correct visual perception we will arrive at a description of a hallucination or an illusion – the observer is in the internal state he is always in when looking at a postman, is convinced of this and behaves as if he was so convinced, but is in fact not looking at a postman.

If we revive condition (1a) but omit conditions (4), (6) and (7), we will obtain an understanding of seeing well suited for describing correct perception in animals and infants. There is thus no need to deny a dog the capacity to see a postman as long as it is actually looking at one, behaves as if it recognizes that it is looking at one and is “equipped” with an internal state associated with postal workers. If a dog is not in the possession of such a state, then we should say that, although in the objective sense it does see a postman, in the subjective sense it sees something else (for example a “man” – this would depend on the state the dog was actually in). The possession by the dog of an appropriate state correlated with postal workers, on the other hand, does not automatically oblige us to accept the risky thesis that the dog can form beliefs regarding postal workers or that it knows it is looking at a postman etc. The required internal state can be correlated with any property or set of properties coextensive with the property of being a postman. We can even unproblematically assume that it is a set for which we do not have a name because we are not able to distinguish it (but the dog is). We would then say that, in the objective sense, the dog sees a postman, although in the subjective sense it sees something we are not able to express. The case of looking at ten cats is similar. If a dog has the disposition to enter a particular internal state every time it is looking at ten cats, then it sees ten cats. Up to what number of cats this kind of state is distinguishable is an empirical issue.

If we negate condition (1a) (and maintain conditions (5), (2a) and (3b)) we will arrive at the sense of the word “to see” appropriate for describing

²²By this I understand perception usually referred to in the literature as *veridical perception*.

hallucinations and illusions in animals and infants (Fujita et al. 1991 and Fish 2009 write about hallucinations in animals). Here again, we can go ahead without implying the possession of beliefs.

Another interesting combination is one where only conditions (1a) and (5) are satisfied – this is the phenomenon of blind sight described by Block, among others. The observer is looking at a postman, who is in his field of vision, behaves as if he believed that he is looking at one but, first of all, when asked, he does not confirm that he is looking at a postman (and thus condition (4) is not satisfied), and secondly, does not have any visual impression (and thus conditions (2a) and (3b) do not obtain) or any belief regarding the impressions possessed at this time (hence conditions (6) and (7) are not satisfied).

A subtle distinction that is easily described using the conceptual apparatus developed above is the type of consciousness Kim calls *executive access consciousness* (Kim 1995) where the subject is experiencing something that impacts his behaviour, has an appropriate impression and believes that he is feeling something specific; however, the subject is unable to report this experience (for example because the language at his disposal is too poor). This situation would be the combination of conditions (1a), (2a), (3b), (5), and (6).

Another well-known instance widely discussed by philosophers of mind and cognitive scientists is the situation where conditions (1a), (4), (5), (6) and (7) are satisfied but not conditions (2a) and (3b). It seems that this situation relatively closely reflects the idea of a zombie developed, for example, by David Chalmers. A zombie is an observer who behaves as if he was seeing a postman (and does so in the right circumstances, i.e. when there is a postman in the vicinity) and believes both that he sees a postman and that he has the right visual impression, both of which beliefs are expressed by him; however, in fact the observer does not have any impressions whatsoever.

If conditions (1a), (2a) and (3b) obtain, but not conditions (4), (5), (6) and (7), we have to do with the situation where the subject is looking at a postman, who is present in front of him, is in the right state and has the right disposition to systematically enter it but for some reason does not realize it. This instance would popularly be described in the following way: the person sees a postman but does not realize that it is a postman.

If instead of conditions (4), (5), (6) and (7) alternative conditions (4'), (5'), (6') and (7') obtained, such that instead of “to be a postman” some other predicate was used, for example “to be a police officer,” and instead of the constant P marking a specific state of visual perception a different constant R

was employed marking some other state of visual perception, then we would have the situation where the observer sees a postman, who is present in front of him, is in the right state and has the right disposition to systematically enter it but for some reason believes that he is in a different state and sees a different object. This would be an instant popularly describable as: I saw a postman but took him for a police officer.

The last possibility I would like to point out, since it entails cognitively interesting consequences, is the situation where conditions (3b), (4), (5), (6) and (7) are met but not conditions (1a) and (2a) and where the alternative condition (2a') obtains according to which the observer is in some alternative state of visual perception *R*. This is the situation where the observer is suffering a hallucination but nonetheless believes that he is in the specific state in which he usually is when he sees a postman – here the observer has the disposition to enter the state *P* when seeing a postman but is now in some other nondescript state *R*. This combination allows us to express the disjunctivist thesis, according to which while hallucinating or experiencing an illusion the subject is, against his own recognition, in a state different from the one he is in when he is actually looking at the object now given in a hallucination or an illusion but he is unable to perceptually distinguish between the two, which finds its reflection in his beliefs (Byrne, Logue 2008).

5.

The main goal of this article was to clearly differentiate two senses of the verb “to see” functioning in the vernacular language: the subjective sense and the objective sense. I have tried to arrive at this distinction at minimum cost, without ascribing beliefs to observers (which would make it difficult to speak of the perceptual acts of animals and infants) and without referring to the non-extensional expression “the impression. . .” To satisfy the latter restriction, I have provided an extensional explication of this expression. Owing to this, I have been able to describe visual perception without committing myself to any position regarding the subject’s higher cognitive capacities (such as the possession of beliefs or the capacity to count) and thus to maintain the intuition that perception is primary relative to other forms of cognition. The subsequent introduction of the observer’s beliefs allowed me to express further distinctions, including those employed in specialized literature dedicated to philosophical problems revolving around the phenomenon of sensory perception. I do not exclude the possibility that more distinctions useful to research on perception and the mind could

be drawn in addition to the ones I have proposed here. Cases where the observer's beliefs regard states other than the one he is in seem to be particularly intriguing and worthy of further inquiry.

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Jacek Wawer¹

How contingent and how a priori are contingent a priori truths?

Abstract In the presented article, I have analyzed the famous Saul Kripke statement that some a priori truths are contingent. I show, that despite Kripke's thesis, in the historical understanding of contingency, the notions of contingency and apriority are in deep conflict with each other. In this understanding of contingency, the past, which can be known a priori, is not contingent, and the future, which is contingent, has difficulty acquiring a priori knowledge. Having stated Kripke's thesis more precisely, I propose three means in order to defend it in the historical understanding of possibility: (a) by introducing the notion of "factual" future, (b) by replacing the notion of apriority with the notion of apriority-in-the-future; (c) by replacing the notion of apriority with the notion of historical apriority, and the notion of contingency with the notion of once-apriority. In the annex of the article, I present the formal analysis of the problem that I have introduced and three solutions which I have proposed in the language of temporal-modal logic of predicates for models of indeterministic time.

Keywords a priori, contingency, modality, time

1. Introduction

In his famous work, *Naming and Necessity* (1980), Saul Kripke provided several examples meant to refute the traditionally sanctioned thesis that all a priori propositions are at the same time necessary.² The best-known is

¹ Institute of Philosophy, Jagiellonian University
E-mail: jacek.wawer@fulbrightmail.org

² References to relevant classic works can be found in (Turri 2011).

related to the notion of one meter (Kripke 1980) and can be paraphrased in the following way:

Pursuant to the decision of the 1875 Meter Convention, a stick was placed at the International Bureau of Weights and Measures in Sèvres near Paris: let us call this stick *S*. The length of the stick *S* was to serve as the standard unit for the measurement of length. Moreover, at the time *S* reached its place, say at noon, November 22, 1875 (let us call this moment *t*), the following words were uttered: “May ‘meter’ refer to the actual length of the stick *S* at this time.” Let us further assume, for the sake of the example, that the subject *L* knows this convention and uses the word ‘meter’ to indicate precisely this length.³

Let us consider, in the context of this example, the sentence uttered by *L* in 2016:

(A) At time *t* the stick *S* is one meter long.⁴

Kripke would like to persuade us that *L* should be convinced about the truth of this sentence a priori. After all, *L* knows that the length of the stick *S* at *t* was used to determine the reference of the word ‘meter’ and thus can accept the truth of (A), as Kripke puts it, “automatically, without further investigation” (Kripke 1980). The subject *L* needs nothing more than knowledge regarding the use of language in order to accept the truth of this statement. This seems to be a sufficient reason to assume that *L* can know a priori the truth of the proposition expressed by (A). At the same time, Kripke argues that the sentence expresses a contingent proposition. After all, the sheer fact that the stick *S* was used in certain ceremony does not make it immune to the workings of the laws of nature – had the stick been previously exposed to heat or stretched a bit, it would have been slightly longer at time *t* than one meter.

Kripke’s example sparked off a lively debate in the philosophy of language, metaphysics, and epistemology. In this text, I would like to join the

³ In reality, since 1960 the distance of one meter has been tied to the specific length of the light wave, not the Paris prototype.

⁴ I use this tenseless version of the sentence in order to avoid additional complications stemming from tense analysis. Moreover, the example is usually presented in the form of an implication: “If the stick *S* exists at time *t*, then it is one meter long at *t*.” To make reception easier, I will keep the non-conditional formulation of the sentence (A), especially since, according to the formal analysis I present in the Appendix, this sentence need not be subject to the condition.

debate with an observation. Given a certain understanding of the notions of possibility and contingency, Kripke's examples miss the point! Namely, it turns out that under this understanding, a priori knowability of the truth of these examples requires, as an essential condition, that *they should not be contingent*. It would thus seem that, against Kripke's claim, the notions of contingency and apriority are in conflict.

The notion of possibility that seems to exclude apriority is temporal possibility or, as I will call it, historical possibility. I mean here the notion we have in mind when we say that in 1919 it was still *possible* to avoid the Second World War, although in 1938 there was no such *possibility*. Should we want to apply a notion dual to possibility in this sense of the term, we would say that something is inevitable, irreversible, or settled. This notion of possibility is essentially connected with time – the flow of time narrows down the range of possible outcomes. In particular, the past is beyond the domain of open possibility: all that has passed is settled and irreversible. In presenting my argument, I will stick to this intuitive understanding of historical possibility. Its formal explication can be found in the Appendix (Section 6.1.). I believe that the use of this notion of possibility is appropriate in the context of Kripke's analysis since the notion of time and its interaction with possibility plays an extremely important role in his examples. In order to properly understand the meter example, for instance, it is essential to take into account when the reference of the word 'meter' is fixed, when this word is used, and which possibilities remain open and at which times.

Finally, I would like to note that my goal is not to point to some fundamental error in Kripke's argumentation. On the contrary, I intend to propose ways in which Kripke can defend himself against my objection. My aim is to elucidate the thesis about the existence of contingent a priori truths by analyzing it in light of the notion of historical possibility. As it turns out, apriority is strictly connected with historical necessity, which sheds new light on Kripke's thesis. I think that such exegesis allows for a better understanding of Kripke's text and the notions of contingency and apriority employed in the contemporary philosophy of language.

The article has the following structure: In Section 2, I cite several ways in which Kripke's thesis has been criticized to date. In Section 3, I present my own objection regarding the validity of his thesis. In Section 4, I propose two lines of defence of Kripke's thesis against my objection: by introducing the notion of actual future (4.1.) and by modifying the definition of certain key concepts (4.2.). Section 5 is a summary of the discussion. In the last part of the text I paraphrase the discussion in the formal setting of branching

time.

2. Several Problems with Kripke's Example

I will begin by presenting several attempts to undermine Kripke's thesis about the existence of contingent a priori truths (the list is likely not exhaustive). This reconstruction is motivated by historical interest only, since my own argument differs from all those presented below (it is closest in spirit to the theses by Soames and Donnellan). A reader not interested in the historical attempts to undermine Kripke's thesis may skip this part without any loss to the consistency of the reading.

Let us begin with the criticism of Kripke's example presented by Chakravarti (1979). Chakravarti notices, in my opinion rightly, that in order to do justice to Kripke's intentions, the sentence (A) should be understood in the following way:

(A)^{Chak} The length of the stick S at time t is the same as the length of the stick S at time t in our world.

Subsequently, the author argues that it is not possible to establish a priori whether the statement expresses a true proposition since it is not possible to establish a priori whether the description "the length of S at t " which opens the sentence (A^{Chak}) refers to the length of S in our world. According to Chakravarti, a context of utterance (in our world) is thinkable in which this description would refer to the length of the stick S in some other possible world. The example he brings up is of two people watching, in our world, a television program broadcasting a ceremony whereby the stick S (here characterized by slightly different parameters) is placed at a relevant location in another possible world. Chakravarti argues that in this situation the description refers to the length of the stick S in the 'transmitted' world and not in our world. As a result, the proposition expressed by the sentence (A^{Chak}) is false and so cannot be the subject of knowledge, including a priori knowledge. If we allow this kind of context, then in order to render Kripke's example proposition knowable a priori, we would have to explicitly add to the first description the following reference to our world:

(A)^{Chak2} The length of the stick S at time t in our world is the same as the length of the stick S at t in our world.

The proposition expressed by the above sentence is undoubtedly knowable a priori, but it is no longer contingent. Therefore, once we question the

assumption that the tacit reference of signs used in our world is in our world, Kripke's thesis becomes unjustified. It may be worth noting here that Kripke would probably disagree with this criticism since the above counterargument presupposes an ontology and epistemology of possible worlds radically different from the one accepted by him. Kripke writes explicitly that "a possible world isn't a distant country that we are coming across, or viewing through a telescope" (Kripke 1980: 44).

Another line of criticism has been proposed by Casullo (1977). He is of the opinion that the notion of reference-fixing description Kripke wants to use for the sake of his example is incomprehensible and vague. Following Donnellan (1966), he distinguishes two understandings of the notion of definite description: attributive and referential. According to Casullo, Kripke's examples do not express contingent a priori propositions in either of these senses. If the description "the length of the stick S at time t " is used attributively, then the term 'meter' is equivalent to it, and the sentence "The stick S at time t is one meter long" is an analytic necessary truth. If the description is used referentially, on the other hand, the reference of the word 'meter' is a particular length meant by the speaker while uttering the description. In the latter scenario, however, there is no guarantee that the length meant by the speaker is the same as the length of the stick S at t since this can at best be established a posteriori. One way or another, the sentence (A) does not express a contingent a priori proposition.

BonJour (1998) and Turri (2011) criticize Kripke in a mutually similar and concise manner. Namely, they hold that Kripke conflated two theses: the necessary a priori thesis that any object used to fix a unit of length will measure precisely one such unit at the time of the fixing, and the thesis that a particular object, here the stick S, at time t is one meter long – this thesis is contingent and a posteriori since it is impossible to establish a priori that S and not another object was used at time t to determine the length of the 'meter' unit.

An interesting line of criticism has been offered by Scott Soames (2003). According to Soames, Kripke's examples are misleading because their author falsely suggests that we can always use a reference-fixing description (for example, "the length of the stick S at time t ") to express a singular proposition⁵ and be convinced as to what this proposition says (that we can possess a belief about an object O that it has a property P). Soames is of the opinion that, in order to understand and believe such an individual proposition, it is

⁵ Although Kripke himself did not use this terminology, Soames (2003: 400–401) argues that this thesis can reasonably be attributed to him.

necessary to be acquainted with the reference of the appropriate description and to possess an independent rationale in favour of the thesis that the description is true of the object O. According to him, the rejection of the latter assumption leads to absurd consequences. One of them is revealed in the observation Soames attributes to Kripke himself (Soames 2003: 411; Kripke is supposed to have cited it during his Princeton seminars convened after the lectures recorded in *Naming and Necessity*). If we assume that the subject L shares a false conviction expressed by the sentence S, then L is inclined to accept the proposition expressed by the sentence “The sole object x such that (if S, then x is Princeton University, and if not-S, then x is Kripke’s left toe) is a university.” As a result, if we are allowed to use the above sentence to express a singular proposition toward which we might hold this or that attitude, we come to the following conclusion: given that L does believe that S, L is convinced that the object which is Kripke’s left thumbnail is a university. According to Soames, Kripke himself considered this example to be the *reductio ad absurdum* of the thesis that a definite description can always be used to fix the reference. However, if using a definite description to fix the reference requires acquaintance with the appropriate object and its properties, we cannot know the proposition given by Kripke a priori. Hence, Kripke’s example does not illustrate a contingent truth knowable a priori.

A similar conclusion had been drawn earlier by Keith Donnellan (1977). In contrast to Soames, Donnellan believes that rigidified descriptions can be used to express singular propositions. However, he claims, this time in agreement with Soames, that one cannot hold attitudes toward propositions expressed using this instrument. In particular, one cannot know, hold or believe such propositions. Hence, Kripke’s meter example does express a contingent proposition, but this proposition cannot be known without the knowledge of the actual reference of the appropriate description. In particular, it cannot be known a priori.

Many examples of contingent a priori truths have emerged in the literature since the publication of *Naming and Necessity*. Every example known to me, however, uses one of the following two methods of constructing truths of this type: (a) φ if and only if actually φ ; and (b) the sole object possessing the property P is the sole object actually possessing the property P. The objections I raise below apply *mutatis mutandis* to all examples constructed using any of these two methods.

3. Apriority and Historical Contingency: When the Stick S Can Measure One Meter, and When It Cannot

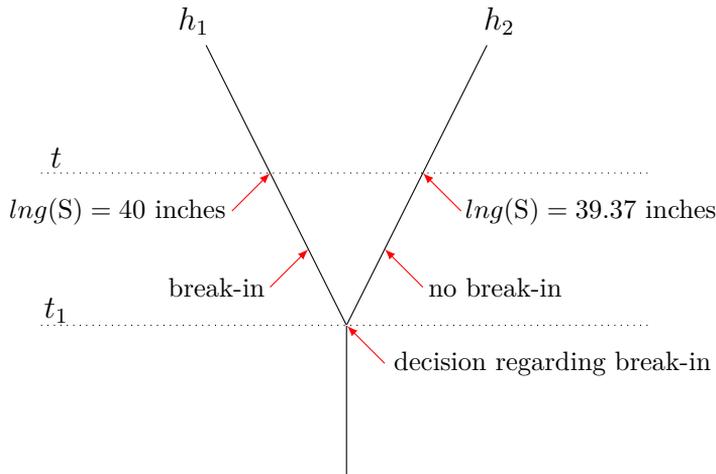
As I have indicated above, the notion of possibility I will use is historical possibility. Further below I will introduce a formal semantics of this notion; meanwhile, the intuitive understanding sketched in the Introduction should suffice. In order to move from the notion of possibility to that of contingency, I will adopt the traditional definition according to which a proposition φ is contingent insofar as it is possible that φ and it is possible that not- φ .

As I have already mentioned, given the understanding of possibility I will refer to, the future is the only domain of open possibilities, while the past is fixed and irreversible. Therefore, the future is the only domain of contingency as well. This view is by no means novel. It was voiced by Aristotle; it was also implicitly held by many theologians who discussed the (perhaps illusory) conflict between human freedom and divine omniscience (see Øhrstrøm, Hasle 1995). Another philosopher who claimed that there is a modal asymmetry between the past and the future was Charles Sanders Peirce (1958: 5.459). In Poland, similar views were articulated at some point by Tadeusz Kotarbiński (1913) and Jan Łukasiewicz (1961). The philosopher who formalized this intuition in the language of modal logic and used relational semantics for its explication was Arthur Prior (1967). Interestingly, in his formal considerations regarding historical modality Prior was inspired by Kripke himself (Ploug, Øhrstrøm 2012; Øhrstrøm, Hasle 1995: 189). As a teenager attending high school in Omaha, Nebraska, Kripke, stimulated by the book *Time and Modality*, wrote a letter to Prior in which he proposed a novel way of modelling the notion of historical possibility. This notion, after proper adaptation, turned out extremely fruitful for Prior and those continuing his work. The idea that possibility has a temporal dimension was thus not alien to Kripke.

Now that we are equipped with the notion of historical contingency, let us look more closely at Kripke's example. Let us focus on the sentence (A) "At time t the stick S is one meter long" uttered today. Anyone familiar with the appropriate convention can know the truth of the proposition expressed by the sentence a priori.⁶ Let us now consider whether the sentence expresses a contingent truth. The proposition says that in 1875 a certain stick possessed a certain property. As long as we accept the notion of contingency proposed

⁶ I set aside the concerns recounted in the previous section.

above, the sentence (A) is not at all contingent today. On the contrary, how long the stick S was nearly 140 years ago is an irreversible fact. It is not a contingent truth since nothing can be done about it anymore. Today we can heat up the stick S and stretch it all we want (as long as we are allowed access by the management and security at Sèvres), yet we will not be able to change its length on November 22, 1875.



Graph 1. Possible fate of the stick S.

It is thus clear that today the sentence (A) does not express a (historically) contingent proposition. Here, someone might rightly protest that this is not at all what is meant. Of course, the past length of the stick S cannot be changed today, but this has not always been the case. For example, at noon, November 21, 1875 (let us call this time t_1) the length of the stick S on the following day was still an open matter.⁷ It may have so happened then that a dishonest competitor of the firm Johnson Matthey, which actually cast the meter prototype, should have commissioned a break-in into the International Bureau of Weights and Measures and a slight stretching of the stick S to the length of 40 inches. This way, the competitor would have undermined the professionalism of the British firm (the stick at Sèvres would have been longer than other specimens provided by Johnson Matthey and its length different from what had been agreed, etc.). The break-in never took place but until t_1 this possibility was still open. Graph 1 illustrates the situation described by me just now. The more mundane reasons for a

⁷ This is clearly the case on the condition that our world is not fully deterministic.

change in the stick's length could have been indeterministic fluctuations in temperature near Paris and their impact on the density of metal. Let us concede then that on November 21, 1875, that is at t_1 , it was still contingent whether on the following day the stick S would be one meter long.

Let us now consider whether at time t_1 any person might have known a priori that on the following day the stick S would be one meter long. Such a hypothesis would be completely breakneck. In order to know that on the following day the stick S would be one meter long (i.e., circa 39.37 inches) that person would have had to be able to exclude the possibility of any break-in, to predict the precise temperature at noon the day after, etc. It is highly unlikely that anyone could be in possession of this kind of knowledge. It would be even more unusual to expect anyone to possess this kind of knowledge a priori. Much more is needed to establish such facts than basic information regarding the use of the English language. One might even argue that if the length of the stick S depended on indeterministic factors, then its prediction was not possible at all. It thus turns out that on November 21, 1875, when the length of the stick the day after was still contingent, it was not possible to know it a priori. This observation allows us to note that the notion of apriority employed by Kripke has an important temporal component: today the truth of (A) is knowable a priori, but it was not so before t_1 when the length of the stick S was still an open matter.

In light of the above argumentation we may say that by the time we know a priori that at noon, November 22, 1875 the stick S was one meter long this is no longer a contingent truth. And conversely, as long as the length of S at noon, November 22, 1875 was contingent, no one could predict a priori that it would be one meter. This observation shows that the necessary condition for Kripke style propositions to be knowable a priori is that they are historically necessary. It clarifies the dependencies obtaining between the epistemic notion of apriority and the metaphysical notion of possibility.

4. How to Defend Kripke?

I would like to propose two natural ways of overcoming the problem indicated above. The first one shows that, contrary to the appearances, the truth of the proposition expressed by (A) is knowable a priori even when it is historically contingent. In the second one, I admit that a priori truths are not historically contingent but I claim that certain modifications to the notion of either contingency or apriority allow one to express theses similar to those held by Kripke.

4.1. Actual Future and Historically Contingent A Priori Propositions

The first idea is to argue that the truth of the proposition expressed by the sentence (A) “At time t the stick S is one meter long” is knowable a priori at time t_1 , when this length is still undetermined and thus contingent.

Let us go back to November 21, 1875 and assume that it is already decided that on the following day the reference of the word ‘meter’ will be fixed as the length of the stick S. So far I have argued that it is not possible to know a priori precisely how long the stick S will be due to the impact of indeterministic factors. However, one might like to address the objection like this: I certainly cannot predict the exact future length, for example in inches, of the stick S, but it will definitely have some particular length and thus I can fix, already today, the reference of the word ‘meter’ by reference to the length the stick S will actually have at time t . It is unfailingly true that the length of the stick S at time t will be equal to the actual length of S at t and so I can establish, without recourse to experience, that the sentence (A) expresses a true proposition and thus that its truth is knowable a priori. By arguing in the above manner, we accept the following (rough) definition of apriority:

Definition 1. It is knowable a priori that a sentence φ expresses a true proposition if and only if, regardless of any circumstances, when the sentence φ is uttered, it expresses a true proposition.

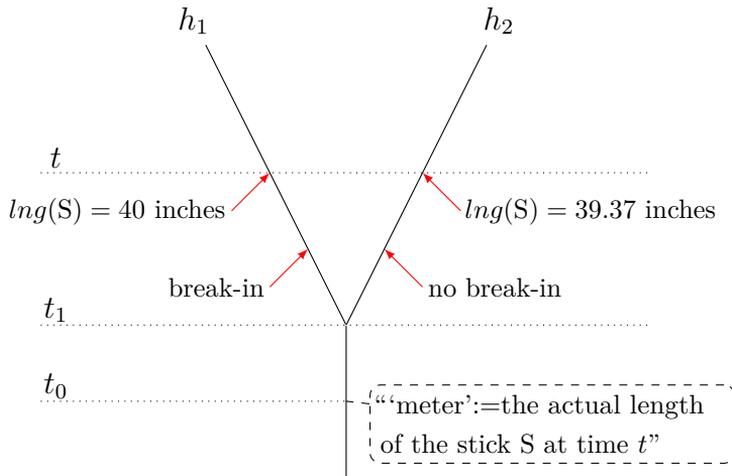
This definition is precise enough for my purposes, although it is likely not fully adequate. The implication from left to right can be questioned by reference to sentences expressing innate truths, intuitively known truths, insight or revelation – it could be argued that their truth is knowable a priori despite the fact that in some circumstances they could express false propositions (see e.g. Kripke 1980: 40, footnote 11; Turri 2011). The implication from right to left, on the other hand, could potentially be undermined (as has been done by Davies and Humberstone 1980) by reference to sentences expressing necessary propositions the truth of which is known a posteriori, such as “George Orwell is Eric Arthur Blair.” I do not take it upon myself to defend the correctness of the above formulation here and if anyone has doubts regarding the proposed definition, I will say that it explicates a certain technical sense of apriority. I will keep this formulation since it is simple and sufficiently precise to meet the needs of this article; it also allows for a simplification of the formal argument I present in the Appendix.

The notion of apriority I adopt here is very close to that proposed by Robert Stalnaker (1978: 83). A similar notion has also been suggested by David Kaplan (1989b: 538, 550, 597). The implication from left to right in the above definition is accepted, in a particular formulation, by Davies and Humberstone (1980). Using the conceptual apparatus proper to two-dimensional semantics of David Chalmers (2005) we may say that the truth of the proposition expressed by a sentence φ can be known a priori if and only if 1-intension of φ yields the truth in all situations in which it is defined (Chalmers himself has doubts whether this characteristic can be identified with apriority).

Definition 1 clearly indicates that what is knowable in Kripke's examples is *the fact that the proposition expressed by the given sentence is true* and not the proposition thus expressed itself. I will not try to undermine this notion of apriority. Instead, I would like to raise the question of whether we can, accepting the above definition, establish the truth of the proposition expressed by (A) a priori. The answer to this question depends on the semantic value ascribed to the rigidified definite description constituting the definiens of the expression 'meter', that is to say, the description "the actual length of the stick S at time t ." In particular, it depends on whether we assume that, given that the future length of the stick S is not determined, the description refers.

Let us take a look at Graph 2 – the diagram clearly shows that at the time when the reference is fixed (that is at time t_0) there are many possibilities as to the length of the stick S at time t . It could be 39.37 inches, but 40 inches is also possible, if the break-in to the Sèvres Bureau does take place. However, 'meter' is supposed to refer to the length the stick S will actually have. For this to make sense, one has to assume that, among the many possible future scenarios, the one which will actually occur can be distinguished. Only on this assumption can the description used at time t_0 refer to one strictly determined quantity.

Many outstanding theoreticians exploring the relationship between determinism and time question this possibility (see, among others, Belnap et al. 2001; MacFarlane 2008; Placek, Belnap 2012). They think that to speak of 'actual' or 'real' future is not valid in light of indeterminism. There is no way to tie the word 'actually' to any one possible future and we are forced to admit that it refers to an entire bundle of possible continuations allowed by the current state of the world. Hence, in the approach proposed by Belnap et al. (2001) and MacFarlane (2008) the actuality operator is in fact an indexical form of historical necessity. Since there is no one length



Graph 2

the stick S would have in every possible continuation, they hold that if at t_0 the sentence “At t the stick S has the length the stick S actually has at t ” expresses any proposition at all, it is a false one. As such, it cannot be the subject of knowledge, all the more knowledge a priori. The relevant formal analysis can be found in Section 6.2. of the Appendix.

The question of the possibility of speaking about the actual future is closely related to the question of the possibility of ascribing truth values to propositions regarding contingent future. If we model indeterminism and the openness of the future using a tree model, this question can be formulated in the following way: Does any one branch of the tree play a special role in the semantic theory? This highlighted future is usually called, after Belnap and Green (1994), the Thin Red Line (TRL). Belnap himself is a staunch opponent of this idea, which has in turn been long defended by Danish philosopher Peter Øhrstrøm. Øhrstrøm claims that there is no contradiction between the indeterministic plurality of possible futures and the actual future course of events. The debate between Belnap and Øhrstrøm is to a large extent formal and revolves around the attempt to show whether branching time theory allows for the creation of a semantics that would use the notion of actual future to interpret sentences about the future. A concise description of this debate with a detailed bibliography can be found in (Wawer 2014).

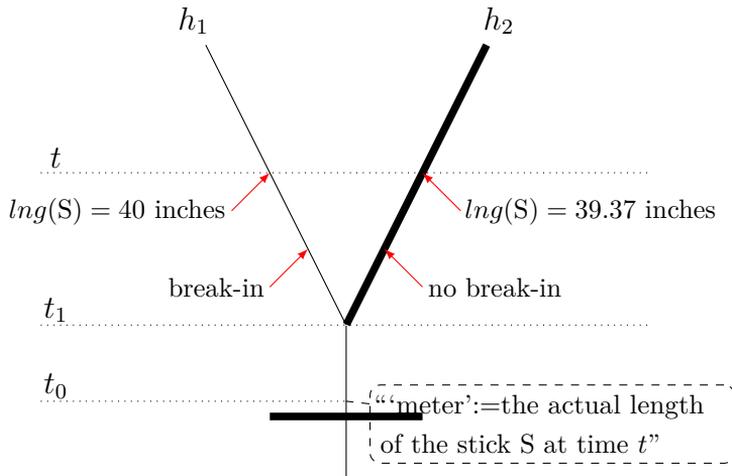
In my recent work (Malpass, Wawer 2012; Wawer 2014) I have argued, in the spirit of Øhrstrøm’s thought, that one can consistently assume that

sentences regarding contingent future possess logical value. However, in the latter article I acknowledged that this thesis is not metaphysically neutral. I claimed that in order to reasonably uphold the thesis about the bivalence of sentences about the future and at the same time to believe in the plurality of future possibilities, one must make two metaphysical assumptions: (a) actualism, that is, the thesis that among all possible states of our world only one is concretely realized, while the rest are either *abstracts* or *modes* of the world's existence; and (b) eternalism, that is, the thesis that our world is an object that is not only spatially but also temporally extended and that is has concrete temporal parts going beyond the present (today I think that the bivalence thesis only requires the first assumption, I discuss this issue at length in the sixth chapter of Wawer 2016).

I believe that assumption (a) (and possibly also (b)) allows one to maintain, in a very natural and philosophically justified way, the bivalence of sentences about the future in light of metaphysical indeterminism. In my article, I also proposed a formal semantics of a tempo-modal language that is free of the problems raised by Belnap (the theory is improved and extended in Wawer 2016). A theory is therefore possible which yields the bivalence of contingent sentences about the future and this theory can be used to argue that the sentence (A) uttered at time t_0 expresses a historically contingent proposition the truth of which is knowable a priori.

There is no need to deal with the formal details here (an interested reader is referred to Section 6.3. of the Appendix). In order to understand the content, it will be enough for us to graphically distinguish the actual course of events using an emboldened line (Graph 3). Once we have at our disposal the distinguished course of events, the reference of the word 'meter' and the logical value of sentences featuring this word at t_0 can be established without any difficulty. Of course, no one can know before time t precisely how long the stick S will be at t . However, the relevant notion is already well defined at t_0 and propositions featuring it possess one of the two truth values.⁸ At this point, one may raise the question regarding the utility of a notion whose conditions of correct use are unknown to the user and which the user will be able to use correctly only after time has revealed its meaning. However, these are pragmatic considerations. On the semantic level the example is perfectly correct.

⁸ This situation formally resembles the instance where we hear the utterance "I am here" without knowing where the speaker is. Here too we know that the utterance expresses a true proposition, although we do not know precisely what proposition is being uttered, that is, we do not know who is where.



Graph 3

It turns out that (A) can be understood as a sentence expressing a historically contingent proposition whose truth is knowable a priori. However, the condition for doing so is that we agree for the ascription of truth values to propositions about contingent future and for the fixing of the reference of concepts by appealing to some future contingent states of affairs. This is also tied to the acceptance of a specific stance toward metaphysics of modality. As far as I can tell, these assumptions are not inconsistent or otherwise undesirable. In fact, some fragments of Naming and Necessity seem to suggest that this view was close to Kripke himself – the view that among the many future possibilities only one is actually realized. One could quote the following passage as an example: “Hence there are thirty-six possible states of the pair of dice, as far as the numbers shown face-up are concerned, though only one of these states corresponds to the way the dice actually will come out” (Kripke 1980: 16). We should note, however, that on this reading of Kripke’s thesis, the view, that there exist contingent a priori truths becomes more controversial. To defend it, one would have to prove reasonable the metaphysical assumptions cited above which constitute the necessary condition for the interpretation of the sentence (A) as expressing a contingent a priori proposition.

4.2. Defence by Definitional Change

If one has no wish to concede that it is reasonable to speak about actual contingent future, but one would nonetheless like to acknowledge that Kripke's observations capture an important phenomenon, they must try to somehow redefine apriority or contingency. I will propose two redefinitions that will allow me to show how we can speak of the contingent apriority of Kripke's examples in the context of historical modality. Both reformulations will require some temporal-modal acrobatics.

4.3. Contingent A-Priori-in-the-Future Truths

In Section 3 I argued that at time t_0 no one can establish a priori the precise length the stick S will have at t since this is still undetermined at t_0 . The response to this objection I presented in Section 4.1. was that, although it is impossible to establish precisely how long, say in inches, the stick will be, it is possible to establish that the sentence (A) expresses a true proposition. This response raises skepticism on the part of some theoreticians because the content of (A) refers to what will actually take place, while it is controversial whether one can speak of the actual future in the context of indeterminism. If we are not entitled to do so, then the proposition expressed by (A) is not only not knowable a priori at t_0 but it expresses a false proposition.

Even if we agree with the above objection, we can still defend the thesis that (A) enjoys some special status. Let us observe that at t_0 it was possible to establish that, regardless of how the world might unfold, the sentence (A) would express a true proposition as of t . Although the sentence would express a different proposition depending on the course of events, it would nonetheless always express a true proposition in the context in which it would be uttered. Therefore, it may be said that at t_0 the sentence (A) had the "a-priori-in-the-future" status, that is, that it was knowable a priori at t_0 that in the future the sentence would express a true proposition.⁹

Definition 2 (a-priori-in-the-future). It is knowable a-priori-in-the-future that a sentence φ expresses a true proposition if and only if, regardless of the past and the future course of events, there is a time such that, from that time on, if the sentence φ is uttered, then that sentence will express a true proposition.

⁹ Keith Donnellan (1977: 24) writes that a very similar notion was suggested to him in a conversation by Roger Albritton. Donnellan uses the following expression to characterize this notion: "(...) what we can know is that certain sentences, if and when we come to be in a position to use them, will express truths" (Donnellan, 1977: 25).

Let us now return to the contingency of the proposition expressed by (A). I have argued above that the proposition is not historically contingent now. However, it is natural to say that there was a time such that it was *then* contingent what the sentence (A) says *now*. In other words, insofar as the reference of the word ‘meter’ has been fixed, we may ask whether there was a time such that it was then possible that the stick S would, and that it would not, be one meter long at t . Of course, this was the case until t_1 . Therefore, we can say *today* that at t_1 it was historically contingent that (A). Moreover, at t_1 it was a-priori-in-the-future that (A). To put it another way, there was a time in the past such that it was then contingent whether (A), yet it was knowable a priori that the sentence (A) would express a true proposition in the future. This is one sense that can be ascribed to Kripke’s thesis about the existence of contingent a priori propositions in the context of historical possibility. Below I will paraphrase this thesis in a similar but more natural manner.

4.4. Previously Contingent A Priori Truths

In the preceding section I tried to defend the thesis about the existence of contingent a priori truths while maintaining the notion of historical contingency and by assuming the notion of apriority-in-the-future. However, another tactic is also possible: to maintain that the truth of the proposition expressed by (A) is *today* knowable a priori, while it is *previously-contingent*. In the context of the historical notion of possibility this new sense of contingency can be explicated in the following way:

Definition 3 (previously-contingent). A proposition φ is previously-contingent if and only if it was once the case that it was historically possible that φ and that it was historically possible that not- φ .

It is easy to note that the proposition expressed by the sentence (A) today has precisely this property. It used to be possible that at t the stick S would have a slightly greater length than it actually came to have. The proposition expressed by (A) is thus previously-contingent. Some of Kripke’s formulations show that this understanding of possibility and contingency was close to him (for example, in describing possible and contingent states of affairs, he systematically employs the past form “might have” and not the present form “might”).

Let us now ask how we should understand apriority in order that it is *today* knowable a priori that (A) expresses a true proposition (even if this was

not always knowable in the past). I think that the following understanding can be proposed:

Definition 4 (now-a-priori). It is knowable now-a-priori that a sentence φ expresses a true proposition if and only if, regardless of the past course of events, from now on, whenever the sentence φ is uttered, a true proposition will be expressed.¹⁰

The sentence (A) satisfies definition 4. Had the stick been slightly longer at t , the sentence “At t the stick S is one meter long” would still express a true proposition today (of course, in language that would be used today, where the word ‘meter’ would not refer to our meter but to a slightly greater unit). We can thus establish without recourse to experience that, regardless of precisely how things are with S at t , from t on the sentence (A) does express a true proposition (although the proposition may change depending on the length of the stick S at t).

Therefore, insofar as we know the relevant linguistic convention, the sentence “On November 22, 1875 at noon the stick S is one meter long” expresses a now-a-priori truth. This truth is at the same time previously-contingent. This is the new sense in which (A) is contingent a priori. Namely, it is previously-contingent now-a-priori. I think that this sense comes closest to the spirit of Kripke’s text.

5. Summary

The subject matter of my analysis was Kripke’s thesis that some sentences express propositions which are at the same time contingent and knowable a priori. I decided to explore this thesis in light of the notion of possibility I dubbed historical. I tried to show that if we define a contingent proposition as one which is historically possible, while its negation is also historically possible, the example sentences expressing contingent a priori truths discussed in the literature become controversial. It turns out that they express propositions whose truth is knowable a priori, but they are historically necessary. On the other hand, when these propositions are still historically contingent, it is doubtful whether they are knowable a priori. It seems that

¹⁰ Let us note that a kindred definition: “It is knowable now-a-priori that a sentence φ expresses a true proposition if and only if from now on, whenever the sentence φ is uttered, a true proposition will be expressed” is flawed since it renders knowable a priori all historical truths, including “The Battle of Tannenberg took place in 1410,” for example.

this conflict is not accidental but stems from the nature of the notions of time, contingency, and apriority.

Having noted the conflict between historical contingency and apriority, I went on to find a way to restore Kripke's thesis to its former power. I considered two lines of defence against the objection I had formulated. First, I argued that we can find sentences expressing historically contingent a priori propositions as long as we agree that semantic value can be fixed by reference to future contingent states of affairs. Following that, I showed how to defend Kripke's thesis by redefining either the notion of apriority or that of contingency.

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6. Appendix

6.1. Branching-Time (*BT*) Language and Models

In order to precisely express the problems I have raised, I will use a language proposed in (Belnap et al. 2001; Belnap 2002). It is perfectly suited for my purposes since, on the one hand, it is sufficiently rich to express all relevant definitions, and on the other hand, it was created with an eye to an interpretation in indeterministic branching models.

To pose our problem, we need a language of modal-temporal predicate logic with identity, equipped with a definite description operator and a truth predicate. Its logical constants are: the standard sentential operators of conjunction \wedge and negation \neg ; the temporal sentential operators "It will be the case that" (F), "It was the case that" (P) and "At t it is the case that" (At_t); the sentential operator "It is possible that" (\diamond); the indexical modal operator "It is actually the case that" ($@$); the indexical temporal operator "It is now the case that" (Now); the truth predicate (tr); and the definite

description operator ι which in Belnap's approach is a nominalizing functor with a sentential argument (regarding this question Belnap follows Frege against Russell). The rules for the composition of terms and formulas are standard.

The extralogical symbols of our language are: individual variables x_1, x_2, \dots (I will denote the set of individual variables with the symbol *var*); predicate constants P, Q, R, \dots , including the two-place predicate of identity =; individual constants a, b, c, \dots , including the individual constant s denoting the stick S and the individual constant \dagger ; temporal constants t_1, t_2, \dots referring to instants; and functional constants f, g, h, \dots , including the one-place functional constant *lng* referring to the function of length.

In order to build semantics for the thus defined language, we need to define the relevant notion of a model. The *BT* model is an ordered quintuple $\mathfrak{M} := \langle M, \leq, D, Inst, I \rangle$, where:

1. $M \neq \emptyset$ is a set of possible moments, where a moment is understood as an instantaneous possible state of the world;
2. \leq is a partial order defined on M , fulfilling the additional conditions of:

(a) no backward branching:

$$\forall m_1, m_2, m_3 \in M ((m_2 \leq m_1 \wedge m_3 \leq m_1) \Rightarrow (m_2 \leq m_3 \vee m_3 \leq m_2));$$

(b) consistency:

$$\forall m_1, m_2 \in M \exists m_3 \in M (m_3 \leq m_1 \wedge m_3 \leq m_2).$$

This order can be understood as a tempo-modal relation “inevitably-earlier — possibly-later.” The pair $\langle M, \leq \rangle$ can be graphically represented as a tree of possibilities which can branch into the future but never into the past. The maximal linearly ordered chains of this tree (the maximal possible courses of events) are called histories and are denoted with the letters h_1, h_2, h_3, \dots , while the set of all histories is denoted with the symbol *Hist*.

3. *Inst* is a partition of the set M satisfying the following conditions:

(a) one-element intersections: $\forall h \in Hist \forall i \in Inst \text{ card}(h \cap i) = 1$;

(b) order preservation:

$$\forall i_1, i_2, h_1, h_2((h_1 \cap i_1 < h_1 \cap i_2) \Rightarrow (h_2 \cap i_1 < h_2 \cap i_2))$$

$$\forall i_1, i_2, h_1, h_2((h_1 \cap i_1 = h_1 \cap i_2) \Rightarrow (h_2 \cap i_1 = h_2 \cap i_2)).$$

The elements of the set *Inst* can be thought of as temporal instants. Graphically, they are lines running perpendicular to the direction in which the tree of possibilities is growing. Thanks to them we can temporally compare events taking place within different histories. Although the order $\langle M, \leq \rangle$ is not linear, the set *Inst* is linearly ordered. Hence, it is not time but possible courses of events that branch out in the misleadingly named branching-time theory. The symbol i_m denotes the instant of time where the moment m belongs.

4. $D \neq \emptyset$ is the set of possible objects containing, among others, the stick *S* and a distinguished non-existent object \dagger serving as reference for non-denoting definite descriptions.
5. I is an interpretation function mapping:
 - individual constants into D ,
 - temporal constants into the set of instants *Inst*,
 - the set of n -place predicate symbols into the set $\mathcal{P}(M \times Hist \times D^n)$,
 - the set of n -place functional symbols into the set of functions of the form: $M \times Hist \times D^n \mapsto D$.

The valuation V is a function mapping individual variables *var* into the domain D . For any $d \in D$, $V[d/x]$ denotes a valuation such that $\forall y(y \neq x \Rightarrow V(y) = V[d/x](y))$ and $V[d/x](x) = d$. The context is any $m \in M$.

The truth and reference for our language are relativized to a pair $\langle \text{moment}, \text{history} \rangle$. This formal measure has been proposed by Prior (1967) and subsequently developed by Thomason (1970, 1984). In the *BT* semantic we always assume that for any given pair $\langle m, h \rangle$ it is the case that $m \in h$; in order to highlight this fact in the notation, we write m/h instead of $\langle m, h \rangle$.

The reference of the term t in the model \mathfrak{M} , in the context m_c , given the valuation V , on the pair m/h (symbolically $t^{\mathfrak{M}, m_c, V, m/h}$), is defined inductively in the following way:

1. for the individual variable x : $x^{\mathfrak{M}, m_c, V, m/h} = V(x)$;

2. for the individual constant a : $a^{\mathfrak{M}, m_c, V, m/h} = I(a)$;
3. for the n -argument functional symbol f and the n -tuple of terms t_1, \dots, t_n :
 $f(t_1, \dots, t_n)^{\mathfrak{M}, m_c, V, m/h} = I(f)(m, h, t_1^{\mathfrak{M}, m_c, V, m/h}, \dots, t_n^{\mathfrak{M}, m_c, V, m/h})$;
4. for the definite description $\iota x(A)$:

$$\iota x(A)^{\mathfrak{M}, m_c, V, m/h} = \begin{cases} \text{(a) the sole object } d \in D \text{ such that} \\ \quad \mathfrak{M}, m_c, V[d/x], m/h \models A, \\ \quad \text{if such an object exists;} \\ \text{(b) } \dagger, \text{ otherwise} \end{cases}$$

The notion of satisfaction for the formula φ in the model \mathfrak{M} , in the context m_c , given the valuation V , on the pair m/h (symbolically $\mathfrak{M}, m_c, V, m/h \models \varphi$) is defined *via* standard induction:

1. for an n -place predicate symbol P , $\mathfrak{M}, m_c, V, m/h \models P(t_1, \dots, t_n)$ iff the n -tuple $\langle m, h, t_1^{\mathfrak{M}, m_c, V, m/h}, \dots, t_n^{\mathfrak{M}, m_c, V, m/h} \rangle$ belongs to $I(P)$;
2. $\mathfrak{M}, m_c, V, m/h \models t_1 = t_2$ iff $t_1^{\mathfrak{M}, m_c, V, m/h} \approx t_2^{\mathfrak{M}, m_c, V, m/h}$, where \approx is the relation of identity;
3. $\mathfrak{M}, m_c, V, m/h \models \neg\varphi$ iff it is not the case that $\mathfrak{M}, m_c, V, m/h \models \varphi$;
4. $\mathfrak{M}, m_c, V, m/h \models \varphi \wedge \psi$ iff $\mathfrak{M}, m_c, V, m/h \models \varphi$ and $\mathfrak{M}, m_c, V, m/h \models \psi$;
5. $\mathfrak{M}, m_c, V, m/h \models F\varphi$ iff $\exists m' \in h(m' > m$ and $\mathfrak{M}, m_c, V, m'/h \models \varphi$). The parameter h thus acquires particular importance during the interpretation of temporal operators. The truth of sentences of the form “It will be the case that φ ” significantly depends on the choice of the history h used to interpret the sentence;
6. $\mathfrak{M}, m_c, V, m/h \models P\varphi$ iff $\exists m' \in h(m' < m$ and $\mathfrak{M}, m_c, V, m'/h \models \varphi$);
7. $\mathfrak{M}, m_c, V, m/h \models At_t\varphi$ iff $\mathfrak{M}, m_c, V, m_{th}/h \models \varphi$, where m_{th} is the only moment in the history h belonging to the instant designated by the constant t (the definition of *Inst* guarantees that such a moment exists);

8. $\mathfrak{M}, m_c, V, m/h \models \diamond\varphi$ iff $\exists h'm \in h'$ and $\mathfrak{M}, m_c, V, m/h' \models \varphi$. This definition reveals the “historical” aspect of our notion of possibility. In order to establish whether at the moment m it is possible that φ , we must check only the histories that run through the moment m ;
9. $\mathfrak{M}, m_c, V, m/h \models @\varphi$ iff $\forall h'(m_c \in h' \Rightarrow \mathfrak{M}, m_c, V, m_c/h' \models \varphi$. @ is an occasional expression. This is evidenced by the fact that the evaluation moment m on the left side of the equivalence has been replaced by the context m_c on the right side. This is a natural adaptation of David Kaplan’s formalism (1989b). As I have written above, in the standard *BT* formalism, actuality is an occasional form of necessity (there is no one “actual” future), which is why we quantify over all histories running through m_c ;
10. $\mathfrak{M}, m_c, V, m/h \models \text{Now}(\varphi)$ if and only if $\mathfrak{M}, m_c, V, (h \cap \text{imc})/h \models \varphi$. “Now” is another occasional expression. In the case of its use, the evaluation history remains unchanged, while the moment of evaluation changes to the moment concurrent with the context of utterance. Precisely this behaviour of the operator @ is required in order that sentences of the type “I could be living in London now” be properly interpreted;
11. $\mathfrak{M}, m_c, V, m/h \models \text{tr}'\varphi$ iff $\mathfrak{M}, m, V, m/h \models \varphi$, where ‘ φ ’ is the name of the sentence φ . The key feature of the thus functioning predicate is that it replaces the context of utterance with the current moment of evaluation. Owing to this, we evaluate sentences in circumstances in which they are uttered and so, for example, the sentence “The children are quiet now” uttered an hour ago was true insofar as the children were quiet an hour ago and not insofar as they are quiet now.

The remaining extensional sentential connectives are defined in the standard way; each modal operator is associated with a dual operator: $\square = \neg\diamond\neg$ (“It is settled that”); $G = \neg F\neg$ (“It will always be the case that”); and $H = \neg P\neg$ (“It was always the case that”).

6.2. Indeterminism, Actual Future and the Conflict of Apriority and Historical Necessity

Equipped with this rich formal apparatus we are finally able to model our example. May lng^* be a length function mapping objects to their lengths,

and may s be the constant designating the stick S ($I(lng) = lng^*$, $I(s) = S$). We can now define the length of one meter (m) in the following way:

Definition 5 (meter). $m := \iota x @ At_t(x = lng(s))$.

Hence, one meter is the distance equivalent to the actual length of the stick S at time t . Given this definition, the sentence (A) has the following logical form:

(A) $At_t(lng(s) = m)$, that is, $At_t(lng(s) = \iota x @ At_t(x = lng(s)))$.

Hence, Kripke's example says that at time t the length of the stick S is equal to the length the stick S actually has at time t . Let us first distinguish this sentence from another similar one:

(A*) $At_t(lng(s) = \iota x At_t(x = lng(s)))$.

This is simply a tautology and thus expresses a necessary proposition. In order to confirm that, I will go through a tedious but simple process of establishing the truth conditions for this example:

1. $\mathfrak{M}, m_c, V, m/h \models At_t(lng(s) = \iota x At_t(x = lng(s)))$ iff (def. At_t)
2. $\mathfrak{M}, m_c, V, m_{th}/h \models lng(s) = \iota x At_t(x = lng(s))$ iff (def. $=$)
3. $lng(s)^{\mathfrak{M}, m_c, V, m/h} \approx \iota x At_t(x = lng(s))^{\mathfrak{M}, m_c, V, m/h}$ iff (def. ι and \mathfrak{M})
4. $lng^*(m_{th}, h, S) \approx$ the sole object $d \in D$ such that $\mathfrak{M}, m_c, V[d/x], m_{th}/h \models At_t(x = lng(s))$ iff (def. At_t)
5. $lng^*(m_{th}, h, S) \approx$ the sole object $d \in D$ such that $\mathfrak{M}, m_c, V[d/x], m_{th}/h \models x = lng(s)$ iff (def. $=$)
6. $lng^*(m_{th}, h, S) \approx$ the sole object $d \in D$ such that $x^{\mathfrak{M}, m_c, V[d/x], m_{th}/h}$ iff (def. \mathfrak{M})
7. $lng^*(m_{th}, h, S) \approx$ the sole object $d \in D$ such that $d \approx lng^*(m_{th}, h, S)$.

Since lng^* is a function, it is guaranteed that there exists precisely one such magnitude d , and therefore, that our sentence (A*) says that $d = d$, which is obviously a necessary proposition.

If the truth conditions for (A) are analyzed equally precisely, it will turn out that it is true at the point $\mathfrak{M}, m_c, V, m/h$ if and only if:

$$\mathbf{A} : \text{lng}^*(m_{th}, h, S) \approx \text{the sole object } d \in D \text{ such that} \\ \forall h'(m_c \in h' \Rightarrow d \approx \text{lng}^*(m'_{th}, h', S)).$$

The difference in truth conditions between (A*) and (A) is therefore fundamental. Whereas the first sentence expresses a logically necessary proposition, the second one is true in certain circumstances, if the length of the stick S in these circumstances at time t is equal to the length the stick has at t in actual circumstances (where actual circumstances of the given utterance are understood to be the bundle of histories running through the context of this utterance). Let us now take a look at the simplified branching model presented graphically in the article, with only two histories h_1 and h_2 branching out at time t_1 . In both histories, the stick S is placed at Sèvres at time t , although it has in each case a slightly different length: 40 inches in the case of h_1 and 39.37 inches in the case of h_2 . Let us denote this model with the symbol \aleph . If we look at it carefully, it will turn out that the equivalence \mathbf{A} introduced above is true if and only if $i_{mc} > I(t_1)$, that is to say, for contexts belonging to instants later than t_1 . Otherwise, the equivalence does not obtain since its left side always yields a positive magnitude (40 or 39.37 inches depending on the history chosen), while the right side always yields \dagger ; this is because there is no magnitude which would be equal to the length of the stick S in every history running through m_c – there is no magnitude which would be simultaneously equal 39.37 and 40 inches. It thus turns out that the sentence (A) uttered at any time after t_1 expresses a true proposition, while at t_1 and earlier it expresses a false proposition.

It is therefore obvious that the proposition expressed by the sentence (A) before t_1 cannot be known a priori since it is not even true. The sentence (A) can thus only express an a priori truth insofar as it is uttered at times later than t_1 .

Let us now consider the modal status of the proposition expressed by the sentence (A) at times later than t_1 . First, the definition of historical contingency (\diamond):

Definition 6 (historically contingent). $\diamond\varphi :\Leftrightarrow \diamond\varphi \wedge \diamond\neg\varphi$.

It is already clear from our graph that if we choose some moment m_c belonging to the history h_1 and to any time $t_x > t_1$, the proposition expressed

by (A) will be a historically necessary proposition. Regardless of which history running through m_c we choose, $lng^*(m_{th}, h, s^{x, m_c, m_{th}/h})$ will equal 40 inches, and the sole object which is the length of the stick S in each history h such that $m_c \in h$ will be 40 inches. Hence, in any history such that $m_c \in h$ and m_c belongs to a time later than t_1 , the sentence (A) expresses the proposition that 40 inches \approx 40 inches, which is obviously a necessary proposition. Analogously, if we choose $m_c \in h_2$ and $m_c \in t_x > t_1$, the sentence (A) will express this necessary proposition: 39.37 inches \approx 39.37 inches.

It thus turns out that, as long as the length of the stick S at time t is not determined, the sentence (A) will express a false proposition, and therefore one not knowable a priori, while once the course of events has determined the length of S at t , the sentence (A) will express a true proposition knowable a priori, but a necessary one. This observation is generalizable over any *BT* model:

Fact 1. $\forall \mathfrak{M} \forall m_c \forall V \forall h (\mathfrak{M}, m_c, V, m_c/h \models A \text{ iff } \mathfrak{M}, m_c, V, m_c/h \models \Box A)$.

6.3. Solution 1: Historically Contingent A Priori Propositions

The idea I presented in section 4.1. was to maintain that the sentence (A) expresses a proposition whose truth is knowable a priori before time t_1 , when the length the stick S is still contingent. However, the *BT* formalism presented above yielded the result that, at such times, the sentence (A) expresses a necessarily false proposition. Therefore, in order to verbalize this idea, we must modify our semantics, or more precisely, we must change the definition of the operator @. Intuitively speaking, we want to tie the interpretation of @ with the possible history that will actually be realized. The information contained in the notion of a model presented so far is not sufficient to distinguish one history as the “actual course of the world.” Therefore, for the sake of formal analysis, we will distinguish one history representing the actual course of events and call it the Thin Red Line (*TRL*). Now the model has the form $\mathfrak{M} := \langle M, TRL, \leq, D, Inst, I \rangle$, where $TRL \in Hist$. We must additionally assume that for any $m_c, m_c \in TRL$ (I justify this assumption in detail in (Wawer 2014)). Despite this change, the definitions of the reference of terms and of satisfaction for connectives remain the same. The only functor that makes significant use of the *TRL* parameter is the functor “It is actually the case that”:

- $\mathfrak{M}, m_c, V, m/h \models @^* \varphi \text{ iff } \mathfrak{M}, m_c, V, m_c/TRL \models \varphi$.

Therefore, it is true that φ is actually the case insofar as φ is true in the history that actually obtains (the *TRL* history). In light of this definition, the sentence (A) has the form

$$At_t(\text{lng}(s) = \iota x @^* At_t(x = \text{lng}(s)))$$

and is true at the point $\mathfrak{M}, m_c, V, m/h$ insofar as:

$$\text{lng} * (m_{th}, h, S) \approx \text{the sole object } d \text{ such that } d \approx \text{lng}^*(m_{tTRL}, TRL, S).$$

In other words, (A) is true in the history h insofar as at time t in this history the stick S has the same length that it has at t in the actual history.

Due to the change made in the notion of a model and the definition of @, the expression “one meter” is well defined regardless of circumstances and refers to one and the same length, that is to say, the length the stick S has at time t in the actual course of events.’

Given this definition, it turns out that in the model \mathfrak{N} , in which we assume h_2 to be the *TRL*, at any moment before time t_1 the sentence (A) expresses a contingent truth since in the history h_2 at time t the stick has the same length it has in the *TRL*, while its length in the history h_1 is different.

Fact 2. $\exists \mathfrak{M} \exists m_c \exists V (\mathfrak{M}, m_c, V, m_c/TRL \models \Diamond A \text{ and } \mathfrak{M}, m_c, V, m_c/TRL \models \Diamond \neg A)$.

We have yet to confirm whether the truth of the proposition expressed by the sentence (A) is knowable a priori before the moment t_1 . In order to give formal expression to the intuitions discussed in this text, I propose the following definition that should render more precise what it means that the truth of the proposition expressed by a sentence φ is knowable a priori ($\bigcirc\varphi$):

Definition 7 (a priori). $\bigcirc\varphi \Leftrightarrow H\Box G(\text{uttered}'\varphi' \rightarrow \text{tr}^*\varphi')$,

where *uttered* is a one-place predicate true of φ in the given circumstances if and only if φ is uttered in these circumstances, while *tr** is the following modification of the predicate *tr*:

- $\mathfrak{M}, m_c, V, m/h \models \text{tr}^*\varphi'$ iff $\mathfrak{M}', m, V, m/h \models \varphi$, where \mathfrak{M}' differs from \mathfrak{M} only in that the *TRL* in the model \mathfrak{M}' is the history h .

Therefore, we may say that the truth of the proposition expressed by φ is knowable a priori if and only if in any temporal and modal circumstances it is the case that the sheer fact of uttering φ guarantees the truth of the proposition expressed by it. In this sense, it is for example knowable a priori that the sentence “I am here now” expresses a true proposition.

It is easy to find that in the context of our narrative modelled by \aleph the truth of the proposition expressed by (A) is knowable a priori since the following condition is satisfied:

$$\forall m_c \forall m \forall h \aleph, m_c, V, m/h \models \text{uttered}' A' \rightarrow \text{tr}^* A'.$$

I leave it to an attentive reader to check the correctness of this implication. I will only point out that the key reason why the condition is satisfied by the sentence (A) is that the operator @ is each time tied to one selected history and not a bundle of histories, as was the case in Belnap’s (2001) and MacFarlane’s (2008) definitions. We can interpret the operator @ the way we do because we have introduced into the definition of the model an additional element: the actual history. Therefore, in keeping with what I held in section 4.1., if we agree to this conceptual move and its attendant philosophical assumptions, we will be able to show that in certain contexts the sentence (A) expresses a historically contingent proposition whose truth is knowable a priori.

6.4. Solution 2: Defence by Definitional Change

Those not willing to admit that we can reasonably speak of the actual future in the context of an indeterministic world, but sympathetic to Kripke’s considerations, may defend his thesis by redefining either the notion of apriority or that of contingency.

6.4.1. Contingent and A-Priori-in-the-Future

Let us formally consider the operator a-priori-in-the-future (\triangle) discussed above (section 4.3.):

Definition 8 (a-priori-in-the-future). $\triangle\varphi \leftrightarrow H\Box FG(\text{'}\varphi\text{' is uttered} \rightarrow \text{tr}'\varphi')$.

Intuitively: in every possible course of events there will be a time such that from that time on if the sentence φ is uttered, it will be uttered truly.

With this notion at our disposal we can argue, as I have in this text, that insofar as the precise length of the stick S at time t is determined, we can say that there was a time in the past such that it was then historically contingent that (A) and that (A) was then a-priori-in-the-future. Symbolically:

Fact 3. $\forall t_x > t_1 \forall m \in t_x \forall V \in h(m \in h \Rightarrow \aleph, m, V, m/h \models P(\diamond A \wedge \triangle A))$.

Let us sketch the proof. In order to assess the truth of the above fact, let us take any instant $t_x > t_1$ and any moment $m \in h$ at this instant. We must check whether there exists a moment $m' < m$ such that:

1. $\aleph, m, V, m'/h \models \diamond At_t(\text{lng}(s) = \iota x @ At_t(x = \text{lng}(s)))$
2. $\aleph, m, V, m'/h \models \diamond \neg At_t(\text{lng}(s) = \iota x @ At_t(x = \text{lng}(s)))$
3. $\aleph, m, V, m'/h \models A$

It turns out that the moment $m' \in t_1$ satisfies these conditions. Let us focus on condition 1 first. $\aleph, m, V, m'/h \models \diamond At_t(\text{lng}(s) = \iota x @ Att(x = \text{lng}(s)))$ if and only if $\exists h' \aleph, m, V, m'/h' \models At_t(\text{lng}(s) = \iota x @ Att(x = \text{lng}(s)))$. In other words, we must check whether there exists a history running through m' such that the length of the stick S in this history is the same as the length the stick actually has (relative to the moment m) at time t (I call it to the reader's attention that here we are using the operator @ and not @*). Of course, every history running through m will be evidence of that. Now, let us take a look at condition 2. We must check whether there exists a history running through m' in which the length of the stick S is different than it actually is, that is, different than in all the histories running through m . Our graph confirms that this is the case. Regardless of which history we refer to for the moment $m \in t_x$, the length of the stick S is already determined in this history (because $t_x > t_1$); moreover, there exists another history running through m' in which the length is different. Hence, the contingency criteria are satisfied. Finally, let us consider condition 3. We need to investigate whether in every history $h \in Hist$ there is a moment $m_1 \in h$ such that for each $m_2 > m_1$, $\aleph, m, V, m_2/h \models ('A' \text{ is uttered} \Rightarrow tr'A')$. This implication is true at any $m \in t$ and so condition 3 is satisfied. As a result, we have the right to draw the conclusion that at any moment at which the length of the stick S is determined it is the case that it was once contingent and a-priori-in-the-future.

6.4.2. Previously-Contingent Now-A-Priori

I will now try to recreate the most natural understanding of Kripke's thesis I discussed in section 4.4. First, I will introduce the notion of previous-contingency (\diamond):

Definition 9 (previously-contingent). $\diamond\varphi \leftrightarrow P(\diamond\varphi \wedge \diamond\neg\varphi)$.

Followed by the notion of now-apriority (\bigcirc):

Definition 10 (now-a-priori). $\bigcirc\varphi \rightarrow H\Box\text{Now}G(' \varphi ' \text{ is uttered} \rightarrow \text{tr}'\varphi')$.

Intuitively: Regardless of what the past was like and what the future will be like, from now on, if one were to utter the sentence φ , one would utter it truly.

This notion of apriority is sensitive to the moment of utterance. For some sentences, it is the case that their truth is knowable a priori at certain moments, while at some other moments it is not. The sentence (A) in our model is a perfect example of this. It turns out that:

Fact 4. $\forall i \in \text{Inst} \forall m \in i\aleph, m, V, m/h \models \bigcirc A$ iff $i > I(t_1)$.

Fact 4 says that until time t_1 the sentence (A) did not express a proposition whose truth could be established a priori, but it has since time t_1 . At the same time, let us note that:

Fact 5. $\forall i \in \text{Inst} \forall m \in i\aleph, m, V, m/h \models \Box A$ iff $i > I(t_1)$.

And thus:

Fact 6. $\forall i \in \text{Inst} \forall m \in i\aleph, m, V, m/h \models \bigcirc A$ iff $m, V, m/h \models \Box A$.

The last fact can serve as a formal expression of the conflict between the notion of historical apriority and that of historical contingency I pointed out at the beginning of the article. Nonetheless, if we adopt the generalized notion of previous-contingency, the conflict can easily be avoided by noting that:

Fact 7. $\forall i \in \text{Inst} \forall m \in i(i > I(t_1) \Rightarrow \aleph, m, V, m/h \models \bigcirc A$ and $\aleph, m, V, m/h \models \diamond A)$.

This formulation is perhaps the closest formal analog of Kripke's thesis regarding the existence of contingent propositions whose truth is knowable a priori.

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Olena Yaskorska¹, Katarzyna Budzyńska², Marcin Koszowy³

The Diversity of Cognitive Processes in a Dialogue

Abstract The aim of the paper is to propose a unified formal account of dialogical cognitive processes so that it allows the analysis of similarities and differences between those processes. Formal dialogue systems constitute two basic categories or paradigms of modelling communication depending on what cognitive process is described by a given system. The first paradigm consists of designing a set of dialogue rules in a similar manner to Lorenzen's dialogue logic (1978), and according to which players jointly aim to prove (argue) the validity of a formula. In such cases we will say that the system describes formal dialogues and the formal cognitive process of proving the validity of a formula. The second paradigm focuses on building a system similar to Hamblin's formal dialectics (1970), which "simulates" the real-life communication practice. In the type of dialogues described by those systems, players perform "good" argumentation, i.e. argumentation which fulfils certain requirements of rationality such as e.g. the requirement of not committing a fallacy of circular reasoning (begging the question). In such a case we will be speaking of a natural dialogue and a natural cognitive process of argumentation.

Keywords formal dialogue systems, formal dialectics, dialogical logic, dialogical cognitive processes, cognitive process of argumentation, cognitive process of proof

¹ Polish Academy of Sciences, Institute of Philosophy and Sociology
E-mail: OYaskorska@gmail.com

² Polish Academy of Sciences, Institute of Philosophy and Sociology & School of Computing, University of Dundee
E-mail: budzynska.argdiap@gmail.com

³ Department of Logic, Informatics and Philosophy of Science, University of Bialystok.
E-mail: marcinkoszowy@gmail.com

Introduction

The aim of the paper is to formulate a proposition for unifying the description of cognitive processes, argumentation and proving in particular occurrences in dialogues. The present study fits into the research line on the relations occurring between dialogue structures expressed in a language (for example, with the discourse symbols such as: *i* says *p*; then *j* asks why *p*; then *i* says *q*), and the cognitive processes represented by these symbols (such as inference: *p* since *q*) (Budzyńska, Reed 2016). The main motivation for undertaking the analyses is the fact that the current researchers in the phenomena of argumentation, dialogue and persuasion, do not devote sufficient attention to the relations between the structure of an utterance containing the discourse symbols and the cognitive correlates of these utterances. The starting point for the direction of our study is the hypothesis suggesting that the analysis of the discourse symbols in terms of syntax, semantics and pragmatics is an indispensable condition of a thorough analysis of cognitive processes typical for the dialogue.

In the present paper, we are interested solely in these cognitive processes, which are described by formal dialogue systems, that is, the systems that treat dialogue as a governed form of play between two parties of a dialogue. The formal dialogue systems are divided into two basic classes, or paradigms of communication modelling, depending on which type of cognitive process is the subject of description within the framework of a given system. The first paradigm consists in constructing a set of dialogical rules, modelled on Lorenzen's (1978) dialogical logic, according to which the players attempt to prove (argue) that a formula is a tautology, and their aim is to verify the correct rule of inference. In this case, we say that the system describes formal dialogues, and the formal cognitive process, consisting in proving that a formula is tautological. In the framework of the second paradigm, one attempts to create a system modelled on Hamblin's (1970) formal dialectics, where actual communication practice is "simulated". In dialogues described by these systems, the players carry out a proper argumentation, that is, the argumentation that fulfils certain postulates of rationality, for instance, not committing a circular reasoning in its justification. The aim of holding such dialogues is to give reasons why a sentence is true. In this case, we will be talking about a natural dialogue and natural cognitive process of argumentation (more on the dialectical and rhetorical aspects of cognitive processes can be found in: Budzyńska, Reed 2016; Budzyńska 2013).

Both paradigms define the cognitive processes in a dialogue in essentially

diverse ways, which prevents the identification of the actual similarities and differences in the dynamics of both of the cognitive processes. For example, in dialogical logic, players can attack and defend certain language structures, for instance, they can attack a conjunction by asking whether one of its propositions is true. On the other hand, in formal dialectics, players do not have attacks and defences at their disposal in the set of their moves; however, they can perform locutions (locutionary acts or speech acts) such as: Statement *S*, Question *S*, Resolve *S*. Does the distinctness of the sets of the permitted moves in both of the systems mean that formal dialogues must be realised differently from natural dialogues? In other words, must the cognising party behave differently in a formal cognitive process if they performed a natural process of argumentation? It seems that these types of differences are purely superficial, and the identification of a significant number of distinct properties will solely be the consequence of a lack of uniformity of the languages of description adapted in these paradigms. On the other hand, the actual similarities and differences between the two types of cognitive processes in a dialogue will be impossible to identify, overshadowed by the incomparability of the languages. For instance, it will be impossible to answer the following question: in that case, what are the moves which can be performed in both formal and natural cognitive process in dialogue, and what are the ones which can be performed only in one of these processes?

In the present paper we shall undertake the performance of the first step in an attempt to answer these questions. We propose a uniform descriptive language for two pioneering systems in both of the indicated paradigms of communication modelling. What is more, we indicate the basic similarities and differences between these types of cognitive processes in dialogue. We have adapted Prakken's (2006) general framework as the methodological base of this study. In this framework, dialogue systems are described by three rules: (1) the locution rules, (2) the protocol rules, specifying which speech acts can be performed at a given point of the game, and (3) the effect rules, specifying the effects of speech acts on the player's commitment store (the set of publicly declared convictions). We reconstruct Lorenzen's and Hamblin's systems according to this description, that is, both of these systems will be expressed with the use of the abovementioned rules. In effect the reconstruction of what becomes possible is a unified description of both types of cognitive processes in dialogue, as well as the identification of their actual similarities and differences. Similar general frameworks for dialogue games involving model communication can be found in literature. However,

unified descriptions are proposed solely for systems within the framework of a single paradigm (e.g., Prakken 2006 for systems modelling natural dialogues or Rahman, Keiff 2004 for systems describing formal dialogues).

The present paper consists of four parts. The first part discusses the original formulations of pioneer systems for both paradigms of communication modelling: Lorenzen's dialogical logic and Hamblin's formal dialectics. The second part is devoted to the description of systems of cognitive processes of argumentation and proving based on the example of the course of dialogue games on the grounds of the systems we will discuss. The third part proposes a reconstruction of both of the systems, which allows for a description of them in a single, unified language of the main elements of dialogue systems, as proposed by Prakken. The reconstruction enables the comparison of dialogical logic and formal dialectics for the player's communication-cognitive processes. The basic differences and similarities are discussed in the final part of the present paper.

I. Two Paradigms for Dialogue Processes

Two basic dialogue paradigms of formal systems are discussed in the present chapter: for natural cognitive processes (pt. 1) and for formal processes (pt. 2). Both of the paradigms are illustrated by the examples of novel dialogue systems for these paradigms.

1. System for Natural Dialogues

The first paradigm of modelling cognitive processes in dialogue consists in a formal description of communication typical for natural contexts. The aim of holding such a dialogue is to justify that a sentence is true. Hamblin's formal dialectics (1970) is a pioneering system, which was developed within the framework of this paradigm. The system is also called system H. The system includes a set of *players* and a set of *moves*, which the players can perform. Two players participate in one game (conventionally called Black and White), and perform moves in turns. The players can have two roles: the proponent (the responding party) and the opponent (the challenging party). The aim of the proponent is to defend the truth of a sentence. The aim of the opponent is to bring reasons against the sentence. These roles may shift during the game.

System H can be described by three rules: the locution rules, the structural rules and the commitment rules (a set of commitments publicly declared

by the player). The locution rules define the moves (speech acts), which the player can make during a dialogue. The player's language can be a language of any propositional calculus with a finite number of atomic sentences. Let S, T, \dots, X be sentence variables. Thus, system H permits the following moves:

Locution rules⁴:

- (D1) "Statement S ", in some special cases: "Statement S, T ";
- (D2) "Retract S, T, \dots, X ", for any number of sentences S, T, \dots, X (one or more);
- (D3) "Question S, T, \dots, X ", for any number of sentences S, T, \dots, X (one or more);
- (D4) "Why S ?" for all S , except for axioms;
- (D5) "Resolve S ".

In formal dialectics, according to rule (D1), a sentence or sentences can be said to be true by making the move "Statement S " or "Statement S, T ". According to (D2), the player can resign from committing to state that one or more sentences are true by making the "Retract S, T, \dots, X " locution. In Hamblin's game, the *ad ignorantiam* rule is in operation, which states that the lack of commitment to S does not implicate commitment to $\neg S$ (Hamblin 1970: 264). In system H, two types of questions are permitted: "Question S, T, \dots, X ", meaning to ask the opponent to express their sentence on the validity of one or more sentences (D3); and "Why S ?", that is to ask the opponent to justify sentence S (D4). The player can also ask the opponent to delete one of the contradictory sentences from their set of commitments by making the move "Resolve S " (D5).

The second type of rules in system H are structural rules, which specify when the player can make a given speech act, i.e., how specific moves of the opponent should be answered.

Structural rules:

- (S1) The players make moves in turns, one move per turn. "Retract S " is an exception which can co-occur with "Why S ?";

⁴ The moves were not indicated in the original description of formal dialectics. For convenience's sake, we adapted the (Di) notation, where i stands for the ordinal number of the rule.

- (S2) “Question about S, T, \dots, X ” must be followed by these moves:
- (a) “Statement $\neg(S \vee T \vee \dots \vee X)$ ”,
 - (b) “Retract $S \vee T \vee \dots \vee X$ ”,
 - (c) “Statement S ” or “Statement T ”, or ... or “Statement X ”,
 - (d) “Retract S, T, \dots, X ”;
- (S3) “Why S ” must be followed by:
- (a) “Statement $\neg S$ ”,
 - (b) “Retract S ”,
 - (c) “Statement T ”, if T is an equivalent sentence to sentence S on the basis of an initial definition.
 - (d) “Statement $T, T \rightarrow S$ ” for any T ;
- (S4) “Statement S, T ” cannot be used except for 3(d) situation;
- (S5) “Resolve S ” must be followed by:
- (a) “Retract S ”,
 - (b) “Retract $\neg S$ ”.

In formal dialectics, due to (S1), each player can make only one speech act per turn. The same rule allows for an exception, i.e., it is simultaneously permitted to retract from a commitment and request justification. Based on (S2), having been asked to specify standpoint about a sentence (sentences), the opponent can: negate the disjunction of these sentences; retract the disjunction; justify at least one of the disjuncts; or commit to none of the sentences asked. The (S3) rule specifies how a request for justifying a sentence can be answered: by negating it; retracting the statement that a sentence is true; stating that an equivalent sentence to the sentence asked is true; justifying the sentence by stating that another sentence is true and by implication, that which is preceded by the stated sentence and followed by the justified sentence. Thus, this rule characterises the way in which argumentation applying *modus ponens* can be made in formal dialectics. Due to (S4) the argumentation can be performed solely by using this rule. Finally, according to (S5), after the “Resolve S ” speech act one may retract from S or $\neg S$.

Commitment rules constitute the third group of rules. It is a set of sentences to which the player commits to publicly, i.e., publicly acknowledges that he is certain as to their truth. The commitment store does not have to be the same as the player's (actual) set of beliefs. Hamblin indicates that in his system, which is a system describing natural communication, the requirement that sentences belonging to the commitment store are consistent is dispensable. In the case of natural dialogues, the player is not ideally "rational" and the player's set of beliefs is not necessarily consistent (Hamblin 1970: 263). The opponent may ask to resolve an inconsistency at any time, for the benefit of one of the sentences, by making the "Resolve S " speech act. The rules stipulated below state how sentences can be placed in and deleted from the commitment store.

Commitment rules:

- (C1) "Statement S " places S in the speaker's commitment store, except when it is already there. Additionally, the act places S in the hearer's commitment store, unless his next locution is "Statement $\neg S$ ", or "Retract S " or "Why S ?" Insertion of S in the hearer's commitment store is suspended until the hearer, directly or indirectly, accepts the proposed reasons for S ;
- (C2) "Statement S, T " places S and T in both the hearer's and the speaker's commitment stores on the rule specified in (C1);
- (C3) "Retract S, T, \dots, X " deletes every extract of S, T, \dots, X from the speaker's commitment store, unless they are axioms;
- (C4) "Question S, T, \dots, X ?" places the sentences $S \vee T \vee \dots \vee X$ in the speaker's commitment store, unless it is already there; the statement is also placed in the hearer's commitment store, unless he answers with: "Statement $\neg(S \vee T \vee \dots \vee X)$ " or "Retract $S \vee T \vee \dots \vee X$ ";
- (C5) "Why S ?" places S in the hearer's commitment store, unless it is already there, or he answers with "Statement $\neg S$ " or "Retract S ".

According to (C1) and (C2) rules, stating S or S, T , places these sentences in both the speaker's and hearer's commitment store. The hearer can "block" placing these sentences in his commitment store by one of these three means: stating that the negation of the opponent's sentence is true; retracting the statement that a sentence is true; or asking for its justification. Retracting the statement that sentences are true, based on (C3), erases all

these sentences from the speaker's commitment store. According to (C4), asking whether the sentences are true places these sentences both in the speaker's and hearer's commitment stores. Similarly to (C1), the hearer can block placing the sentence, this time by using one of the two means: by stating that the negation of the sentence is true; or by retracting the sentence. (C5) specifies that the request for justifying sentence S places the sentence in the hearer's commitment store, unless the sentence is not "blocked" by stating the negation of S or retracting S .

2. Systems for Formal Dialogues

The second paradigm of creating dialogue systems is aimed at modelling the dialectic means of verifying the tautology of formulae, which can be used to define the rules of proper reasoning. Lorenzen's dialogical logic (Lorenz, Lorenzen 1978) is a pioneering system for this paradigm.⁵ The system describes formal dialogues, i.e., the ones which are carried out in the language of a given formal logic and are based on the rules of the logic. The description of dialogical logic in this study is limited to the rules of propositional calculus.

In dialogical logic, two players participate in one game: the *proponent*, i.e., the person defending a formula A , and the *opponent*, i.e., the person attacking the formula A . At the beginning of each party, the proponent states a formula which is at stake in the game. The subsequent moves in the dialogues are either an attack against, or a *defence* of, the sentence previously made by the opponent. Following the differentiation introduced by Lorenz (1987: 85)⁶, let P signify proponent, O – opponent, $X = \{O, P\}$ is any player, and A and B signify the formulae of propositional calculus. Thus, X *attack* (A) means that the player X attacks the sentence A , and X *defend* (A, B) means that the player X defends the sentence A with the help of the sentence B . The player's winning move is a move whereby the opponent does not have the possibility to make a move permitted within the rules of a given game.

⁵ Dialogical logic is called the Lorenzen system, although his most cited position is from his joint publication with Lorenz. However, it is Lorenzen, and not his student, who is considered the system's author.

⁶ Lorenz sees an attack as a predicate having one argument with the name of the attacked statement, and defence as a predicate having two arguments, the first of which is the name of the defended statement, and the second – the statement with the use of which the player performs the defence.

Lorenzen's system is defined by structural and specific rules of the game. The structural rules specify what types of moves are permitted on a given stage of the game. For propositional calculus, the following rules are in force (symbols based on: Alama, Uckleman 2011):

Structural rules of the game:

- (D00) P makes the first move; after that, O and P make moves in turns;
- (D10) P can state an atomic formula only if it has been stated earlier by O ;
- (D13) P 's defence can be attacked only once;
- (E) O can react only to P 's directly preceding sentences.

According to (D00) each game is initiated by the proponent and after that each player makes one move per turn. The (D10) rule introduces a limitation on stating an atomic formula by the proponent, as the formula can be stated only if it has been stated by O earlier. The (D13) rule, on the other hand, limits the opponent, who can only attack the proponent's defence only once. The (E) rule indicates that the opponent can only attack or defend the sentence that directly precedes the attack or defence. Proponents, however, can address any earlier move made by O .

The detailed rules of the game specify the means of a player's attacks and defences of a formula. All attacks and defences depend on the main functor in the attacked or defended sentence. The following expressions are used to describe the rules of the game: (1) $?$ is a type of attack used in relation to disjunction and it stands for the "whether" question in relation to the attacked sentence; (2) $k?$ is a type of attack on conjunction and signifies an attack on a specific proposition of a sentence, i.e., for $k \in \mathbb{N}$, k -th proposition of the conjunction is attacked; (3) \otimes is a symbol which indicates the player is unable to make a move in response to the opponent's move.

According to (P1a), a negation can only be attacked by proving the sentence is the negation of the attacked sentence (see: Table 1). If no defence is provided for negation (rule (P1d)), the attacked player should choose an action relating to another available connective at a given stage of the game, or end of the game. To attack a conjunction, it is necessary to ask about the validity of one of the propositions being a part of the conjunction (P2a); to defend the attack, it is solely necessary to state the sentence that the player was asked about is true (P2d). To attack a disjunction, it is required to ask about the disjunction's justification (P3a); to defend it, it is enough to

			Attacks	Defences
(P1)	negation	$\neg A$	A	\otimes
(P2)	conjunction	$A \wedge B$	1?	A
			2?	B
(P3)	disjunction	$A \vee B$?	A
				B
(P4)	implication	$A \rightarrow B$	A	B

Table 1. Detailed rules of the game (adapted from Lorenz 1987: 87).⁷

state that one of the propositions of the disjunction is true (**P3d**). Finally, to attack an implication, it is necessary to state that its precedent is true (**P4a**); to defend it, it is required to confirm that the following sentence is true (**P4d**).

II. The Dynamics of Cognitive Processes in a Dialogue

In this chapter, we present our motivation for creating the said systems in the context of cognitive-communicative processes modelling (pt. 1) and examples of cognitive processes in a dialogue studied in both paradigms (pt. 2).

1. The Motivation for Creating Dialogue Systems

Formal dialectics is a pioneering system, which describes natural dialogues, that is dialogues occurring in everyday practice in a natural language. The result of the dialogues described in a formal dialectics system is that of accepting a certain sentence, whose acceptance is justified. Hamblin’s system rules models a dialogue so that no incorrect argumentation can be made. These errors are called fallacies (gr. *σόφισμα*; łac. *fallacia*), and they are deceptive cognitive-communicative techniques applied, for instance, in public speeches, dialogues and discussions (Hołówka 1998; Koszowy et al. 2013; Tokarz 2006). Addressing fallacies is substantiated both cognitively – their

⁷ For simplification’s sake of subsequent descriptions, the original description of dialogical logic has been extended by labelling the rules by **(P1)**–**(P4)** and using the “a” and “d” indices to indicate whether the rule refers to an attack or a defence, for instance, for the **(P1)** rule which specifies the functioning of a negation, the **(P1a)** rule shall signify an attack on a negation, and **(P1d)** – defence of a negation.

deletion increases the likelihood of gaining knowledge (e.g., Koszowy 2013) – as well as practically – their deletion facilitates achieving the main aims of dialogues and discussions, including determining different attitudes on a given issue (e.g., van Eemeren, Grootendorst 1992). In effect, fallacies have become one of the main topics addressed within the framework of interdisciplinary studies on argumentation (Woods, Walton 1989; Hansen, Pinto 1995; Walton 1995).

Dialogue is a natural environment for the cognitive process of argumentation and, thus, for incorrect argumentation. As a result, Hamblin created a dialogue system based on rules designed in such a way that the sentences which include incorrect argumentation cannot be made in a dialogue game. Hamblin devoted special attention to such fallacies as circular reasoning and many questions. Circular reasoning (in other words, *petitio principii* or *idem per idem*) occurs in reasoning when the conclusion is one of the premises, which may be stylistically different from the conclusion (begging the question). The fallacy of many questions is a communicative-cognitive tactic, which embraces many simple questions disguised as one complex question. The manipulative characteristics of this move is due to the fact that the dialogue party who responds to only one question actually accepts the assumptions of all the other component questions of the complex question (Walton 1999: 379).

In creating formal dialectics, Hamblin assumed that the system has to be consistent in terms of the established rules; in the meaning that one move cannot simultaneously be permitted and banned on the grounds of a given system. These rules should be defined so that they strictly define each locution on a given stage of the game, i.e., they should clarify when a move can be made and what form it can have. A consistent system seems to be a basic assumption in creating rules of any game. However, Hamblin underscores that in dialogues that people engage in, in everyday practice, this rule is frequently omitted. Many systems, which have adapted Hamblin's assumptions, have since been created, the most famous of which are system *DC* (Mackenzie 1979), system *CB* (Woods, Walton 1978), systems *PPD* and *RPD* (Walton, Krabbe 1995), system *TDG* (Bench-Capon 1998), and system *ASD* (Reed, Watlon 2007).

In system H, the cognitive process in a dialogue can be described in the categories of making one's commitments public, which the player can perform by such attacks as "Statement S" or "Retract S". The dialogue also enables the gaining of new information by interaction between the question and the response. For example, one player can ask for justifying a sentence

by a “Why S ?” locution, to which the opponent can reply with “Statement T , $T \rightarrow S$ ”, thus justifying the sentence S with T and the implication of these sentences (presenting an argumentation for the S sentence).

The main motivation for creating dialogical logic, on the other hand, was applying game theory to argumentation in propositional calculus, first-order logic and intuitionistic logic. This approach led to the development of communicative models created in order to verify the rules of correct inference. In effect, Lorenzen constructed the *pragmatic notion of truth*, which specifies the tautology of sentence A with an existing winning strategy for the proponent in a dialogue game for A (Lorenz 1987: 83). This system has become the inspiration to create a number of other systems which verify the truth of sentences on the grounds of other logics, for example, modal logic (Rahman et al. 1997), hybrid logic (Blackburn 2001) or linear logic (Blass 1992).

The cognitive processes described in the original view of dialogical logic can be expressed through the attacks and defences for given language structures. An attack on a formula or its part is a question about the truth of a previously attacked formula or its part, or an assumption of its part being true. Defence, on the other hand, is aimed at providing evidence for the formula or its part, which has been attacked previously. Thus, a player who wants his opponent to demonstrate that an implication is true, attacks it by assuming its precedent is true. To defend the implication, the player has to assume the following sentence to be true.

2. Argumentation and Proving

The present chapter describes means of dialogue modelling in which the participants carry out the cognitive processes of argumentation and proving. Their dynamics are discussed through the example of dialogue games realised in accordance with the rules of formal dialectics and dialogical logic.

In the example dialogue in Table 2, the player White, in the first move, announces a lack of knowledge about B , and asks to justify its negation: Why $\neg B$? Black then answers by presenting argumentation in which he justifies that sentence $\neg B$ is true. Having stated A , $A \rightarrow \neg B$, Black announces his belief about A , the implication $A \rightarrow \neg B$, and manifests that, in his mind, an inference has taken place, which, basing on implication and its precedent, $\neg B$ has been derived. This move is a discursive symbol of the speaker’s cognition of a certain structure for the hearer’s argumentative act. However, the following course of dialogue shows that White will not use this possibility,

displaying a sceptical attitude towards Black’s argumentation.

In the second move, White refers only to implication, which, according to the rules of formal dialectics, means that White has publicly accepted (acquired) that a fact is being described by sentence A . In effect, A is placed in the commitment store. However, if White retracts, it means that he has not accepted (has not acquired) the message that A implies $\neg B$. Yet, White simultaneously asks for validating this implication, which means readiness to accept it under the condition that Black provides White with acceptable argumentation for proving the implication. In the next move, Black withdraws from his commitment to $A \rightarrow \neg B$, which results in deleting this sentence from his commitment store.

WHITE	BLACK
<p style="text-align: center;">1. Why $\neg B$?</p> <p>White’s commitment store does not change.</p>	<p>Statement A, $A \rightarrow \neg B$ $\neg B$ is placed. $A \rightarrow \neg B$ is placed.</p>
<p style="text-align: center;">2. Retract: $A \rightarrow \neg B$</p> <p style="text-align: center;">Why $A \rightarrow \neg B$?</p> <p style="text-align: center;">A is placed.</p>	<p style="text-align: center;">Retract: $A \rightarrow \neg B$</p> <p style="text-align: center;">$A \rightarrow \neg B$ is deleted.</p>

Table 2. An example of Hamblin’s game (adapted from: Hamblin 1970: 267).

The fundamental aim of formal dialectics was not a mere study of the cognitive process of argumentation, but the study of its correctness. Thus, Hamblin introduces rules regulating the conditions of making attacks on argumentation so that it is impossible to make such mistakes as circular reasoning. Hamblin’s dialogic game allows for the elimination of this error by adding two rules:

Additional rules of system H:

- (W) “Why S ?” move cannot be made if S is not in the hearer’s commitment store or is in the speaker’s commitment store.
- (R1) A response to “Why S ?”, unless it is “Statement $\neg S$ ” or “Retract S ”, has to concern the sentences which have already been placed in the players’ commitment stores.

The consequences of adapting these rules, for the possibility of committing circular reasoning, are illustrated by the example in Table 3. According

to **(R1)** rule, if Black responds “ $B, B \rightarrow A$ ” to White’s question “Why A ?” then this response means that both B and $B \rightarrow A$ must be both in White’s and Black’s commitment stores. In this case, White’s second move is incorrect due to the **(W)** rule – White could not have asked the question “Why B ?” because B is already in his commitment store.

WHITE	BLACK
1. Why A ?	Statement $B, B \rightarrow A$
2. Why B ?	Statement $A, A \rightarrow B$

Table 3. An example of circular reasoning (adapter from: Walton, Batten 1984).

An example course of a game in Lorenzen’s system is described in Table 4. The following labels were used to describe this example: P signifies the proponent; O – opponent; k – k -th move in a dialogic game; l signifies the number of the move where the formula is attacked in the move (k).

O			P	
			$((a \rightarrow b) \wedge a) \rightarrow b$	(0)
(1)	$((a \rightarrow b) \wedge a)$	0		
(3)	$(a \rightarrow b)$	1	1?	(2)
(5)	A	1	2?	(4)
(7)	B	3	a	(6)
			b	(8)

Table 4. An example of Lorenzen’s game (adapted from: Lorenz 1987).

In this example, what is at stake is the truth of the $((a \rightarrow b) \wedge a) \rightarrow b$ formula. In move (0) in the cognitive process of proving in dialogue, the proponent P states the truth of the formula. In move (1), the proponent makes: O attack $((a \rightarrow b) \wedge a) \rightarrow b$. The main functor of the attacked sentence is the implication functor. Thus, according to the **(P4a)** rule, player O makes the move assuming the precedent of the implication, that is $((a \rightarrow b) \wedge a)$. In move (2), P cannot defend an attack as it is described in the **(P4d)** rule. According to **(D10)**, the proponent may not state the truth of an atomic sentence if they have not been previously stated by the opponent. Hence, P attacks in move (2) O ’s previous sentence, that is, P

attack $((a \rightarrow b) \wedge a)$. The main attacked functor in the sentence is the conjunction functor; therefore, according to **(P2a)**, P asks about the truth of the first proposition of conjunction. According to **(P2d)**, O defends the attack in move (3), that is: O defend $((a \rightarrow b) \wedge a, (a \rightarrow b))$, assuming that the first proposition of the conjunction, $a \rightarrow b$ is true.

P again attacks the sentence $(a \rightarrow b) \wedge a$ in move (4), this time asking about the second proposition of the conjunction. In (5), O defends the conjunction: O defend $((a \rightarrow b) \wedge a, a)$. According to **(P4a)**, P can attack the implication $a \rightarrow b$ by assuming the truth of its precedent, but since it is an atomic formula (see **(D10)**), it is only possible thanks to the fact that O assumed its truth in move (3). According to **(P4d)**, O in move (7) states the implication's successor, b , by making the move: O defend $(a \rightarrow b, b)$.

According to **(D10)**, P can in move (8) state the truth of the atomic sentence b because O has stated it previously (see move (7)). The move is a response to the request for its justification, which was made by O in move (1). P defend, assuming the truth of b , that is, the attacked implication's successor: P defend $((a \rightarrow b) \wedge a \rightarrow b, b)$. The move ends the game. The proponent wins because he makes the final permitted move in the game. According to the game's assumptions and the pragmatic definition of truth, the formula $((a \rightarrow b) \wedge a) \rightarrow b$ is true in pragmatic sense (is a tautology of propositional calculus).

III. Reconstruction of the Two Types of Dialogue Systems

In this chapter, we offer a unified description of Hamblin's (pt. 2) system and Lorenzen's system (pt. 3) using Prakken's general framework (pt. 1) as a methodological basis.

1. Prakken's General Framework

Prakken (2006) puts forward a general framework of formal dialogue systems, highlighting those components which can be found in the majority of such systems. The central category in the description includes three rules: rules determining permitted speech acts in a given dialogic game (locution rules), rules describing permitted responses to the speech acts (protocol rules), and rules describing the effects of making certain moves (effect rules).

In the first group of rules, Prakken distinguishes the six most frequently used speech acts and provides their least controversial interpretation.

The rules of permitted moves:⁸

- (PR1) **Claim** “*Claim* φ ” is made when the speaker states that φ is true;
- (PR2) **Concession** “*Concede* φ ” is used when the speaker confirms that φ is true;
- (PR3) **Argumentation** “ φ *since* Ψ ”,⁹ where $\Psi = \{\psi_1, \psi_2, \dots, \psi_k\}$ for $k \in \mathbb{N}$ is used when the speaker gives the reasons why the statement φ is true; Ψ set is a set of argumentation premises;
- (PR4) **Challenging** “*Why* φ ” is used when the speaker questions the φ statement and asks for substantiation;
- (PR5) **Questioning** “*Question* φ ” is used when the speaker asks the hearer to give an opinion about the truth of φ ;
- (PR6) **Withdrawing** “*Retract* φ ” is used when the speaker declares that he is no longer committed to φ ; this speech act is used in a dialogue when the speaker has already been committed to φ ; in other cases it is enough to state $\neg\varphi$ when being asked about φ .

According to Prakken, in a majority of dialogue systems, the moves which allow us to perform the following moves are present: claim (*Claim* φ) or confirm (*Concede* φ) that a statement is true; argue for a sentence: φ *since* Ψ ; or declare that the player no longer accepts that a sentence is true: *Retract* φ . It is also possible to ask questions in two ways in a majority of systems: ask if the sentence is true (*Question* φ); or ask for its justification (*Why* φ).

The second group of rules, which Prakken uses to describe dialogue systems, specifies the protocol rules:

Protocol rules:

- (PO1) The following moves are permitted after *Claim* φ : (1) *Why* φ , (2) *Claim* $\neg\varphi$, (3) *Concede* φ ;
- (PO2) The following moves are permitted after *Why* φ : (1) φ *since* Ψ (or: *Claim* ψ for each $\psi \in \Psi$), (2) *Retract* φ ;

⁸ For consistency’s sake, we introduced the (PR i) labels, where i is the ordinal number of the rule.

⁹ In Prakken’s original description, this speech act is presented as φ *since* S . The symbols have been substituted for convenience’s sake.

(PO3) The following moves are permitted after φ since Ψ (for $\Psi = \{\psi_1, \psi_2, \dots, \psi_k\}$ for $k \in \mathbb{N}$): (1) *Why* ψ , where $\psi \in \Psi$, (2) *Concede* ψ , where $\psi \in \Psi$;

(PO4) The following moves are permitted after *Question* φ : (1) *Claim* φ , (2) *Claim* $\neg\varphi$, (3) *Retract* φ .

Basing on **(PO1)**, after the speech act of a statement, the opponent can: ask for justification of the sentence; state that its negation is true; or accept that the sentence is true. According to **(PO2)**, after *Why* φ , it is permitted to: give reasons why the sentence φ is true by argumentation or stating that one of its premises is true; or resign from commitment to φ . According to **(PO3)**, the opponent can follow the argumentation with: ask to give reasons for the premise; or to accept that the premise is true. Basing on the **(PO4)** rule, having been asked whether the sentence is true, it is possible to: provide a sentence; negate the sentence; retract from claiming that the sentence is true.

Prakken also provides rules specifying how making certain speech acts influences the commitment store (i.e., a group of sentences which a given player declares as his beliefs). Let s denote a player, $s(m_n)$ – the speech act made by s in the move m_n (where $n \in \mathbb{N}$), and $C_s(d, m_n)$ – the commitment store of the player s in the move m_n in the dialogue d .

Effect rules:

(PZ1) If $s(m_n) = \textit{Claim } \varphi$, then $C_s(d, m_n) = C_s(d, m_{n-1}) \cup \{\varphi\}$;

(PZ2) If $s(m_n) = \textit{Concede } \varphi$, then $C_s(d, m_n) = C_s(d, m_{n-1}) \cup \{\varphi\}$;

(PZ3) If $s(m_n) = \varphi$ since Ψ , where $\Psi = \{\psi_1, \psi_2, \dots, \psi_k\}$ for $k \in \mathbb{N}$, then $C_s(d, m_n) \supseteq C_s(d, m_{n-1}) \cup \Psi$;

(PZ4) If $s(m_n) = \textit{Why } \varphi$, then $C_s(d, m_n) = C_s(d, m_{n-1})$;

(PZ5) If $s(m_n) = \textit{Retract } \varphi$, then $C_s(d, m_n) = C_s(d, m_{n-1}) \setminus \{\varphi\}$.

Basing on the **(PZ1)** and **(PZ2)** rules, having made *Claim* φ and *Concede* φ , the sentence φ is placed in the previous commitment store of the player. It has been specified that with **(PZ3)**, after φ since Ψ , the previous store has been extended by a store of premises (i.e. $C_s(d, m_{n-1}) \cup \Psi$) and is included in the current store (i.e. $C_s(d, m_n)$) because the current store also includes the implicational premise: $\psi_1 \wedge \psi_2 \wedge \dots \wedge \psi_k \rightarrow \varphi$. Having made why

φ , according to **(PZ4)**, the player's commitment store remains unchanged. If I retract φ is made, basing on **(PZ5)**, the sentence φ is removed from the earlier commitment store.

Reframing Hamblin's System

A reconstruction of Hamblin's system is presented in the present part. It is conducted in such a manner that the description of cognitive processes in dialogue represented by formal dialectics in Prakken's framework of main elements of dialogue is possible. To achieve this, system H needs to be expressed in the categories of three types of rules specified by Prakken: locution rules, protocol rules and effect rules.

Players in system H make similar speech acts to those in Prakken's description, which means that in both cases players can give reasons why a sentence is true, ask for justification, or retract from stating that a sentence is true. However, the interpretation of most speech acts in system H and in Prakken's framework are different. Thus, it is necessary to reformulate some of the rules adapted in formal dialectics. According to **(D1)**, the player can make "Statement S " or "Statement S, T ". In Prakken's language, these acts can be interpreted as:

- *Claim* φ , where φ is sentence S ;
- *Concede* φ , where φ is sentence S ;
- φ *since* Ψ in the case when the player makes "Statement S, T ", where one of these sentences (e.g. T) must be an implication, and the second sentence (S) is the implication's antecedent; then φ follows the implication (succeeds T sentence), and $\Psi = \{S, T\}$.

In Prakken's language this speech act is expressed as: *Claim* φ (see the general framework rule **(PR1)**), and it can be used in formal dialectics when one of the players makes the speech act "Statement S ", and his opponent does not have S in the commitment store yet. This situation has been described in the reconstructed system H by rule **(HL1)** (see below: locution rules). The second speech act: *Concede* φ can be made in formal dialectics only when the opponent already has φ in the commitment store (see **(HL2)**).

The third of the abovementioned acts, which was described in **(PR3)**, φ *since* Ψ is reconstructed on the basis of **(S3d)** and **(S4)** in system H. **(S3d)** indicates that the response to "Why S ?" (which in Prakken's language

denotes an illocutionary act why, see the reconstruction “*Why S?*” below), that is an appropriate answer to justifying S can make two sentences T , $T \rightarrow S$. The response is *modus ponens*, and hence the act “Statement T , $T \rightarrow S$ ” can be viewed as argumentation. Additionally, **(S4)** indicates that making two sentences is only possible in the case described in **(S3d)**, that is when one of these sentences is an implication and the second is its precedent. Therefore, it disqualifies using different rules of inference, except for *modus ponens*, in formal dialectics (see **(HL3)** below).

Yet another system H rule **(D2)** says that the player can make the move: “Retract S, T, \dots, X ” in the dialogue, which in Prakken’s language can be interpreted as:

- *Retract* $\varphi_1 \wedge \varphi_2 \wedge \dots \wedge \varphi_k$, where $\varphi_1 \wedge \varphi_2 \wedge \dots \wedge \varphi_k$ is a conjunction of sentences S, T, \dots, X and $k \in \mathbb{N}$.

The effect of making even the simplest version of this move (i.e. “Retract S ”) on the player’s commitment store (see **(C3)**) is identical to the effect of the move: *Retract* φ in Prakken’s description (see **(PZ5)**). Hence, the moves have been equated. What is more, the reconstruction of the contents of *Retract* to the form of a conjunction can be achieved on the basis of **(C3)** which specified that, having made the move from the speaker’s commitment store, each of the sentences made is deleted. Therefore, the commitment store not being a part of “Retract” is treated as a conjunction of this store (see **(HL4)** below).

Basing on **(D3)**, the player can make “*Question* $S, T, \dots, X?$ ”, which in Prakken’s language can be treated as making:

- *Question* $\varphi_1 \vee \varphi_2 \vee \dots \vee \varphi_k$, where $\varphi_1 \vee \varphi_2 \vee \dots \vee \varphi_k$ is the disjunction of sentences S, T, \dots, X and $k \in \mathbb{N}$.

Making the “*Question* S ” is identical to *Question* φ in Prakken’s framework. This interpretation is possible due to **(S2)** and **(PO5)**, which specify that after both of the moves the following acts are permitted: (i) responding with the sentence which the player has been asked about, (ii) negating the sentence, and (iii) retracting the sentence. The content reconstruction of *Question* to the disjunction form can be conducted by **(C4)**. According to the rule, making “*Question* S, T, \dots, X ” places $S \vee T \vee \dots \vee X$ in the player’s commitment store. Thus, the set of sentences contained in “*Question* $S, T, \dots, X?$ ” is treated as a disjunction of this set (see **(HP5)**). Basing on another rule of formal dialectics, **(D4)**, the player can make “*Why* $S?$ ”. In the general framework, the act can be realised with:

- *Why* φ , where φ is S .

Basing on **(PO3)**, **(S3)**, and **(C5)**, “*Why* S ” and *Why* φ are used in an analogous manner in both systems. Both of these sentences can be followed by either retracting from a commitment or arguing for the sentence (see **(HL6)**).

The speech act described in **(D5)**: “*Resolve* S ” can be interpreted in Prakken’s language as a complex act:

- *Question* φ , *question* $\neg\varphi$, where φ is S .

“*Resolve* S ” does not have a directly corresponding sentence in Prakken’s framework. In system H, this move is included neither in the rules of permitted rules nor in operation rules on the commitment store. In effect, its reconstruction can only be performed based on the structural rule **(S5)**. It specifies that “*Resolve* S ” can be followed by: “*Retract* S ” or “*Retract* $\neg S$ ”. In Prakken’s framework, it is either I retract φ or I retract $\neg\varphi$. Additionally, based on Prakken’s protocol rules, *Retract* can follow *Why* φ **(PO2)** or *Question* φ **(PO4)**. “*Resolve* S ” is not a request to justify S , just like why **(PR4)**, but the hearer’s response to state one’s position towards φ , just like *Question* **(PR5)**. Thus, the only act which can potentially realise the sentence similar to “*Resolve* S ” is: *Question* φ , where φ is S .

However, system H assumes that after “*Resolve* S ”, not only can the opponent retract S , but also $\neg S$. According to **(PO5)** in Prakken’s framework, having made *Question* φ , the hearer can make *Retract* φ ; however, *Retract* $\neg\varphi$ is impossible. On the other hand, this act can be a response to *Question* $\neg\varphi$. In this case, the complex move *Question* φ , *Question* $\neg\varphi$ seems to be the only possible reconstruction of “*Resolve* S ” (see **(HL7)**).

Hamblin’s “*Resolve* S ” is a single move; thus, in the reconstructed system H, the move *Question* φ , *Question* $\neg\varphi$ is also treated as a single act. It eliminates the problem of equating “*Resolve* S ” with making two moves: “*Question* S ” and “*Question* $\neg S$ ” which in Prakken’s language would also mean making: *Question* φ and *Question* $\neg\varphi$. In formal dialectics, the player can only ask these two questions in two separate moves, which are intermitted by the opponent’s move. To conclude, system H allows us to make the speech acts which conform to Prakken’s framework. The moves are the following:

Locution rules:¹⁰

¹⁰ The locution rules in the reconstructed formal dialectics have been labelled by HM_i , where HM stands for Hamblin-Locution, and i – the ordinal number of the rule.

- (HL1) **Claim** “*Claim* φ ” is used when the speaker states that φ is true when his opponent does not have this sentence in his commitment store;
- (HL2) **Concession** “*Concede* φ ” is used when the speaker states φ when the opponent has the sentence in his commitment store;
- (HL3) **Argumentation** “ φ *since* Ψ ” occurs when the speaker argues for φ with the use of set of sentences Ψ ; the argumentation can be used only according with the rule *modus ponens*, thus $\Psi = \{\psi \rightarrow \varphi, \psi\}$;
- (HL4) **Withdrawal** “*Retract* $\varphi_1 \wedge \varphi_2 \wedge \dots \wedge \varphi_k$ ”, for $k \in \mathbb{N}$, is used when the speaker resigns from deeming all the sentences $\varphi_1 \wedge \varphi_2 \wedge \dots \wedge \varphi_k$ true;
- (HL5) **Question** “*Question* $\varphi_1 \vee \varphi_2 \vee \dots \vee \varphi_k$ ”, for $k \in \mathbb{N}$, is used as the opponents query whether the sentences $\varphi_1 \vee \varphi_2 \vee \dots \vee \varphi_k$ are true;
- (HL6) **Challenge** “*Why* φ ” is used as a request to state why φ is true;
- (HL7) **Complex question** “*Question* φ , *question* $\neg\varphi$ ” is a request to make a statement about φ by removing the sentence or its negation from the hearer’s commitment store.

Another group of rules in Prakken’s framework, the protocol rules, is characterised similarly by Hamblin’s structural rules. In effect, the reconstruction of the formal dialectics protocol primarily entails writing down Hamblin’s rules (S1)–(S5) with the reconstructed protocol rules (HL1)–(HL7). Only (S3d) and (S4) have undergone a bigger change in system H. (Sd3) describes how a player can perform argumentation. Due to (S4), it is permitted to state that two sentences are true (i.e. argue) with the speech act “*Statement* S, T ” only in the situation specified in (S3d), which in the reconstructed system is explicitly expressed as the argumentative move φ *since* Ψ . (S4) has been removed from the rules of response in the reconstruction of the speech act as a move which is permitted in system H (HL3), and not a rule which describes the game’s protocol.

Protocol rules:¹¹

- (HP1) Each of the players makes one move per turn. The exceptions are:

¹¹ The protocol rules in the reconstructed formal dialectics have been labelled by HPi , where HP stands for: Hamblin-Protocol, and i – the ordinal number of the rule.

1. *Retract* φ , which can co-occur with *Why* φ ,
2. Compounding two simple acts *Question* φ , *question* $\neg\varphi$;

(HP2) *Question* $\varphi_1 \vee \varphi_2 \vee \dots \vee \varphi_k$ can be followed by:

1. Confirming the negation of the act's content, that is (a) *Claim* $\neg(\varphi_1 \vee \varphi_2 \vee \dots \vee \varphi_k)$, or *Concede* $\neg(\varphi_1 \vee \varphi_2 \vee \dots \vee \varphi_k)$,
2. *Retract* $\neg(\varphi_1 \vee \varphi_2 \vee \dots \vee \varphi_k)$,
3. Saying that one of these sentences is true, i.e.: (a) *Claim* φ_1 or *Claim* φ_2 or ... or *Claim* φ_k , or (b) *Concede* φ_1 or *Concede* φ_2 or ... or I concede φ_k ,
4. Withdrawing all sentences, i.e. *Retract* $\varphi_1 \wedge \varphi_2 \wedge \dots \wedge \varphi_k$;

(HP3) *Why* φ can be followed by:

1. Saying that φ is false, i.e. (a) *Claim* $\neg\varphi$ or (b) *Concede* $\neg\varphi$,
2. *Retract* φ ,
3. Giving the ψ sentence, which is an equivalent sentence to φ on the basis of a primitive definition, i.e. making (a) *Claim* ψ or (b) *Concede* ψ ,
4. Justifying the sentence, i.e. making φ *since* Ψ , where $\Psi = \{\psi \rightarrow \varphi, \psi\}$;

(HP4) *Question* φ , *Question* $\neg\varphi$ can be followed by:

1. *Retract* φ ,
2. *Retract* $\neg\varphi$.

Effect rules in formal dialectics, just like structural rules, are specified in a similar way to their description in the general framework for dialogue systems. Thus, their reconstruction will entail writing down the rules of formal dialectics **(C1)–(C5)** in Prakken's language, with the addition of a few characteristic features of formal dialectics. First of all, making speech acts in system H does not only result in changes to the speaker *S*'s commitment store, but also in hearer *H*'s as well. Moreover, not only do the changes in *H*'s commitment store depend on the speech act, which *S* makes in m_n , but also on the move which H makes in the next move m_{n+1} . Finally, **(C1)** has been reconstructed in the form of two rules: **(HE1)** and **(HE2)** (see below) because "Statement *S*" **(D1)** in the new interpretation includes two

interpretations: *Claim* φ (**HE1**) and *Concede* $\neg\varphi$ (**HE2**). Making *Claim* φ means that the opponent does not have the sentence φ in his commitment store, and that is why we shall assume that φ is placed in both *S*'s and *H*'s commitment stores. *S* makes I concede φ when *H* has already committed to φ ; thus, φ is only placed in the speaker's commitment store.

Let $s \in \{N, O\}$ signify a player, where *N* stands for the speaker and *O* for the hearer $s(m_n)$ – the speech act made by *s* in move m_n , and $C_s(d, m_n)$ *s*'s commitment store in move m_n in dialogue d . The rules of system *H* written below have been reconstructed in the language of Prakken's general framework.

Effect rules:¹²

(HE1) If $s(m_n) = \textit{Claim } \varphi$, and *N* makes the speech act, then:

1. $C_N(d, m_n) = C_N(d, m_{n-1}) \cup \{\varphi\}$,
2. $C_O(d, m_n) = C_O(d, m_{n-1}) \cup \{\varphi\}$, unless *O* will not make *Claim* $\neg\varphi$, *Concede* $\neg\varphi$, or *Why* φ in m_{n+1} move.

(HE2) If $s(m_n) = \textit{Concede } \varphi$ and *I* makes the concession, then:

1. $C_N(d, m_n) = C_N(d, m_{n-1}) \cup \{\varphi\}$,
2. $C_O(d, m_n) = C_O(d, m_{n-1})$;

(HE3) If $s(m_n) = \varphi$ since Ψ , where $\Psi = \{\psi \rightarrow \varphi, \psi\}$ and *N* makes the speech act, then:

1. $C_N(d, m_n) = C_N(d, m_{n-1}) \cup \Psi$,
2. $C_O(d, m_n) = C_O(d, m_{n-1}) \cup A$, where $\psi' \in A$, if $\psi' \in \Psi$ and unless *O* makes in move m_{n+1} : *Claim* $\neg\psi'$, *Concede* $\neg\psi'$, *Retract* $\neg\psi'$, *Why* $\neg\psi'$;

(HE4) If $s(m_n) = \textit{Retract } \varphi_1 \wedge \varphi_2 \wedge \dots \wedge \varphi_k$ and *N* makes the speech act, then:

1. $C_N(d, m_n) = C_N(d, m_{n-1}) \setminus \{\varphi_1, \varphi_2, \dots, \varphi_k\}$,
2. $C_O(d, m_n) = C_O(d, m_{n-1})$;

(HE5) If $s(m_n) = \textit{Question } \varphi_1 \vee \varphi_2 \vee \dots \vee \varphi_k$ and *N* asks the question, then:

¹² Rules of commitment rules in the reconstructed formal dialectics have been labelled with HE*i*, where HE stands for Hamblin-Effects and *i* – the number of the rule.

1. $C_N(d, m_n) = C_N(d, m_{n-1}) \cup \{\varphi_1 \vee \varphi_2 \vee \dots \vee \varphi_k\}$,
2. $C_O(d, m_n) = C_O(d, m_{n-1}) \cup \{\varphi_1 \vee \varphi_2 \vee \dots \vee \varphi_k\}$, unless O claims $\neg(\varphi_1 \vee \varphi_2 \vee \dots \vee \varphi_k)$ or does not concede $\neg(\varphi_1 \vee \varphi_2 \vee \dots \vee \varphi_k)$ in m_{n+1} ;

(HE6) If $s(m_n) = \textit{Why } \varphi$ and N makes the act, then:

1. $C_N(d, m_n) = C_N(d, m_{n-1})$,
2. $C_O(d, m_n) = C_O(d, m_{n-1}) \cup \{\varphi\}$, unless O makes *Claim* $\neg\varphi$ or *Concede* $\neg\varphi$ in m_{n+1} .

In **(HE1)**–**(HE6)**, some fragments of the original system H formulation have been changed, which were not related to its reconstruction in Prakken’s language, but to some technicalities. Firstly, **(C1)**, **(C2)**, and **(C4)** were changed in relation to the limitation caused by the original framework, which specifies that having made the acts described there, the sentences constituting their content are placed in the speaker’s commitment store, unless these sentences have already been placed there. According to **(HE1)**, **(HE2)**, **(HE3)** and **(HE5)**, after: *Claim* φ , *Concede* φ , φ *since* Ψ , and *Question* φ , the sentence which is the content of these acts is always placed in the speaker’s commitment store. This change applies one of the basic laws of set theory. If φ is an element of a certain set (e.g. the commitment store before the speech act of confirmation), and the singleton set $\{\varphi\}$ (which can be the result of, for instance, stating φ) is added to that set, then the output set is not “extended”. In other words, for any two sets, if these two sets contain the same element, then the said element will occur only once in the set which contains their sum, e.g.: $\{x\} \cup \{x\} = \{x\}$.

Moreover, the reconstruction of **(C1)**, **(C2)**, **(C4)** and **(C5)** to **(HE1)**–**(HE3)** and **(HE5)**–**(HE6)** has been conducted without taking an equivalent act, “Retract S ”, into consideration. In formal dialectics, “Retract S ” realises two functions: retracting from stating that a sentence is true, and “blocking” placing the content of the previous locution in the commitment store of the player who “blocks” it. This process of “blocking” has been reconstructed in the following manner: firstly, the sentence S , which is the content of the locutions described with the discussed rules, is placed in the commitment store of the player X , the hearer. Next, when X makes “Retract S ”, the sentence S is removed from his commitment store. As illustrated in Table 5, modelling the said process either with the use of “blocking” (in the original formulation of formal dialectics), or with the use of placing a sentence, which

is later deleted (in the reframed approach), has the same final effect on the hearer’s commitment store.

WHITE	BLACK
1. Statement S	<i>Retract S</i>
S is added	The commitment store does not change

Table 5. An example dialogue in the original formal dialectics.

In the example above, once White has stated S , Black makes: “Retract S ”, thereby, basing on **(C1)**, he “blocks” placing S in his commitment store. Thus, according to the original description of system H, Black’s commitment store does not change. In the reconstruction we put forward, the same example can be illustrated with the rules **(HE1)** and **(HE4)**. After White has stated that S is true, the sentence has been added to Black’s commitment store (see **(HE1)**). In the next move, Black retracts from stating that S is true, which removes this sentence from his commitment store (see **(HE4)**). In the new version of dialogical logic, making the two moves has no effect on Black’s commitment store as well. Based on the aforementioned example, it can be stated that the function of placing, and then deleting, the sentence from the commitment store and the “blockade” function, which prevents placing the sentence in the commitment store with the use of “Retract S, T, \dots, X ” are equivalent from the aspect of the effects exerted on the commitment store.

3. Reframing Lorenzen’s System

The present part is devoted to a brief reconstruction of dialogical logic, which has been carried out in a similar fashion to the reconstruction of formal dialectics. In other words, the Lorenzen system rules have been formulated so that it would be possible to describe: the speech acts which players make in a game based on dialogical logic (the locution rules), protocol rules (the rules of permitted answers) and the effect rules (the effects of making certain moves).

In the original formulation of dialogical logic, the players can only defend and attack formulas of certain logic. However, attacking and defending consists of, for example, stating that a sentence is true or requesting its justification. Thus, these actions can be described with the speech acts specified in the locution rules of Prakken’s general framework. For example,

basing on the rule of dialogical logic (**P2a**), attacking the conjunction: *X attack* ($A \wedge B$) is made by questioning the truth of a sentence which is a proposition of the conjunction. In Prakken's language, this move can be made by: *question* φ , where φ is any proposition of the attacked conjunction, i.e. sentence A or sentence B (see the reconstructed rule (**LL5**) below). On the other hand, basing on (**P2o**), defending the conjunction ($A \wedge B$) consists in stating a sentence whose truth has been questioned in an attack. The defence can be made by: (1) *Claim* φ , where φ is either sentence A or B (see (**LL1.2**); or (2) *Concede* φ , where φ is either sentence A or B for a proponent, when φ is an atomic formula (**LL2.2**) (for a detailed description of the reconstruction of the locution rules, see: Yaskorska, Budzyńska 2016). As a consequence of this reconstruction, rules (**P1**)–(**P4**) of dialogical logic can be described in line with the standard adapted in Prakken's general framework for dialogue systems in the following manner:

Locution rules:¹³

- (**LL1**) **Claim** '*Claim* φ ' is made when the player: (1) attacks $\neg A$, then φ is sentence A , (2) defends $A \wedge B$, then φ is either sentence A or B , (3) attacks $A \rightarrow B$, then φ is sentence A , (4) defends $A \rightarrow B$, then φ is sentence B ;
- (**LL2**) **Concession** '*Concede* φ ' for φ being an atomic formula when the proponent: (1) attacks $\neg A$, then φ is sentence A , (2) defends $A \wedge B$ is either sentence A or B , (3) attacks $A \rightarrow B$, then φ is sentence A , (4) defends $A \rightarrow B$, then φ is sentence B ;
- (**LL3**) **Argumentation** ' *φ since* Ψ ' is made when the player defends $A \vee B$; then φ is sentence $A \vee B$, and Ψ is a set which includes sentence A or B ;
- (**LL4**) **Challenging** '*Why* φ ' is made when the player attacks $A \vee B$, then φ is sentence $A \vee B$;
- (**LL5**) **Questioning** '*Question* φ ' is used when the player attacks $A \wedge B$; then φ is either sentence A or B .

The second type of rules in Prakken's language includes protocol rules. Each game in Lorenzen's system includes the attack and defence of sentences,

¹³ The locution rules in the reconstructed dialogical logic have been labelled with LLi , where LL stands for: Lorenzen-Locutions, and i – the ordinal number of the rule.

which can be a negation, conjunction, disjunction or implication. Thus, the reconstruction of the rules we offer consists of characterising all the possible answers after certain attacks and defences of these structures, which are described with the use of structural and specific rules of dialogical logic, considering the permitted attacks of speech acts described by rules **(LL1)**–**(LL5)**. For example, responding to an attack and responding to a defence can be made in the following manner: basing on **(P2a)**, attacking a conjunction is performed via asking whether one of its propositions is true, which is performed by *Question* φ . The response, i.e. defending against the attack, is assigning truth to the attacked proposition of the conjunction realised by *Claim* φ (see the reconstructed rule **(LP7.1)** below); or in the case when φ is an atomic sentence, and the attack is made by the proponent: *Concede* φ (see **(LP7.2)**).

In turn, answering to the defence of a conjunction in dialogical logic can be realised as follows. Let us assume that the player defends a conjunction by *Claim* φ (see **(LP7.1)**). If φ is a negation of any sentence, then, considering Lorenzen's rule **(P1a)**, the opponent can respond with an attack by stating a sentence which is contradictory to the attacked sentence by *Claim* $\neg\varphi$ (see **(LP7.1)**) or *Concede* $\neg\varphi$, if $\neg\varphi$ is an atomic formula and the proponent is the attacking player **(LP3.2a)**. If φ is a conjunction of sentences, then due to the **(P2a)** rule, the opponent can respond by an attack which questions one of its propositions, by making *Question* ψ , where ψ is a proposition of the conjunction φ (**(LP3.3)** below). If φ is a disjunction, then due to rule **(P3a)**, the opponent can attack by performing the locution *Why* φ **(LP3.4)**. However, if φ is an implication, then basing on **(P4a)**, the player can attack by responding with *Claim* ψ (LP3.2c), where ψ is the antecedent of the implication φ .

In formulating the rules of permitted responses, we have also taken into consideration the structural rules of dialogical logic. For instance, **(LP2)** is a reconstructed **(D10)**, which says that the proponent can make a simple assertive speech act which contains an atomic sentence, only after the opponent has made it (the full description of the reconstruction of rules of permitted responses can be found in: Yaskorsa, Budzyńska 2016). Below, we enumerate the reconstructed rules of responses in dialogical logic expressed in Prakken's general framework.

Protocol rules:¹⁴

¹⁴The rules of permitted answers in dialogical logic have been labelled with LPi , where LP stands for: Lorenzen-Protocol, and i – the ordinal number of the rule.

(LP1) In the initial move, the player P makes *Claim* φ , where φ is a sentence whose tautology is the subject of the game; next, the players make moves in turns, one move per turn;

(LP2) The proponent cannot make the move *Claim* φ , where φ is an atomic sentence; P can state that the atomic sentence is true only if it has been stated by the opponent by making *Concede* φ ;

(LP3) After *Claim* φ , the defender of the sentence can make one of the following moves:

1. *Claim* ψ , if (a) φ is the sentence's negation, and ψ a sentence contradictory to it, (b) φ is an attacked implication, and ψ is the antecedent of φ (LP3.1 is performed by the proponent, bearing in mind the limitations described in **(LR2)**),
2. *Concede* ψ , if the player is the proponent, and ψ an atomic sentence, or that ψ has been earlier stated as a true sentence, and if (a) φ is this sentence's negation and ψ a sentence contradictory to it, (b) φ is the attacked implication, and ψ follows φ , (c) φ is an implication and ψ precedes φ ,
3. *Question* ψ , if φ is a conjunction of sentences, and ψ is an operand of a conjunction φ ,
4. *Why* φ , if φ is a disjunction,
5. An attack or a defence in relation to a permitted act which has earlier been made by the opponent, if the player is the proponent,
6. No move, if (a) *Claim* φ is an attack on a negation and φ is an atomic sentence, (b) *Claim* φ is the proponent's defence and the opponent has already attacked this defence;

(LP4) If the proponent makes *Claim* φ , where φ is an atomic sentence, it is followed by:

1. *Claim* ψ , if I confirm φ is an attack on implication, and ψ is a successor of the attacked implication, when the proponent says *Claim* ψ ;
2. No move, if (a) *Concede* φ is an attack on negation and φ is an atomic sentence, (b) *Concede* φ is a defence made by the proponent and the opponent has already accepted the defence;

(LP5) After φ since Ψ , where $\Psi = \{\psi\}$, the following moves must be made:

1. *Claim* φ , if (a) ψ is a sentence's negation, and φ a sentence contradictory to it, (b) ψ is an implication, and φ precedes ψ (LE5.1 is made by the proponent, considering the limitation described in (LE2)),
2. *Concede* φ , if the player is the proponent, and φ is an atomic sentence or if φ has already been stated to be true, and (a) ψ is the sentence's negation, and φ a sentence contradictory to it, (b) ψ is an implication, and φ precedes ψ ,
3. *Question* φ , if ψ is a conjunction of sentences, and φ is a proposition of the conjunction ψ ,
4. *Why* ψ , if ψ is a disjunction,
5. An attack or a defence against any previous act made by the opponent, if the player is the proponent,
6. No move for the opponent, if φ since Ψ is a defensive move made by the proponent, and the opponent has already accepted the defence;

(LP6) The following moves are permitted after *Why* φ :

1. φ since Ψ (LO6.1 is made by the proponent, considering the limitation described in (LR2)),
2. an attack or defence against a permitted act which has already been made by the opponent, if the player is the proponent;

(LP7) The following moves are permitted after *Question* φ :

1. *Claim* φ (the rule is made by the proponent, considering the limitation described in (LR2)),
2. *Concede* φ , if the player is the proponent, and φ an atomic sentence;
3. an attack or defence against a permitted locution which has already been made by the opponent, if the player is the proponent;

The third type of rules indicated by Prakken concern the rules of operation on the commitment store. The dialogical logic itself does not include the notion of a commitment store, which is why it is impossible to

find rules which specify the effects of making certain moves in this system. These rules, however, can be characterised based on the reconstruction of locution rules in the dialogical logic **(LL1)**–**(LL5)** and the effect rules for specific acts in Prakken’s general framework **(PZ1)**–**(PZ5)**. In the reconstruction which we offer, it is assumed that during one game the players use a *temporary commitment store* C' , that is a commitment store adapted for the time of the game. In turn, the commitment store C described by Prakken will be a set where the formula’s whose truth is in question during the game will be placed in or deleted from. The formula is placed when the proponent wins the game, and it is deleted when the opponent wins.

Let C'_s denote a temporary commitment store of the player s in a given dialogue game, m_n is the n -th move in this dialogue (where $n \in \mathbb{N}$) and $s(m_n)$ is a kind of move made by the player s in move m_n in this dialogue.

Effect rules:¹⁵

(LE1) If $s(m_n) = \textit{Claim } \varphi$, then $C'_s(d, m_n) = C'_s(d, m_{n-1}) \cup \{\varphi\}$;

(LE2) If $s(m_n) = \textit{Concede } m \varphi$, then $C'_s(d, m_n) = C'_s(d, m_{n-1}) \cup \{\varphi\}$;

(LE3) If $s(m_n) = \varphi \textit{ since } \Psi$, then $C'_s(d, m_n) \supseteq C'_s(d, m_{n-1}) \cup \Psi$;

(LE4) If $s(m_n) = \textit{Why } \varphi$, then $C'_s(d, m_n) = C'_s(d, m_{n-1})$;

(LE5) If $s(m_n) = \textit{Question } \varphi$, then $C'_s(d, m_n) = C'_s(d, m_{n-1})$.

IV. A Comparison of Systems for Natural and Formal Dialogues

The reconstruction of Lorenzen’s and Hamblin’s systems has allowed a unified description of these systems and, by extension – it allows for the comparing of cognitive processes in dialogue modelled by these systems. The present chapter indicates the basic differences and similarities between the cognitive processes of argumentation and proving by juxtaposing these three types of rules obtained from the reconstruction: the locution rules (pt. 1), the protocol rules (pt. 2) and the effect rules (pt. 3).

¹⁵The rules of operation on the commitment store in the reconstructed dialogical logic have been labelled with LE*i*, where LE stands for: Lorenzen-Effects, and *i* – the ordinal number of the rule.

1. Types of Moves in a Game

The juxtaposition of the locution rules in force in the reframed dialogical logic and formal dialectics is presented in Table 6.

General framework	Dialogical logic		Formal dialectics
<i>Claim</i> φ	X attack:	negation implication	Statement S
	X defend:	conjunction implication	
<i>Concede</i> φ	X attack:	negation implication	Statement S
	X defend:	conjunction implication	
φ <i>since</i> Ψ	X defend:	disjunction	Statement $T, T \rightarrow S$
<i>Retract</i> φ	—		Retract S, T, \dots, X
<i>Question</i> φ	X attack:	disjunction	Question S, T, \dots, X
<i>Why</i> φ	X attack:	disjunction	Why S
<i>Question</i> φ , <i>question</i> $\neg\varphi$	—		Resolve S

Table 6. A juxtaposition of locution rules.

In the reframed Lorenzen system, it is visible that during formal dialogues, the players can use almost all speech acts provided in the Prakken’s general framework, except for *Retract* φ . The lack of possibility to retract indicates certain important characteristics of the cognitive process of proving which distinguishes it from argumentation. In dialogical logic, stating that sentences are true consists in assuming that they are true during the game. If a player assumes that a certain formula is true, then having made a few steps, it is impossible to resign from this assumption (in the same game).

In the original description of formal dialectics, similarly to Prakken’s general framework, the rules of permitted moves were defined. However, making some of the speech acts is interpreted differently in both of the systems. For instance, Hamblin defines a speech act “Statement S ” which is made always when the player wants to state that a sentence is true, i.e. wants to declare his beliefs about a certain fact and to inform his opponent about it. Expressing such a communicative intention of the speaker with the use of

one speech act is a kind of simplification. According to Prakken's framework, three acts describing these dialogue situations are possible: (1) *Claim*, when the speaker has the aim of informing the opponent about his beliefs, (2) *Concede*, when he wants to inform him that he agrees with the opponent's standpoint, (3) *since*, when he additionally justifies a given sentence.

Making speech acts is different in both systems in terms of content and the acts made. It is connected with the fact that in communication realised on the grounds of these systems, the players gain knowledge about different types of objects corresponding to different linguistic structures. Having a natural dialogue based on formal dialectics, the players gain knowledge about facts. In a formal dialogue, the players attain knowledge about dependencies between facts, the dependencies being characterised by adequate tautologies. However, it is possible to describe some common communicative-cognitive processes in these systems, e.g., the act *Claim* φ expresses the same activity in both systems. It means that the behaviour of the cognitive subjects, in terms of dialogue systems of argumentation and proving, is essentially similar.

2. Rules of the Game

In the reconstructed Lorenzen's and Hamblin's systems, the most differences can be seen in the rules of permitted responses which are juxtaposed in Table 7.

In Lorenzen's system, the rules of responses are specified only for the opponent; the proponent, in turn, can make any move pertaining to the opponent's previous utterances. In Hamblin's system, the rules of permitted answers pertain to both of the players; however, they are formulated only in the responses to the speech act with which the opponent has asked a question. In other words, the limitations in system H are only specified for the party responding to questions. This means that in the proving process, only the attacking party is limited, and in the process of argumentation – only the defending party. The aim of system H is to model natural communicative-cognitive processes, and more specifically, errors in argumentation. Therefore, the system imposes limitations solely on responses to questions, that is, the means in which one can justify or express one's standpoint once specific questions have been asked.

In dialogical logic, after the request for justifying a sentence, the opponent can only perform argumentation; in formal dialectics, on the other hand, apart from argumentation, he can also confirm that a sentence is true or

retract from stating a sentence. What is also indicated is the difference between the communicative-cognitive processes in both models. In a formal dialogue, the player has to defend his standpoint when he is asked for argumentation, as otherwise he loses. However, in a natural dialogue, the player does not have to argue for every sentence that has been attacked by the opponent.

Speech act	Response in dialogical logic	Response in formal dialectics
statement	<i>O</i> : no move claim concession challenging <i>P</i> question any act	any act
confirmation	<i>O</i> : no move claim	any act
argumentation	<i>O</i> : no move claim concession challenging question <i>P</i> : any act	any act
challenging	<i>O</i> : argumentation <i>P</i> : any act	claim concession argumentation withdrawal
question	<i>O</i> : claim <i>P</i> : any act	claim
request for resolution		withdrawal

Table 7. Juxtaposition of the protocol rules.

Yet another difference between the modelling of communication in Lorenzen's and Hamblin's systems is the possibility to change the rules during one game. System H provides for the possibility of changing roles, that is, at a certain stage, it is possible for the player to shift the role from the role of the party asking questions (the cognising party) to the validating party. It permits: (1) having dialogues with a few subjects of discussion,

and (2) having a dialogue where both players acquire information by asking questions. Let us assume that Black states that *A* is true in the first move. White asks Black to justify the sentence in the second move, which allows him to acquire knowledge about the facts which constitute the justification of the sentence if Black makes argumentation in the third move. If White states that another sentence, *B*, is true in the fourth move, the roles change and in this case, Black can become the asking and the cognising party. Lorenzen's system does not allow such a change, which means that dialogical logic permits the verification of whether a sentence is true and acquires the conviction only about one formula. Thus, in argumentation, as well as in proving, both players acquire knowledge, but the cognitive process in the systems is different. Parties in natural dialogue exchange information, whereas in a formal dialogue, players together acquire knowledge about a formula.

3. The Effect Rules

Juxtaposing the effect rules store (**LE**) and (**HE**) reveals certain basic differences between the systems and the cognitive processes in dialogue which they describe. In the reframed approach to dialogical logic, only a temporary commitment store is used, which in reality only constitutes the player's assumptions (assumptions in evidence), and not a set of beliefs that he has publicly declared. The proponent by, for example, making a statement, does not reveal his knowledge about the world, but tries to justify or negate the truth of a formula in an interaction with the second player. The players do not acquire knowledge about the content of the speech act during a dialogue, as it is in formal dialectics. The discussing parties assume or refute that a given formula is true only after the game has ended, when they have acquired knowledge whether a sentence at stake is a tautology or not.

On the other hand, the rules of operation on the commitment store in system H are characterised by the effects of moves on the commitment store of the party who performs the act (the speaker) and the hearer's commitment store, which allows us to analyse the influence of making given speech acts on the speaker's and hearer's public states of knowledge. What is more, the player can retract from stating that a sentence is true, whose truth has been stated by the opponent, which may be interpreted as a manifestation of different views on whether a sentence is true or not.

Conclusion

We have shown that the two models of dialogue which have different aims – argumentation and proving – can be described with the use of a single language basing on the philosophical notion of a speech act. Unifying the description of the two systems, which gave rise to two basic paradigms of formal modelling of dialogue – formal dialectics and dialogical logic – has been performed by the reconstruction of the systems according to Prakken’s standard. As a result, it is possible to compare the factual similarities and differences between the cognitive processes of argumentation and proving.

This paper indicates a few basic characteristic features of these processes. In dialogue games, players gain knowledge by making certain moves, e.g. an attack or a request to justify a sentence. In a natural dialogue, the player (the cognising party) can acquire knowledge about facts by interacting with another player (the informing party), by requesting to justify a given sentence and receiving an appropriate inferential structure in response, which provides the justification. The cognitive process of argumentation is thus realised jointly by both parties in the sense that the cognising party initiates the process by asking a question, and the informing party gives an answer to the question asked.

In a formal dialogue, however, players jointly acquire knowledge about the validity of schemata of proving (both are cognising parties) because they jointly perform the process of proving. The role of the informing subject is taken over by the rules of a given logic in the sense that they regulate the means of performing a game. It allows for the discussing parties to decide who will be the winner in a given game, and – whether a formula is a tautology (if the proponent wins) or not (when the opponent wins).

The logical rules in both dialogical logic-type systems are fully deterministic, i.e., a dialogue always permits us to decide who wins a given game. These rules are coded mainly in the limitations imposed on the opponent in protocol rules, which force him to make subsequent moves in the direction which will lead to resolution. An unambiguous result of a dialogue process of proving forces both of the players to accept the result (assuming that they are rational). In contrast with the seemingly “aggressive” resonance of the term “attack”, specifying one of the moves permitted in the original Lorenzen system, a formal dialogue is cooperative in nature. However, in natural dialogues, the opponent does not have to accept the opponent’s argumentation, and, at a certain stage of the game, the proponent can change his standpoint and retract from acknowledging his own conclusions,

which is typical for everyday practices.

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Wiesław Walentukiewicz¹

Do Children Commit Categorizing Errors While Using Proper Names?

Abstract The author of the article regards the source of the distinction for singular names/general names not to have a cultural character, but a cognitive one, and on these grounds tries to solve one important modern problem: how is it that when a child learns words, the child commonly applies an aggressive strategy and does not make category mistakes connected with the (apparent) use of some singular names – individual names (when it is required to refrain from applying this strategy). Next, the author argues that although a child at the age of two can properly use a singular name, it does not constitute any evidence that it can properly use a proper name, as psychologists assume. For that to happen the child would have to understand the nature of a proper noun.

Keywords social communication, learning singular names, learning general names, learning proper nouns, categorization

Introductory Remarks

Children commonly adopt an aggressive strategy when they first learn to use names. The result is that they commit categorizing errors. Interestingly, according to psychologists, this regularity does not obtain for certain special singular names: proper names with reference. According to psychologists, children do not commit categorizing errors while learning to use proper names of this kind, although they commit them while learning to use general names. We would like to investigate this psychological thesis more closely.

¹ University of Economics in Katowice.

E-mail: w.walentukiewicz@ue.katowice.pl

Our analysis will be restricted to the period during which the child learns its first proper names and we will only be concerned with proper names belonging to persons. Let us begin our analysis at the time the child does not yet know any words.

It seems that language acquisition begins from the following situation (described by Quine in connection with a foreigner learning the word “Gava-gai”): the teacher utters a new word and applies it to an object with which the learner does not associate any name.² The learner must decide whether the teacher applies this word to the entire thing, its part, its property, or perhaps an activity it is performing, if it is performing any, etc.

The time period from the end of the 1980s to the beginning of the 21st century saw the formulation of the principles (assumptions) children adopt while forming their first semantic relationships (a summary of this research can be found in Hirsh–Pasek and her team (2004)). In order that a name is successfully tied to its scope, the human mind must have at its disposal principles that would allow it to successfully pick out the relevant elements in the world and to assign to them appropriate words. Researchers distinguish two layers among these principles. The first layer, applied by the child at the age of twelve months, includes:

- a) the principle of reference: the first words designate things, activities (these would correspond to relations) and properties belonging to the basic level; these words are, for example, “dog” as opposed to “mammal” or “dachshund,” “green” as opposed to “colour” or “pistachio,” or “above” as opposed to “relation” or “5 cm above” (Clark 2003: 135);³
- b) the principle of extendibility: a word is not a ‘label’⁴ glued to the first object it was assigned to; it should be extended onto other heretofore unnamed items. It refers not only to a singular object but to a category (class) of objects;
- c) the principle of object scope: a word refers to the whole thing and not to its part or the complex comprised from this and other things;

² An object can be a thing, a property or a relation.

³ In psychological literature (Rosch 1978; Hall 1993; Hall, Waxman 1993; see also Hall, Lavin 2004) it is relatively commonly held that children show the basic–level object–category assumption for things, that is, they connect the word “dog” with dogs and not with animals in general or with dachshunds (since they possess a mental representation of dogs – the psychological aspect).

⁴ The symbol ‘. . .’ indicates that the term occurring in the place of the ellipsis is not used in the technical sense.

for example, the child will pick out a squirrel and not the complex squirrel-on-the-branch (Clark 2003: 134).

The second layer principles are the following:

- a) the principle of novel name – nameless category: new names should be tied to heretofore unnamed categories. In consequence, it is also assumed that a new name should be assigned to a new object and not an object that is already named:

“Speakers take every difference in form to mark a difference in meaning” (Clark 1995: 394).

For a child using the above principle the object may only have one name;

- b) the principle of categorical scope: words can be extended onto taxonomic categories not based on general similarity but based on properties which distinguish, in a more precise manner, the scope of the given name;
- c) the principle of conventionality: names can be given to objects based on social conventions. According to this principle, the child seeks these conventional means of referring and adapts to them, the same way it would to a necessity of any other kind:

“For certain meanings, there is a form that speakers expect to be used in the language community” (Clark 1995: 394).

These principles undergo changes and emerge as certain inborn prejudices are combined with experience gained in the course of language acquisition (Hirsh-Pasek et al. 2004: 177–178). They are used by the child from a very young age, although they are discarded over time (Clark 2003: 133). In the literature (Clark 2003: 138) there is no agreement as to how they form, when they begin to be operational, how long they are in use, and why they are ultimately discarded by the learner.

Since our goal is to discuss proper names, and these most often concern persons (who are things), we will be interested in two principles formulated based on experiments carried out, among others, by Baldwin (1989), Kobayashi (1998), and Hirsh-Pasek and her team (2004): the learner ties a name to an entire thing (the object scope assumption), and it is a thing

from the basic level (the reference assumption). The child must subsequently decide if it will use the name with regard to one thing constituting the sole element of a one-element class, or to many things belonging to a multi-element class. This is the proper beginning of our analysis. How does the child determine that?

Learning Strategies

The simplest solution to this question can be found within learning strategy theory. Generally speaking, we can distinguish two relevant positions: some authors think that children adopt a conservative strategy, that is, they only use a word with regard to the object it has been assigned to by the teacher and await further instruction. In this case, the solution to our problem would be simple: when the child hears a new name, it ties it to an entire object. So long as the name is not applied to another object the learner will only apply it to that one item. If we assume that a conservative strategy is used at first, the outstanding issue will be how to teach a child to use a general name. The procedure would be the following: the adult would use the same name with regard to many objects and would encourage the child to extend the scope of the name's use accordingly (Waxman 2004).

However, only few experiments accord with the thesis about the adoption of a conservative strategy by the child and those which confirm it are questioned (Markman, Jaswal 2004). It can at most be assumed that the child adopts such a strategy so long as it has learnt a small number of words (for example, research by Samuelson and Smith 1999). Later, the child begins to adopt an aggressive strategy. Landau (2004: 117) claims that children begin to generalize and extend the use of names onto objects that have not been previously indicated once they have mastered fifty words.

According to other authors, the child adopts an aggressive strategy from the start: as soon as it has mastered the use of a word with regard to one indicated object, it will use it with regard to other items that have not been previously indicated (Golinkoff and her team 1995). Woodward and her team (1994) have discovered that eighteen-month-old children extend the use of a new word onto other things that differ in colour (see also Markman, Jaswal 2004: 379). If it is indeed the case that the child adopts an aggressive strategy, then the problem will arise of how to restrict the extension of a name's use onto items that are not the name's designates. Once the child has erroneously extended the use of a general name, we can correct it using expressions such as "This is not *N*." This works in the case of general as well

as singular names. Once the child has begun to use the singular name “Anna” with regard to other people, it is sufficient to use the expression “This is not Anna.” The use of expressions with negation does not stop the child from adopting an aggressive strategy and there must occur situations where the child will use a singular name inappropriately. If the above is correct, we can state the following: (1) as can easily be gathered, the adoption of an aggressive strategy is the reason why children commit categorizing errors with regard to the use of both singular and general names; and (2) it would seem that we have also explained how the child comes to distinguish singular names from general ones. Namely, if the name refers to more than one object, it is a general name, and if it only refers to one, it is a singular name. The capacity to distinguish them is acquired on cognitive grounds.

However, several more problems now arise. Are all singular names distinguished from general ones on cognitive grounds? Do errors accompany the acquisition of all singular and all general names? Is the error always a matter of extending the use of a given name beyond its scope? It seems that the last question can be answered in the affirmative with regard to all general names, but is it the case with regard to all singular names?

Special Singular Names: Proper Names

In psychological literature, some authors (e.g. Macnamara 1982) note that children use proper names (one should add: non-empty ones), that is to say special singular names, more or less error free. This thesis is confirmed by other psychologists (Markman, Jaswal 2004).

Macnamara (1986) distinguishes proper names from generic names. Markman and Jaswal make similar linguistic distinctions: proper names versus common names (Markman, Jaswal 2004: 371) and proper names versus count nouns (Markman, Jaswal 2004: 372). These distinctions on the level of language are related to a metaphysical distinction between particulars (Bill) and kinds (chair) (Markman, Jaswal 2004: 402).

In our analysis of views held by psychologists we will follow the example provided by Markman and Jaswal (2004): Bill (proper name) and chair (general name). Proper names referring to existing objects are singular names, while common names and count nouns referring to existing objects are general names.

The distinction created by psychologists does not accord with the divisions made by philosophers. In philosophy, general names feature in the classification of names according to the number of possessed designates: here

we distinguish general, singular and empty names. Proper names feature in the division based on the semantic function they play: here we distinguish proper names, whose function is to name⁵ – this function does not allow for reference to a designate, if the name has one, via connotation (proper names do not have connotation) – and other names, whose function is to designate; the latter function allows for reference to a designate via connotation. To name is to assign a name regardless of the object's characteristics (connotation), while to designate is to assign it due to the object's characteristics (connotation) (Mill 1962: 51).

The distinction between singular and general names (the linguistic problem) is related, under certain conditions, to the distinction between particulars and classes or, as Markman and Jaswal (2004) put it, between: particulars and kinds (the metaphysical problem), individuation and generalization (the gnozeological problem), knowledge about particulars and general knowledge (the theory of knowledge problem), and concepts that are mental representations of individuals and those that are mental representations of classes (the psychological problem). In contrast, the distinction between proper and general names can only be applied in light of what we have assumed here (we do not deal with empty names) to proper names that possess a designate. They are special singular names which fulfil the function of naming. In this division, general names fulfil the function of designating. From here on we will write about proper names possessing a designate using the term “proper name.”

Let us now return to our analysis. The last point we made was that, according to psychologists, children tend not to commit errors in their use of proper names. Does this mean that they do not adopt an aggressive strategy with respect to these special singular names – proper names? If children indeed do not commit such errors, how do they restrain themselves from using an aggressive strategy in this particular instance? Given that they generally adopt the principle of extendibility, why do they not do so with respect to proper names? Do they recognize proper names and know the principle: do not use a proper name with regard to objects other than the named one? There are several possible answers to this question: (1) we may assume that children do not adopt an aggressive strategy at all but a conservative one, in which case, however, we go against empirical findings; (2) we may assume that children do not adopt an aggressive strategy with regard to

⁵ “For, though we may give to an individual a name utterly unmeaning, which we call a proper name – a word which answers the purpose of showing what thing it is we are talking about, but not of telling any thing about it...” (Mill 1882: 41).

proper names, in which case we are bound to presume that they distinguish proper names from general ones (therefore, we can no longer argue based on the assumption that children use a single strategy to learn their first names, an aggressive strategy, and we still do not know how children make the distinction in question); or (3) we may assume that children adopt an aggressive strategy only, in which case we must explain how it is that they do not commit errors.

Let us remember that in psychological literature (Hall, Lee, Bélanger 2001) it is commonly held that at the age of twenty-four months children distinguish proper names from general ones. Before we present our own explanation, let us briefly describe how psychologists have proposed solving this problem.

Not Using a Proper Name with regard to Similar Objects

In the literature (Markman, Jaswal 2004: 386) the principle of exhaustive reference has been formulated, according to which the speaker should use a new name (of a natural kind) to all objects that are its designates and are seen by the speaker.⁶ If the speaker uses a new name with respect to one object and not to the other objects (seen by the speaker) such that the name could justifiably be applied to them and the learner expects it (for example, due to a resemblance between the named object and the other seen ones), then this should suggest to the learner that the name fulfils its semantic function with regard to the one object only (Markman, Jaswal 2004: 390).

These conclusions have been drawn based on experiments with children who were three years old (as we have indicated, two-year-old children distinguish proper names from general ones). Although this particular study concerned the introduction of general names, Markman and Jaswal (2004) have attempted to carry it over to their analysis of proper names. However, it seems that the experiment confirms a learning process aimed at restricting the principle of extendibility rather than the use of proper names.

Animation

As early as 1974, Katz, Baker and Macnamara (1974) argued that children tie proper names to animate entities. If an object is an animate

⁶ Could this assumption be a semantic and not a linguistic rule supplementary with regard to Grice's theory of conversational implicature?

entity, it is more probable that a new word used by the teacher will be interpreted by the learner as a proper name, especially if it is used with regard to a single item and not two different items (Markman and Jaswal 2004: 373). In other words, if an animal has a name and the child knows it, and the teacher goes on to use another word, then the child will interpret that other word as a proper name (Hall 1991; Markman, Jaswal 2004: 374). This decision is further reinforced by the information that the user of the new name knows the animal (Birch, Bloom 2002; Markman, Jaswal 2004: 374).

Imai and Haryu (2001) have established that preschoolers treat new names for things as general names from the basic level and extend their use to other objects (Markman, Jaswal 2004). They go by the assumption of mutual exclusion according to which the second word used with regard to an animate object is interpreted as a proper name, whereas the second word used with regard to an inanimate object, as a name referring to objects of the subordinate category.⁷

What objects count as animate? Based on empirical research (Hall 1991), it has been established that they are objects characterized by the following physical traits: has skin, fur, a face, eyes, the shape of an animal or a human being. Children give human characteristics to objects that have a face, speak or move (including toys such as a toy train; Markman, Jaswal 2004). Girls aged two assign proper names to their dolls. Insects do not have faces; hence, they are considered inanimate and no proper names are tied to them unless it is said that a given insect is somebody's animal (for example, "This is my butterfly. Its name is David."). If girls (but not boys) are informed that an object feels some kind of emotion, they assume that it is animate. Evidently inanimate objects such as ships were not connected with any proper names (Markman, Jaswal 2004: 392, 393). Based on these remarks we may advance the thesis that physical traits attesting to the object's animation can but do not have to facilitate their connection to proper names. One should remember that there exist animate objects that do not have a proper name (e.g. most dolphins) as well as inanimate objects that have one (e.g. Koh-i-Noor). If the psychologists who adhere to the thesis that animation helps the learner acquire the ability to use proper names are right, then the following principle

⁷ Three levels of categories can be distinguished (see Rosch 1978): the superordinate level (for example mammal), the basic level (for example dog), and the subordinate level (for example dachshund). In language, they correspond to general names: of the superordinate, the basic and the subordinate level. These levels differ in terms of the degree of abstraction.

could be formulated: if you want to teach a child to use a proper name, use a general name from the basic level with regard to the object first, followed by the proper name. However, could this be the right procedure to introduce proper names? Will the child understand, in the described situation, what a proper name is?

It seems that the argumentation presented so far only confirms that the child uses a singular name and not a proper name. To learn to use a name with regard to one object and to master the use of a proper name are not one and the same thing (in the latter case, one must understand what a proper name is). Although the repetition by the child of the sound of a proper name may suggest that it understands what a proper name is, this behaviour is merely apparent. The child may have learnt to use a singular name. If two or three-year-old children understood what a proper name is, they would be able to use it with regard to inanimate as well as animate objects.

The Inability to Transfer

The debate between the proponents of the aggressive strategy and those of the conservative strategy concerns, *inter alia*, the question of whether, before a word is introduced, the child has any mental representation, however rudimentary, of what it might refer to. Three, four-month-old children construct basic-level concepts which are later tied to general names (for example, Behl-Chadha 1996, Quinn, Eimas 1996). Do children, before they learn to use a singular name, already possess a concept for its designate, even a preliminary one? Children adopt an aggressive strategy also in the case of singular names: they use the same singular names with regard to the same persons over time and in different circumstances, not because they know that the given word is a singular name but because they commonly adopt an aggressive strategy for singular and general names. If the child adopts an aggressive strategy, it must have a previously constructed singular concept, at least a preliminary one, with which to tie the singular name. Can a child construct such a concept?

In psychological literature (e.g. Machery 2009, 2011; Brooks 1978; Murphy, Medin 1985) the following kinds of concepts are mentioned: exemplar concepts (for general names) constructed based on similarity (reducible to characteristics)⁸ with an individual; prototype concepts constructed based on

⁸ “Exemplar-based models assume that cognitive processes involve the computation of the similarity between exemplars and other representations. [...], when I categorize

typical traits which allow one to only pick out items that are for some reason considered typical; and theory-dependent concepts constructed based on characteristics which allow one to establish whether a given element belongs to the scope of the concept, where the choice of some characteristics over others is explained by a theory. Some authors (McDonnel, Gureckis 2011) also write about classic concepts which are built based on necessary and sufficient characteristics. However, they identify them with theory-dependent concepts.

All concepts listed above are general concepts constructed based on characteristics, not singular concepts. In philosophical literature (Walentukiewicz 2011, 2014) there are two conceptions of singular concepts: the exemplar conception (for singular names), according to which the individual is determined by individual characteristics (for example, fingerprints and retina possess such characteristics); and the basic conception, according to which the individual is distinguished based on overall similarity (not reducible to any strictly defined common characteristics) to the last seen image (most often the face) of a person (who, if given a name, becomes a semantic type; Walentukiewicz 2011).

If we accept the thesis that the child is able to construct basic concepts in the first month of life, then we will be able to explain how it can distinguish its mother's face so early on (within less than a month since birth; Walton, Bower, Bower 1992; Walton, Bower 1993).

Following Macnamara (1986) observing his son Tom at fifteen months of age, Tom understood the name "Spot" uttered by his father to designate their dog. Tom was subsequently able to refer to the dog using this name and to understand the same act of reference carried out by others. However, Macnamara specifically states that he does not hold that Tom possessed the concept of proper name.

In opposition to what Macnamara claims, we think that the child not only does not understand what a proper name is but it cannot use it either. It does not carry out any act of reference by means of a proper name. The child merely uses a singular name and carries out an act of reference by such means. It has constructed a concept for a singular name and not for a

Fido as a dog, one or several exemplars of dogs are retrieved from long-term memory (together, maybe, with exemplars of other categories, such as some exemplars of cats); this exemplar (or these exemplars) is (are) matched with the representation of Fido" (Machery 2009: 96).

"The exemplar paradigm of concepts is built around the idea that concepts are sets of exemplars. In turn, an exemplar is a body of knowledge about the properties believed to be possessed by a particular member of a class" (Machery 2009: 93).

proper name. In order to construct a concept for a proper name, it would have to understand the function fulfilled by proper names in language. This understanding is cultural (philosophical⁹), while the grasp of the function fulfilled by singular names is cognitive.

The use of a proper name with comprehension requires not only that one master the ability to use it with regard to a single object (the cognitive requirement) but also that one have enough knowledge to be able to use it every time, everywhere and in every situation where its reference exists (we are still discussing proper names possessing designates). By using a proper name, one can successfully refer to an object regardless of its characteristics. A proper name is given to a person regardless of any characteristics and belongs to the person regardless of any characteristics. Hence, if a person changed all their characteristics (were such a change possible), other than the possession of a name, this name would still belong to that person by virtue of naming (the cultural requirement).

When the child learns its first words referring to particulars, it learns singular names and not proper names. In order for the child to learn to use proper names, it must first understand what their basic semantic function is. And this function is not just to distinguish a single object but also to allow reference not based on any specific individual characteristics. Singular names, in contrast, are used with regard to particulars due to the characteristics they possess or their similarity to a semantic type.

⁹ The fullest description of the nature of proper names has been attempted by philosophers of language. General names are replaceable by descriptions through which it is possible to establish their scopes, while proper names are not replaceable by any such descriptions (Mill 1882; the weak version). Some authors go further and hold that these descriptions are necessarily tied to some general names, while proper names are not replaceable by such descriptions (Kripke 1980; the strong version). The act of christening, the intention of the person carrying it out, establishes a necessary connection between a proper name and its referent. Searle (1969) responds to this proposition in the following way: although a single description could be connected with the referent of a proper name only accidentally, a disjunction of descriptions could be connected with such a name necessarily. Other counterexamples to Kripke's proposition could be the following: during the war people assumed names temporarily; moreover, history does feature instances in which not the christener's intention but some other reasons decided about the assignment of a proper name – the assignment of the name “Madagascar” could be one example. To summarize, the thesis that general names are connected with descriptions, while proper names are not, and that proper names are introduced into language by acts of christening, while general names are introduced through descriptions, is not convincing. It seems that proper names can be connected with certain descriptions (Searle 1969), while general names are introduced by inaugural acts of christening of the form “This is *N*.”

It is now time to answer the most important question: since the child adopts an aggressive strategy, why does it not commit categorizing errors while using proper names (or commits them less frequently than in the case of general names)? First of all, the child is in possession of a singular concept and uses a singular name. Secondly, it cannot transfer a singular name (or a proper name, for that matter) tied to this singular concept onto any other object and this is why it does not commit errors. There is evidence (Walton, Bower, Bower 1992; Walton, Bower 1993) that the face allows the child to recognize the right person. If the child has learnt to recognize the faces of its parents and not to mistake them for other people's faces, this is because most of the time there is no face in the vicinity that would be similar to either parent's face. The only face "similar" to the face of the parent seen earlier is precisely that parent's face. As long as the child does not see any other similar face, it uses the name with regard to the person that had been appropriately named and that has a face associated with that name by the child. This name is a singular name since it is used by the child with regard to a single object. If a face is seen often and for long enough at a time, it becomes "clear" and is easily distinguished from others. The frequent and prolonged presence of a face in the child's perception enhances the "clarity" of the overall image of that face and its distinctness from other faces. However, once another similar face is presented, the child may recognize it falsely (often with age brothers are mistaken for each other, although not by the parents). However, there are few doppelgangers in the world and so the child has very little chance to misidentify a person while relying on overall similarity to a previously memorized semantic type.

The above explanation is not applicable to proper names.

Summary

By way of a summary, let us mention other ways of distinguishing certain singular names, such as proper names, from general names. Linguistic literature has listed methods by which children can be taught to distinguish proper names from general ones. In the English language, there are certain markers for it, for example articles. The child can establish their presence or absence. General names are accompanied by the articles "a(n)" or "the" which do not accompany proper names. Children who learn English may be able to distinguish proper names from common nouns owing to the grammatical form at seventeen months old, and they can definitely do so at two years old. However, not all languages possess articles – they do not

feature in Polish. In the Polish language, proper names are distinguished from other words since they, and only they, are capitalized. However, this is not an eat distinction in all languages – in German, for example, all nouns are capitalized. Moreover, this criterion is only applicable to the written language. There is yet another proposition: while introducing a word, use a numerical greater than one so that the learner can gather that it is not a proper name. If we say “There are five apples,” it becomes clear that the word “apple” is not a proper name. However, this and similar propositions are strictly technical and do not capture the gist of what the use of proper names consists in.

In order to understand what proper names are it is mandatory that all the relevant problems discussed by philosophers are somehow grasped. It seems that a two-year-old child is too young to be able to capture a proper name’s role. A mere utterance of a sound identical with a proper name, even a successful one, does not prove that a proper name has been used with comprehension. To achieve the latter, the child would have to understand that proper names are introduced into language by an act of “christening” regardless of the referent’s past, present or future characteristics. This is the main function proper names are created to fulfil.

The distinction between singular names and general names is a cognitive one, that it to say, it can be introduced via cognitive activities. The distinction between proper names and general names, on the other hand, is cultural and can only be introduced after relevant criteria have been presented to the learner. The use of a proper name requires the mastery of the correct use of a singular name and an understanding of the role played by proper names in language, the latter of which is achieved on cognitive-cultural grounds.

Based on empirical research we have assumed that children adopt an aggressive strategy and do not commit errors while using singular names. What remained to be done was to explain how this is possible. We have tried to prove that before acquiring a singular name the child has at least a preliminary concept referring to the appropriate individual – a basic singular concept. A child cannot use a proper name correctly, or incorrectly, because at the beginning of its linguistic education it uses singular names and not proper names. During the process of learning its first names, it is only able to capture the distinction between singular and general names. Psychological findings do not confirm the thesis that two-year-old children distinguish proper names from general names. Our analysis too only justifies the thesis that the child can use singular and general names at this age. Some singular names can be distinguished from general names on cognitive

grounds only, while some other, that is, proper names with a designate, on the cognitive-cultural grounds.

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Sylwester Orzechowski¹, Sławomir Wacewicz², Przemysław Żywiczyński³

The Problem of "Modality Transition" in Gestural Primacy Hypothesis in Language Evolution: Towards Multimodal Hypotheses

Abstract In our paper we review the gestural primacy hypotheses in language evolution, starting with the discussion of the historical advocates of this approach and concluding with the contemporary arguments, derived from empirical research in various fields of study. Assessing the strengths and weaknesses of the gestural scenarios we point to their main problem, namely their inability to account for the transition from a mainly visual to a mainly vocal modality (the so called "modality transition problem"). Subsequently, we discuss several potential solutions to this problem, and arrive at a conclusion that the most satisfying option is the multimodal perspective, which posits that language evolved as a bimodal system, with the vocal and visual modalities very closely integrated from the very early stages.

Keywords language evolution, gestural protolanguage, modality transition problem, multimodal hypotheses

¹ Institute of Psychology, Maria Curie-Skłodowska University.
E-mail: sylwesto@gmail.com

² Center for Language Evolution Studies, Nicolaus Copernicus University.
E-mail: wacewicz@umk.pl

³ Center for Language Evolution Studies, Nicolaus Copernicus University.
E-mail: przemek@umk.pl

1. Introduction

1.1. Research background – the evolution of language

Despite the belief that language origins cannot be pursued scientifically (Campbell 1998; Fisiak 1985) still being present in the 20th century, the *evolution of language*, research on the phylogenetic source and development of language ability, has become a well-established, recognisable and dynamically developing field of study. According to the data from *ISI Web of Science*, the number of publications on language evolution increased tenfold from 1990 to 1999, and threefold from 2000 to 2009 in proportion to the previous decade. There are textbooks (e.g. Johansson 2004; Hurford 2007) and encyclopaedic compendia (Tallerman, Gibson, 2011) on this domain. Furthermore, the debates on evolution have become central to linguistic inquiry (Hauser, Chomsky, Fitch 2002; Pinker, Jackendoff 2005). This change has mainly been possible through significant advances made in empirical studies in recent years – particularly, in the research on communication and cognitive abilities of non-human animals, neuroscience, genetics, and computer modelling. A more thorough description of the subject comes from Fitch (2010), Tallerman and Gibson (2011); an overview in Polish comes from our previous writings (e.g. Waciewicz, 2008, 2013; Żywicznyński and Waciewicz, 2015).

1.2. Gestural primacy hypotheses in language evolution

According to gestural primacy hypotheses, sometimes referred to as gestural⁴, language phylogenetically stems from a gestural form of communication conveyed in the visual channel (see 1.3.). In an obvious way, these explanations of language origin compete with vocal-auditory hypotheses that trace back the origin of language to non-linguistic vocalizations (e.g. Burling 2005; Dunbar 1998; Mithen 2005; MacNeilage 2008). Vocal hypotheses are usually based on the intuitive assumption that the development of human communication from the original to current language form was shaped entirely by the vocal modality. Although this assumption is intuitive, it should not be taken as implicit. The vocal-auditory modality is so firmly established that other proposals on language origin are hardly ever noticed (e.g. Kenneally 2007). Lack of awareness on the status of sign language – language in the full sense of the word – is a related problem (see 3.2.); Charles Hockett's

⁴ Terms such as “*gestural primacy hypothesis*” (GPH); *gestural hypotheses*; *gesture-first hypotheses*; *from hand to mouth*; *language from gesture* are present in the literature; *gesture together with speech* falls under this category as well.

designed features of language (e.g. 1960) constitute a familiar and telling example, which in its initial form relates to speech and the exclusion of gestural modes of linguistic expression.

Gestural primacy scenarios have been considered by many authors, representing both speculative philosophising and contemporary science. There are a few types of gestural primacy hypotheses, differing in descriptions of gestural and vocal communication, and organisation of the postulated gestural system. These types include:

- gestural language before speech hypotheses,
- gestural protolanguage hypotheses.

Gestural hypotheses also peripherally embrace:

- *gesture together with speech hypotheses.*

Gestural language prior to spoken language hypotheses (e.g. Corballis 2002; Stokoe 2001) assume the stage of developed gestural language before speech emerged. Although these authors do not rule out the role of vocalisation in language development, they highlight that its function was limited to transmission of nonverbal information such as emotions.

Gestural protolanguage hypotheses in turn assume that protolinguistic communication mainly relied on gestures functioning as simple, syntaxless signs. Gestural primacy hypotheses come in two varieties:

- *synthetic gestural protolanguage* – gestures stand for words and represent referents (objects or actions) that can be combined into short strings with compositional content (the meaning of a whole stems from the meaning of components), but lack the syntactic or morphological structure (e.g. Hewes 1973);
- *holistic gestural protolanguage* – individual gestures are equivalent to whole utterances, representing complex thoughts or situations, e.g. “I am hungry” (Arbib, 2005).

Gesture together with speech hypotheses, based on the close link between speech and gesticulation during linguistic expression, assume that language development always comprised both modalities: vocal and visual (e.g. Goldin-Meadow 2011; McNeill 2012; Kendon 1991). We discuss this problem in detail in section 5.

In spite of the differences between these approaches, they are viewed jointly. The gestural component unites all the aforementioned views in the sense that they oppose the intuitive assumption about the dominance of the vocal-auditory channel in the evolutionary history of language. Our paper does not discuss the arguments for gestural hypotheses extensively (for more see Corballis 2002; Armstrong, Wilcox 2007; Fitch 2010) but reviews them briefly in sections 2.2. and 2.3. Our goal is to make an attempt to solve the core problem of most gestural hypotheses – the problem of modality transition described in section 3, which could be described as follows: *if language originated as a system of gestural expression, how can we account for its transition to the current, mainly vocal form?*

1.3. Gestures – definition

A straightforward and theoretically neutral definition of gesture is problematic due to the multiple meanings of the term – both colloquial and technical. Broadly speaking, gesture comprises every expressive movement – expressing an emotion or thought, performed by means of any part of the body (*Oxford English Dictionary*, after: Kendon 2004), including the face and eyes. Kendon (2004) proposes that only those actions that can be interpreted as volitional and intentionally expressive rather than serving any other purpose (e.g. pragmatic) should be termed as gesture. In accordance with this strict approach, the term gesture is reserved mainly for idiosyncratic and spontaneous hand and arm movements synchronised with speech (McNeill 1992). Some authors ascribe this term to instrumental actions (oriented towards physical objects) such as hand grasping (see Fogassi, Ferrari 2004). Interestingly, the articulatory movements are sometimes classified as gestures (described in more detail in section 4.5.).

Gestures do not solely belong to the domain of human communication. Importantly for language evolution studies, nonhuman great apes use this form of communication too (DeWaal, Pollick 2011; Pika, Liebal, Call, Tomasello 2005; Pollick, DeWaal 2007; Tomasello 2008), as well as more distantly related to us Old World Monkeys (Maestripieri 2007; Meguerditchian, Cochet, Vauclair 2011). Below, we compare two different perspectives on defining gesture: the interpersonal communication perspective and the primatological perspective.

1.3.1. Gestures in interpersonal communication

Gestures are an integral part of the human communication system. Due to a number of forms they assume and functions they perform in message transfer (Goldin-Meadow 2003), it is not easy to classify them into distinct categories. One of the most influential descriptions of gestural behaviours – *gesture continuum* – comes from McNeill (1992, 2005, 2012). Within this idea, gestures are placed on the continuum of behaviours as follows:

gesticulation–language-slotted gestures–pantomime–emblems/deictics–sign
languages

The continuum is arranged with respect to three criteria (from the left to right side of the continuum): 1) the role of speech decreases; 2) the presence of linguistic features increases; 3) the level of conventionalization increases as well.

The term *gesticulation* refers to the hand and arm movements accompanying speech (Kendon 2004). However, although such movements are closely connected with narration, they do not show any linguistic systematicity. Their form stems from an ongoing coupling with meanings expressed by words and is of a spontaneous character. Gesticulation is not a simple category with various authors differently classifying gesticulations types (Ekman, Friesen 1969; Krauss, Chen, Gottesman 2000); again, McNeill's is the most influential one (McNeill 1992) and distinguishes the following categories:

- *iconics* – resemble the semantic content of an utterance by representing concrete objects or actions;
- *metaphorics* – similar to iconic gestures; however, they represent more abstract concepts or ideas;
- *beats* – the form of these gestures is the same (usually rhythmical movements of the arm or hand up and down, front and back, or left to right); they lack semantic reference to the content of speech but are synchronised with its rhythm;
- *deictics* – their main function is pointing to objects or activities, not present in any physical way, in the context of an ongoing communicative situation. Due to their structure and function, they may constitute a separate category, but along with emblems, they may also be subsumed under gesticulation.

Language-slotted gestures bear similarity to gesticulation but differ in the syntagmatic relationship they have with words. Let's look at the following example: "the weather was good, but the food [hand wave]." The gesture completes the sentence and fills the syntactic blank slot that arises as a result of the omission of the predicate. *Pantomime*, on the other hand, is of a completely different character – it cannot be accompanied by speech. Here, objects and actions are represented by means of gesture sequences. A string of gestures is an example of pantomime: calling someone by a hand movement, holding a finger against the lips to mean "keep silent" and pointing towards a place where joint attention is directed. Although pantomime is characterised by a sequential organisation of signs (in the manner indicated above), it does not show the properties of syntax. Next, the main function of *emblems* is to replace individual words. In their gestural repertoire, each culture or society has a set of emblems that are characterized by arbitrariness and conventionality (special rules of conduct require that emblems be produced in a particular way – in analogy to the phonological rules in language), intentionality⁵, and cultural transmission. An example of the Polish emblem is the "OK" gesture, performed by raising the arm and putting the tip of the thumb and of the index finger against each other, with the rest of the fingers directed upwards. Emblems are reminiscent of linguistic signs, but they appear as single signals transferring short messages. *Signs of sign languages* occupy the right extreme of McNeill's gesture continuum. Sign languages have all the features of language systems, and the crucial difference between them and spoken languages is the modality – vocal-auditory for speech and motor-visual for gesture (see section 3.2.) It should be further stressed that despite common intuition, signs of sign languages constitute a system that is completely different from gesticulation not only in terms of its formal and communicative manifestation but also cortical localisation.

The above account situates gesture in the context of interpersonal communication, related to specific cognitive abilities, social structure and the presence of language. Defining gestures in different contexts, e.g. in primate communication, requires consideration of different conditions. Below, we present selected definitions and typologies of gesture derived from primatological research.

⁵ Here and further in the text we use the term intentional in the psychological sense: "deliberate", "resulting from the intention of the subject" – not in the philosophical sense: "having intentional content", "on something".

1.3.2. Gesture in the communication of nonhuman primates

Although primates use various means of communication, their gesture usage has drawn particular interest of researchers. Gestures differ from other communicative behaviours (de Waal, Pollick 2011; Pollick, de Waal 2007; Tomasello 2008) in that they involve:

- acquisition through individual learning,
- intentional use and flexibility,
- relative independence of emotional processes,
- targeting specific recipients.

Gestural communication based on ritualised behaviours is present mainly in nonhuman apes, which suggests the late phylogenetic emergence of this form of communication (de Waal, Pollick 2011).

Comparative studies on gestural communication of nonhuman apes (bonobos, *Pan paniscus*; chimpanzees, *Pan troglodytes*; gorillas, *Gorilla gorilla*; orangutans, *Pongo pygmaeus*) showed that their gestures resemble (to an extent) gestures of infants and toddlers who are right at the beginning of language acquisition (Pika, Liebal 2006). Similarities concern the diversification of gestural repertoire and its intentional use in both groups. Differences are connected with the nature of gestures and the way they can be used: the majority of gestures in nonhuman apes are of dyadic character – the sender drawing the receiver’s attention expresses a wish (the imperative gesture use); children, on the other hand, can use gestures triadically – they direct the receiver’s attention to an external event or object in order to share attention or comment upon the shared object of attention (the declarative gesture use). These differences stem from a different cognitive bias (understood as “social-cognitive abilities”; see Tomasello 2008), in human and nonhuman apes. Furthermore, they shed light on language origin problems and the nature of interpersonal communication.

Primatologists studying nonhuman apes’ communicative behaviour developed a few gesture classifications. DeWaal and Pollick (2011 as well as Pollick, deWaal 2007) propose to limit the term gesture to manual movements, which exhibit features different from other communicative movements (see gesture characteristics, above). Tomasello (2008) characterises gesture broadly as intentional communicative behaviour executed in the visual modality, mainly body posture, facial expression and manual gestures, characterized

by flexibility, and acquired by means of ontogenetic ritualisation. Pika (2008) proposes a slightly different definition. She explains gestures as expressive movements of the limbs, head and the whole body, which:

- target specific recipients,
- are mechanically ineffective – such as e.g. pushing someone – which differentiates gesture from instrumental movements,⁶
- provoke specific reactions,
- are performed intentionally (deliberately).

Intentionality is a crucial criterion in the aforementioned definitions. It enables the differentiation of gestural behaviours from other communicative behaviours of intrinsic and hence non-intentional character, which are found in animal communication (Tinbergen 1951). The intentionality of gestures is established by the following criteria:

- *relative context-independence* – the same gesture is used to attain different communicative goals, and different communicative goals are attained by the same gesture (de Waal, Pollick 2011; Tomasello 2008),
- *audience-checking*,
- *response-waiting*, and
- *persistence*.

As the problem of sensory modality is key to our argument, we will adopt Simone Pika's (2008) gesture typology, which is largely modality-based; she distinguishes the following gesture types:

- *auditory gestures* – accompanied by sound production, e.g. hand clapping or chest-beating in gorillas;
- *tactile gestures* – involve physical contact between the producer and receiver, e.g. a directed scratch in chimpanzees; the first referential gesture discovered in wild nonhuman apes (Pika, Mitani 2009);

⁶ The difficulty arises as the criterion complicates the recognition of an important gesture class – touch gestures – which require some mechanical influence on the receiver.

- *visual gestures* – engage only the visual modality.

In our paper, we adopt a broad definition of gestures. We start with an intuitive understanding of gestures as intentional, communicative and hence non-instrumental hand and arm movements, but we extend the definition to the majority of bodily signals operating in the visual modality.

The prototypical examples of gestures are arm, hand and finger movements performed in order to transfer information. More peripheral examples embrace a variety of visual signals, such as proxemic behaviours, body postures and positions, consciously produced facial expressions or even gaze patterns. Speech-related articulatory movements, although they may constitute a continuum with the aforementioned movements, especially facial expressions, are included in the gesture repertoire only if they can be perceived visually.

2. Arguments in favour of gesture primacy hypotheses

The first speculations on the role of gestures in language evolution had appeared long before the idea became an object of science. It was not until the 1970s that the gesture primacy hypothesis was based on more extensive empirical foundations. Currently, its various versions jointly constitute the most influential position in the discussion on the phylogeny of language. In the present section we present an outline of the history of gestural hypotheses and sum up the most important evidence supporting these positions.

2.1. Gesture and language origin – a brief historical background

For many centuries – since antiquity until the 18th century – it was commonly held that gestures constitute a natural form of human communication – an autonomous and universal language. The supporters of this idea included: Roman rhetorician Quintilianus, and later, Giovanni Bonifacio (1547–1645) and John Bulwer (1606–1656). Similarly, the inventors of the first sign language systems, Charles-Michel de l'Épée (1712–1789) and Roch-Ambroise Cucurron Sicard (1742–1822), believed that gestural communication is a perfect basis for the creation of a universal language independent of speech. Diderot (1713–1784) argued that gestures used by the deaf provide a direct insight into cognitive processes as they are free from the distorting influence of convention and tradition.

The problem of gestures was also present in speculations on language origin. Condillac (1715–1780) assumed that in the time before people learned to control speech, they had communicated by means of gestures and body

movements. Gestural primacy was also assumed by Giambattista Vico (1688–1744), for whom gestures were a perfect way of representing visual experience. Edward Tylor (1832–1917) concentrated on how thought can be expressed, including through the means of gestural languages, pictograms and writing systems, which led him to the conclusion that studies on gesture and pictograms may be helpful in understanding the origin of language. Wilhelm Wundt (1832–1920) also sought to trace back the source of language to expressive movements, the patterns of which are dependent on emotional experience. Interest in gestural scenarios abated in the first half of the 20th century and arose anew in the beginning of the 1970s.

2.2. Hewes's position and the revival of interest in gesture in language evolution

The modern hypothesis of gestural primacy was formulated by American anthropologist Gordon W. Hewes in the article *Primate Communication and the Gestural Origin of Language* (1973). The article is a synthesis of data coming from various fields of research and lays out a range of arguments supporting the gestural scenario of language origin. Some of the arguments postulated by Hewes are still used in the ongoing debate on language evolution (see Corballis 2002; Tomasello 2008), others have either been updated (in line with the newest research) or rejected. In the following section, we look at the most important arguments from Hewes's original presentation.

Hewes's main argument pertained to the *relative success in teaching nonhuman apes a version of sign language* (Gardner and Gardner, 1969), which contrasted with the complete failure of many attempts to teach them spoken language. It can therefore be assumed that early hominins whose cognitive abilities must have been much like those of modern nonhuman apes were capable of creating a gestural protolanguage.⁷ Although early hominins, just as the other primate taxa, used vocal communication, Hewes suggests that it could not have been the starting point for the development of linguistic communication, which is compositional, propositional, and relies on conventional-arbitrary signs, etc. The main obstacle was the lack of volitional control over their voice. Based on the research of the time, Hewes

⁷ Hewes was the first to use the term *protolanguage* referring to the transition period between nonlinguistic communication of apes and fully linguistic communication. The current understanding of the term which in its simplified form means language deprived of grammar – in the sense of morphological rules or syntax – was promoted by Derek Bickerton (1990).

noticed that vocal reactions of nonhuman apes are triggered by emotional stimuli to which they relate; moreover, such vocalisations do not have an addressee – they are nonselective – and can be elicited in the absence of any other animal. These facts were viewed against the gestural communication of nonhuman apes, which is characterised by volition, flexibility and is based on higher cognitive processes (importantly, the available results of the current research – although they do not question the aforementioned qualitative difference – point to a much more complex nature of vocal communication in nonhuman apes than was previously thought⁸).

Hewes relied on the research indicating that a *human vocal tract is a relatively late adaptation*, found in *Homo sapiens* only (c.f. section 3.1.). At the same time, he believed that the species preceding *Homo sapiens* had the abilities that required at least an elementary form of language: usage of fire, tool manufacture and big-game group hunting. Hewes assumed that gestural protolanguage was enough to sustain a culture organized around such activities.

Hewes (1973, 1981, 1996) addressed a few crucial problems that continue to be discussed in the ongoing debate on the roles of gesture in language evolution. He underlined a possible role of the deictic gesture in the early stages of language development, he noticed the phenomenon of gestural imitation as a potential way of establishing a linguistic sign, he also pointed out the significance of lateralisation and movement control in shaping gestural language. Another interesting argument articulated by him focused on the depigmentation of the inner part of the palm in non-white individuals – Hewes (1996) suggested that this property may serve to increase hand-visibility and hence, it might have emerged as an adaptation for gestural communication.

Lastly, Hewes articulated the problem of “modality change”, and proposed his own solutions based on the idea of mouth gestures and sound symbolism as evolutionary mechanisms of transition from gesture to speech⁹ (see also section 4.5.1.).

⁸ It is characterised by *functional reference*, *audience effect*, *productivity* (without compositionality) and *tactical deception* – overview of the new data e.g. in Slocombe (2011).

⁹ “A plausible theory of the primacy of gestural language over speech must, as has already been noted, account for its general replacement by spoken language” (Hewes 1996: 587).

2.3. Contemporary gestural hypotheses

Currently, gestural hypotheses are still being developed and hold an important position in the debate on the phylogeny of language. In the following section we present a few lines of evidence supporting the gestural hypotheses that appeared after Hewes. They point to the iconic potential of gestures as the most intuitive form of linguistic expression, new findings on brain functions, and *mimesis* – the uniquely human form of imitation.

2.3.1. Iconicity of gestures

William Stokoe, one of the pioneers of modern research on sign language, demonstrated that the expressive potential of sign languages is equal to that of spoken languages and proposed solutions to key problems of language evolution (Stokoe 1960). The first of these relates to the emergence of arbitrary speech sound and meanings, which can be addressed with reference to a gestural stage in language evolution, whereby the iconicity of gesture (the resemblance of the visual form to content), creates a bridge between sound and its referent. The other problem is connected with the origin of grammar. According to Stokoe (1991; later also Armstrong, Stokoe, Wilcox 1995), the iconicity of a gesture allows us to represent simultaneously the activity, and the agent that performs the action as well as the patient that is affected by the action. In this respect a single gesture can represent an action as a complex whole: the hands and arms function as a prototypical noun, their action is a prototypical verb – collectively, they create a prototypical sentence (Armstrong, Wilcox 2007). The spatial nature of gesture further facilitates an intuitively clear visualisation of semantic roles (the hand hits the hand or draws a path) and spatiotemporal relations. It is the reference to the gesture stage in the evolution of language that facilitates the explanation of the origin of the arbitrariness of speech and the origin of grammar.

On a par with theoretical arguments supporting this line of reasoning there are also interesting empirical data, especially from the experiments conducted by Susan Goldin-Meadow's research team. In one of the experiments, (Goldin-Meadow et al. 2008) the respondents were describing simple activities by means of speech, gesture and pictures. Verbal descriptions were compatible with the structure of the sentence of the respondents' native language. However, the gestural or pictorial descriptions, independent of the native language of the respondents, were characterised by a stable order: "actor – patient – act", congruent with the SOV word order. Based on that it can be purported that gestural communication presents a somewhat "nat-

ural” or “original” form of the mental representation of event structure. In another experiment (Fay, Arbib, Garrod 2013), the respondents, by means of gestures or nonverbal vocalisations, communicated “meanings” from the finite repertoire of meanings – emotions, objects, or actions. Gestural communication proved more effective than the vocal one. The authors of the research considered it a piece of evidence in favour of the visual modality for motivated expressions, and stated that it might have been useful in the initial stages of language development.

It should be noted, however, that the status of iconicity as a cognitive facilitator inhibiting the transition to symbolic communication is far-fetched. For instance, in ontogenesis, the iconic representations do not seem privileged over arbitrary ones, e.g. children do not acquire them easier or faster (Tomasello 2008: 147). Also with respect to the cerebral realisation, the processing of iconic gestures and symbols are dissociated (Niederhut 2012).

2.3.2. Handedness and lateralization

Handedness and lateralisation were for a certain period taken as supporting the gestural scenario of language origin. In the majority of people, the left hemisphere of the brain is responsible for both language processing tasks (it is here where “language areas” are located) and motor control of the dominant hand (90% of all people are right-handed). The sources of this correlation are not entirely clear, but the available data show explicitly the systematic character of the correlation, e.g. the degree of language processing in the left hemisphere is directly proportional to the level of preference towards right-handedness (Knecht et al. 2000). There are also hypotheses on language and lateralisation. Hewes (1973) assumed that lateralisation for precise movement control, and hence gesticulation, emerged before speech. According to Corballis (2003), representations of communicative movements of hands and arms were gradually absorbed by vocalization governed by the left hemisphere of the brain. Furthermore, according to the throwing hypothesis proposed by Calvin (1982, 1983; see also Calvin, Bickerton 2000), one of the first expressions of the lateralisation of brain functions and handedness was the action of throwing stones to hunt small game. Well-aimed throws require the calculation of a projectile’s trajectory and creation of an appropriate motor plan that will coordinate movements of the body parts (including fingers, wrist, arm and torso). Calvin stated that one-hand throwing led to the selection of a dedicated neural circuit in the brain that facilitated such computations. The circuit was then exapted for tool

production, gesticulation and eventually for articulated speech and syntax.

Currently, the relevance of handedness and lateralisation as evidence supporting gestural hypotheses is decreasing. First, the newest research challenges the position that handedness at the population level is a solely human feature. Although the data are ambiguous, it seems that our species differs from others only in the scale and systematicity of the described phenomena (e.g. Cashmore, Uomini, Chapelain 2008). If we look at nonhuman great apes, some studies (e.g. Harrison 2008) do not confirm any preference at the level of population, while others (e.g. Hopkins 2006) note its presence, most often right-handedness, at least in the case of some species and some activities. Similar data exist for nonhuman apes – for example baboons show the preference to perform communicative gestures, but not instrumental ones, with their right hand (Meguerditchian Cochet, Vauclair 2011). Furthermore, the left hemisphere controls vocal communication in many species including those distantly related to humans, e.g. frogs and birds (Corballis 2003). These observations undermine the assumption that handedness is uniquely human related selective pressures from the hominin history, such as the need for precise motor control necessary to manufacture tools. Brain neuroimaging proved that the term “left lateralization for language” is far-fetched, and the functions responsible for language processing engage various areas all over the cortex (e.g. Deacon 1997; Lieberman 2003).

2.3.3. Broca’s area and mirror neurons

Neurocognitive research provided a few interesting clues leading to gestural hypotheses: they concern the revision of understanding the function of Broca’s area and the discovery of mirror neurons. The role of Broca’s area, believed to be primarily connected with speech production, change in the light of the newest research (Fadiga, Craighero, D’Ausilio 2009). It was proved that this area is engaged in comprehending language, performing and observing manual activities, performing and listening to music and representing abstract hierarchical structures. On this basis, some authors (Fadiga, Craighero, D’Ausilio 2009) conclude that Broca’s area is responsible for detection and representation of complex hierarchical/syntactic relationships, irrespective of modality and use (i.e. whether it is used for production or reception). It is hypothesised that the evolutionary foundation of these abilities stems from the motor function connected with performing activities and – thanks to mirror neurons – their comprehension. This data suggest the equation of the visual and the vocal modality as potential ways of the transmission

linguistic information, concurrently granting phylogenetic primacy to the motor system.

An interesting perspective on language evolution was proposed by Rizzolatti and Arbib (1998): mirror neurons – a set of nerve cells that fire during both performing an action and observing how another is performing the same action. Mirror neurons were initially discovered in the rostral part of the ventral premotor cortex (area F5) of macaques, which is situated roughly around Broca’s area in the human brain (Rizzolatti et al. 1996). Later studies confirmed the existence of mirror neurons in humans (Iacoboni et al., 1999). The hypothesis of mirror neurons identifies the neural mechanism responsible for equivalence and reversibility of the sender and receiver roles in a communicative act (parity requirement) as a preliminary and essential condition of information transfer. A nonhuman primate seeing its kin (or human) reaching for a peanut, understands the meaning of this action due to a copy of motor representation of the event in their own brain. Thereby, a mental link is created between the “sender” (actor) and the “receiver” (observer), which represents the same information simultaneously.

Arbib (2002, 2005, 2012) modified the initial idea, emphasising, along with the function of mirror neurons, the role of imitation and volitional control over communicative movements. The gradual model of language phylogeny was established: the first three stages involve all primates until the emergence of the common ancestor of the chimpanzee and *Homo sapiens*, the consecutive stages relate to changes after the split of the two taxa. The model is presented by Arbib in the following way (2005):

S1: grasping,

S2: mirror system for grasping,

S3: simple imitation (chimpanzees only),

S4: complex imitation (after the homo-chimpanzee line split),

S5: proto-sign (key change leading to the emergence of an open repertoire of signs),

S6: proto-speech (key change leading to the motor control over voice),

S7: fully fledged language.

Although manual activities and the mirror system still constitute the basis of the model, the key feature granted to primates is the use of pantomimic

imitation comprised of interim proto-signs representing whole situations and activities (holistic protolanguage). Furthermore, due to the extended motor control of the tongue and larynx, the vocal modality and arbitrary symbol-based communication might be gradually incorporated.

2.3.4. Mimesis and pantomime

Another influential line that draws on imitation stems from the mimetic concept of language evolution, initially developed by Merlin Donald (1991, 2001). According to Donald, the fundamental difference between nonhuman primates' and humans' cognitive processes is related to mimesis – the ability for conscious, self-initiated, intentional representations lacking linguistic character. The mimetic ability enables us to remember motor schemas for such activities as jumping, throwing or dancing, as *activities that are detached from their subject*. Such representations do not have to be activated as a direct stimulus reaction – the object may consciously recall them from memory at any time (*autocueing*). Therefore, one may perform an activity at any time – be it an actual dance movement or just a dance-based exercise. Such a sequence of movements may also be recalled only from the working memory – where one imagines it “off-line” – as an action plan. The subject capable of mimetic representation can separate movement sequences (e.g. throwing a stone) observed in others, remember them, imagine them, and re-enact them on one's own. In this way, mimesis underpins imitation. An activity represented mimetically – be it the imitation of a stone throw – is identified as the same by both the actor and the observer; hence, it can be used for communication. It should be noted that such mimetic signs are neither arbitrary, nor conventional, nor compositional, and their nature is entirely corporeal. Furthermore, although mimesis is a multimodal ability, the visual domain is crucial in this case.

Jordan Zlatev (e.g. 2008)¹⁰ offers the most detailed explanation of Donald's concept. He puts forward a hierarchy of mimetic abilities arranged into the stages of their phylogenetic development:

- *proto-mimesis* – based on imitation taken from external observations (exteroception, e.g. vision) of one's own body movements (proprioception, e.g. kinaesthesia), present in nonhuman apes and ontogenetically in newborn babies; it manifests itself through such activities as eye contact or simple coordination of behaviour;

¹⁰ The mimetic standpoint of Zlatev's (e.g. 2008, 2013) is nonetheless closer to multimodal theories (see section 5), than *stricte* gestural ones.

- *dyadic mimesis* – based on volitional representation, present in its basic form in nonhuman apes; it underpins imitation or imagination, including representation of the future;
- *triadic mimesis* – based on communicative intention, present in humans and some enculturated nonhuman apes; it manifests itself e.g. through purposeful iconic gestures or declarative pointing;
- *post-mimesis 1* – based on normativeness and convention; present in humans (and in nonhuman apes taught symbolic communication); it manifests itself through symbolic communication;
- *post-mimesis 2* – based on systematic and compositional usage of symbols in both communication and internal thought processes; only present in humans; it underpins the language ability and the ability to understand false premises.

Daniel Hutto (2008) espouses a similar position – the initial form of communication was, according to him, a mimetic re-enactment of events not segmented into any meaningful units, but presenting a holistic, bodily representation. Hutto assumes that regular re-enactments of events might have had an important social function, establishing a basis for customs, strengthening bonds and gradually replacing grooming. Michael Tomasello (2008) acknowledges pantomime and pointing as the natural and first specifically human forms of communication, representing a transition phase from nonhuman apes' communication to conventionalised language. Their basis (just as further-developed conventional languages) are founded mainly on the exclusively human form of sociality and motivation: shared intentionality based on the recursive mindreading and cooperative communication.

2.3.5. Further arguments

Waciewicz and Żywiczyński (2008) have underscored greater secrecy of communication in the visual channel, which is suited to the transfer of a message to a selected addressee rather than all individuals close-by. Evolutionary logic suggests that such selectivity might have been used at the early stages of the development of communication, when it was an evolutionarily unstable system – it lacked propositional content characteristic of language but was highly manipulative – as is typical of nonhuman animals. Some recent field experiments on chimpanzees resorting to the use of gesture in conditions requiring secrecy (Hobaiter, Byrne 2012) confirm this idea.

An alternative approach to the role of gestures in the evolution of language comes from David McNeill (2012). In his view, theories assuming gestural primacy are not capable of explaining satisfactorily the deep and multilevel integration between gesture and language. These ideas diminish the role of gestures in embodying language in favour of speech. Assuming that gestures are an integral part of speech, not only its complement, McNeill proposes that both types of semiosis (global and discrete) stem from the *dynamic units of online verbal thinking* which he terms *Growth Points* (GPs). They contain ideas simultaneously expressed in gesture and speech at the same time. In this way, ideas are expressed by means of imagistic and linguistic codes. According to McNeill, the acquisition of this ability is a critical moment in the cognitive development of humankind, leading to the emergence of language. The cognitive interface, which formed the link between thought, language and gesture from the very beginning, is central to the idea. We comment upon this proposal extensively in section 5.

3. The problem of transition to speech

The key problem of modality transition can be summarised in the following way: if language emerged as a largely gestural phenomenon, how can we explain its transition to the current, mainly vocal form? Although the transition from the hypothetical gestural language to the current – mostly vocal – communication system was already acknowledged by early authors as a difficulty (Hewes 1973), the most extensive criticism comes from Fitch (2010), who stresses two points: – *the scale of anatomical and neural adaptations of humans for spoken language*, – *the completeness and functionality of the currently existing sign languages*.

3.1. *Homo sapiens*'s adaptations to speech

First of all, humans differ significantly from their closest relatives – nonhuman great apes – in terms of the anatomical structure and motor control of the vocal tract. The human species-specific features include:

- a descended larynx,
- a lack of air sacks,
- a better innervation of the thoracic muscles,
- advanced ability for vocal imitation.

For some of these differences alternative explanations cannot be conclusively ruled out. For example, the lowered larynx may be a side effect of the erected posture or the reconfiguration of the face, or as the result of pressures for the enlargement of body size during vocalisation (for discussion see Fitch 2010); the loss of air sacks may be the result of the proneness of this organ to infection; the better innervation of the chest may be an adaptation for breath control during physical effort; the ability for vocal imitation may be linked to musicality. Still, the most convincing interpretation is that all these changes constitute adaptations for articulated speech.

To sum up, from the perspective of researchers such as Fitch (2010), the extent of speech adaptations constitutes a crucial argument in favour of its early development, i.e. in hominins preceding *Homo sapiens*. At the same time, it becomes an argument against the gestural hypotheses only when we assume a “late” emergence of language. The facts relating to speech adaptations may be made compatible with the gestural hypotheses by assuming an “early” emergence of language based on even earlier visual proto-communication (e.g. a gestural protolanguage in *Homo erectus*), with further gradual development of articulated speech. An early language emergence is compatible with the view supported by new empirical data. For example, recent studies (Johansson 2012; Dediu, Levinson 2013) conclude that the reconstructions of the Neanderthal genome, anatomy (also of the vocal tract), and ontogeny, while not directly confirming the presence of language in this species, are consistent with such a possibility. These new findings make a recent language emergence unlikely, but are consistent with the gestural scenarios, provided that the latter assume a sufficiently large timescale.

3.2. Sign languages as fully-fledged languages

A much greater problem comes from the completeness and functionality of the existing sign languages. Although it is not intuitive, this argument presents a serious challenge to gestural primacy hypotheses. To understand why this is the case, it is crucial to take a closer look at the nature of sign languages.

Sign languages are fully-fledged languages, equal in expressiveness and sophistication to spoken languages (Stokoe 1960; Stokoe et al. 1965; Emmorey 2002). It concerns both the properties of the code, the level of brain description, ontogenetic development (acquisition by children) and historical development (emergence and development of the language system itself), and most importantly, functionality. Since their status as such is officially recog-

nised by linguists, sign languages, similarly to spoken ones, are present in the databases of world languages e.g. *Ethnologue* or *World Atlas of Linguistic Structures*.¹¹

Sign languages, similarly to spoken ones, use conventional and arbitrary signs that can express any abstract or metaphorical concept – an example of which is sign language poetry (e.g. Sutton-Spence 2005). Similarly to speech, they have a combinatorial structure at the level of morphology, syntax and even “phonology”; hence, the *duality of patterning* is present as well.

The cerebral areas processing sign language are largely identical with those processing speech (Corina et al. 1992), and their specialisation seems to relate to language processing in general – independently of modality – rather than non-linguistic aspects such as motor control of articulators (Emmorey 2002). Thus, these centres are different from those responsible for spontaneous gesticulation. For this reason, damage to the language areas in deaf signers results in symptoms typical of aphasia, including its language-specific nature, while the ability for gesturing (e.g. Bellugi, Klima 2001; Hickok et al. 1996) or pantomime (Emmorey 2002) is preserved.

Acquisition of a sign language takes a similar time span to that of a spoken language, and is characterised by the same stages of development and the same phenomena such as babbling (its manual equivalent) or hyperregularisation of grammatical forms; furthermore, children do not show any preferences towards either spoken or sign language while exposed to both of them in equal measure (Petitto, Marentette 1991).

The recent example of ISN (*Idioma de Signos Nicaraguense*), the Nicaraguan sign language, illustrates the *de novo* emergence of a complete language system – with the stages of pidginisation and creolisation comparable to those in spoken languages (Kegl et al. 1999).

Most importantly, sign language researchers have shown that in terms of their communicative potential and efficiency, sign languages are equivalent to speech (Stokoe 1960; Emmorey 2002).

Despite the aforementioned characteristics and equality of signs and speech, human verbal communication is predominantly vocal, and sign languages generally perform only secondary or auxiliary functions.¹² Such

¹¹ *Ethnologue*: <http://www.ethnologue.com/>), *World Atlas of Linguistic Structures*: <http://wals.info/>).

¹² Usage of sign language signs or gestures as a replacement for speech is usually motivated by religious causes, as in case of some medieval monastic orders; cultural causes, as in case of the Warlpiri – an indigenous people of Australia’s signs; or *practical* causes, as in the case of South African hunter-gatherers San people during hunting.

populations as in Al-Sajid (Israel), Adamorobe (Ghana), Kata Kolock (Bali) or Jukatana (Mexico) are exceptions, because vocal communication is impeded by the incidence of hearing impairments. In all the remaining societies the primary form of linguistic communication is speech. This fact implies that – if we accept the gestural hypotheses with their focus on the fact that language originated in the visual modality – we must account for a change of the dominant modality – a change difficult to explain when analysed more closely. Fitch poses a question about selective pressures and mechanisms of such a change;¹³ many researchers (e.g. Burling 2005; Corballis 2003; Kendon 1991, 2008; MacNeilage 2008; Tallerman 2011) agree that it is the most difficult problem for gestural hypotheses.

4. Solutions

Solutions to the problem presented in section 3., although they may seem concurrent, are logical and independent from arguments opposing or favouring gestural hypotheses. Below, we propose answers to the questions posed in section 3 that are biologically plausible: we try to establish a link between the modality transition and knowledge of anatomy, evolution and brain functions.

Two general answers are possible. Firstly, we may point to potential selection pressures facilitating the development of vocal communication despite the original gestural basis. The other possibility, more interesting and discussed in section 5., questions the very problem of “modality transition”. According to this proposal, the separability of visual and vocal communication is only superficial, and the evolutionary emergence of language could have been happening in both these modalities simultaneously. We would have to account not as much for a sharp transition, but a change of emphases in the extent and kind of transferred information (nonverbal, analogue, holistic vs. verbal, symbolic, combinatorial).

¹³ Fitch (2010: 434): “[A] significant disadvantage of gestural models is their difficulty in explaining the virtually complete transition to vocal, spoken language in modern *Homo sapiens*. . . Whatever their virtues, models of gestural protolanguage are incomplete without a detailed and compelling model of the transition to spoken language, as most gestural proponents have recognized” (Hewes 1973; Corballis 2002; Arbib 2005); (2010: 442): “but the lack of a plausible selective force to drive signed language into vocal language remains a compelling argument against a fully gestural, and fully linguistic, protolanguage.”

4.1. Traditional arguments

The overview of solutions starts with the already-existing ideas on gestural hypotheses. We find such observations interesting but insufficient to solve the problem. Therefore, we enumerate the ideas that indicate the *shortages* of visual communication, which seemingly go against gestural hypotheses:

- speech is more economical (e.g. Knight 2000) – articulatory movements need less time and energy than hands, arms and body movements;
- speech enables communication in reduced visibility or darkness (Rousseau 1775);
- voice attracts attention more effectively (Rousseau 1775);
- speech does not engage hands, which may therefore be engaged in practical tasks (work, carrying objects) during a communicative event (e.g. Carstairs-McCarthy 1996);
- speech enables the teaching of manual activities such as toolmaking (Armstrong, Wilcox 2007);
- speech acquisition starts already in foetal life, which grants a developmental advantage to this modality (Hewes 1996);
- vocal communication facilitated the monitoring of the location of a baby, which might have been important in hominins due to their hunter-gatherer lifestyle, and with lack of constant physical contact between mother and child, as is the case in other nonhuman primates (Falk 2009);
- voice is directed to everyone and not only to a specific individual (Tomasello 2008).

Fitch (2010) criticises the majority of the above-mentioned arguments. He states that it is difficult to speak of any superiority of speech over gesture in any of these aspects. Moreover, it is easy to find a balancing measure in visual communication for all the enumerated advantages of speech. Gestures are not visible in the dark, but they are visible by the firelight, and they can be used in the tactile modality, which is used by the visually impaired signers. The visual channel gains an advantage in long-distance or noisy communication; it also successfully attracts attention in these situations.

Fitch notices that although the vocal modality frees hands and arms, the visual modality frees the mouth, which was very significant in the Palaeolithic Period – the fossil data show that hominins intensively used teeth to chew hard foods and perform various mechanical operations. Furthermore, the argument concerning the energetic effectiveness is not convincing because – as Fitch points out – speech is accompanied by spontaneous gesticulation, which eventually makes this way of communication equally costly.

The arguments not mentioned by Fitch are likewise insufficient. During teaching manual activities, verbal instructions are much less effective than a demonstration or physical guidance of the learner's hands. Hewes's argument is too weak, especially in view of the developmental data on the equal pace of spoken and sign language acquisition (see section 3.2.). Falk's remark is interesting, but it does not require articulate and propositional language but just emission of any sound. Tomasello's proposition is also compelling but easy to counterpoise. The already-mentioned advantage of gestures is the secrecy of communication allowing for a more accurate choice of addressee and limited possibility of being discovered by enemies and predators.

4.2. Information duality

Susan Goldin-Meadow (e.g. 2011) noticed that the visual modality could be used to successfully transmit both *combinatorial-segmented* and mimetic (*holistic-imagery*) information. The first possibility is realised through signs of sign language – separate units of discrete and arbitrary character, which can be combined into longer compositional structures (phrases, sentences). We deal with the other possibility in the case of gesticulation or pantomime, where information is not composed of discrete units but is of holistic and imagistic nature. Goldin-Meadow notices that the vocal modality serves the transfer of discrete, combinatorial-segmented units (phonemes or morphemes) only. Instead, the ability to transfer mimetic information in vocal communication is limited to prosodic features and onomatopoeic or sound-symbolic units; therefore, their role is secondary.

In natural circumstances, for example in a conversation between two or more people, an efficient transfer of both the aforementioned information types occurs *simultaneously*. To the first approximation, gesticulating accompanies speech almost all the time (Goldin-Meadow 2003; Kendon 2004) – it also holds for telephone conversation or speech produced by visually impaired people. The visual modality may use a segmented code, but voice cannot transfer any mimetic information. Due to this fact, effective commu-

nication in a natural conversation manifests itself in speech (which encodes information in an arbitrary and segmented way) and gesticulation, which is used to transfer holistic information. Goldin-Meadow (2008) points out that this advantage of the visual modality might have paradoxically been the reason for the transfer from the hypothetical protolanguage to speech.

Erin Brown (after Zlatev 2013) puts forward a similar proposal. According to her, the vocal modality started to express symbolic code due to the fact that sound is a naturally poor vehicle for transferring motivated meanings, which in turn facilitates ascription of nonmotivated meanings. Similarly, Kendon¹⁴ notices that gesture is a signal indispensably having a specific spatial form and location referred to as “spatial concreteness,” which is not true of speech. This feature is crucial in the transfer of displaced meanings referring to the future and past, as well as to abstract concepts and ideas. Spatial concreteness of gestures may decrease their ability to express abstract meaning. Vocal signals, on the other hand, having no spatial characteristics, are easier to comprehend as abstract. A similar intuition – on higher arbitrariness and hyper-concreteness dominating the comprehension of the abstract meaning – is presented by Hewes (1973, 1996: 587) who proposes sound symbolism as a “temporary” mechanism introducing partial justification of the sign.

4.3. Acquisition of sign and spoken languages in children

Children acquire sign and spoken languages with the same ease. As it was mentioned in section 3.2., this process is reflected in the manual counterpart of babbling. Petitto and Marentette (1991) state that the ease of sign acquisition also concerns hearing children who, having the same access to speech and sign, acquire language in sign or speech at the same pace. Furthermore, they do not show a strong preference towards one or the other type: they can master language in either modality. Ontogeny provides us with arguments for seeing the transition to the vocal modality as only a surface phenomenon: it concerns Chomskyan e-languages and not language faculty (a set of biological adaptations) *per se*. Our ability to acquire language is amodal – it does not have any preference towards the modality used. This is supported by neurophysiological evidence – as we have already stated, linguistic information, regardless of its modality, is processed in roughly the same region of the brain, which concerns both sign production and sign perception.

¹⁴ *Protolang* 2, conference speech, 19.09.2011, Toruń.

The link between the two modalities is visible in the acquisition of spoken language and single gestures. Babbling (6–8 months), for example, is accompanied by rhythmical hand movements. Before uttering their first word, babies use deictic or even iconic gestures (around 10 months). Later, they start to combine gesture and speech of the same meaning, and further, gesture and speech expressing different meanings (saying: *give* and pointing to a fruit). Both modalities are also visible in the course of cognitive development. Golin-Meadow (2003) show that at least some newly acquired concepts (conservation task, equivalence), before having a verbal representation, can first manifest themselves in gestures.

Interestingly, many experimental studies conducted mainly by Susan Goldin-Meadow, demonstrate that early gesture use predicts a wide range of linguistic achievements in later development. For example, the way an 18-month-old child uses gestures predicts their lexical repertoire and complexity of utterances in the future (Rowe, Goldin-Meadow 2009). Another example is the aforementioned speech-gesture combination: the age in which a child can use such a combination may betray the age of when the child will start to construct two-word utterances (*give apple*).

4.4. Natural connections between the hand and the mouth

The division of communication into vocal and visual is useful, but these modalities are closely connected. The interplay is visible at both the superficial level of message transfer and the deep level of cognitive and neural implementation of the appropriate systems.

The movements of the mouth and hands seem to be largely governed by a common and phylogenetically old motor control system. It is indicated by the empirical data on the neighbouring cerebral areas controlling the movements of these organs. For example, electrical stimulation of area 44 (the homologue of Broca's area in humans) evokes movements of the upper limbs and lips in rhesus monkeys (Petrides et al., after Meguerditchian, Cochet, Vauclair 2011; see also Corballis 2003). The premotor cortex of macaques (F5) includes, apart from mirror neurons, neurons that activate when a graspable object is seen: coding its size in order to prepare a plan for grasping it with the hands and mouth simultaneously (Murata et al. 1997; Rizzolatti et al. 1998). Evidence for natural motor relations between the hands and mouth in people has been collected by Gentilucci and Corballis (2006). The authors describe differences in the mouth aperture and voice range when the examined subjects are uttering a syllable depending on the

size of an object they have to catch while vocalising. A similar principle is observed when the examined subjects watch the action of grasping performed by another person, which indicates the involvement of the mirror neuron system in these processes.

It is believed that a natural hand-mouth relationship is rooted in mouth feeding behaviours, which were later exaptated for linguistic operations. This might have played a role in the transformation of gestural communication – the transition from hand gesture to mouth gesture (Gentilucci, Corballis 2006). The concept of a link between the hands and mouth is long and originates from Richard Paget’s “tongue gestures” proposal.¹⁵

4.5. Articulatory movements as a type of gesture

Motor speech perception theory gives an interesting insight into the problem of the gesture-to-speech transition (Lieberman et al. 1967; Lieberman, Mattingly 1985; Lieberman, Whalen 2000). Accordingly, the motor system is responsible not for only speech production but also speech comprehension. The theory holds that our mental representations of phonemes are not manifested as physical sounds, but as motor programmes, and similarly phoneme recognition is possible linked to its sound value but through the reference to movement sequence of the tongue and other articulators. This idea points to the primacy of motor aspect over an acoustic aspect allowing for the classification of *speech as gesture* as a system of orofacial gestures that also produce sounds.

Conceptualising speech as gesture entails the co-occurrence of the visual and vocal component. The most obvious manifestation of this is lip-reading, which makes it possible to reproduce part of a message without access to sound (Summerfield 1992). Another proof of a deep integration of visual and auditory information is the McGurk effect (McGurk, MacDonald 1976): placing the *ga* sound to a video where the lips pronounce the *ba* sound, makes the observer hear the *da* syllable. This data unequivocally show the multimodal character of speech perception and an important role that motor-visual components play in it.

¹⁵ According to Paget (1930, see Kendon 2011), the tongue and other articulators movements are naturally connected with hands – they can unconsciously follow hand gesticulations and perform ‘tongue gestures’ which might have been the base for speech sounds. Paget’s contemporary commentators were critical towards this proposal (see Kendon 2011; Fitch 2010).

4.5.1. Orofacial gestures

Orofacial gestures, according to the gestural primacy hypothesis, might have initially performed a communicative function in the visual modality, with co-sounds only later acquiring a communicative meaning. Let us note that such an idea does not identify a selective pressure but is important due to the biologically realistic mechanism. The potential of orofacial gestures did not go unnoticed by evolutionary scientists, becoming an important element of numerous scenarios, especially those of the gestural provenance:

- Hewes (e.g. 1973) identifies *mouth gestures* as the second, next to sound symbolism, link between gesture and speech;
- Corballis (e.g. 2003) argues that similar facial gestures might have been better identified because of the co-occurring sound;
- Studdert-Kennedy (2005) assumes that mimicry of facial expressions played a crucial role in the development of control over the articulators – recurring acts of imitation led to an increasing control of various facial regions, which expanded to vocal articulators due to the link between mimicry and vocalisation;
- MacNeilage (1998, 2008), although he is not a supporter of gestural theories, acknowledges the importance of facial gestures: based on the similarities between speech and sound-producing facial gestures of nonhuman apes (smacking), the author proposes the following scenario – opening and closing of the mouth while chewing, sucking and licking, started to acquire communicative functions and took the form of facial gestures, which further transformed into syllables and phonemes;
- Meguerditchian, Cochet and Vauclair (2011) emphasise the importance of facial gestures from the perspective of neurobiological research on nonhuman apes, which reveals a deep connections between the hand and mouth, as discussed in section 4.4.;
- Orzechowski, Wacewicz and Żywiczyński (2016; Wacewicz, Żywiczyński, Orzechowski 2016), highlight the role of *auditory feedback* – the authors extend Corballis’s proposal, stating that the benefits from a sound component are not limited to the receiver, but include the sender of the message for whom it is easier to discriminate certain gestures at the level of production. This position is supported by empirical

research indicating that a delayed auditory feedback or lack of it, leads to serious problems with articulation.

5. Conclusion – towards multimodal hypotheses?

There are a few crucial problems in each of the extreme positions. Theories supporting a vocal origin of language must account for the uniqueness of linguistic adaptations: nonhuman primates' vocalisations and language are separate communication systems which have little in common apart from the use of vocal modality. On the other hand, the radical gestural perspective, assuming an original gestural language, faces the problem of modality transition: from visual to vocal. Moreover, neither of the positions is able to provide a convincing explanation for a deep integration of gesticulation and speech. A multimodal perspective facilitates the understanding of these problems: gesture and speech are various realisations of the same, common system. In consequence, we can adopt a vision of language evolution engaging both modalities at a highly integrated level. A temporal specialisation or advantage of one of these modalities is possible due to the development of environmental adaptations. It may be the strength of gestural hypotheses that they posit the dominance of the visual modality, at least at an early stage of protolanguage development. Further, a multimodal perspective enables the most natural integration and provides arguments in favour of the gestural approach (sections 4.2–4.5.), by emphasising the significance of the visual modality at early stages of the human language ability.

Gesturologists such as Kendon (2011), McNeill (2012) or Sandler (2013) are firm supporters of the multimodal perspective. Their research emphasises the connection between gesture and speech (see section 1.3.1.). Gesticulations are an integral part of human conversation; therefore, we gesticulate during a phone conversation although we know that our interlocutor cannot see us (Bavelas et al. 2008). The finding that congenitally blind speakers use gesticulation provided yet another insight into the strength of gesture–speech integration (Iverson, Goldin-Meadow 1997). Neuroscientific data on the dissociation between gesticulations and signs of sign language (section 3.2.) or instrumental movements (e.g. grasping) prove the stability of gesture–speech integration. The case of I.W., who lost proprioceptive control of his body – is not able to perform instrumental movements without looking at his hands, but his gesticulations are not limited – illustrates the latter example (McNeill 2005).

The multimodal perspective has gained in popularity in various fields of

language evolution research. Primatologists point to multimodal communication patterns present in nonhuman apes. On the one hand, gestures, or communicative activities (e.g. drumming or manipulating a tree branch), are often accompanied by intentional or nonintentional production of sounds (e.g. Hobaiter, Byrne 2012). On the other hand, as Falk (2009) points out, primates' vocalisations are often linked directly to emotional state and facial expressions, which can be perceived visually. As Slocombe et al. (2011) point out, facial expressions are an important but scientifically neglected component of the "holistic information". In their literature overview, these authors have identified a tendency to adopt a simplified unimodal perspective and are now calling for others to turn to multimodal research.

Neuroscientific findings support the multimodal perspective as well – the division of vocal and visual modalities do not conform to the linguistic content of the message. Sign languages and non-linguistic communication may serve as examples. Gonseth, Vilain and Vilain (2012) argue that pointing is an activity that can be placed between modalities, where indexicality of a communicative act is achieved by means of vocal-gestural interaction. The level of the brain description seems to confirm that idea – it is not the modality that is crucial for the neural implementation of a system, but the way of processing iconicity or conventionality (Niederhut 2012). Adopting the possibility that dissociations, crucial from a language perspective, are independent from the modality is very promising to the current research in the field.

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Michał R. Węsierski¹

The Hermes Effect. An Analytical Study in Theoretical Semiotics

Abstract This paper is an attempt to show the basic relations between the content of the given announcement by the prognosticator and its subsequent receivers. The article presents semiotic qualities of the cognitive operations, and the process of receiving and interpreting the final results of such operations, as well as the qualities crucial to the effectiveness of the communicative act between the sender and the actual and potential receivers of the prognosis.

The aim of the paper is to explore the semiotic specification of semantic-pragmatic phenomenon called by the author the “Hermes effect”. The article presents the relation between the sender of the prognosis and the primary prognosis conceived as a text (book, article etc.), the specific type of reasoning (inference, i.e. prognostic argumentation) and the conclusion of the reasoning, as well as the relation between the prognosis and its subsequent receivers. The aforementioned Hermes effect concerns the relation between the way of transferring the content of the prognoses (understood threefold) and the reaction of the addressees, and what happens with the prognosis when it is beyond the first degree sender’s control.

Keywords prognosticating, notions of prognosis, communication process, communication strategies, text, message, encoding, decoding, interpretation

1. Introduction

For at least several decades, the literature on logical and empirical methodologies of real sciences has proved that the final results of research operation

¹ Department of Sociology, Warsaw University of Life Sciences.
E-mail: michalrwesierski@wp.pl

of prognosticating, influences the future states of events, i. e. the subject of that operation. This peculiar phenomenon is referred to as the Oedipus effect. Moreover, it is not the only aspect accompanying prognosticating worthy of methodological-semiotic analyses. The prognosticator – prognosis – receiver of the prognosis relation, conditioning the aforementioned effect, often ceases to exist in research. Therefore, the question arises: what are the basic relations between the content of the given announcement by the prognosticator and its subsequent receivers? The subject of the considerations at hand are certain semiotic qualities of the cognitive operations, and the process of receiving and interpreting the final results of such operations, as well as the qualities crucial to the effectiveness of the communicative act between the sender and the actual and potential receivers of the prognosis (message). The aim of the present article is to explore the semiotic specification of this phenomenon emphasised and analysed by the author. The work does not discuss all of the problems exhaustively, but should be understood as a comment upon the subject. Nevertheless, it constitutes a conceptual framework for complementary, empirical research.

While constructing the discussed communication model characterising the relations between the prognosticator, understood as the primary sender of the prognosis, and the receivers (and their individual types) of the prognosis, the author adapts the idealization method which meets the requirements of the semiotic analyses presented.

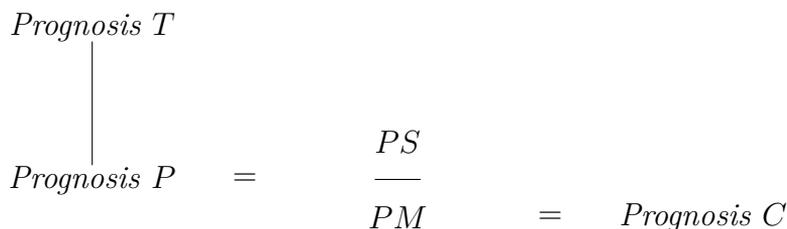
2. The notions of prognosticating and prognosis

Proper considerations should be preceded by semantic remarks which elucidate the terminological framework of the presented procedure. Prevision, that is previdistic reasoning (the ability to foresee future events), mistakenly identified with prognosticating, is a thought process in which, based on certain object knowledge, particular (not always *explicite*) and auxiliary assumptions, one can formulate propositions on the past, present (but not yet manifested) and future states of events. Henceforth, previsions can be divided into prospections, conspections and retrospections. I will focus on prospections – inferences about future states of affairs based on the knowledge of past and present events. The premises comprise of factual and theoretical knowledge. However, a conclusion, being a single proposition or a set of them, informs us what will happen in the future.

It should be noted that prognosticating is one of the two basic kinds of thought processes qualified as prospective reasoning. The second are prophe-

cies. The difference between the two stems from their formal-logical structure and epistemological status. Prognosticating is a conditioned reasoning of the “if A then B” structure. On the contrary, prophesying is unconditioned: a considered future state of affairs “B” does not give the grounds for sentence “B”, or premises of argumentation are not creditable epistemologically or they simply remain unverifiable. I shall note that a set of propositions constituting premises in previdistic reasoning is usually referred to as *preadicans* (*PS*). Concomitantly, these premises form a prognostic argument, based on which the *preadicantum* (*PM*), i.e. conclusion of the reasoning, in the form of a set of propositions, is formulated.

The term “prognosis” has multiple meanings. In a narrow sense it is a conclusion of prognostic thinking – a certain type of sentence referring to the future. Furthermore, it is the prognostic argument and its result. Broadly speaking, it designates a text in which the prognosis (in first and second meaning) is expressed and made public by such media as books, scientific journals, or websites. Therefore, three types of prognosis (senses of the term) can be established: a prognosis understood as a text (prognosis T), a prognosis understood as a procedure – a certain inference including *PS* and *PM* (prognosis *P*), and a prognosis understood as a conclusion of reasoning (prognosis *C*), here: *PM* only. It can be presented by means of the following simple graph (Scheme 2):



Scheme 1

For example, such works as *The Limits to Growth* (1972) or *Mankind at the Turning Point* (1974), being the First and the Second Report issued by the Club of Rome, are the prognosis T as they present the complex statistical models reflecting the *PS* of the prognosis *P*. The conclusions drawn from these reports, concerning the consequences of population explosion and the shrinking of some natural resources, based on the mathematical model, are the prognoses *C* (Cf. Meadows, Meadows, Randers, Behrens 1972; Mesarović, Pestel 1974).

The semantic correlate of propositions being the result of prospective reasoning, here: prognostic reasoning and shall be further referred to as “prospective image” (*PI*). The prospective image is the conclusion of reasoning (prognosticating): in other words, the *PI* is the future state of events denoted by the *PM* and based on the *PS*.

3. The Oedipus and Hermes effects

The question of the difference between the Hermes effect and the Oedipus effect should not be left unanswered. The second effect concerns the relation between the prognosis *P*, implicitly also *C* – their addressees and the prognosticated reality that can be influenced by those addressees (by their acting or passiveness). However, the Hermes effect covers the relation between the sender of the prognosis and the primary prognosis (here in meaning: *T*, *P*, and *C*) being the result of the sender’s cognitive operations, as well as the relation between the prognosis and its subsequent receivers. It is, therefore, a phenomenon semiotically much more complex than the Oedipus effect. The Hermes effect should be identified with a distortion or far-reaching change of the initial content of the prognosis *T*, *P*, or *C*, or inappropriate interpretation of the content of the prognosis *T*, *P* or *C*. The subsequent receivers, both direct and indirect, having no contact with the original source of the prognosis *T*, become the senders (in a various scale and scope) of a primary prognosis. These modifications can be of qualitative and quantitative character. Furthermore, the changes on the part of the receivers may concern the *PS* – the prognostic argument, or the *PM* – the result of the prognostic reasoning. Henceforth, the changes affect not only the prognosis *per se*, but also the text being the vehicle for the *PS* and the *PM*.

As far as the Oedipus effect is a semantic-ontological phenomenon concerning the limits of prognosticating as the methodological function, the Hermes effect – as it has been defined for the purpose of the present analyses – is above all a semantic-pragmatic phenomenon suppressing the informative functions of an utterance.² The Oedipus effect concerns people’s reactions to the content of the prognoses and the way it influences the reality of the prognosis. The aforementioned Hermes effect concerns the relation between the way of transferring the content of the prognoses (understood threefold)

² Initially, the term “Hermes effect” was introduced in an unpublished dissertation; where the inability of the prognostic to anticipate the interpretation of the prognoses by the receivers was considered. This observation pointed to the lack of control over the message of prognosis after its transfer (Węsierski 2004: 312).

and the reaction of the addressees, and what happens with the prognosis when it is beyond the first sender's control. In other words: how the sender (model and empirical one) of message (prognosis *T*, *P* and *C*) can influence the receiver (model and empirical one) of the prognosis, including the means of expression used, and the link between the event and the subsequent receivers who become senders of a modified message.

The sketches show that the Hermes effect is potentially primary: it has a genetic and logical primacy over the Oedipus effect. Therefore, the attention should not be directed towards the prognosticated reality showed in the *PI*, but rather to what happens with the *PI*, describing the prognosticated reality denoted by the *PM*, as well as the *PS* which has facilitated both the presentation of the *PI* and the formulation of the *PM*. In simple terms: whoever is baffled by the Oedipus effect, will think of the influence of the content of the prognosis on its subject. Personally, I am interested in the influence the sender and the receiver have on the prognoses *T*, *P* and *C*.

It should be kept in mind that the mythological Hermes, whose name is used to designate the phenomenon, is both an Olympic god and the divine messenger of rhetorical skills. He could perform the work entrusted to him in Hades due to these attributes.³ Therefore, the Hermes effect is the problem of the messenger – the transfer of information incorporated in a particular kind of message.

4. The structure of the communicative process: general characteristics

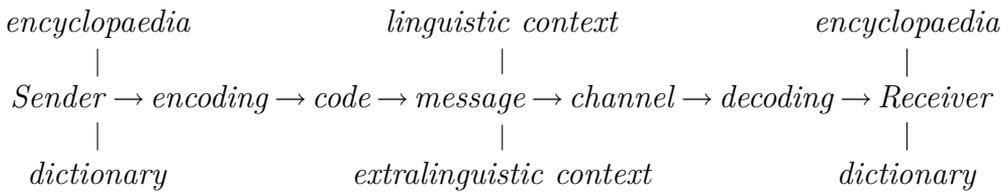
The standard model of communication (Eco 1976: 141; Lyons 1984: 38–43), reflecting the process discussed, includes several constituents. They can be present in the order corresponding to the transfer of information from the sender to the receiver (Scheme 2):

Sender → *code* → *message* → *channel* → *context* → *Receiver*

Scheme 2

³ In the context of the further semiotic characteristics of the Hermes effect, in detail: the prognosis of the semantic content synthesised by the receivers, it may be crucial to mention that Hermes and Aphrodite were the parents of Hermaphrodite – the androgynous god.

The presented simple model is not, obviously, complete. Therefore, it will be successfully extended and factualised until it reflects the Hermes effect. The components that have to be replenished in the first place are the semiotic competencies of the sender and the receiver, embracing their individual encyclopaedia and dictionary. Another element, closely connected to semiosis, which must be considered is the process of encoding and decoding the message transferred. The first mechanism is granted by the sender, the second – by the receiver of the message. However, the linguistic and extralinguistic context of the message transfer is present in both participants of the interaction. An extended initial model characterizes this communicative act (Scheme 3):



Scheme 3

The sender (prognostic) uses a certain encyclopaedia (whole knowledge possessed by the cognitive subject) and a dictionary (system of words and meanings assigned to them) used in context and directed towards the receiver of the message (here: prognosis understood as text, *PS* and *PM*) transferred by means of a code (a sequence of signs and rules of their assignment to elements of the given message) and within a channel (medium of the message). On the other hand, the receiver, also having a specific encyclopaedia and a certain dictionary, perceives the message in a specific context and interprets the message. From the praxeological and informational points of view, the encyclopaedia and the dictionary of the sender and the receiver should at least partially overlap with each other. The code of the sender (prognostic) must be at least partially understandable to the receiver. In other words, the communication is effective, if the sender and receiver have a certain common scope of knowledge.

The encyclopaedia and dictionary of the receiver, or the context of the communicative situation alone, are not enough to decode the prognosis properly. The condition that allows for the effectiveness of every communicative act is the adequacy of en- and decoding of a message transferred via certain code. The other elementary condition is an unobstructed channel of communication and the understandability of the message carrier. (The

channel and carrier of message transfer can be used interchangeably, but in the age of modern technology, *vide* personal computers, laptops, notebooks, tablets or smartphones, it is not advisable. For example, the Internet can be the channel run on a smartphone, and the scan of an article including prognosis *T* and placed on a website – the carrier.) Barriers and technical limitations come to play a role when the channel or carrier is damaged: yellowed or crumbled paper, blurry print, typesetting errors or limited access to the Web and the server which sends information to the computer or another electronic device that enables the access to the WWW – a crash of the operation system that is used while reading the message.

5. Between the prognostic, prognosis and the addressees

The research procedure and its outcome – the prognosis *W*, described in the present work, has a creator. The creator is a primary sender – the first-degree sender (1°). However, the consecutive receivers may differ not only in their abilities (encyclopaedia and dictionary), but also in their intentions towards the message they became acquainted with and their reaction to it. Two key conditions are observed here: the first, “initial situation” (starting position), concerns the transfer of a source message (prognosis *T*, *P* and *C*) by the 1° sender to a 1° receiver; the second, the “derivative situation” concerns what happens to the *T*, *P*, or *C* prognosis when it reaches the 1° receiver and is transferred further on. The former idea shall be considered first – this will facilitate the analyses of the latter, processed in much more complex internal and external circumstances of a communicative act.

5.1. The initial situation: the 1° sender and the 1° receiver

In the initial situation, the prognostic is the creator and the 1° sender of a written message which is a graphic representation of the prognosis *P*; and the 1° receiver – the individual who has contact with the original text. The text is either entirely or partially a monologue referring to written forms of language (Głowiński 1973: 107), the carrier of which is, for example, a paper book, a periodical or a website. Moreover, the text should not be identified with the *PM*. The 1° receiver has contact with the original text and therefore the 1° receiver is the original text user (*OTU*). The prognostic, if his or her cognitive attempts should be recognised as scientific, presents an entire prognostic reasoning (prognosis *P*) in a text (prognosis *T*). The prognostic reasoning *P* should comprise of the prognostic premises (*PS*) and

their result, i.e. conclusion (*PM*), constituting the prognosis *C*. The entire prognostic reasoning, conclusion, some fragments or aspects of the text can be of interest to the 1° receiver. The intentions of the receiver interested in the text vary: a technically qualified receiver's expectations are different from a receiver who is layperson. The use of the text is manifold: the *OTU* user may get acquainted with, or operate on, a text as a whole or on its fragments, it can be done for pleasure or professionally etc. Furthermore, the intentions of prognostics are not homogenous either.

The prognostic as the 1° sender, and the 1° receiver as the *OTU*, play the roles of participants of an utterance, literally: the author and the reader. A text must be decoded by the receiver for it to be updated. In a scientific text, unlike in a literary text, the external author (the real entity, the speaker) is the same person as the narrator (the speaking subject, the "I") of the text (Markiewicz 1984: 73–76). The physical, empirical author (*E*) assumes a model-reader (*M* reader) to be a competent addressee of certain skills, able to update the text properly (for more, see Eco 1994: 87–96). Thinking of the reader *M*, the author *E* selects concepts, uses a lexical and stylistic practice, and presupposes the receiver's knowledge (the encyclopaedia and the dictionary). On the other hand, an empirical reader (*E*) assumes the model-author (*M*) independently of the author's *E* actual intentions. (The image of the author *M* depends on the clues incorporated in the text). The reader *M* and the author *M* are textual strategists (Eco 1994: 89–90). The reader *M* is a textually-established collection of fortunate conditions which should be met to update a text in its prospective content entirely (Eco 1994: 90). A complementary note should be made here: in the event of communication between the prognostic (the primary sender), and the 1° receiver (the *OTU*), so at the initial stage, it is recommended to use the already-established notions, created by the literary theorists and linguistically-oriented semiologists, to analyse the narratives. The notional apparatus complies with the semiotic attributes of the relations between the 1° sender and the 1° receiver.

It has already been mentioned that the sender's and the receiver's competence may differ. If the language of the author *E* is e.g. an idiolect – a language of an individual user, the receiver (the reader *E*) will lose the ability to understand the content of the message properly. For example, an individual code of the sender is reflected in some stylistic habit or linguistic mannerism, circumscribing an individualistic idiolect to a piece of work (Cf. Eco 1996: 85–86). When the code is unknown to the receiver, the information transferred remains unknown as well. It may also happen that

the message of the sender is unclear (vague) and ambiguous, although the sender and the receiver have the same code at their disposal. When the message is vague, and hence difficult to understand, the proper interpretation of it remains unknown. There may be plenty of interpretations, but they do not have to carry a cognitive value. A scientific prognosis, in both its broad and narrow understanding and if it has some cognitive and practical functions to perform, cannot be as ambiguous and indefinite as a piece of art *ex definitione*. These conditions concern the senders and receivers of various degrees.

The reception of a message does not happen in a semiotic “void”. Attention should be paid to the role of the context: a linguistics and extralinguistic context should be distinguished from a co-text. The co-text is comprised of all texts corresponding to the source text (prognosis *T*), e.g. works mentioned directly in the main part of the prognosis *T*, or cited. (Their role is crucial as they justify the premises constituting the *PS* of the prognosis *P*). The sender is unable to control the entire extralinguistic context. He or she can, however, arrange or adapt some facts e.g. by specifying the date of publication, but they have no influence on social, political, economic circumstances, or cognitive situation. Neither do they have influence on the circumstances in which the addressee will use the prognosis *T* – let it be physical (environmental) or physiological (metheoropathic *casus*); or a very prognosticating event.

The prognosis *T* is a complex semantic and syntactic structure the decoding of which (paradigmatic aspect of communicative act) happens at an individual level. It is also important that a linguistic context – determined by the structure – embraces the aforementioned co-text. To decode the prognosis *T*, *P* and *C* properly, the 1° receiver must have some additional intertextual competence. While reading, the 1° receiver interprets or misinterprets the message, and inscribes some intentions to the author *M*. There may be many interpretations, but even though there are no guidelines (rules) indicating the best (the most appropriate) interpretation, the “bad” (Eco 1996: 51–52) ones can be detected. The receiver assesses the text as a whole according to his or her own criteria. For example, for the reader *E* who has an extensive encyclopaedia, broad dictionary and is intertextually very competent, a prognostic argumentation (*PS*) may be unconvincing or even wrong, but to another reader, of lower intellectual skills and less knowledge, the same line of argumentation may be correct and justified. Some readers *E* may be offended by resignation (although not always absolute) from usage of a scientific apparatus (quotations, references) in the prognosis *T*.

Obviously, the prognostic may take the role of a direct sender i.e. transferring the message – the content of the already-published prognosis – without any external, written text. For example, the sender as the prognostic may be interviewed for the radio or the TV, or put information forward by means of the Internet or through software. Then, the direct message becomes a de facto new prognosis. The message is only seemingly the same – independently of the efforts the prognostic will take to remain consistent with his or her own text – the selectiveness of the transfer becomes his or her part as well.

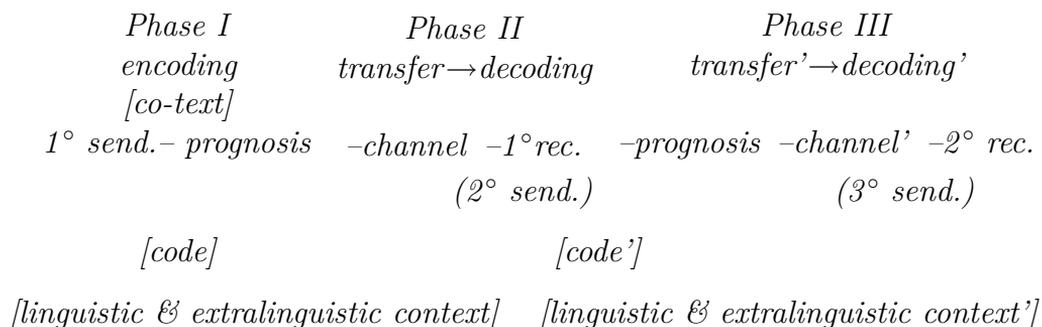
5.2. The $N + 1^\circ$ sender and the $N + 1^\circ$ degree receiver

The 1° receiver is not the only subject who may have contact with the message of interest. Apart from the 1° receiver, there are also second-degree and higher-degree receivers. The $n + 1^\circ$ receiver has only a limited “contact” with the text – he or she knows it from the second and the next hand due to the gradual transfer from the higher degree senders. On the whole this, somewhat cascading, process and the contact with the initial text is indirect. I shall analyse the communicative process and the relations between the prognostic (1° sender) and the receivers of the prognosis, from a broader perspective – taking into consideration the axes of the prognosis T , P and C respectively, as it reaches the 1° receiver.

Even though the prognostic – author E – can try to influence the 1° receiver in different ways, the influence on the 2° receiver is limited. The 2° receiver must rely on the 1° receiver. The 1° receiver becomes the 2° sender only after his or her message is transferred. Moreover, since the selectiveness and overinterpretation are not strange to the 1° receivers, a proper transfer of the content of the prognosis T , P or C becomes a challenge. It is impossible to anticipate the interpretation of the prognosis by the 1° receiver and to anticipate the reaction of the 2° receiver to information obtained from the 1° receiver.

Taking into consideration the already-established evidence, the communicative act between the prognostic as the 1° sender, the 1° receiver as the OTU becoming the 2° sender, and the consecutive receivers of higher degrees, can be divided into three basic phases and presented as a graph (Scheme 4). Nevertheless, the presentation requires some further explanation.

The message is encoded in the phase I by the prognostic (1° send.) in a system of signs. The message as a whole, i.e. prognosis T , prepared and transferred in specific linguistic and extralinguistic context, and conditioned by the co-text. In phase II, the same message reaches the 1° receivers group



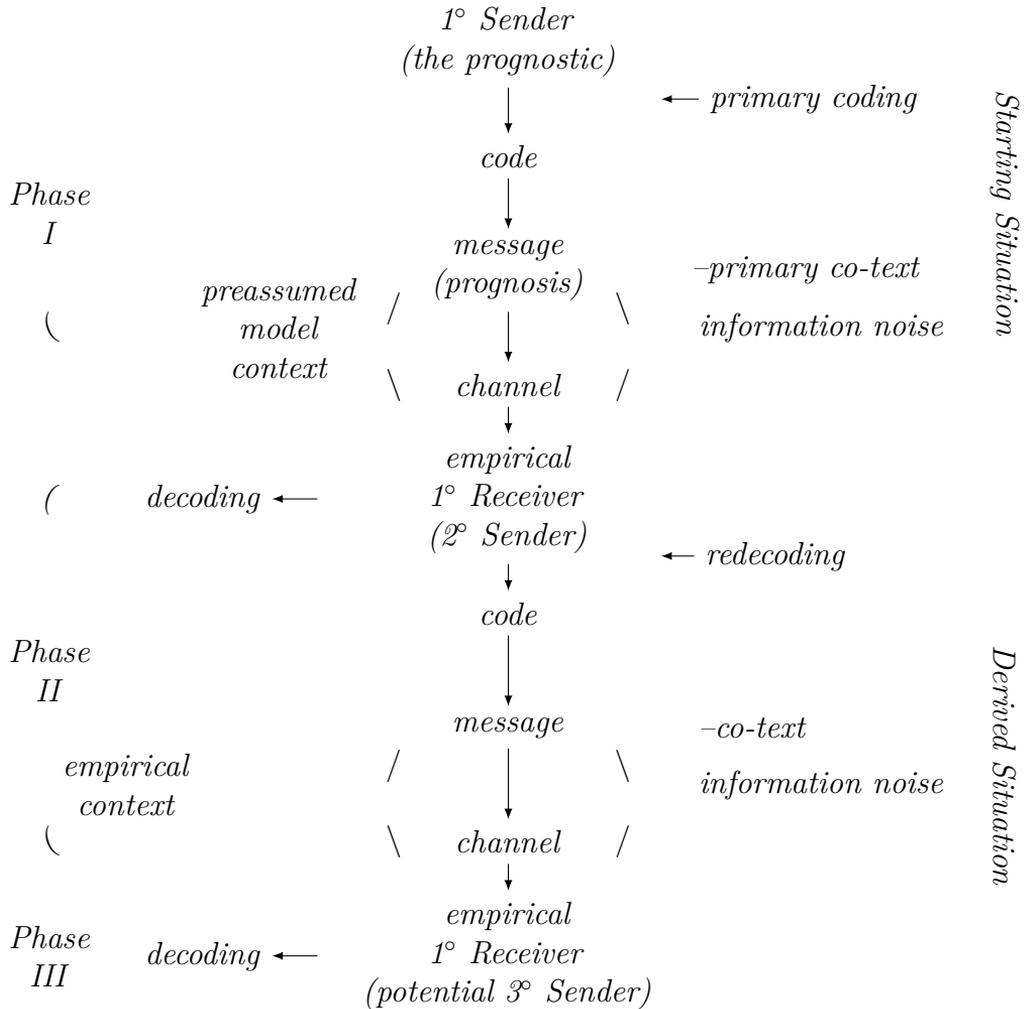
Scheme 4

(1° rec.) via a channel. The receivers who got the message (1° rec.), in its linguistic and extralinguistic context and conditioned by the co-text, decode, convey it and become the 2° senders (2° send.). In phase III, the 2° receivers (2° rec.) – following their predecessors – become the 3° senders (3° send.). The message is decoded every time it is sent (phases II and III). The knowledge of the code is crucial for understanding the message. Starting with phase II, the 2° and further receivers, already in phase III, have at their disposal only recounted information, and must rely on decoding and interpretation of the 1° and further receivers. In natural circumstances, the transfer is encumbered with distortion or loss of information or its parts. The longer the transfer of the message, the greater the possibility of distortions in the prognosis *T* and its fragments e.g. the prognostic reasoning (prognosis *P*), and conclusions (prognosis *C*).

The communication model presented in schemes 3 and 4 is still not complete and requires further corrections (see Scheme 5). Particular attention should be paid to the factor which is, to an extent, independent from the higher-degree senders – the noise occurring along the transfer: the channel in which the message is conveyed, the context (both extra- and linguistic), or the manner of decoding itself. The noise should be identified with the disruptions disabling the receiver to understand the message or its parts. In other words, the noise limits the access to the informative content of the prognosis *T*, *P* or *C*.

The process of encoding was modified in the extended model – the communicative acts were divided into the primary coding, coming from the original prognostic; and, on the part of the receivers – redecoding – where the possible changes were introduced in the code. Furthermore, the

decoding mechanism of the 1° and 2° receivers was taken into consideration. As scheme 5 shows, phase I of the communicative process happens at the initial situation (starting position), the phases II and III – at a derived situation.



Scheme 5

Prognoses do not come into existence and exist without their referent and their addressee. (They do not remain in public sphere in isolation from what they refer, and from this, to whom they are addressed.) Ultimately, whether

and what kind of reactions can be expected from information contained in a prognosis is dependent not only on how it is formulated by the sender, but also on who the receivers are and in what context they will decode the content of the prognosis. Therefore, a few questions arise: what is the goal of the prognostic as the 1° sender; by what means does the 1° sender influence the receivers; how are the reactions of the receivers of the prognosis related to the assumptions of the prognostic as the 1° sender; and how can the original material (content of the initial message) be “processed” by the receivers? The aims set by the prognostic, and the types of the reactions of the receivers of the prognosis have lead to the issue of accuracy and effectiveness of the prognoses. These ideas will be subject to further investigations.

5.3. Communication strategies of the empirical sender of the first degree

The prognostic, attempting to perform an research procedure – prognosticating, must choose the code, the carrier, the way of presenting the data, as well as define the receiver and point out the goal of the procedure. Furthermore, prognoses *P*, due to their functions and goals, are divided into: exploratory, cautionary and normative. Since the latter are close to plans and their aim is to activate the receivers and force them into particular actions leading to the achievement of a goal central to the prognostic. A more accurate name for them would be the “activating-normative prognoses”. The exploratory prognoses ought to be related to the cognitive function of the outcomes of cognitive operations, the cautionary and activating-normative prognoses – with the practical function of the outcomes of cognitive operations.⁴ The aim of the two latter prognoses is to influence, to an extent possible, the course of events (facts) and social processes, as well as natural processes.

Information incorporated in the prognosis *T*, and especially *P* and *C*, may influence the attitude and actions of the receivers. What is important from a semiotic point of view is the ability to comprehend the content of the premises creating the prognostic argument (*PS*), and the semantic content of the conclusion (*PM*). Exploratory, cautionary and activating-normative prognoses must be designed differently in terms of their contents. The major difference resides not in the content and structure of the *PM*, but

⁴ If the informative layer of cautionary and activating-normative prognoses are treated autonomously, it will be difficult to rule out certain cognitive functions they perform. Furthermore, these prognoses may perform cognitive functions indirectly, but only towards the empirical practice of the scholars. What I mean are metatheoretical analyses and improving the methodological cognisance of the researchers.

in the content and structure of the *PS*. Exploratory, prognoses are strictly cognitive and are directed to a professional receiver; the presentation of the prognostic argument (*PS*) is key to such individuals. In case of cautionary and activating-normative prognoses, it is the structure and content of the *PM* which are brought to the forefront – the knowledge of the future states of events should be the core element of a warning or a factor which motivates to specific actions.

In philosophising on how the Hermes effect is linked with the accuracy and effectiveness of the prognoses, some prototheoretical terminological remarks are needed. Referring to the linguistic situations alone, it can be said that the accuracy concerns the coherence between the prognosis and the reality. The ultimate goal is to fulfil the phenomena, processes or events contained in the prognosis *C*. However, it is not precise enough for conducting a methodological – semiotic analyses. The accuracy should be analysed in two interlocking aspects: reliability and precision of the prognoses (Delorme, Woleński 1984: 25–26). Reliability informs about the degree to which information contained in the prognosis *C* (*PM*) can be fulfilled based on the *PS*. In the structure of prognostic reasoning, particular *PM* is relative and logically possible to a degree *p* to *PS*. Broadly speaking, the idea concerns the level of certainty towards the prognosticated events or processes denoted by the *PM* and guaranteed by the *PS*. Precision is linked with the ability to fulfil what is denoted by the *PM*, in other words, what is presented by the *PI*.

It can be said that the prognosis is complete reliable if and only if it fulfils everything that the *PM* predicates. To put it another way: when everything goes as the *PI* indicated. Such an assumption needs a restriction: a doubt arises whether the prognostic has really previsioned an event, or has made a lucky guess. If the events indicated by the *PI* happen, it does not show the abilities of the prognostic. In a scientific prognosis one must present not only what will happen in the future but also how it is known. From a methodological point of view, the accuracy of the prognosis is guaranteed by the correct choice of the *PS* and the formal and substantial appropriateness of the predictive reasoning including *PS* and *PM*. It must be noted, however, that precision as one of the aspects of the accuracy, should be considered jointly as sentences creating *PM*. (As it has already been mentioned, the conclusion of previdistic reasoning is not always, or even rarely, a single sentence on future states of events).

The effectiveness is more problematic as it is connected with the influence

of the prognosis on the receivers and their actions. Both dead and alive⁵ prognoses can be effective. Each alive prognosis which can be “effective” should be “given a chance” to be fulfilled, as long as the established time horizon is distant. Following A. Podgórecki it can be said that “an optimally effective action is the one in which all the postulated states of events were fulfilled – only these states of events, and no others” (Podgórecki 1962: 130). Three questions help examine effectiveness: 1) how much of what was to happen was accomplished; 2) how much of what was to be avoided was not fulfilled; and 3) how much of what was to be fulfilled or changed was accomplished? The prognostic as the 1° sender must be aware of the receiver, otherwise his or her actions may be counter-effective. Prognosis aspiring to be “effective” should be suitable for any receiver *E*, which should be reflected in an adequately chosen, that is representative, receiver *M*.

From a methodological point of view, extending the range and time span (the time horizon connected with it) lowers the precision of the prognosis.⁶ From a semiotic point of view, extending the range and time span enhances the probability of incorrect recoding of the content of the prognosis *P* and *C*, which influences the precision and effectiveness of these prognoses. In the case of cautionary prognoses and activating-normative prognoses, the longer the time horizon and the less prepared receiver, the easier the code of prognosis *C*.

The announcement of a given prognosis *T* may cause the realisation or lack of realisation of what the *PI* concerns. In this case, when the prognoses *P* and *C* can alone become the causes of further events. These are called self-fulfilling prognoses (facilitating their own realisation) and self-annihilating prognoses (self-destructing, acting against their own realisation; see e.g. Giedymin 1964: 136–141; Nowak 1985: 391–393; Merton 1982: 463–464). Such actions, i.e. the modification of the content of the *PS* and *PM* bringing self-fulfilment or self-destruction of the prognosis may be the manifestation of a conscious act taken up by the prognostic at the preparation stage.

It is said that the self-fulfilling prognoses (and self-destructing) are

⁵ Prognosis of the time horizon which has expired – its range reached its final stage, can still influence their receivers and achieve the non-cognitive objectives, provided that no crucial changes in the message will be performed alongside its transfer.

⁶ The range of the prognosis concerns how distant into the future the prognosis reaches. The time span of the prognosis refers to the time (period) it concerns. The range and time span of the prognosis not always covers the same periods. The time span of the prognosis is never greater than its range but the reverse. Not all prognoses are applied just after preparation. A prognosis can arise in e.g. 2012, which the *PI* describes as coming into force in 2015, and expiring in e.g. 2020 (Rolbiceki 1970: 154–155).

those which in the moment of their formulation, and due to the state of events they refer to, are based on false premises. These premises are false but by means of spreading the prognosis lead to the expected results; a methodologically unfounded prognosis is fully functional. In case of self-destructing prognoses, the announcement and spread of the prognosis leads to a point where the anticipated events will not come to pass by themselves. Both these types of prognoses are not necessarily based on false premises, i.e. their *PS* components do not have to be false.

Regarding self-fulfilling and self-destructing prognoses, two types of situations linked with logical structure of the propection (Nowak 1985: 392–393) should be taken into consideration. The first type formulates a statement in the shape of a conditioned prediction (“If *B* then *Z*”), and the anticipated results are not neutral to the researcher or the research group. If the results *Z* are marked as positive, people whom they concern begin to act to create or maintain conditions *B* described by a predecessor of a given law (statement). If they are marked as negative, people act to prevent the event *B*, the predecessor of a given law (statement), from happening. For these events, a particular human action is their predecessor, or a predecessor is dependent from a human action. Furthermore, the consequences are so important that a lack of any action seems unlikely. If the result *Z* is attractive (or dangerous) enough to cause actions to achieve (prevent) it, and the initial conditions of a given law are subject to manipulation so that it becomes likely to take actions facilitating its achievement (prevention), then detection of the $B \rightarrow Z$ -type law is a condition that enables the result *Z* to happen (or not to happen). This is called the conditioned self-fulfilling (self-destructing) prognosis based on a true statement. The second type encompasses situations in which prediction is based on either false cause-effect thesis relationships or is not based on any law of consequence, but has a form of unconditioned predicting which assumes that the moment it was formulated in meets some unidentified initial conditions, and unidentified dependence so that the predicated event will surely happen.

This to say that prognosis *P* can be supported by an active intervention facilitating or preventing an event or process mentioned in the *PS* from happening, by means of an action or a passive intervention, which consists in facilitating or preventing an event or process mentioned in *PS* from happening, by means of refraining from taking up actions. In case of a prognosis with a hidden accomplishing mechanism, two systems of the *PS* statements are possible: explicit, which consists of an officially announced prevision, true of false, but leaving information crucial for prevision unsaid;

and implicit, which consists of hidden information known only to the author (authors) of the prognosis (Giedymin 1964: 142–148).

A conduct of such a construction of the *PS*, where key premises of prognosticating arguments are concealed, is unfair towards the 1° receiver as the *OTU*, and indirectly towards the subsequent receivers. Despite the ethical judgment of such actions, it should be noted that the result of such behaviour can be detected by a well-prepared and perceptive 1° receiver. It is even more likely when the receiver is a critical *OTU* at the same time.

5.4. The Apollo syndrome and the empirical receiver as an empirical sender

From the point of view of the prognostic and as the 1° sender, the optimal situation is one in which the receivers of all degrees understand and get an undistorted message of the prognosis *T*, fully accept the *PS* and *PM* and work in accordance with the expectations of the sender. The empirical 1° sender may idealise the receivers of the former degrees, and identify the *M* receiver with every *E* receiver without any revision of real cognitive processes, and a linguistic and extralinguistic context in which a communicative act takes place. The signalised attitude of the 1° sender is accompanied with a set of beliefs that shall be termed here as the “Apollo syndrome”. The syndrome concerns the far-fetched expectations towards the receivers and can be defined as the acceptance of an unlikely and uncertain assumption that these receivers will decode, accept and correctly transfer a piece of information contained in the message, and will further act in accordance with the guidelines from the 1° sender. The syndrome is also an example of a particular communication strategy of the empirical 1° sender. The receiver who decodes the text (message), interprets the text properly: taking into consideration all of the sentences coming from the sender (prognostic), and takes up an action meeting the demands and suggestions of the prognostic, can be called the “perfect receiver” (*PR*). It must be noted, however, that the *PR* is an ideal subject and does not appear in real communicative acts.

The question is: how will the receiver *E* of a certain degree react when he receives the message? Let us consider the repertoire of reactions to this message (*R_m*). A variety of potential reactions can be divided into three instances: the understanding of the message (*um*) – the prognosis *T*, *P* or *C*, the causative actions linked with the content of the prognosis *T*, *P* or *C* (*ca*), and the further transfer of the message to successive receivers (*tm*). These instances are represented by a threefold system:

$$R_m = \langle um, ca, tm \rangle$$

The person who is the addressee of the exploratory, cautionary or activating-normative prognosis, may succeed or fail to access it. If contact with a particular type of prognosis will actually happen, the person receiving a source message becomes the empirical 1° receiver or the empirical $n + 1$ degree receiver (when the contact is indirect). Every receiver E – despite their degree – can succeed or fail to understand the message (prognoses T , P and C) as a whole or as fragments. If the text is understood (fully or partly), then the receiver E may take up certain actions as a result of knowing, as a whole, or in part, the message. The receiver E may therefore react and take a position towards the prognoses P or C , or remain passive towards the content of the message, but may also (regardless of his or her actual position) transfer the message or its part to the subsequent receivers independently. When the receiver does so, the message may be transferred properly (i.e. without noise or distortions) or with changes that may include the prognosis T , but especially prognosis P and C . The improper understanding of the message or a part of it, is connected with its misinterpretation, and further in its transfer – with the complete or partial deformation of its primary content.

Due to the possible actions of the receivers E of further degrees, the key role is granted to the way the prognostic argumentation, or its fragments – certain premises constituting PS , and the conclusion of reasoning – PM , is conveyed. (Obviously, the message can be purposefully misinterpreted and transferred further in this form). Investigating the logical structure of the prognosis P , as this problem is crucial here, and its transmission, one should pay attention to the lack of changes in the content of the prognoses PS and PM , partial changes of the PS or PM and complete changes of the PS and PM . The situation discussed can be exemplified by means of two matrices (schemes 6A and 6B) where the first part of notation in brackets is always the PS , and the second – the PM . In the first and second matrix, 0 and the letter a stand for the lack of changes in the content, $1/2$ and b – partial changes, and 1 and c – complete changes, accordingly.

Changing the enumerated components of the logical structure of the prognosis P may vary significantly: they can cover e.g. some premises constituting the PS or some sentences constituting the PM .

Possible changes introduced into the PS may be linked with transposition – the conversion of the mechanisms responsible for self-fulfilment or self-destruction of the prognoses. It is not difficult to imagine that the global

(0, 0)	(1/2, 0)	(1, 0)
(0, 1/2)	(1/2, 1/2)	(1, 1/2)
(0, 1)	(1/2, 1)	(1, 1)

A

PS_a/PM_a	PS_b/PM_a	PS_c/PM_a
PS_a/PM_b	PS_b/PM_b	PS_c/PM_b
PS_a/PM_c	PS_b/PM_c	PS_c/PM_c

B

Scheme 6

result of mis- or overinterpretation of the prognosis, or changes to the content may have a reversed result than the one assumed by the prognostic – in this way, the goals of the prognosis are neutralised. A further consequence of such circumstances may be the majority of receivers of the prognosis T , P or C , who will get its message wrong in relation to its primary content, or will act in a way different than expected.

Widespread and methodologically unfounded prognoses can cause unintentional but effective causes of expected results. Methodologically correct prognoses P can bring unexpected results as well. The situation is analogical for overinterpreted prognoses or ones that are wrongly decoded and further recoded. They can also bring results expected by the higher degree senders but not by the 1° sender. They can even oppose the primarily assumed result or act against the results expected by the 1° sender.

Let us imagine an initial situation in which an executive board of a stock company orders a professional exploratory prognosis on the company's productive capacity in relation to growing competition and labour expenses. The prognosis T , the vehicle of which is an internal public notice, is presented to the board members being the professional 1° receivers who are well-acquainted in *OTU* with an adequate encyclopaedia and dictionary. The content of the prognosis P and C shall be an instrument to designate a long-term marketing policy for the company. Let us assume that the information delivered to the board is beneficial from the view of developmental perspectives of the company. Further, let us assume that the prognosis T reaches some inexperienced spokesperson of the company. The spokesperson, being an unprofessional receiver 1° or 2°, reports the message, especially

prognosis *P* or *C*, at an annual news conference where the aim is to present the financial results of the company to the shareholders. In this derived situation, unfortunate circumstances of the transfer (lack of electronic presentation of figures reflecting the *PS*) and lack of factual preparation of the spokesperson (which debilitates the exact understanding and recoding of the message) means the message reaches the journalists (receivers 2° and 2°) in a distorted and incomplete form. Further on, the journalists, as 3° senders, spread and recode the text aiming its message at so-called public opinion (potential 4° receivers). The promulgation of fragmented information on methodological and factual basis of the prognosis *P* in the mass media evokes scepticism in investors who no longer know the potential of the company. The fact that the notice holding the prognosis *P* is an internal document (available for selected members of staff only) can evoke justified suspicion from investors and market analysts. Global results for investors, shareholders and stockbrokers may lead to a drop in the company's listing. The circulation of the imprecise message from 2° sender can cause a slowdown, if not a breakdown, of a promising company.

Some economic prognoses are prepared by specialized research institutions based on a standard methodology, without the need for their detailed discussion, and their *PM* is just a few-sentences statement. Therefore, e.g. the quarterly prognoses for GDP that are made public by the national statistical authority, despite their simplicity, do not have to – as exploratory and activating-normative prognoses *P* – encourage receivers *E* who, apart from analysts, are the people responsible for economic entities and individual consumers. This happens mainly when the factors causing economic growth are beyond national economy, e.g. they are linked with recession or financial crisis of the world's economy, and investments or consumption is linked with risk and high individual costs.

In spite of motifs and determination of the prognostic or the receiver of the prognosis, there exist strictly ontological limitations of the possibility on prevention or support used towards the content of the prognosis *C* or a premise of the prognosis *P*. L. Petrażycki had good intuition in this case – many years ago he distinguished potestative and non-potestative prognostications. According to Petrażycki, potestative prognostications are those that the realization or non-realization of the condition of what is provisioned depends on human will and actions, non-potestative, on the other hand, are those in which the condition of what is provisioned does not depend on human will and activities (Petrażycki 1985: 124–125). I will cling to this distinction literally. The case concerns human possibility to break

the links in a prognosticated chain of events; in other words, the ability to stop prognosticated course of events. It is to look at the power a person can or cannot have over phenomena (states of events) prognosticated about. For example, prognosticating the course of geological processes, such as tectonic movements and emergent earthquakes or volcanic eruptions, and most importantly, astrophysical processes such as the evolution of stars etc. – although it fits into the current cognitive abilities of contemporary science, harnessing these phenomena is outside human technological skills and developments. However, preventive or restrictive actions against the social impact of such events are, to some extent, available.

Non-potestativity of prognoses excludes the possibility to stop the cause-effect chain (e.g. from natural phenomena) being the condition of what is being prognosticated about, but not necessarily the human actions taken up as a result of knowledge on these chains. Therefore, although the course of an event cannot be stopped or changed (e.g. the fall of a big asteroid or release of jets of Gamma radiation from magnetars towards the Earth), then as a result of a collective psychosis or group thinking, arranged and non-arranged aims of the prognostics can be fulfilled. Henceforth, the knowledge which was supposed to save people and help them prepare for the upcoming and inevitable natural disaster, can cause – in an event of a derived communicative process – unnecessary panic and a negative social aftermath of an estimated natural phenomenon.

6. Final remarks

An introductory view of the presented problem is not exhaustive to all its research questions. Discussing further ideas connected with the phenomena of interest, such as processing and transferring information, including their personal potential: emotional aspects of cognition, psychoneurological mechanisms of decision-making, personal proneness to persuasion and capability of manipulation, the role of self-assessment and self-knowledge, and the role of the environment (cultural and technological factors) for the effectiveness of mass communication etc., requires a deep cooperation with the representatives of logical semiotics and epistemology and the representatives of empirical sciences of cognition and communication. Such an extended methodological approach, including and integrating the knowledge gained on the ground of many scientific disciplines, usually – provided that the research is conducted correctly from a workshop perspective – enables us to view the phenomenon in a richer and more exhaustive perspective, and to answer

these questions that are impossible to answer from a limited, monodisciplinary and single-paradigm perspective. It is also possible that the Hermes effect was a useful phenomenon to separate microscale experimental studies, if not at a municipal level then at least in a laboratory environment, or as a pre-prepared digital simulation experiment.

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