COMMUNICATION AGAINST LOGICAL FORM
A critical survey of Hans Freudenthal's LINCOS

1. *Introduction*

In 1960, German professor of Mathematical Logic Hans Freudenthal published an ambitious and in many ways peculiar essay titled *LINCOS: Design of a language for cosmic intercourse*; its aim was the development of the canonical logistic notational system into a proper language that could allow, if any language could, communication with intelligent life forms from other planets. Freudenthal clearly wasn't the first – nor the last – to attempt such a project; his case, though, differs from all others in that – as made clear by the title of the series his work appeared in, «Studies in logic and the foundations of mathematics» – his starting point was the by then well-rooted philosophical debate on the foundations of language and linguistical thought (propositional attitudes, one might now say), with special reference to the concept of "logical form", and to how it might collide with the pragmatic and communicational aspects of language itself. It must be remarked that, as opposed to specifically logistic languages or notational systems, LINCOS aimed at providing a means of communication intended as an effective and applicable tool for information exchange: which implies, above all, that it was meant to develop a semantics articulated enough to cover all possible subjects of conversation in its broadest sense: mathematics, logics, physics, as well as ethics, politics, behavior and language games. Owing to this purpose, it is obvious that LINCOS would have been granted a logically consistent development only insomuch this wouldn't have jeopardized its communicative prerogatives; its aim was not simply to vehiculate inconfutable tautologies, but to provide a tool for dialogue, thus allowing – for example – nonsense, contradictions and even the possibility to suspend the bivalence principle.

The fundamental question resonating behind Freudenthal's project is whether one can legitimately ask logics to provide the structure – the "logical form", that is – for a perfect language, whose field can then neither

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be reductively narrowed down to the sound constitution of scientifical knowledge – as part of logical empiricism seemed to be content with – nor expanded to the foundation from scratch of a fully aprioristical language, a *characteristica universalis*. Without questioning the legitimacy or usefulness of such approaches – Freudenthal will diffusely and explicitly refer both to logical empiricism and to the leibnizian ideal of a *characteristica universalis*, quoted at the beginning of his work as a kind of mission statement – LIN-COS will aim at generalizing the former's results, applying them to a field historically much more refractory to formalization: the field of language as a vehicle of communication.

No message in LINCOS has ever traveled through sidereal space; a second part of the project, meant to deepen its semantics with reference to the more "informal" fields (Earth, Life, Behavior) never was blessed by the press; no alien intelligence ever talked to us modulating radio waves as professor Freudenthal theorized or dreamed. His project nonetheless maintains a deep and specifically philosophical interest, representing – as it does – the first and only rigorous and coherent attempt at applying the methods and results of logistics to actual *communication*, and, more importantly, *logopedy*, as we shall see. This paper will analyze the peculiarities, insights and fundamental defects of Freudenthal's experiment. It shall not presuppose a knowledge of LINCOS, nor will it teach it: the best source in this respect remains Freudenthal's work itself. The notions taken as examples will be briefly explained when necessary, so as to underline their opacities and inconsistencies and, eventually, show how the latter all connect into the fundamental problem of the compatibility between logical form and communicative aim; then, considering the project's being a logopedy in addition to a language, it shall be shown how Freudenthal's didactical aim necessarily brings him to important presuppositions over the nature of mind and its role in organizing linguistical knowledge, space, time, subjectivity. In this respect, an integral logopedy – a logopedy, that is, aiming at teaching a fully developed language to a potentially "blank" receiver, for some meaning of blank – will be configured as a negative mapping of the transcendental subject – of subject itself.

NOTES: in this paper the term "LINCOS" will refer both to the language itself and to the project of transmitting it and teaching it to alien life forms – a project, as we have said, that has never been carried out; this is meant to underline the necessary bond between the *structure* of the language and its *didactic purpose*, without which the former would be empty and meaningless. Logical notation will be carried out using Quine's canonical system, devoid of any of its presuppositions over the nature and implications of logics; Freudenthal explicitly and diffusely denies any ontological claim behind the structure of his language, merely grounding it on a broadly behaviorist point of view – although, as we shall see, this is more easily said than done.

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2.   *LINCOS: An overview*

The aim of this paper is to uncover and trace a mapping of the *pre-suppositions* Freudenthal progressively needs to assume in the pursuit of his project to the extent we have seen. For clarity's sake we should start by outlining what exactly a presupposition is, and what kind of structure their layerings form. Freudenthal's project starts from the hypothesis that it effectively be possible to establish a communication with a form of intelligence remote in outer space. The *actual existence* of such a form of intelligence, as well as its ability to receive our messages, understand them as significant, interpret, elaborate, and lastly answer them, is here not investigated as an effective possibility subject to empirical or theoretical verification: it is assumed *ex hypothesi*. Freudenthal's aim is not the design of a language that could be *absolutely intelligible*, whatever this might mean, but simply of one that can in general be understood, if any language can. The simple fact that LINCOS, in its structure, is based on a notion of logical form deeply connected to theories on logics and mind, is proof enough that some kind of analogy need be postulated between the structure of the receiver's mind and our own way of elaborating and construing experience. The objection that the existence of such an intelligence is extremely improbable, or that time-signals (cfr. *infra*) are an intrinsically failing system owing to the temporal distortion they would be subject to whilst traveling between two bodies in constant relative movement, loses here all strength and pertinence: the rejection of this initial hypothesis – which we could call *presupposition of communicability* – would not represent the proof of a failure in the project itself, but simply the decision to deny any relevance whatsoever to the conclusions one could draw *about this presupposition*, and what it may or must entail.

What is to be examined here are then specifically the *theoretical consequences* of this first presupposition of communicability Freudenthal assumes. That is, hypothetically admitting such a communication could effectively be established, *what other conditions is he forced to postulate so that the teaching can reach a success*? And, more specifically, what is Freudenthal forced to assume regarding the nature of the receiver's *language*, *context* and *mental structure* (for some meaning of the term), so that communication can be carried out? We could call this second layer of presuppositions, respectively, *logical, semantical* and *intellectual*; their complex will so outline what we could identify as the *conditions of possibility of any communication*, in the broadest sense. By tracing them internally to the communicational situation itself, Freudenthal's LINCOS implicitly construes what we could come to define as a *transcendental logopedy*.

After an introduction aimed at providing a theoretical framework for his project, Freudenthal's work is divided into four sections or didactical units: Mathematics, Time, Behavior and Space. The main problem to be

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faced is, as we have hinted, that of *teaching*: a language for "cosmic inter-course" that doesn't purport a claim of immediate universal intelligibility, for some meaning of the term, must first of all be *taught* to the potential receiver of the communication itself. The problem arises when the structure of such a teaching is made explicit, for it obviously can't rely – as everyday logopedy does – on a shared preexistent language, nor can it, apparently, proceed by ostension. One can not simply be content with the develop-ment of a system of symbols – uninterpreted signs – logically defined and exhaustively listed: the logical form and apparatus will be involved only in a later step of the process, as a means to derive new concepts from those already known. Without a "link" to reality, for some meaning of the term, a series of concepts logically presented in their mutual connections and possible interrelations – even when such a series would be consistent and *closed* – would be devoid of any communicative usefulness whatsoever, the relation of "meaning" thereby reduced to that of «interlinguistic equiva-lence». The latter is, Freudenthal remarks, the main weakness of all logistic languages yet developed: the fact that their semantics, limited to interlin-guistic relationships (definitions or «postulates of significance» [1]), offers no "anchor to reality" that could be used as a guideline for interpretations, thereby allowing any of them provided it is consistent with the system's internal structure. Such an "anchor" can be granted by ostension only; were that route to be found impossible, the project of LINCOS would be over before its beginning. It is at this stage that Freudenthal remarks that, even in such a situation without any shared context, not all osten-sions are impossible: two kinds of concepts can still be designated that way, and those are numbers and time. Numbers, the elements introduced in the first communication of the LINCOS programme, will be initially represented by a series of «peeps» on the same wavelength, separated by pauses or dashes. This introduction is *ostensive*, or, even better, *ideophonetic* (0.17) [2], for the signs thus introduced mean themselves, they «both signify and represent their significance» (1.01). From then on it will be possible to introduce logically or contextually all other mathematical concepts, with-out the indeterminacy they would have had if that had been the only way of presenting new concepts. This obviously presupposes some degree of knowledge of mathematics, but, in the context of the general problematic here exposed, there are reasons not to discard this claim as groundless; for, if mathematics could be construed, as has been done, as a product of our mind's fundamental ability of considering functionally bound series of representations, some knowledge of it – or at least the possibility to develop

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[1]) Cfr. Carnap 1956.
[2]) All such quotations refer to the paragraph/proposition divisions in Freudenthal's original text; cfr. Freudenthal 1960.

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it – falls under our initial presupposition of communicability. The point to be made here is that mathematics does not owe its prominence to an allegedly universal or "pure" status of its subject matter, but more simply to the fact that it is the only conversational subject whose elements we are able to introduce ostensively; the first chapter will thus develop some mathematical instruments and, more importantly, logical connectives and concepts such as "statement", "implication", "truth" – construed as the set of true statements – "question" and the like, which will be essential in developing all the remnant semantics.

As for the other subject ostensively introduced, time, the same order of considerations seen for mathematics will apply there, rendering substantially meaningless the objection of whether we can claim our perception of time and succession to be universally shared: for, more than a claim, it is here a postulate, included *ex hypothesi* in the conditions of possibility of the present project as represented by our presupposition of communicability. The second chapter is hence devoted to the development of a semantical system for time, starting with ostensive «time-signals» – peep-dashes whose length in seconds is numerically stated immediately after their sending – and culminating in the setting of a *clock*, meant to tick away at a frequency different from the one where communication usually occurs: it will from then on be possible to refer to an *event* simply by mentioning the time-interval in which it happened. This, in turn, provides the possibility of introducing the concept of event, its only instance we can presume to be known being – quite appropriately – *conversation*. The third chapter, devoted to behavior, will *stage* conversations between speakers – initially identified simply as "sources of propositions" and only later defined as subjects with memory, will, personality and body – that will *show* and not simply explain increasingly complex behavioral and ethical concepts, and discuss them until some definition of them can be reached. The possibility of understanding our "fictive utterances" as intertwined into separated dialogues will be granted by the uniqueness of each utterance as expressed by its time-interval, to which each speaker will initially refer to when answering or debating – this, as with ostensive numerals in favour of arithmetical ones, will be one of many formalized requirements gradually dropped out once a notion can be presumed as acquired. This chapter on behavior will culminate into the definition of human life, the human subject and a sort of simplified formal ethical system; the fourth – and last – will develop both axiomatically and conversationally the concept of space, geometrical and physical alike, with particular attention to the known astrophysical principles and laws – which would, in the eventuality of an actual dialogue, be among the prominent subjects of effective conversation.

The language thus resulting from the whole of Freudenthal's work appears then to be an articulated system responding to a rigorously logical syntax – hence one determining on purely formal grounds the significance

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of every expression – with a semantics articulated so as to cover most subjects and fields, albeit at times through unnecessary and artificious periphrases that could eventually be dropped with practice. One of the most notable characteristics it can boast is a fully formalized semantical system – obviously consequential to the necessity of introducing new concepts by definition solely, contextual or otherwise: this claim, as well as the syntactical one, is exactly what will be discussed here.

As has been hinted, a second part of the system, meant to develop the semantical fields of earth, human life and a new part on behavior, had been planned to follow but never actually came into existence; the whole project spawned a series of inconsistencies and contradictions which eventually deemed its failure, inconsistencies and contradictions ultimately rooted in the philosophical issue at the core of Freudenthal's LINCOS: the purported compatibility of its communicational aims with the logical form on which it is structured.

3.   *Logical form vs. communication. Intention*

The notion of logical form has no definite boundaries – its application permeating all use of modern logics as an explanatory tool to solve apparent contradictions by explicitating the structure of thought (Frege), judgment (Wittgenstein), proposition (Russell), or ordinary language (Grice); though lacking an explicit definition, Wittgenstein offers scattered material enough to grant the possibility of construing one (for example cfr. Wittgenstein 1961: 6.1264; 5.5423; 5.54; 6.124). It is however worthwhile to remark that in its successive applications – as summarily sketched *supra* – it has somehow lost a degree of abstractness by which it was initially permeated: the relation, as Frege clearly pointed out in his *Logische Untersuchungen*, to structures of thought. Just to provide a starting point to analyze the use of the notion of logical form on which is based Freudenthal's project, we might quite generally define here its idea as the assumption of a *logical structure* underlying propositions subject to truth values, hence judgments, hence thoughts. Such a structure has been explicitly introduced to provide a means to explain away apparent contradictions that it allows to construe as resulting simply from an intrinsic opacity of natural languages, and not by the lack of clarity or coherence in the *thought itself* (e.g. Russell's famous reduction of existence implications in definite descriptions, or Epimenides' pseudo paradox). This in turn causes the proposition to be regarded simply as an *imprecise translation* of its logical form, which is then seen as the only reliable source of information regarding its truth-value, and must consequently *incorporate all significance, if any, of the proposition it represents*. A proposition's logical form appears then to be, quite literally, the

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condition of possibility of the proposition itself («Logics is transcendental»: Wittgenstein 1961, 6.14).

It follows from this theory that a hypothetically perfect language should not be grounded on one particular ordinary language, nor on a "collage" of those characteristics of ordinary language that most approximate some ideal of perfection (as was the case of most modern *a priori* universal languages), whatever it might be, but instead on *that logical structure all ordinary languages are supposed to share insomuch as they are meant to vehiculate meaning and truth*, and of which the latter are but epiphenomenical instances, both historically and culturally bound. As we have noted, on many an occasion the structure of LINCOS abandons the logical rigor from which it started; we shall now try and outline where and why this happens. A list of all the instances of the clash between logical and communicative form would be long and redundant; we have chosen here to concentrate on four examples, and that is: the method of quasi-general definitions, questions, the definite article and the progressive contextual definition of the concept of "perception".

3.1. *Quasi-general definitions*

The first instance of the departure from formalization is to be had with Freudenthal's standard method of *quasi-general definitions* (cfr. *passim* his whole introduction, and particularly 1.00); they are presented as informal definitions nonetheless allowing to «expect that the receiver will generalize the quasi-general definition or the proposition that is intended by the program text», and are, quite basically, non-recursive, non-contextual, non-axiomatic (for they are meant to *precede* and *grant the possibility* of axiomatic definitions by characterizing at once their primitive elements). They represent, in a way, a reduction of the method known as complete induction (induction from *n* to *n+1*: this last method would actually require the existence of a known metalanguage to ground its generalizing procedure, which Freudenthal clearly can't aspire to). In the end it is spectacularly similar to ostensive teaching: as a child understands what a "stone" is after the ostension of a finite number of stones, following which he is presumed able to understand what falls under the concept and what doesn't, so in a quasi-general definition Freudenthal lists a small number of occurrences of a concept and then explains it away as "grasped" – this is, for instance, the way basic arithmetical operations are introduced. But it is easily noted that an explanation of the "=" operator with numerical arguments from "1" to "5" does not formally authorize its application to a context such as "6 =...", which a formalized semantical system would at this point define either as meaningless or as wrong. This method needs something more, to be acceptable – something which is alluded to in the

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general idea of "grasping" a concept from a short list of its instances, and tacitly presupposed through all the section on *Ontogenesis of reference* in Quine's *Word and object*: intention. This intention, explicitly referred to by Freudenthal himself (cfr. *supra*: «the proposition *intended* by the text»), is the presupposition grounding all of LINCOS' transgressions to the rigor of logical formalization. It is a wholly justifiable transgression, for in no other way could Freudenthal have granted his concepts an *intension* (no pun intended) lacking both a sound metalanguage and the possibility of exhaustion of primitives. Intention, in this particular context, simply means *the receiver is supposed to consider the message as (a) significant and (b) being granted its significance by its status as a product of the intentional act of a speaker aimed at communication* [3], intention that thus constitutes the "real" meaning of the message itself. Exemplifications provided as quasi-general definitions, then, aren't to be seen as a "partial contextual definition", but more appropriately as an "inductive basis" on which the receiver will be able to apply an independently developed mechanical procedure from *n* to *n+1*; the development of such a procedure would ideally be summarized in a question more or less like "What was the speaker's intention in elaborating this message? What did he *mean*?" [4].

Quasi-general definitions appear then to be characterizable as *incomplete inductions* (or quasi-complete), whose completion in turn relies on the receiver's good will, in some way. As we shall see, on this good will is grounded all possibility of communication in general.

3.2. *Questions*

The introduction of questions is Freudenthal's first step from pure mathematics into the realm of actual or at least potential communication. They appear to behave syntactically as quantifiers, engendering propositions such as "?x…x = 1+10………………x = 11" ("What is the x such that x = 1+10?" "It is 11"; dots are here meant to represent pauses of a length proportional to their number); their main impact, as communicative elements, is on the identity principle itself, and especially in regard to its corollary on the substitutivity of identity. Due to the lack, at the stage of their in-

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[3]) On the role of intentionality in the definition of meaning, cfr. Grice 1957 and 1969.

[4]) It is unclear to what degree the problem of intention and significance in philosophy of language would have been avoided had English not offered the unfortunate homonymy between an utterance's meaning and what its speaker intended by saying it – what he meant; we shall try, as much as possible, to keep the two dimensions separate as they are and should be.

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troduction, of the possibility to reject a wrong answer or characterize it as inadmissible – a possibility that, as we shall see, must rely on the development of a sort of serviceable ethics – Freudenthal sees himself forced to provide only instances of *right* answers and presume the concept could be defined by those alone; he must, specifically, avoid to legitimate answers such as "?x…x = 1+10…………….x = 1+10", albeit nothing in the receiver's knowledge can – at this stage – outline the difference between the two. Even the *grasping itself* of the concept of "question" actually presupposes such a difference to be tacitly assumed – the difference between answers "11" and "1+10". But the former is effectively equal to the latter, identical, thus entailing the principle of substitutivity; such a principle was actually explicitly legitimated when the identity sign, first introduced between equal series of peeps (ideophonetic numerals), was used to introduce arithmetical ones in their place. The difference between them is actually the one between an *extensional* and a *non-extensional context*, in which substitutivity is known to fail; but Freudenthal has no way to construe o explain it in LINCOS, for it would appear as a contradiction such as "1+10 = 11 ∧ 1+10 ≠ 11"; the difference – for some meaning of difference that does not entail the opposite of identity – between the two expressions must be postulated as known or deductible by the receiver: but on what is such a difference grounded? It is an *operative* difference – a pragmatical one.

A computer evidently considers the two expressions "10+1" and "11" as purely synonymous; the same is not valid for an actual speaker, for whom – as is specially clear when it comes to more complex calculations – the equivalence of the two is not immediately self-evident, but must be reached through a possibly lengthy analysis. In this case it is legitimate to suppose the difference between the two expressions would be construed as that between *operation* and *result* – but this layer is unattainable by formal logic alone: it is the layer of communication, requiring for its definition the existence of an *interpreting receiver*, and not merely a function or combinatory mechanism.

As a side remark it can be interesting to note the questions here discussed are simply quantifier-like mechanisms, and not actual dialogic acts – which will come much later in Freudenthal's project: they are the questions pertaining to the possibility of a *mathematical discovery*. Their introduction is seen by the author as a way of underlining the fact that mathematics must not be considered merely as an axiomatized tank of tautologies, but as an «art of discovering» (1.12): this same phrase, knowingly or not, can be literally traced back to Leibniz, whom in his *Generales Inquisitiones* used it to define his ideal of a perfect language, a combinatory *charachteristica universalis*: «ars inventionis».

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3.3. *The definite article*

The definite article is represented in written LINCOS by a "ι" quantifier binding the variable it means to characterize as an *individual*. By deciding to provide his language with the possibility of a definite article in general, Freudenthal single-handedly avoids – and more or less drastically so – one of the problems that over the course of time have proved to provide ceaseless difficulties to philosophers and logicians alike – the one problem, actually, that first prompted Russell [5] to develop one of the fundamental traits of the notion of logical form as we now know it: the problem of the *purport of uniqueness*. The admittal of expression such as "the only x that is such and so" has actually never failed to entail the problem of how to deal with its falsehood: as is known, Russell solves the problem by considering the proposition false in the event of there being either no individual x to satisfy the description, or more than one; Carnap (cfr. Carnap 1956) is required by his semantics to define its *designatum* without referring to the truth value of the proposition the description occurs in, and explains it, in both the cases seen above, as a phantomatical enough empty set of instant-points, a^*; Quine (cfr., amongst others, Quine 1986) flips the problem over and away by treating definite descriptions as *stipulations of identity* (passable, that is, of a paraphrase more or less like "I *define* the individual x as the set of all point-events that happen to be such and so").

Freudenthal, on the other hand, sees no problem in the eventual falsehood of propositions in LINCOS, and in the possibly nonsensical results that would be caused by admitting potentially nonreferential phrases (for example – considering his operator "ι" as more or less equivalent to Carnap's *iota* – ones such as "$\iota x\dots10{<}x{<}1$", but also "$\iota x\dots100{>}x{>}1$", the former of which names no entity, whilst the latter is in violation of the purport of uniqueness). By admitting such an operator into an otherwise formalized language, Freudenthal is effectively *giving up the ideal of a significance decidable on purely syntactical grounds*: to understand whether a ι-phrase has a meaning an analysis of it – and of the things it refers to – will always be necessary: one will have to "go and see the world out there", as Carnap might have put it. But Freudenthal actually sees no harm in this possibility; quite contrarily, he interprets it as granting the fundamental option to say *meaningless things*. Such an option is to him a basic instrument of communication as we intend it: in many cases, he argues, what a formalized language would rule out as nonsense is actually granted a serious pragmatic value – a *force*, to speak with Austin [6] – specifically by

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[5] Cfr. Russell 1905.
[6] Cfr. Austin 1962.

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its nonsensical status; quite similarly, the semantical underdeterminacy of a definite description often is precisely what makes definite description so useful a tool in everyday communication, and is anyways in most cases passable of integration through contextual analysis.

As Freudenthal himself states, «LINCOS has been designed for the purpose of being used by people who know what they say, and who endeavour to utter meaningful speech» (1.31). Once again, only the presupposition of an intention on the receiver's side – both as interpreter and future source of messages – allows Freudenthal to avoid the simple axiomatization of a foolproof notational system, instead developing a language that, if used correctly, can prove to be much more useful a tool – maybe without considering how, in the process, the theoretical background in which the whole project sought legitimacy and grounding was gradually jeopardized and questioned.

3.4. *Perception*

Perception – rendered in written LINCOS with the predicate "Ani", from Latin "animadverto" – is introduced by Freudenthal in explicit violation of the semantical formalism he himself had previously codified and established. We shall as of now not be interested in debating whether the predicate, as is here exposed, could function as a serviceable translation of "to perceive", or whether the modes of its introduction actually *explain* or *define* what it means instead of simply providing with a *nominal definition* – in Descartes' and Leibniz's meaning of the term: such problems of semantical realism shall be addressed in the next section. What we shall analyze here is merely the mode of introduction of "Ani" insomuch as it is a new predicate in general, and what kind of semantics is implicitly assumed so as to render such an introduction possible and fruitful. As with all new terms, the predicate "Ani" is first defined through a previously grasped term, "Sci" – "to know", from Latin "scire". This last concept had been introduced as a dialogic result: after a dialogue between two fictitious speakers, starting with a question from one of them and ending with its full and correct answer, the questioner states that from that moment on he will "know" the answer to that question. With iteration in slightly different contexts it was then made clear that the only condition following which one could know something was having received an explanation of it from someone, and the only proof of it was being able to repeat such explanation oneself. It was a two-argument function matching couplets from the set of questions and the set of speakers to truth-values; its proper meaning was thus more exactly "has been told the answer to …". From this, thanks to a presupposition we shan't analyze here but that could fall under the name of *permanence of subject*, the receiver could presumably infer her way

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to "could in the future answer the question …", and thence to its assigned meaning of "knows …". In any case, its nature was that of a dialogic result; an answer is known once obtained; wondering whether *the one answering it in the first place* knew it himself before saying it – so long as one sticks to this reductive meaning of "knowing" – would have been meaningless. The following inference would then have been valid:

("Hx" represents the name of speaker x; "Inq" the predicate for "saying", in the broad sense of "communicating" and without explicit statement of the means of such a communication; "ℵ" is a metatextual substitute for any question)

"Ha Sci ℵ $\Rightarrow \exists$x.. x Inq Ha. ℵ"

Actually, this last was more than a valid inference: it was the semantical postulate defining the meaning of "Sci", as it could be obtained from its iterated contextual definition as we have seen it above; in Carnap's terms, it was an L-truth, the *condition of possibility* of truth in LINCOS itself. The introduction of perception actually starts by denying such a postulate.

The following is the dialogue where perception is first introduced; on the right we shall provide a serviceable translation in English of the various propositions involved.

#^{t1}ℵ^{t2}	(noise ℵ between clock times t1 and t2)
^{t3}Ha Inq Hb. ?x..t1t2 Fit x^{t4}	A tells B: what happened between t1 and t2?
Hb Inq Ha. Fit ℵ	B: ℵ.
Ha Inq Hb. Ver	A: Right.
Ha Inq Hb. Utr $\exists$(y,t,ti)..t2<t<ti<t3 $\wedge$ t ti y Inq Hb t1t2 Fit ℵ	A: Is there anyone who told you, after it happened and before I asked you?
Hb Inq Ha. Fal	B: No.
Ha Inq Hb. Utr t1t2 Hb Sci ?x t1t2 Fit x	A: Did you know it nonetheless?
Hb Inq Ha. Ver	B: Yes.
Ha Inq Hb. Cur	A: Why?
Hb Inq Ha Qia t1t2 Hb Ani ℵ#	B: I perceived it.

As we can see, the first introduction of perception is done through the denial of the aforementioned inference ("¬$\exists$(y,t,ti)..t2<t<ti<t3 $\wedge$ t ti y Inq Hb t1t2 Fit ℵ"); the fact that speaker "Hb" *knew* what happened without anyone telling him was then explained as his having perceived it. Setting aside the problem of what this explanation could have in common with a

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complex and perhaps indefinable concept as "perception", what we here have is *Freudenthal's first explicitly self-contradicting statement*. A term had earlier been introduced thanks to a definition with the rigor of a semantic postulate – an L-truth – and is now being extended by *violating the postulate itself* – by stating a proposition Carnap would have defined as L-false, and actually using it as a tool for the restructuring of a semantical field. A computer – or a formalized language system – would have simply rejected the proposition as false, hence interpreting "Ani" as "has uttered an L-false statement" – which on formal grounds would be a fully valid inference. But then, what other path of inferences did Freudenthal presuppose to validate his reasoning and define it as he meant to? What other grounds did he mean to be considered? What kind of *interpretation* is needed, and what does it presuppose?

The reasoning he assumes the receiver would follow, when interpreting the previous dialogue, to reach the notion of "Ani" as he had meant it, could be described as such:

i)   the proposition received is L-false;
ii)   "Ani א" would thus mean "has uttered something L-false concerning
      א"; but
iii) there already is a word for that, and
iv)   whoever is sending these messages has criteria of economy and per-
      spicuity to which he's until now sticked to; and
v)   he presumably *wants* to say something new with this term; moreo-
      ver,
vi)   he *does* know the language, whilst I'm still learning it, hence
vii) if I *want* to find a meaning for it I'll have to fix my definition of
      "Sci" – thus rearranging accordingly my semantical postulates – so as
      to include this new meaning:
viii) New postulate: "Ha Sci א ⇒ …∃x.. x Inq Ha. א ∨ Ha Ani א"

It can be noted that such a path of reasoning and belief revision is exactly what could be defined as "to learn from one's mistakes"; it is actually also similar to the mechanism Quine described in his *Two dogmas of empiricism*, the revision of the core assumptions of one's theory as a whole (L-truths) instead of the "peripherical" empirical truths in case of apparent falsification of the latter, whenever the operation would complexly prove proficuous (as, for example, when the revision would result in a broadening of one concept – "Sci" – as well as the addition of a new one – "Ani" – instead of simply furnishing the copy of a previously mastered concept through the use of a contradiction by a speaker who should presumably not want to say falsities).

As is made clear through the use of italics in the previous exposition of the receiver's supposed path of inference, it is only through an appeal to *the receiver's will* and to what *the receiver will presumably construe as the speaker's will* that a broadening of a semantical field can be reached; to do

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so, the receiver does not simply apply truth-values mechanically to every proposition and then calculates the whole, but *decides* what to consider true and what false following an evaluation of the consequences each truth-value would lead to: the truth of "$\neg\exists$(y,t,ti)..t2<t<ti<t3 $\wedge$ t ti y Inq Hb t1t2 Fit $\aleph$" is not found but *assumed* by the virtue of its usefulness and its complying to the communicational situation, and in its assumption is purported a revision of the semantical postulates.

Such a mechanism, learning, is here shown to imply the conjunction of *presupposition of intention in the receiver* and *presupposition the receiver will himself presuppose an intention in the source*; the two have been seen at work, separately, in the previous examples; it has also been seen, then as before, that the actual *teaching* of LINCOS – the possibility it could serve as a means of information exchange – is fully based on their tacit assumption; their conjunction thus is to Freudenthal a *condition of possibility* of communication itself: not simply alongside formalization, but much more importantly, whenever necessary, in spite of it.

4.   *Definitions. Semantical realism*

We have thus seen that the idea of a language suitable as a proper means of communication is inherently contradictory of its full formalization in classical logic, *when such a language has to be taught*, or *when it has to allow dissimmetry of information between speakers* [7]; but the doubt might still arise, whether *any logic*, paraconsistent as it might be, could indeed provide grounds sufficient to erect an entire language. One might, so to say, enlarge Freudenthal's grounds to include *both* paraconsistent logical form and some presupposition of intention within the general presupposition of communicability – there indeed could be reasons for such a move – and still maintain the original aim of being able to erect a whole semantical structure on that, a *perfect language*, for some meaning of the term. We shall now try and show how even such a claim would still be unrealistically wide; to allow such a project, as we shall see, the development of a workable semantics will require – to be even remotely intelligible – to presuppose those very categorical structures it was meant – to some degree – to *teach*.

[7] Paraconsistent logics, on the other hand, can perhaps dispose of the latter problem, and partly of the former, although there seems to be no way to allow them to bypass the issue of quasi-general definitions, it being indeed what prompted Brouwer's mathematics to assume its most controversial positions.

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In order to do so, we will discuss the introduction of a few semantical concepts in LINCOS; not before, however, a brief overview of Freudenthal's general semantics. As we have seen, LINCOS is grounded on a sharp refusal of traditional semantical analysis, accused of whittling all significance down to a system of synonymies or, more generally, intra-linguistic relationships; it aims instead at *speaking of the world*, for some meaning of that. The system itself is allegedly based on two initial ostensions, numbers and time; all other meanings will then be defined intra-linguistically, but through a series of connections the relationships thus established will always bring back to the initial ostensions, hence "anchoring" the whole semantical structure – that is, narrowing the set of possible interpretations to those preserving the two meanings thus fixed. LINCOS semantics then have, so to say, a pyramidal structure: two direct "language-world" links hold a progressively more intricated series of internal links, granted their stability by that initial anchoring. If it can be proven that all concepts can be defined sufficiently and necessarily through those two ostensions only, albeit with the mediation of an increasingly complex series of inferences (even quasi-general, for we have by now allowed the presupposition of intention within the work's general hypothesis), it will follow that the set of interpretations preserving them will have but one element, hence granting the resulting semantics completeness and closure.

What this section shall show is how Freudenthal's exposition, far from providing a *logical consitution* of such concepts, instead presupposes them as given; their being already known to the receiver will prove to be the *condition of possibility* of their interpretation; the method thus obtained will then be more of an *illustration* than a definition, furnishing but conditions necessary albeit far from sufficient to their understanding, which would require them to be supplemented with the actual knowledge of the concept itself. The three passages we shall use as a benchmark for categorical structures in LINCOS semantics are those regarding set theory, ethics and space – categorical structures *par excellence*.

4.1. *Set theory*

Set theory is introduced by Freudenthal as the last part of mathematics; such a choice is not to be seen as a statement regarding the primacy of one over the other, but merely as a way to introduce it as what it will be used for: metamathematics and, more specially, metageometry as a necessary premise to physics. The first problem about set theory is to be had in that its primary elements – sets – have to be introduced alongside its basic operator "∈", so that the strings "∈ Pri" ('belongs to the set of prime numbers'), "∈ Rat" ("belongs to the set of rational numbers"), etc., can never be specifically analyzed in their constituents. This is actually due

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to the very reasons adduced by theorists of its "primitiveness": by having only one primitive predicate (and elements of one type only), nothing can be said of sets save through the use of "$\in$", and in no context can "$\in$" be used save for sets. After these first occurrences, "$\in$ Pri" and the like could very well be interpreted as unanalyzable predicates or operators ranging over particular numbers; the concept of *set* as inequivocably itself first occurs in the statement "a $\in$ a", considered as different but interderivable with "(x) x $\in$ Num $\Rightarrow$ x = x". Such an axiom taken by itself is contradictory: not only because it opens the way straight towards Russell's paradox (which will indeed be stated and rejected as morally reproachable albeit not false), but because, lacking the possibility of developing the axiomatization deep enough to define the boundaries between first- and second-order theory, it allows derivations such as "(1$\in$1 $\Leftrightarrow$ 1 = 1) $\Rightarrow$ (1$\in$Pri $\Leftrightarrow$ 1 = ri)". Such a conclusion would completely undermine the development of set theory, and can actually be avoided only by explaining *what a set is*. Which is what Freudenthal tries to do.

LINCOS semantical guidelines prescribe, as the quasi-general definition of a concept, to provide with (a) some instances of it, (b) a list of rules applying to or properties belonging to everything falling under the concept, and – more importantly – (c) an instance of something not comprised under it. Such a rule fits perfectly most definitions (prime numbers, humans, planets); some problems would have arisen with *numbers in general*, but as we have seen they had been avoided by assuming number as known and proceeding by ostension. The system thus has it that a concept can only be defined once the language already has independent means to trace its boundaries – already has, that is, a way to refer to individuals belonging both to the concept itself and to its negation. Such an easy path is not applicable here. The introduction of sets thus begins by stating a new set "Agg" [8] (from Latin "aggregatum") to which every set belongs – instances are provided for (a); a few propositions follow stating basic axioms of set theory – the rules, as of (b); the last, fundamental issue is how to provide for (c) – an instance of something not belonging to "Agg". Moreover, defining numbers – alongside the tradition – as sets of sets, Freudenthal loses the only legitimate example of something which *is an object and not a set*; he thus provides for that (c) what – he advocates – any mathematician would name were he asked to define such a primitive notion: a non-object: a connective. We thus have, for example, "$\neg(\wedge \in$ Agg)".

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[8]) Such a move, albeit risky, is possible even when lacking a definition of set – otherwise it indeed would be circular, provided the receiver can have fathomed by incomplete induction the working rules – if not the meaning – of the previously illustrated predicate "$\in$".

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Such an operation not only purports a presupposition of intentionality and belief revision somehow more extreme than the one seen before [9]: it actually does not offer a definition of what is a set, for it says nothing about what is *not*; what it does is trace its *boudaries*, provide an illustration of it. If – and only if – the receiver has a set theory comparable to Freudenthal's, on which are based mathematics and more general linguistic operations, will he be able to interpret the exta-grammatical proposition "¬(∧ ∈ Agg)" as what it is meant to signify, something like "a set is anything that could be argument of a predicate or function; that is, anything that could be said anything of; that is, anything that could be *object of thought* (which sounds like Dedekind's definition); that is, everything *there is*". Consider that this explanation couldn't have been reached by a simple "∀x ∈ Agg", which would have simply been a banalization of the general term. This process, as the others we shall see *infra*, is not circular *per se*: it doesn't include its logical conclusion within its premises; it is *communicatively circular*, for it is, in Austin's terms, a perlocutionary act in whose happiness conditions is included the situation it is aimed at causing. All it demonstrates is that set theory, lacking a sufficiently developed metalanguage, can only be *shown* and not defined; its elements are primitive; to be understood, they have to be aready known to the receiver: only in that circumstance will he be able to attach the notion of "Agg" to a much more complex concept whose definition he had to master beforehands. Freudenthal's explanation has only resulted in *making sure it was precisely set theory the name* "Agg" *referred to*, if anything could be.

Consider, finally, that presupposing some degree of set theory as known to whomever has developed more than basic arithmetics is not such an awkward step; it is known to be derivable from those same laws of associations and seriality of thought-functions which would ground the assumption of numbers within the presupposition of communicability. As such, this first example could then be explained away: but the problematics it detailed, as we shall see, are the same Freudenthal shall encounter every time he tries and makes a semantical "step" further.

4.2. *On good and evil*

The introduction of ethical concepts ("Ben" and "Mal", good and evil, construed as sets of events of action) through a rigurously formal scheme

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[9]) For it supposes the receiver, instead of rejecting the message as meaningless and non-syntactical, or interpreting it – as with "Ani" – as an extension of syntactical rules previously used, would instead assume it as *anyhow meaningful* – for some meaning of meaningful – and try and make sense of what truth might hide behind it.

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is seen by Freudenthal as an incredible step in the construction of logistical languages and indeed one that ought to enter all canonical notations proper (cfr. 3.00.4). The definition he reaches is indeed one overlapping with *some* meanings usually attributed to those concepts; we shall now analyze how those meanings are reached, and what assumptions are necessary for them to be grasped.

"Ben" and "Mal" are originally presented as sets of events in which the speaker, respectively, says something true or false. Their first definition is then parallel to the true/false one, differing only in their object; such a ground is then expanded – through the use of a precedure analogous to the one seen for perception – so as to broaden their applicability. The following dialogue is the first to enact such a differentiation ("Tan" being more or less a translation of "but"):

Ha Inq Hb. ?x.. x=100+1	A: How much is 100+1?
^{t1}Hb Inq Ha. 100+1^{t2}	B: It is 100+1
Ha Inq Hb. ɪx...x=100+1.. = 100+1...∈ Ver Tan ɪz...t1t2 Fit z ∈ Mal	A: What you said is true, but the event of your saying it is bad.
^{t3}Hb Inq Ha. 101^{t4}	B: It is 101
Ha Inq Hb. ɪx...t3t4 Fit x∈Ben	A: That is good

The distinction is introduced in line 3 by the "Tan" operator; what it does is dissociate the moral value of an event from the truth value of propositions then uttered. But since in Freudenthal's view such a dialogue is meant not to replace, but to *broaden* the concept of moral value at stake, a *new criterion* must be put in place of the previous. Such a criterion would be, as seen before for perception, a disjunction of the various instances of something being morally reproachable: an event belongs to "Mal" if (a) it displays an utterance of falsity or (b) (as seen in the dialogue) it is an instance of uninformative answer. As subsequent examples in LINCOS speech will specify to the receiver, further clauses will be added to this disjunction, namely, (c) if it displays an unperspicuous answer to a question, and (d) if it displays the event of an unsolicited utterance – for instance, an unprompted answer by a third party. Once the definition is deemed complete, however, a more important problem arises: for a single concept to be designated by any one of those multiple occurrences, there need be a common factor, so to speak, a trait characteristic of all acts – *speech acts* – Freudenthal wishes to classify as morally reproachable. The *logical* difference between "101" and "100+1" had been addressed before (cfr. *supra*, 3.2); but how can it be associated with the utterance of a falsity – or with cases such as (c) and (d)? The acknowledging of a shared characteristic is by itself preliminary to the possibility of inferentially grasping their unifying concept; such a common

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factor arises then to the status, to this respect, of a *prerequisite* – a presup-
position; in this case, the only one shared trait between those events – the
one who ultimately will, in Freudenthal's programme, be identified with
"Mal" itself, and that as such need be known *beforehands* – is the violation
of a conversational maxim.

The notion of conversational maxim has been introduced by Paul
Grice [10] – interestingly enough, years after LINCOS was born – specifically
to seek a logical account of certain apparent inconsistencies in ordinary
speech (for example in relation to failures of the substitutivity principle).
What it essentially consists in is the assumption that an utterance *as part
of a conversation between intentional speakers* is required not only to be
true, but also perspicuous, concise and relevant; violation of one of these
maxims – implied by the cultural status of conversation – is in its conver-
sational effects fully equivalent to utterance of falsity, for the proscription
prending on the latter is but another conversational maxim. The concept of
"Mal", as we have seen it, is applied *merely and only* to events displaying the
violation of a conversational maxim; but these are no *definition* of Grice's
concept, due to a lack of necessary metalinguistic vocabulary; they can't
but *illustrate* it. Freudenthal merely presents a set of examples of certain
speaker behaviours and defines them as similar on grounds unrestricted by
any single utterance's content. A receiver that, albeit capable of linguistic
and symbolic acts, were nonetheless ignorant about all conversation – such
as Swift's *object language* speakers – would never be able to fathom what
commonality underlies those multiple occurrences, for – as we have seen – it
is not solely determined by the utterance's propositional content, but, more
importantly, by its role in a complex social interaction governed by tacitly
assumed rules. The knowledge of conversational maxims is hence supposed
by Freudenthal as known and essentially vital for the new concept to be
grasped: it is an actual *condition of possibility* of its apprehension.

4.3. *Perception and space*

Two notions will here be gathered, which Freudenthal introduced in
and applied to neatly distinct contexts; it appears, as it were, quaint that
the tight connection between such two notions hadn't been noticed and
worked upon by Freudenthal himself – but such an omission is probably
due to the relative lack of attention paid to the last part of the project,
perhaps originated by the increasing clarity with which LINCOS' structural
failures appeared alongside its development. The introduction of perception

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[10]) Cfr. Grice 1975.

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("Ani"), besides purporting problems regarding its *logical presuppositions* – as we have seen in 3.4 – implies an assumption in many ways comparable to the one seen for set theory – one the investigation of which could prove fruitful to this paper's ends.

Let us suppose, for a start, that the apparent logical contradiction following its first introduction be worked through. The receiver has hence already grasped the meaning of "Ani" within an emendated version of "Sci", which we have seen is something as "Ha Sci ℵ ⇒ …∃x.. x Inq Ha. ℵ ∨ Ha Ani ℵ"; to make out its "real" meaning, though this is far from enough: she must next figure out by herself what there could be in common between this new concept – regarding argument "ℵ" – and the *dialogic description* of "ℵ" itself. For the latter was the previous definition of "Sci"; all that is going to become the meaning of the new word has been now defined, roughly, as a way of getting the same result with a different means. The meaning must then be divined on the sole assumption that whoever is subject to "Ani" is a bearer of knowledge, that is, can talk about what he perceived; moreover, the inference "Ha Ani ℵ ⇒ ∀x..x Ani ℵ" will be explicitly denied – the predicate is not universally applicable to "Hx", differing, in this respect, from "Sci", which was true of all members of a conversation in which the thing to be known was explained. Such an inference is actually explicitly denied when, during a same conversation, just one of the speakers will perceive something he will then proceed to explain its fellow voices: this last step, necessary to the full outlining of the new notion and of its differentiations from "Sci", is what hides the assumption proper.

For this new predicate to have a meaning, that is, *something* must be assumed as common to both the perceiver and the event perceived, and not to all the others; there must be some determination – as of now completely unspoken – explaining the different reactions of various speakers to that same event; moreover, the *possibility* itself for this highly generic form of differentiation to be understood has to be *assumed* for "Ani" to be understandable – perception gathering its full meaning only once it is explained as a particular, position-driven relation of knowledge between subject and object. That *something*, as it were, is obiously space, meant literally as a form of organization (*coexistence*) of things, both subjects and objects, in a continuous and ordered series. This is not a way to surreptitiously infiltrate a new notion where apparently there was none: the possibility of grasping space as a dimension of gathering and relational differentiation of *things* in general is here not purported by "Ani", but instead assumed as a precondition necessary to its understanding. The fact that Freudenthal just tacitly assumed it merely shows how such a preliminary knowledge had to be given for granted if one wanted to carry over the introduction of a full vocabulary – even in its nonspatial elements.

Such a space, however, is left implicit and conceptually inert for the whole of the third chapter, until, in the fourth and last, it shall be char-

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acterized as space proper – albeit through a new introduction bearing no reference to this first instance. It is thus at last introduced by means of delayed speech: a dialogue is presented where various speakers interact with each other, but their messages are lagged; when they start wondering about what could be the cause of such a delay, the concept of *position* is introduced. Positions are initially represented as linear, one-dimensional numerical values; everything, both speaker and event, is defined by one and only one, and the communicational delays are then shown as proportional to the relative distances. Such an introduction, ruling out scenarios of telepathy or instant communication, appears indeed solid if any can be: time being the only dimension already known in some measure analogous to the one here to be introduced, it seems natural indeed for it to be chosen as a starting point in this new conceptualization. Giving for granted the concept as grasped, through this preliminary characterization and its following iteration and flourishment – which will progressively define space as three dimensional and thence state basic axioms and theorems both of solid geometry and physics – the system seems to work indeed. The problem arises once the mechanisms behind its grasping – the presuppositions involved – are investigated and clarified.

This characterization explains space as something *common to all speakers* and dividing them by the sole virtue of its series into positionally relative clusters: some can communicate among themselves, others are out of their reach but can nonetheless get to whomever they are reached by, and so on; moreover, those positional relations univocally determine communicational lag, which is here defined as *distance*. Such a characterization, as a definition of space, is not merely lacking: it is quite simply unacceptable. It could perhaps be construed as a general, informal description of the notion of ordered manifold on which space is to be conceptually construed (as far as it is assumed to be grounded in general group theory and thus determined: cfr. Carnap 1922). Freudenthal must surely have noticed the unforgivable limits of such a step: the only way to bypass them is quite simply to accept it to be not exactly a definition, so much as a *description*. LINCOS didn't need to *explain* space; it simply needed a way of referring to something so that *space and only space could fit the description*, forcing whomever tried interpreting the language to accept it as the new expression's *denotatum*. The way out of the problem apparently offered by the simple procedure of sending any axiomatization of geometrical space is here unavailable and explicitly forsaken on the grounds that, since none could possibly be "truer" than all others, there could always remain the possibility for the spatial *denotatum* to be misunderstood for reasons independent from the receiver's intelligence or good will (one might wonder, as an example, what Descartes would have gotten out of Hilbert's axiomatizations of geometrical space). Quite analogously, it is trivially and *ex hypothesi* impossible to *teach the spatial category* (the pure form of external intuition, as it

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were) to one who doesn't possess it. Such is not Freudenthal's point; his is merely in providing conditions sufficient for it to be clear that *space is what he's talking about*; which, in some way, is simply a pragmatic extension of the quasi-general definition method. The *descriptum*'s knowledge, its being there already for the receiver to grasp (or, so as to mitigate this expression's metaphysical realism, the possibility for it to be construed within the receiver's categorial structure – his *theory* – hence presupposed as totally analogous to ours) is a *condition of possibility* for the grasping of the concept purporting to define it. As seen for set theory, such a procedure is not circular: it is, quite simply, no longer a *teaching* proper: but rather, in some way, a translation without a shared language.

We have thus outlined what could be defined as Freudenthal's realism. Faced with the challenge of developing a semantics covering every possible field of experience, he has been forced to a halt by the simple fact that any interpretation of an unknown language, when prescinding from ostension or a shared linguistical system, need pass through a language, if any, known to the receiver – that is, through her theory – her *organization of the world*. Albeit the reluctances and perplexities often expressed, Freudenthal is thus forced to assume all he talks about *already exists*, for some meaning of the word, limiting himself to offering exeplifications apt to point inequivocably, case after case, to the one and only thing the concept could refer to. This not only presupposes everything he refers to as already known to the receiver; it also implies no categorial structure possessed by the receiver unbeknownst to him, for then his definitions would not be granted unambiguity. What Freudenthal's semantics does is thus simply offering names *a posteriori* for a repository of referents – of "things" – whose previous knowledge need be presupposed for the process to have any fruitfulness: it is then not a didactics and not even an encyclopedia, but a mere vocabulary.

5.   *Conclusions. Hans Freudenthal's transcendental logopedy*

The initial aim of all logistical research had been to investigate the innermost laws of thought insomuch as they pertain the activity of judgment as it is expressed through ordinary language; the latter's limits, inconsistencies and apories have gradually prompted philosophers and logicians to postulate at its core a layer where such disorder could be absent. Such a layer had then been adopted by logical empiricism as a foundation for an epistemologically sound constitution of sciential knowledge, and by some ordinary language philosophers as a way of understanding the role of *meaning* in human behaviour. From the same assumptions follows its choice as core structure for a modern-day *characteristica universalis*; such, in fact, ought to have been its first and ethically foremost application; such

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is LINCOS' aim, albeit participating of its age's sci-fi concoctions. The failure of Freudenthal's project illustrates the fundamental inconstistencies in its logical assumptions, and preconizes or entails the failure of projects sprung from the same fount.

As we have seen in section 3.2 through 3.4, a first halt in Freudenthal's logical firmness is caused by its structural inability to deal with some syntactical refinements ordinary communication can't seem to do without; namely, questions and the dissymmetry of knowledge they reflect, definite articles and their implications, and apprehension and belief-revision processes when faced with core assumptions or semantical postulates. As we have hinted before, though, such limitations could be due to Freudenthal's (and Russell's, and Carnap's, and most of that time's philosophers' in general) too narrow conception of logical form; three- or four-valued logics, or paraconsistent deductive structures, might now seem much more appropriate for the task. Nonetheless such languages would have encountered the same difficulties every time their author was faced – as was Freudenthal – with the clash between the need for formalization and the aim at providing an effective tool for communication between speakers. In all such cases, the natural reaction – indeed, the only one compatible with the project's meaning – was to "loosen" the logical restrictions so as to allow more room for communication. The result, as it were, is a language apparently and graphically fully formalized, but in fact (a) lacking an analytical semantics; (b) lacking a rigorous syntax; (c) lacking syntactically-based meaningfulness criteria; (d) lacking L-truths and substitutivity principles; (e) ambiguous in its treatment of quantifiers, variables and failed descriptions; (f) lacking a critera for the purport of existence. But it can be noted that these characteristics are exactly the ones whose discovery has prompted the elaboration of a logistical language to begin with; LINCOS – as it has appeared after this analysis – is as ambiguous, imprecise and inconsistent as any ordinary language. On the other hand, sections 3.1 and 4 have indeed posed another kind of problem, the one previously named "Freudenthal's realism"; the project also fails in its attempt at outlining a formalized semantical system – that is, its attempt at teaching new objects or concepts through an axiomatic or definitory way. The author of LINCOS seems in fact necessitated to assume the existence and self-evidence of everything he intends to talk about, even when, apparently, he manages to derive its notion from the two "anchor-points" or initial ostensions. It is at this point noteworthy to underline that the problem of quasi-general definitions as we have seen it hides within itself the more general problem of the concept of *concept*; what underlies the inductive process they mean to stand for is the formation of a universal or general concept from a limited array – indeed, not a *series* – of its instances. The difficulty in allowing them thus parallels or includes the assumption that a common concept of *concept*, thus a common logical theory, thus a common theory of the world

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need be found prior to any communication whatosoever. Freudenthal's
need of presuppositions is thus not limited to the universe of "things" for
which names stand for, but indeed it covers the foundations themselves
of both all allegedly self-evident or "innermost" logical structure, such as
the concept of concept, and of its purported communicative aim, such as
intentional structures and Grice's maxims.

All these failures entail nonetheless some discoveries Freudenthal
himself was not fully aware of. The first is that he has, if half-heartedly,
underlined the limitations of the concept of logical form. A fully formalized
logistical language, lacking a metalanguage in which the logician can allow
himself all sorts of inconsistencies so long as they don't show up in the
object-language [11], far from being the "deep structure" or the "condition of
possibility" of speech, appears now for what it is: the *conscious reduction
of ordinary language aimed at accomplishing certain aims*. Such aims, philo-
sophical or otherwise, need not subsequently be uninteresting, shallow or
deceptive, but quite simply *static*, not communicative. It is, as it were, an
imprecise translation – a partial one – of the ordinary language. LINCOS'
failure has also shown, not only before Grice but also without clinging
to the logicism the latter couldn't manage to forsake, how the *communi-
cative use* of language subordinates its logical component to the stronger
principles of *intentionality* – in their double – or even triple – version, as
advocated by Strawson. Lastly, Freudenthal's realism can be inscribed in
the broader category of Quine's indeterminacy of translation problem:
as his attempts have shown, semantical teaching can apply only *within* a
categorial framework – a theory – and hence obviously can't include the
theory itself; for a theory to be taught in an allegedly "neutral" idiom it
is actually necessary to implicitly assume such a theory as a root of said
language itself, thus rendering it unfathomable to whomever might lack
it – as for the teaching's supposed recipient [12].

What LINCOS' project thus appears to be is a negative analysis of
the limits of logistical language – both syntactical and semantical – and
a survey of the requisites a language is required by the needs it is called

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[11]) Following Quine's famous exhortation to "kick epistemology back upstairs" (cfr.
Quine 1960).

[12]) Both failures, it can be noted, have to do with LINCOS' *dynamic* aims more than
with the language's structure itself; the logical inconsistencies, as has been seen, only pertain
to its communicative uses, and are of little or no consequence to a formalized language aim-
ing at a sound constitution of scientifical knowledge; but such a language would be a *subset*,
and not a deeper structure, of ordinary language itself. Quite similarly, Freudenthal's realism
ceases to be a philosophical position and becomes an insurmountable problem only when
its aim is not simply the development of a formalized dictionary – as has been, more or
less successfully, already done – but the actual *teaching from scratch* of such a dictionary – a
dynamic enterprise.

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upon for: *communicative needs*. Such needs, rendered more transparent by Freudenthal's didactical project, configure by themselves a sort of map of the *conditions of possibility* of linguistic communication as we mean it, pertaining both to the structure of the language and the categorial framework of those who are to use it; LINCOS could then be defined the application, albeit failurable, of an integral transcendental logopedy.

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