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FRANCO SPISANI

LOGICA DEGLI OPPOSTI E LOGICA DELLA CONTRADDIZIONE

In occasione del IV Congresso Internazionale di Logica, Metodologia e Filosofia della Scienza, nel settembre 1971, ho incontrato a Bucarest il Presidente della Repubblica Romena. All'uomo che piú decisamente ha concorso a cambiare il volto della Romania (proprio quest'anno ricorre il decimo anniversario della presidenza di Ceausescu e della sua assunzione della segreteria del Partito), ho chiesto quali sviluppi fossero prevedibili nei rapporti culturali e scientifici dei nostri Paesi. Egli ha risposto che molto si è fatto e molto ci si appresta a fare: ha confermato la sua fiducia in un progresso comune dei popoli.

Da allora si è percorso un lungo cammino. Scienziati romeni e italiani hanno potuto incontrarsi a Roma come a Bucarest, a Bologna come a Iași, e, nella capitale della Repubblica Romena, nel maggio 1973, in un clima di partecipazione attenta, si è svolto quel Simposio sulla Logica Produttiva, di cui in questo numero della rivista, dedicato al XXX Anniversario dell'Indipendenza romena, vengono pubblicati gli Atti nella sintesi di Stancovici e Stanciu.

Gli studiosi romeni hanno pienamente compreso l'urgenza e la necessità di proporre, nell'ambito della logica, il problema vivo della dialettica oggi: non semplice antitesi di elementi di cui ciascuno — nella prepotenza di un sistema — concorrerebbe a frenare, comprimere o dominare l'altro (il suo reale ovvero presunto antagonista o sottoposto); non piú, neppure, la vocazione d'accordarsi apertamente con l'avversario, ma l'emergenza della contraddizione (che prima di tutto è autocontraddizione), capacità, cioè, di confermare il valore autosintetico del rapporto.

Non sono solamente i concetti, gli elementi del discorso, i frammenti dell'universo concettuale, a procedere, dall'interno, alla realizzazione libera di sé: sono gli uomini, i popoli, quando l'arbitrio lasci posto all'esercizio dell'autonomia. Essi danno cosí la "misura" di se stessi.

La logica dialettica come logica dell'autocontraddizione, non crede nell'immobilità dell'*identico*. Non tenta di fingersi — di fronte o contro —, la *differenza*: è convinta della capacità dell'*eguale* di produrre, esso, il diverso, di andare avanti, di momento in momento,

non autoritariamente, ma liberamente, nel moto della propria determinazione.

La dialettica può creare un mondo di esseri liberi, senza cadere nella pragmatica immobilità di un "vero" e di un "falso", che, come giustapposizioni (persino intercambiabili) spegnerebbero il processo della definizione interna delle sintesi.

Sono i canonizzatori della dialettica di vecchio stampo, gli epigoni del tardo hegelismo, a diventare, oggi, gli alleati delle soluzioni pragmatiche, "classicheggianti"; ed un simile modo di concepire il processo dialettico va respinto, perché contrario alla realizzazione, nel contesto concettuale, come in quello storico, umano, di quei fattori che si vorrebbero ridotti, dalla logica del dominio e dell'oppressione, a caratteri attributivi, subalterni, secondari di una presunta primalità della sostanza: mondi immobilizzati, nella fissità del succubo, del soggetto, nell'indifferenza dell'*eguale*.

Nel mondo della logica — come in quello della vita — non vi possono essere *stati* privilegiati e dominanti. L'universo concettuale ed umano riconfermano il valore della loro autonomia. Nessuno ha diritto di stabilire dall'esterno ciò che può trovar integra la forza d'un cambiamento interiore. La dialettica per questo è rifiuto della stasi. Non basta guardare al *positivo* e al *negativo*: c'è l'autosintesi che afferma, dal proprio interno, la sua piena reale autonomia.

Per questo si può parlare di collegamento dei processi logici — e, in generale, di tutti i processi — alle manifestazioni di "partecipazione diretta", in cui si realizza quella che è stata chiamata "etica dell'eguaglianza" [1].

Ancora è il principio di autodeterminazione che può condurre al dissolvimento ogni politica autoritaria fondata "sull'impiego della forza" [2]. E sono le forme oppressive d'un pensiero che si collega, nella teoria come nella prassi, alla violenza di forze egemoni a provocare quello stato di disagio e di ribellione che ha sconvolto l'intera umanità sino a indurre a chiedere con sempre maggiore consapevolezza la cessazione dell'esercizio ravvilente della logica del dominio [3].

[1] N. Ceausescu, *Lo Sviluppo della Democrazia Socialista Romena*, in *Scritti Scelti* (1972), vol. III, Milano, 1973, pp. 105-106.

[2] N. Ceausescu, *Distensione e Lotta di Liberazione Nazionale*, in *Scritti Scelti* (1973), vol. IV, Milano, 1974, p. 307.

[3] Cfr. N. Ceausescu, *La politica Antimperialista della Romania Socialista*, in *Scritti Scelti* (1973), vol. IV, p. 324.

FRANCO SPISANI

THE LOGIC OF OPPOSITES AND THE LOGIC OF CONTRADICTION

At the 4th International Congress of Logic, Methodology and Philosophy of Science, held in Bucharest in September 1971, I had a chance to meet the President of the Rumanian Republic, the man who has most decisively contributed to changing the face of his country (this year, 1975, sees the tenth anniversary of Ceausescu's Presidency and his leadership of the Party). I asked what developments he foresaw in the cultural and scientific relations between the two countries, and he replied that much had been done and much was shortly to follow. He reiterated his faith in a common progress between nations.

From that time we have indeed come a long way. Rumanian and Italian Scientists have met in both capitals, in Bologna and in Iași. In may 1973, Bucharest was the scene of a Symposium on Productive Logic, held in a climate of eager participation; and in this issue of the review, which is dedicated to the 30th Anniversary of Rumanian Independence, the proceedings of the Symposium are published in the summary of Stancovici and Stanciu.

The Rumanian scholars fully appreciated the urgency of the need, in the field of logic, to tackle the root problem surrounding the dialectic today: not a simple antithesis of elements, with each one competing — from within an overbearing system — to check, impose on or dominate the other (its real or assumed antagonist or subordinate); nor indeed a call for artful compromise with the opponent, but the emergence of a contradiction, which is first and foremost self-contradiction, a capacity, that is, to confirm the autosynthetic value of the relationship.

It is not only concepts, elements of the discourse and fragments of the conceptual universe which progress, internally, towards free self-fulfilment. Men and peoples will, too, as soon as their wills leave room for the exercising of autonomy. It is in this way that they provide the "measure" of themselves.

As a logic of self-contradiction, dialectical logic does not believe in the immobility of the *identical*. It makes no attempt to invent its *difference* — standing opposite or against it. It is convinced of the capacity enjoyed by the *equal* for producing its own difference

by itself, for going ahead, from one moment to the next, in a free, non-authoritarian way and a rhythm of self-determination.

The dialectic manages to create a world of free beings, without falling into the pragmatic immobility of a "true" and a "false": for these, as juxtapositions (and interchangeable at that) would eclipse the process of inner definition of the synthesis.

It is the canonizers of the dialectic of the old school, the epigonae of latter-day Hegelianism, who have today become the allies of pragmatic solutions of a "classicizing" kind. Any such way of conceiving the dialectical process is to be rejected: for this is to oppose the attainment of those factors, in the conceptual as in the human, historical framework, which the logic of dominion and oppression would like to see reduced to a role of secondary, attributive elements, subordinate to an alleged primacy of substances: worlds frozen in a fixed static nature of succubus and subject, where the *equal* remains indifferent.

In the world of logic — as in that of life — there can be no privileged, dominating *states*. The conceptual and human universes reconfirm the value they place in independence. No one has the right to establish from without what may be found by the force of internal change if left uninterfered with. For this reason the dialectic rejects stasis. It is not enough to look to *positive* and *negative*: one also has autosynthesis which, from its own interior, asserts a full and real autonomy of its own.

One may accordingly speak of a link-up of logical processes — and of all processes generally — with the displays of "direct participation" through which what is known as the "ethics of equality" has been achieved [1].

Once again, it is the *self-determination principle* which can lead to the dissolution of authoritarian politics based "on the use of force" [2]; and it is the oppressive form of thinking which connects, in theory as in practice, with the violence of imperial forces, that has provoked the state of alarm and rebellion which has thrown the whole world into turmoil. One reaches the point of demanding with growing insistence that a halt should be put to the humiliating employment of a logic of dominion [3].

[1] N. Ceausescu, *The Development of the Rumanian Socialist Democracy*, in *Selected Essays* (1972), vol. III, Milan, 1973, pp. 105-106.

[2] N. Ceausescu, *Détente and the Struggle for National Liberation*, in *Selected Essays* (1973), vol. IV, Milan, 1974, p. 307.

[3] Cf. N. Ceausescu, *The Anti-imperialist Policies of Socialist Rumania*, in *Selected Essays*, (1973), vol. IV, p. 324.

GIANCARLO ELIA VALORI *

LOGICA CLASSICA E LOGICA DIALETTICA

La riflessione sui problemi della conoscenza, sulla *validità*, soprattutto, *del conoscere* non può essere inutile nemmeno oggi che ci troviamo di fronte al « trionfo » della tecnologia, al comodo dominio della natura da parte dell'uomo.

Una riflessione, questa, iniziata con Socrate e i socratici e via via portata avanti per piú di duemila anni, lungo tutto l'arco della storia della filosofia; una riflessione che s'è sempre lungamente soffermata, prima ancora che sul rapporto dell'uomo col mondo delle cose, sul suo stesso 'modo' d'entrare in contatto con questo mondo, dato senz'altro come esistente per sé, almeno fino all'avvento dell'idealismo moderno.

La logica, come studio del "logos" — ch'è tutto insieme, come vuole la sua origine etimologica, "pensiero", "parola" e "discorso" — ha un padre legittimo, riconosciutole dal consenso degli uomini fino ai giorni nostri, in Aristotele. La sua autorità, in questo particolare terreno della riflessione filosofica, non è mai stata messa nemmeno in discussione per tutto il medioevo e nei secoli successivi, fino alla nascita della logica moderna che, nella sua novità ed originalità, non ha potuto far a meno di caratterizzarsi, almeno in parte, come "opposizione" a quella Aristotelica.

Per Aristotele, l'essere pensato e l'essere reale sono diversi fra loro: il pensiero riproduce la realtà, ma non è esso stesso la realtà. In questo Aristotele si muove ancora sulla falsariga del platonismo, asserendo che l'errore nasce col giudizio, vale a dire predicando qualcosa di qualcos'altro senza che questo qualcosa sussista realmente.

Principio informatore di questa logica è il p r i n c i p i o d i i d e n t i t à per cui A è uguale ad A. Questa legge dell'identità, immediata nella proposizione, ch'è la congiunzione diretta di due termini, nel sillogismo, cioè in quel procedimento riflesso del pensiero che collega soggetto e predicato attraverso la loro attinenza ad un terzo termine, viene applicata non direttamente ai termini, bensí ai loro rapporti. Cosí, in sintesi, il ragionamento sillogistico, almeno il piú semplice, ha questo andamento: A è B, B è C, quindi il rapporto AB è identico al rapporto BC.

Quello che la logica aristotelica non dice è il perché dell'identità

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di A e B, sicché il sillogismo lascia indiscussa la verità del giudizio, dandola senz'altro come preesistente al giudizio stesso.

Una simile posizione porta ad una conseguenza ovvia: la scienza assunta a modello e criterio dalla logica aristotelica è la scienza dell'universale puro. In questo, Aristotele non s'è distaccato di molto da Platone; anche per lui la scienza è soprattutto ricostruttiva di una realtà data ed il suo intento è quello di riprodurre fedelmente l'ordine naturale delle cose. Quindi il pensiero non ha una legge autonoma che regga e giustifichi la sua attività e viene a modellarsi del tutto passivamente sul suo oggetto: questa logica non è ricerca della differenza (misura, costruzione della realtà), ma organo della verità in sé, d'una verità *ab aeterno*, indipendente da ogni possibilità creativa autogenerativa.

Questa logica che fa del pensiero la brutta copia della realtà, è in sé tanto sistematica, definita e rigida, che ha potuto resistere a qualsiasi attacco critico per ben venti secoli. Essa ha la forza delle cose rigide e prive di vita, delle cose che sfidano il tempo perché non lo vivono. E' una logica che non ha niente a che fare con l'autocreativa dinamica del pensiero. Il principio d'*identità statica* è il suo criterio; il suo criterio è l'analisi dei prodotti immobilizzati del pensiero. Essa non è arricchimento né creazione, ma riduzione e improduttività permanente.

Certo, attraverso ulteriori riflessioni che esulano dal campo della logica per attingere quello della fisica e della metafisica, Aristotele intuisce l'importanza del principio del *divenire*, della sintesi contrapposta all'analisi, della giustificazione dell'esistenza del singolo di contro all'eternità ed immutabilità dell'universale: i concetti di potenza e di atto, di materia e di forma entrano cosí ad animare il mondo immoto della logica, ma ormai le basi sono state gettate, irrimediabilmente, per il riconoscimento dell'esistenza d'una realtà che sfugge il dominio del pensiero, che ne segna ad ogni momento i limiti, che imbriglia colle pastoie del d o g m a ogni slancio creativo [1].

Il tutto, sempre, in nome d'una verità che sovrasta l'uomo, che lo determina in ogni momento della sua esistenza; il tutto, in uno spirito di conservazione quasi feroce dei valori della tradizione, per un'atavica paura del nuovo.

[1] E del dogma elevato ad istituzione di governo si servirono la Chiesa e l'Impero per perpetuare il loro dominio: il singolo, per essi, era un'entità del tutto priva di valore, un momento dello sviluppo del reale ch'era sempre fatalmente destinato a risolversi nel Tutto, un piccolo nucleo di bisogni e volizioni che non dovevano assolutamente contrastare con quelli della collettività, o meglio della collettività soggiogata dal Papa o dall'Imperatore.

Il mondo delle cose rimase diviso, contrapposto al mondo del pensiero, per secoli, fino alla Rivoluzione francese [2].

Tutto comincia a maturare in Francia, sul finire del XVIII secolo, in modo confuso e ad un tempo chiaramente avvertibile. Nello stesso periodo di tempo in Germania, in un clima sociale e politico del tutto diverso ed ancora fortemente restrittivo della libertà individuale, si viene elaborando dai filosofi idealisti il "concetto" di libertà, risposta astratta alle concrete realizzazioni della vicina Francia, ma a suo modo certo non priva di validità.

Insieme coll'idea di libertà, si comincia ad elaborare sempre piú seriamente anche quella di "ragione", un'idea ch'è il tema conduttore di tutto l'idealismo tedesco e che addirittura trionfa nel sistema filosofico di Hegel. Hegel — giova ricordarlo — si esalta di fronte ai successi della Rivoluzione francese, tanto da pronunciare, nel corso d'una delle sue conferenze sulla storia, alcune frasi indispensabili, mi pare, per comprendere il perché dell'euforia del filosofo tedesco per i fatti di Francia: « Mai da quando il sole rimane fermo nel firmamento e i pianeti ruotano intorno ad esso era stato compreso che l'esistenza dell'uomo trova il suo fondamento nella mente umana, cioè nel Pensiero, ispirato dal quale l'uomo crea il mondo della realtà. Anassagora è stato il primo ad asserire che il *Nous* governa il mondo, ma fino a oggi l'uomo non era giunto a riconoscere che il Pensiero dovrebbe governare la realtà spirituale. Questa è dunque una gloriosa alba dello spirito.

Tutti gli esseri pensanti si uniscono nel giubilo di questa era » [3].

In queste poche parole c'è davvero, in sintesi, tutto il pensiero hegeliano, per il quale fra realtà e ragione v'è coincidenza e identità assoluta, come fra l'*essere* e il *dover essere; dover essere* che, appunto, privo di realtà concreta non ha alcun senso, come la nottola di Minerva che leva il suo volo sul far della sera e che arriva sempre troppo tardi alla meta: la filosofia del *dover essere* arriva sempre

[2] Fu proprio la Rivoluzione francese, infatti, ad abolire l'assolutismo feudale ed a sostituirvi il sistema politico ed economico della classe media. Fu proprio la Rivoluzione francese ad additare all'uomo prospettive prima nemmeno sospettate, a renderlo fiducioso di sé e capace di determinare liberamente il proprio destino.

[3] Rifacciamoci ancora alle parole stesse di Hegel per cercare di comprendere appieno la portata dell'innovazione del pensiero critico di fronte a quello classico, dogmatico, dominato e condizionato dalla logica dell'astratto. Hegel ebbe a dire nella prefazione alla « Filosofia del Diritto »: « Ciò ch'è razionale è reale; e ciò ch'è reale è razionale ». Non credo di andare molto lontano dal vero nell'asserire che la filosofia di Hegel è tutta qui, in questa doppia proposizione.

troppo tardi a dare un'interpretazione della natura e dello Stato: la realtà è sempre bell'e fatta.

Anzi la ragione è la realtà stessa, anche se, tuttavia, nella realtà, essa è talvolta alienata da sé: spetta quindi alla logica ed alla filosofia fare in modo che la ragione riconosca nella realtà un proprio prodotto e si riunifichi con sé: ed ecco delinearsi la logica dialettica. Dialettica è, per Hegel, il processo mediante il quale la ragione si riconosce nella realtà che pare come estranea e opposta ad essa, ed è anche il processo per cui la realtà si riconcilia con se stessa e si attua nella sua unità razionale. E' *sintesi degli opposti*. E in piú, come superamento dei conflitti, e quindi del male, della morte, della falsità, è la trascrizione filosofica del concetto religioso di provvidenza [4].

E' proprio in seno a questa logica che Hegel chiarisce il concetto del *divenire*, estremamente importante per le conseguenze prodotte sul pensiero contemporaneo.

Il *divenire* è la sintesi fra l'essere e il non-essere, fra ciò ch'è appena stato e ciò che non è ancora. L'essere determinato viene fuori proprio dall'opposizione fra l'*essere* e il *nulla*. Arricchito dalla riflessione su di sé, l'essere diventa concetto, soggettivo o puramente personale ed oggettivo, come si manifesta negli aspetti fondamentali della natura. Infine è Idea, cioè unità di soggettivo ed oggettivo, ragione autocosciente.

Per la logica classica, A è uguale ad A, in virtú del semplice (fondamentale) principio d'identità; per la logica dialettica, A è uguale A in quanto si oppone al non-A e, risolvendolo, lo riassume in sé come momento necessario del suo sviluppo: di qui, la portata storica, politica e sociale di quest'innovazione filosofica; infinite possibilità, prima nemmeno immaginate, s'aprono finalmente allo spirito bramoso soprattutto d'una conquista: la propria libertà e, con essa, il proprio diritto all'autodeterminazione, alla scelta.

Liberata dal limite dell'" altro da sé " la Ragione comprende ogni cosa in sé e risolve ogni problema. La Ragione è conoscenza umana in sviluppo, è libero pensiero e, applicata alla vita, ha dato luogo al mondo in cui viviamo noi oggi. Ma, a guardarla bene, la Ragione hegeliana è forse il momento meno " dialettico " del suo sistema: pur importantissimo per la formazione dalla coscienza dell'uomo

[4] Il concetto di dialettica prepara a cogliere quello di logica, definita da Hegel come scienza dell'idea pura, della ragione assoluta e quindi dell'assoluta verità o realtà. I concetti della logica sono quindi dei momenti necessari della realtà stessa, ed è per questo che Hegel definisce piú volte la sua logica come logica del concreto, diversa ed opposta rispetto a quella classica, intesa come logica dell'astratto, cioè di concetti ritenuti privi di realtà.

contemporaneo, infatti, questo concetto, proprio per la sua perfezione che, alle lunghe, l'avrebbe portato a giustificare come opposizione razionale, ogni aspetto, anche il piú immorale, della realtà, contiene già in sé il germe della propria " negazione ". Una negazione destinata a liberarlo da ogni residuo dogmatismo, a restituirgli la razionalità proprio nel riconoscimento lucido e cosciente dei suoi limiti, per i quali prima si trascurava di rilevare che ogni *identico* ha dentro di sé, non esternamente, i modi della propria contraddizione.

Ora già Marx guidato nella chiara analisi critica della realtà politico-economico-sociale dei suoi tempi, ha una grande intuizione del carattere rivoluzionario d'una dialettica in cui opera una grandissima volontà autonoma d'azione; una volontà bruciante, che lo porta addirittura a definire il rapporto che corre fra la filosofia e la prassi di vita come il rapporto che corre fra l'onanismo e l'amore eterosessuale.

La logica di Marx, piena degli echi e della stessa impostazione metodologica di quella della cosiddetta " sinistra hegeliana ", è ripensamento della logica dialettica delle mere opposizioni; è logica critica, rivelatrice di modi di pensiero che vanno oltre lo stesso schema codificato delle giustapposizioni dei contrasti del pensiero. Questo pensiero dialettico è pensiero critico e, come tale, necessariamente creativo e perciò anche autocritico, liberatorio, per l'uomo, dei limiti imposti dai fatti (sempre fatti economici) alla libera e piena realizzazione della umana personalità [5].

Riemerge chiaramente nella logica di Hegel, il significato che ha l'universalità dell'uomo, uomo che è da considerarsi libero solo se « la natura è opera e realtà sua »: solo se l'essere supera e risolve in sé il non-essere, e l'*identico* è anche *diverso*, autocontraddittorio e non semplice effetto di opposizione.

Hegel non era apparentemente molto turbato dal permanere dell'uomo a lui contemporaneo in una condizione di vita sovente subumana, del permanere dei grandi mali come la guerra, la fame e l'ignoranza: Marx, invece, sí e vede nell'abolizione della forma di lavoro alienante una possibilità per l'uomo d'autorealizzarsi.

Il concetto del superamento del valore statico degli enti logici come di quello del lavoro "alienato" e della necessità ed urgenza d'una trasformazione dei sistemi esistenti è la base perché in essi

[5] Anche per Marx, come per Hegel e per Feuerbach, la vera natura dell'uomo risiede nella sua universalità: le facoltà essenziali dell'uomo, le facoltà intellettuali e fisiche, possono realizzarsi completamente solo se ogni uomo esiste come *uomo*, solo se ogni uomo viene messo nella condizione di sviluppare le proprie risorse in tutta la loro ampiezza possibile.

possa finalmente dispiegarsi tutto il potenziale energetico, fisico e spirituale dell'uomo. Questo è senz'altro — a dispetto di tutti i canonizzatori — il concetto "chiave" della filosofia: è il trionfo d'una nuova logica delle cose, tutta materializzata degli effettivi bisogni dell'umanità ed espressiva del fondamento autocontraddittorio e perciò davvero rivoluzionario dell'intera realtà.

Si badi bene: ho detto "rivoluzionario" e non "innovatore", per dire meglio che fra il sistema dei valori tradizionali, conservatore di limitati interessi e cieco di fronte ai bisogni della collettività umana, e quello dei valori nuovi, negatore della sopraffazione, della violenza dell'uomo sull'altro uomo, deve prodursi un "crac", forse drammatico, ma certo necessario, perché i singoli individui — anche i cosidetti *individui logici* — come i popoli assaporino una libertà nuova, fatta di liberazione dal bisogno, dall'ignoranza e dall'odio: una libertà che ridía al singolo momento logico come ai popoli la perduta fiducia nelle proprie possibilità creative, nella validità di tutti quei principi che fanno capo alla dignità dell'autodeterminazione e che rendono l'uomo, ogni uomo, artefice sereno del proprio destino, in armonia colla collettività.

GIANCARLO ELIA VALORI *

CLASSICAL LOGIC AND THE DIALECTIC

Although today we find ourselves confronted by the triumph of technology and man's effortless control over nature, it still cannot fail to be use to reflect on the problem of knowledge, and above all the *validity of knowledge.*

This line of thought, which began with Socrates and the Socratics and has been handed down for more than two thousand years over the entire span of philosophical history, has tended to dwell, not so much on the relationship between man and the world of things, as on the precise " means " by which he makes contact with that world, whose existence *per se* continued to be taken for granted at least until the advent of modern idealism.

Logic is of course the study of the "logos" — which is at once, as its etymological origin suggests, "thought", "word" and "argument". It finds its legitimate father in Aristotle, a paternity acknowledged by the consensus of mankind down to our day. In this particular sphere of philosophical reflection his authority was never so much as questioned throughout the Middle Ages and down the succeding centuries until the birth of modern logic. And the latter, too, for all its novelty and originality, has had at least partly to take its stand as "opposition" to Aristotelian logic.

To Aristotle there is a difference between the being one thinks of and the being that really exists: thought reproduces reality, without being it itself. Aristotle is here still taking his cue from Platonism, with the declaration that error derives from judgement, which is to say from predicating something of something else, without that something else really existing.

The informing principle of this logic is the p r i n c i p l e o f i d e n t i t y whereby A is equal to A. This law of identity is immediate in the proposition, which is the direct conjunction of two terms. But in the syllogism, i.e. that reflex process of thought linking subject and predicate via their connection with a third term, the identity principle is applied not directly to the terms but to their relationship. In short, therefore, syllogistic reasoning, or its simplest form, follows the ensuing pattern: A is B, B is C, so relationship AB is identical with relationship BC.

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What Aristotelian logic omits to say is the reason for A's identity with B. Hence the syllogism skirts round the question of whether this judgement is really true or not, a thing which it takes as given even before the judgement itself.

Such a position leads to one obvious consequence: the science taken by Aristotelian logic as its model and criterion is the science of the pure universal. In this Aristotle is little removed from Plato: for him too science is, above all, recontructive of a given reality, while his intent is to provide a faithful reproduction of the natural order of things. It seems, then, that thought lacks a law of its own, ruling and justifying its activities: it boils down to a totally passive modelling of itself upon its object. Such a form of logic is a long chalk from research into the difference in reality (its measurement, or construction): it is the organ of truth in person, of a truth *ab aeterno*, divorced from all possible self-generating creativity.

So systematic, rigid and defined is this logic which would turn thought into the rough copy of reality, that it has resisted all critical assault for a clear twenty centuries. It has the force of all things rigid and lifeless, things that challenge the ages by never coming to grips with them. As a logic it has nothing to do with the self-creating dynamics of thought. The principle of s t a t i c i d e n t i t y is its criterion; and this criterion is the analysis of thought through its immobilized products. These is no scope for enrichment or creation, only reduction and permanent lack of productivity.

Aristotle's reflections were, of course, later to border more on physics and metaphysics than on the field of logic, and here for the first and only time he does sense the importance of the principle of *becoming*, of synthesis as opposed to analysis, of justifying the existence of the individual against the eternal immutability of the universal. The concepts of power and action, matter and form thus for the first time come to animate the motionless world of logic. By now, however, the foundations have been laid, irremediably, in a conception of a reality that exists in defiance of the powers of human thought, pointing its limitations at every turn and shackling all creative effort with the trammels of d o g m a [1].

All this, of course, in the name of a truth that transcends man,

[1] Dogma raised to the plane of a governmental institution served the turn of Church and Empire in perpetuating their hold on power: for them, the individual was an entity of absolutely no value, a cog in the development of reality, which was always fated to resolve in the whole. The individual with his small nucleus of needs and volitions must on no account conflict with those of the community, or rather of the community under the thumb of Pope or Emperor.

determining his every moment of existence. All, too, in a spirit of fierce conservatism of traditional values, out of an ancestral dread of all things new.

For centuries the material world was cut off in marked opposition to that of thought; down, in fact, to the French Revolution [2].

All this was beginning to take shape in France at the close of the 18th century in a confused and yet clearly perceptible fashion. In the totally different social and political atmosphere of Germany where individual liberty was still harshly suppressed, the same period of time saw the idealist philosophers at work on the "concept" of freedom — their abstract reply to the concrete achievements of neighbouring France, though in its own way not without a certain validity.

Along with the idea of liberty, there began to take ever more serious shape the concept of "reason", which forms the guiding theme of German idealism as a whole, and triumphs manifestly in the philosophic system of Hegel. Hegel — it may help to recall — was elated by the success of the French Revolution. Certain remarks proclaimed by him in the course of one of his historical lectures seem to me of key importance in understanding the German philosopher's real reason for exultation at events in France: " Never since the sun has stood firm in the firmament and the planets have revolved around it, has it been grasped how man's existence has its foundations in the human mind: in Thought, therefore, inspired by which man creates the world of reality. Anaxagoras was the first to proclaim that *Nous* governs the world, yet until this day had failed to recognize how Thought should rule over spiritual reality. This is hence a glorious dawning of the spirit. All thinking creation joins in rejoicing at this era » [3].

These few words are, in fact ,the nutshell for Hegelian thought in its entirety, according to which reality and reason coincide and are absolutely identical, just like *essences* and *necessities*. For

[2] The French Revolution it was that did away with feudal absolutism, replacing it by the politico-economic system of the middle classes. It was the French Revolution which steered man towards hitherto undreamt-of horizons, giving him confidence in his own ability to decide his destiny for himself in a free way.

[3] Let us refer once more to Hegel's words to try and fully understand the extent of this innovation in critical thought in opposition to classical, dogmatic reasoning, dominated and conditioned as that was by the logic of abstraction. Hegel was to say in his preface to the « Philosophy of Right »: « What is rational is real; and what is real is rational ». I scarcely feel wide of the mark in affirming that the whole philosophy of Hegel lies here, in this double proposition.

indeed *necessity* has no meaning if it lacks concrete reality, much after the way of Minerva's bat which wings upon its way at the fall of dusk, and always arrives too late at its goal. The philosophy of *necessity* always arrives too late to give any interpretation to nature and the State: reality has by that time always done and had done!

Reason is indeed reality itself, even though in reality it is on occasion alienated from itself. It is the job of logic and philosophy to enable reason to recognize reality for its own product and be reunited with itself: along these lines the course of dialectical logic unfolds. Dialectic is, to Hegel, the process via which reason recognizes itself in reality, which is apparently estranged from and opposed to it. It is also the process whereby reality is reconciled with itself and comes alive in its rational unity. It is a *synthesis of opposing factors*. Moreover, as the overcoming of conflicts, and hence of evil, death and falsehood, it is the philosophical transcription of the religious concept which is Providence [4].

It is from within such a logic that Hegel goes on to expound his idea of *becoming*, which was to be so important for its consequences upon contemporary thinking.

Becoming is the synthesis of being and non-being, of what has just been and what is yet to be. The determinate being emerges from that very opposition between *being* and *nothingness*. Enriched by reflection upon itself, the being becomes a concept, subjective or purely personal and objective, which is to say, as it shows itself in the basic aspects of nature. Lastly it is an Idea, a unit composed of subjective and objective, self-conscious reason.

In classical logic A is equal to A, in virtue of the simple (basic) identity principle. Dialectical logic holds A equal to A in that it opposed not-A and by resolving it, embodies it in itself as a necessary step in its development: and hence the historical, political and social import of such a philosophical innovation. Infinite possibilities, hitherto unimaginable, are opened up to the spirit which yearns above all else for one particular conquest: its own freedom and, along with that, its own right to self-determination, to choice.

Freed from the limitation of "otherness", Reason incorporates everything in itself and solves every problem. Reason is human

[4] The concept of dialectic prepares one to accept that of logic according to Hegel's definition of it as the science of the idea pure, of reason absolute and thus of absolute truth or reality. The concepts of logic are accordingly necessary components of reality itself, which is why Hegel several times defines logic as the logic of the concrete, differing from and indeed opposing classical logic, which is taken as the logic of abstraction, or that is, of concepts held to be devoid of reality.

knowledge in formation; it is freedom of thought which, when applied to life, has given rise to the world we live in today. But, on closer inspection, Hegelian Reason is perhaps the least "dialectical" element in his system. Despite its great importance in the formation of awareness in contemporary man, the very perfection of this concept which, in the long run, would have led it to justify every aspect of reality, even the most immoral, as being *rational opposition*, actually encloses within it the seed of its own "negation". A negation destined to free it from all residual trace of dogmatism and restore it to rationality by the very recognition, in lucid conscious terms, of its own limits. For previously it had failed to note how every *identical* holds within itself, and not external to it, the seeds of its own contradiction.

What is to distinguish Marx in his clear analysis of the politico-socio-economic reality of his times is his great insight into the revolutionary nature of the dialectic. He burns with an independent desire for action, a desire that leads him to the point of defining philosophy's relation to practical life as akin to that between onanism and hetero-sexual love!

Marxian logic, which abundantly echos, and adopts the same methodological approach as, the so-called "Hegelian left-wing", is a re-thinking of the dialectical logic of mere contrasts. His is a critical form of logic, revealing lines of thinking that go beyond the codified scheme of juxtaposed contrasts in thinking. Being critical, therefore, such dialectical thought is also creative — even destructive of stasis, for this reason, a form of liberation for man from the limits that "facts" (economic facts, of course) impose on the unimpeded, free fulfilment of his personality [5].

Hegelian logic clearly re-emerges and the significance it attaches to man's "universality": for man can be held to be free only if "nature is his own work and reality": only if being transcends and resolves non-being, where *identical and different* are self-contradictorily the same, and not the simple effect of opposition.

Hegel was not apparently distressed at the continuing existence of his fellow-men in often sub-human living conditions, or at the persistence of the major evils, such as war, hunger and ignorance. Marx was, on the contrary, and saw some hope of self-fulfilment for mankind in the abolition of alienating forms of labour.

The idea of a breakthrough beyond static values for logical

[5] In Marx's view, as in that of Hegel and Feuerbach, man's true nature lies in his universality. The essential human faculties, intellectual and physical, can only be realized if every man exists as a *man*, and if every man is enabled to develop his own resources to their full capacity.

entities, as well as job "alienation", plus the urgent call to transform existing systems and allow man's full energetic, physical and spiritual potential to blossom, undoubtedly represent the "key" to this philosophy, *pace* the viewpoint of the so-called "canonizers". It is the triumph of a new logic of things, wholly materializing out of the actual needs of men and expressing the self-contradictory, hence truly revolutionary, foundations of human reality in its entirety.

Be it noted: I say "revolutionary", not "innovatory". In other words, the clash between the traditional system of values, which conserves the interests of the Few and turns a blind eye to the needs of mankind as whole, and the new values which reject the overbearing violence of one man upon another, must result in a snap, dramatic maybe, but certainly necessary, in order for individuals — including the so-called *logical individuals* — and peoples, too, to savour a new kind of freedom, founded on liberation from need, ignorance and hatred. Such freedom would restore to single logical moments, individuals and whole peoples alike their shattered faith in their own creative potential and in the validity of all those principles associated with dignity of self-determination, where man, every man, might become the unharried forger of his own destiny, at harmony with the collective world.

IL SIMPOSIO DI BUCAREST SULLA LOGICA PRODUTTIVA

Premessa

L'idea di presentare al pubblico rumeno la concezione logico-filosofica di Franco Spisani mi sembra di particolare rilievo.

Quelli che conoscono le opere del pensatore italiano, sanno che negli ultimi anni, egli ha sviluppato tutta una serie di idee personali, assai interessanti, ora riunite nel sistema teoretico che va sotto il nome di *logica produttiva*: si tratta di un tentativo di sviluppare la logica in stretta connessione con il pensiero scientifico contemporaneo (specialmente con le tendenze neodeterministiche di tipo dialettico e la fisica delle microparticelle), per applicarla alla risoluzione di alcuni problemi scientifici per i quali sia l'osservazione che l'esperimento si rivelano scarsamente utilizzabili.

Spisani si è proposto di sviluppare una struttura logicamente capace di cogliere alcune particolarità dello *spazio* e del *tempo*, presenti a livelli improponibili al prelievo sperimentale, e attraverso ciò di allontanare una serie di carenze e difficoltà della microfisica dovute all'applicazione, in questo campo, delle logiche abituali, fondate sul principio d'identità statica (sulla dicotomía di *vero-falso* e sul concetto del carattere tautologico, improduttivo, dei principi tradizionali della *mathesis*).

Le pagine che seguono vogliono essere una fedele presentazione delle idee di questa logica, cosí come sono state espresse al Simposio di Bucarest, nel maggio 1972. I professori Stancovici e Lucian Stanciu non hanno fatto una semplice esposizione di tali idee, ma hanno cercato di commentare e di far risaltare il significato del contributo di Spisani al pensiero logico-scientifico contemporaneo, inquadrando, cioè, tale pensiero nella storia della logica e arricchendolo con riferimenti alle scienze contemporanee.

Mi è sembrato assai interessante il richiamo alla logica dialettica, congiunto al rilievo degli elementi di convergenza, con evidenziazione di idee comuni e di alcune differenze. Notevoli sono i rimandi a Kierkegaard, ad Husserl, a Heidegger, a Radulescu Motru e altri.

Degno di rilievo è anche il confronto fra le idee del pensatore italiano e quelle dei piú grandi fisici (Einstein, De Broglie, Feyman), valorizzando, in questo contesto, alcuni rimandi ad autori romeni e stranieri, come Meakişef, Guyau, Rigal, Thomson, Dumitriu, Rosescu e Calina Mare.

Si apprezza il fatto che gli autori della comunicazione, ponendo in evidenza l'originalità e il valore della *logica produttiva* di Spisani, abbiano altresí proceduto ad un'analisi critica, indicando le parti che potranno essere ulteriormente elaborate. Ci si sofferma, cosí, sul problema dell'irreversibilità del tempo e dell'entropia, idea che gli autori — anche indipendentemente dalla teorizzazione dell'*endometria* di Spisani — sviluppano con piena competenza.

Costantin Grecu

V. STANCOVICI - L. STANCIU

LA STRUTTURA DELLO SPAZIO E DEL TEMPO NELLA LOGICA PRODUTTIVA DI FRANCO SPISANI *

Franco Spisani è autore di opere assai rilevanti nella logica contemporanea. Fra i suoi lavori ricordiamo: *Logica ed esperienza* (1967), *Logica della contestazione* (1968), *Neutralizzazione dello spazio* (1968), *Significato e struttura del tempo* (1972). Egli ha pubblicato, in qualità di direttore della *International Logic Review*, numerosi articoli in cui ha presentato la concezione della sua logica.

Spisani, Presidente del Centro Superiore di Bologna, che annovera fra i suoi membri alcuni fra i piú illustri pensatori contemporanei, è uno dei rappresentanti piú validi della scuola di logica in Italia, i cui promotori sono Padoa e Peano: egli rientra, con il suo orientamento, in questa scuola, e, nello stesso tempo, apporta significativi contributi personali.

1) *Concetto di produttività.*

Accanto ad Annibale Pastore ed a Pietro Mosso, Spisani fa parte di quella categoria di logici che in epoca recente si sono posti la domanda che concerne il problema per cui la logica presenterebbe, non una sola forma, ma una diversificazione formale. Anche in questo senso Spisani è con Bogdan V. Sesic [1], uno dei piú importanti continuatori del pensiero logico dialettico.

La *logica produttiva*, che si trova alla convergenza di due curve d'evoluzione del pensiero filosofico contemporaneo, comincia ad operare una triplice distinzione fra i sistemi:

1) *sistemi logici dogmatici*, in cui il *vero* e il *falso* appaiono come criteri perentori (sono propri delle ideologie autoritarie; non offrono la possibilità di una differenziazione, ma danno solamente opposizione o giustapposizione);

2) *logiche formali*, in cui il *vero* ed il *falso* dipendono da una discriminazione extralogica e non sono superati in se stessi, in quanto i due termini sono intercambiabili;

3) *logica produttiva*, che pone alla base della *mathesis*, non il *vero* od il *falso*, bensí l'*identico* ed il *diverso*. Entro questi limiti, anche *vero* e *falso* si giustificano come *differenze*.

A guardar bene — sostiene Spisani — non si tratta di due pro-

* Comunicazione tenuta all'Istituto di Filosofia dell'Accademia di Scienze Politiche e Sociali di Romania nel quadro del settore di Logica e di Epistemologia. La comunicazione ha subìto delle modifiche in seguito agli interventi dei partecipanti.

[1] Cfr. B. ŠEŠIC, *Logic of Change*, Ed. C.S.L.S.C., Bologna 1972.

prietà, ma di una sola. L'*identico* è uguale a se stesso, perché produce il *diverso*, ed il *diverso* è differente perché si pone come *uguale*, converge cioé verso l'*identico* e lo realizza. L'*identità* e la *differenza* sono due aspetti della medesima realtà determinabile sul piano della *mathesis*.

Hegel considera che, per il funzionamento dei princípi d'identità e di contraddizione, siano peculiari sia la sintesi che l'analisi, ed ammette, poi, la loro intrinseca correlatività: il *principio di contraddizione* contiene nella sua formula, non soltanto la vuota e semplice eguaglianza con sé, e neppure la semplice presenza dell'*altro* in generale, bensí un'*ineguaglianza assoluta* in sé contradditoria.

Lo stesso *principio d'identità* contiene un movimento di riflessione come toglimento del modo d'essere qualcosa d'altro. Ora Spisani, fondandosi sul principio d'identità autodifferenziata — che diversamente dallo hegelismo non ammette una pluralità ipostatica d'opposti — mette a punto una logica autogenetica che, in base ad un formalismo adeguato, fissa le regole di fondo. Cosí il lettore prende in considerazione parallelamente alla logica formale classica, le idee di doppia differenza, di prodotto fra l'*identico* e il *diverso*: è produttiva quella logica che non si limita ad affermare la presenza delle "variabili" e delle "costanti" nel discorso, ma tende ad estrarre nuovamente (a produrre) la variabilità dalla costanza dei rapporti formali che operano all'interno di qualsiasi universo concettuale e che, nel campo della matematica, rappresentano la relazione di addizione, di sottrazione, di moltiplicazione e di divisione (nel caso della logica formale, l'implicazione, la congiunzione, la disgiunzione e cosí via) [2].

La nuova logica elimina la natura puramente analitica della *mathesis* come pure il suo assoggettamento al criterio empirico: è produttiva nel senso che le condizioni logiche — e di conseguenza scientifiche — risultano dallo sviluppo intrinseco del processo logicale. La logica produttiva si propone, cosí, come antidogmatica, antidiscriminante ed autogenetica.

Spisani avverte che non dobbiamo intendere per *produttività della logica* quello che si includerebbe sotto la nozione di logica macchinistica, ingegneristica, economica, funzionale, pratica. Per cui, tracciando una linea di demarcazione da A. Pastore e da P. Mosso, ai quali rimprovera di non aver insistito nel precisare la natura produttiva della tautologia (essi limitandosi appena a "smascherare" l'errore tautologico), Franco Spisani si avvicina ad A. Dumitriu nella

[2] Cfr. F. SPISANI, « Fondamenti di Logica Produttiva », in *Rassegna Internaz. di Logica*, Nr. 1, maggio 1970, p. 6; Cfr. anche A. DUMITRIU, « Logica produttiva », in *Revista de Referate şi Recenzii*, vol. VIII.

critica che fa della tautologia uno strumento di definizione logico-matematica. Spisani sostiene che la tautologia non rappresenta altro che una definizione circolare, che contravviene alle regole della definizione.

Tra gli orientamenti fondamentali della logica, già l'*intuizionismo* considera il metodo analitico come una funzione naturale dell'intelletto umano. Sotto questo aspetto sembra che l'intuizionismo rappresenti un passo in avanti rispetto al *formalismo* e al *logicismo* in quanto considera l'intervento logico e l'invenzione matematica come un prodotto della mente umana.

Tuttavia, l'*intuizionismo* non è la chiave di volta della *logica produttiva*. Questa si propone come costruzione autonoma.

Dal punto di vista della *logica produttiva* — afferma Spisani — possiamo considerare un'entità arbitraria (*a, b, c, d* . . .) in relazione con la quale ci proponiamo di dedurre tutte le possibili differenze, con l'ausilio dei rapporti di addizione, moltiplicazione, sottrazione, divisione (R+ R · R— R :). In luogo di *a* si possono considerare le differenze *b, c,* o qualsivoglia altra entità numerica (*n*), per ritornare all'*identità* con la misura della *differenza*.

Si prenda, poniamo, un numero *n*. Lo si ponga in una qualsiasi relazione con se stesso: *n* (*R*) *n*. Possiamo scrivere:

$$n + (n—n) = n \qquad n : (n \cdot n^{-1}) = n$$
$$n — (n—n) = n \qquad n \cdot (n : n) = n$$

Qui, di fatto, le relazioni fondamentali, in corrispondenza alla *logica matematica*, si riducono a quattro, e si può quindi scrivere:

$$a\ (R+)\ a \qquad a\ (R \cdot)\ a$$
$$a\ (R—)\ a \qquad a\ (R :)\ a$$

da cui risulta che, cambiando il termine di riferimento, si hanno proposizioni tendenti alla determinazione di quantità, in aritmetica, e alla determinazione di posizione in logica.

In questo modo la tautologia non è semplice espressione che non dica niente di piú di quanto ha detto all'inizio. Apre, anzi, a questo punto, un'immensa zona di pensiero. La logica produttiva è proprio il modo di ricavare il *diverso* dall'*identico* (sulla base dell'identità) e di far di questa la matrice generale di tutte le uguaglianze ed inuguaglianze. In tal modo, i criteri *vero-falso* della logica dogmatica e della logica formale lasciano posto alla misura dell'*identico-differenziato*.

Le conseguenze sono importanti: per la *logica produttiva* il princípio d'*identità statica* (o tautologica) non ha valore. Vale solo l'identità in movimento (autodifferenziazione dell'identità). La distinzione di criterio logico di *vero-falso* vien meno; ed appare il criterio autosintetico dell'*identico-diverso*.

La *logica produttiva* presenta, cosí, evidenti analogie con la logica dialettica. Tuttavia, la logica hegeliana, appesantita da significati metafisici, perde di vista il motivo dominante dell'autocontraddizione. La "produttività" della logica hegeliana è espressione di uno stato del pensiero che si autodifferenzia costruendo il mondo demiurgicamente, ma astrattamente. Nella sua forma capovolta, la dialettica genera la concezione che piú adeguatamente rimanda alla concretezza, concezione per cui l'ordine ontico si auto-esprime.

2) *Il principio di identità concreta.*

La logica produttiva non afferma né il pensiero come *Logos*, in sé, né la storia come pura giustapposizione di opposti (dove le manifestazioni dialettiche finirebbero per compromettersi con le tendenze pragmatiche), ma sostiene che ogni avvenimento dell'universo deve essere inteso come movimento d'identità che si autodifferenzia. Logica del movimento è differenziazione da sé.

La logica produttiva dimostra matematicamente la possibilità di diversificare la relazione d'identità, nelle quattro dimensioni fondamentali delle operazioni aritmetiche, palesando, cosí, il senso autogenetico, analitico-dinamico del pensiero.

Non bisogna disgiungere il principio d'identità in *astratto* e in *concreto* per farne uno strumento di conoscenza dialettica, o, se si intraprende questa via, occorre preliminarmente dimostrarlo, e non solo enunciarlo, come un assioma.

Fra la tautologia A ed A e l'identità concreta A e W, che riceve la struttura del flusso in cui si muovono gli elementi dell'universo concettuale, non si definisce alcuna differenza logica, se essa non sopravviene come risultato di un argomento dimostrativo. Si potrebbe al massimo sostenerla come punto di vista presupposto e non definito. Ogni dimostrazione può partire dallo stesso principio di identità come è formulato nella logica aristotelica: $A=A$; ma la dimostrazione di $A=A$ deve cominciare, poi, con un momento preliminarmente dialettico, per mezzo di un'analisi che finisca per statuirne la differenza prodotta. Questo appare evidente se cerchiamo di far emergere — come si sono sforzati Poincaré, e come tenta di fare Spisani — i valori multipli in cui può essere inteso il principio d'identità, fra i quali, anche, il valore produttivo. Al di fuori della semplice tautologia, che esprimerebbe una verità indipendentemente dall'esperienza, questo principio si pone allora come espressione della stessa esperienza, come atto fondamentale di conoscenza umana: quell'esperienza, cioè, che dà un senso al *conoscere*.

Ecco da dove risulta l'intero processo: il simbolo A designa ogni oggetto o l'oggetto in genere. Nella relazione d'identità A (sembra curioso, eppure questa è la situazione reale) designa l'*altro*, il *di-*

verso. Diverso da chi? Dal secondo *A*? No: diverso da sé, dal soggetto (oggetto), in rapporto al quale *A* si è posto primieramente in relazione. *A* è identico ad *A*, ma *A* è anche diverso da sé. La differenza è stabilita -- ed espressa — come risultato dalla relazione di eguaglianza. Questo 'uguale' è la funzione cognitiva che afferma l'esistenza di un oggetto *A* e che lo conferma come identico a sé. Questa conferma ha luogo con un atto di esperienza, che certifica l'eguaglianza o l'identità; ma né l'eguaglianza, né l'identità sono stati d'oggetto che non derivino dai modi di relazione. La conferma dell'eguaglianza è quindi il risultato di un'autoriflessione, che implica, anche, la relazione immediata dell'oggetto con l'oggetto. Questa relazione dell'oggetto con l'oggetto designa intanto un'esplorazione intensiva dell'oggetto da parte del soggetto medesimo. Significa una presa diretta del pensiero rispetto alla realtà. Questa fa sí che l'espressione logica del princípio d'identità risponda alla funzione di fondamento dialettico, la cui prima caratteristica è d'essere base di una logica del reale, come logica di movimento.

Orientata intensivamente o verticalmente verso il contenuto dell'oggetto, l'espressione logica $A=A$ significa proprio l'atto fondamentale di conoscenza, il modo in cui il soggetto si correla all'oggetto nel percorso della traiettoria cosmica, luogo d'esistenza comune[3].

Niente è piú facile che lusingarsi e far credere agli altri che si pensi l'identità del tutto, lasciando cadere le differenze. L'universo, come realtà cosmica, segnala, però, la sua presenza, in ogni momento; ed è una realtà mutevole, non statica. In ogni momento, il situarsi dell'universo $\mathfrak{U}$, caratterizzato da parametri sintetici *P*, si pone con segni *S*; è captato, intanto, dal soggetto con i messaggi *m*, corrispondenti ai segnali *S*. Si può quindi scrivere:

$$\exists\, \mathfrak{U}\ p\ S - M$$

Fra *S* ed $\mathfrak{U}$ si deve stabilire una relazione d'identità logica, per avere il senso di ciò che si conosce. Ora, quello che possiamo stabilire è una relazione di equivalenza o corrispondenza, se *S* ha origine oggettuale, mentre *m* ha derivazione soggettiva. L'esperienza con-

[3] Il fondamento dei principi della logica, sulla base dell'identità, è indicato con sottigliezza da Kierkegaard, che intravvede tutti i limiti inerenti alla permanenza d'una considerazione astratta dell'identità, cui rimane tributario anche Hegel. L'identità non è che un'astrazione, una linea d'orizzonte che chiude la prospettiva quando concepiamo l'unità separata dalle sue differenze, quando ignoriamo le differenze prodotte in essa, e da essa, la sua capacità, insomma, di autodifferenziazione. Che il principio d'identità domini il principio di contraddizione e serva ad esso di base — pensa Kierkegaard — lo scopriamo senza difficoltà. Eppure non è che un limite del pensiero umano, come i monti azzurri in lontananza, quella linea che i pittori chiamano orizzonte.

(Cfr. S. KIERKEGAARD, *Journal* (Extraits), vol. 1, 1834-1846, Paris, 1963, p. 327).

ferma una corrispondenza biunivoca, ma non anche un'identità $S=M$. A livello di equivalenza, la definizione rimane ambigua. La rimozione dell'equivoco non si realizza che come conseguenza dell'equivalenza nell'identità $S=m$. Per una tale trasformazione è necessario un processo di induzione che ci garantisca che se appaiono S_1, S_2, $S_3 \ldots S_n$, come segnali consecutivi del situarsi di un universo cosmico, corrispondono ad essi sempre i messaggi m_1, m_2, $m_3 \ldots m_n$. Cioè S si trova in relazione causale con m; S_1 con m_1; S_2 con m_2; S_3 con m_3; $\ldots S_n$ con m_n. Ed è chiaro che ogni qual volta appaia S, segue tutta la serie di segnali fino ad S_n, cosí, a ben guardare, viene espressa una situazione seriale di messaggi.

Dal punto di vista logico si può affermare che non si fonda il principio d'identità, se non nel momento dell'esperienza $S=S$ ed $m=m$, come corrispondenza biunivoca tra $S_1=S_1$ ed $m_1=m_1$, $S_2=S_2$ ed $m_2=m_2$ e cosí via. Si trasforma in tal modo l'equivalenza $S=m$, in due identità $S=S$ ed $m=m$. Ma osserviamo che in tutte e due le identità funziona lo stesso fattore di relazione che afferma e conferma l'esistenza del rapporto differenziante.

Ora, pur apparendo un fattore comune di relazione, risulta matematicamente che le due identità si possono ridurre ad una singola alterità ricavata dall'essere ciascun termine eguale a se stesso. E' chiaro che soltanto in questo modo l'equivalenza si trasforma in identità, l'eguaglianza in alterità, proposta non solo in tautologia formale, ma anche in eterologia concreta. Questo breve rilievo evidenzia la funzione dell'*identità*, che una volta asserita la capacità autodeterminativa dell'*uguale* — ed intanto stabilito il suo meccanismo di relazioni — costruisce sulla base operativa una logica dell'autoproduzione.

Ne deriva l'idea che la dialettica per essere assunzione concreta del pensiero della realtà, dev'essere condotta sino al limite autotrasformazionale del concetto che l'esprime.

3) *I fondamenti dell'endometria e la struttura dello spazio.*

Nel ricercare i moduli operativi dell'*eguale*, Spisani si avvede che l'identità autogenetica, che possiamo seguire nella sua manifestazione come identità prodotta, è un immenso serbatoio della realtà, in differenziazione continua. Evidentemente, qualsiasi oggetto A, oppure B, o C, e cosí via, è identico a se stesso e ciò fa sí che esista una relazione produttiva fra A ed A, B e B, e cosí via.

Ogni dato empirico, rilevato in una ricerca scientifica, non si presenta piú soltanto come identico a se stesso, ma in un'immagine gradualmente differenziata che si passa a determinare. Ciò è dovuto ad un processo di trasformazione continua ed interna delle cose (come sostiene anche Heisenberg). Di conseguenza non è piú possibile un'indicazione puntuale in cui l'oggetto ed il soggetto si pos-

sono incontrare di tanto in tanto: l'oggetto empirico costituito nell'atto di constatazione, come identico a se stesso, appare differenziato nella pratica epistemologica (sicuramente, l'atto di analisi va oltre l'esperienza ed offre l'esplicazione dell'identico diverso da sé). Cosí, per la logica produttiva, non ha valore il princípio "dell'identità statica" (tautologia), ma quello "dell'identità di movimento" (o identità dinamica, auto-differenziazione dell'identico).

In un tal tipo di logica non è in vigore la distinzione perentoria fra "vero" e "falso"; il simbolo '~' assume il significato di "differenziante" in luogo di "non-vero".

Nella nuova logica cominciano ad essere significanti le relazioni di identità e d'implicazione, quali mezzi di determinazione della differenza.

La tendenza ad identificare il *diverso* con l'*identico* interessa, in tal maniera, la logica; e, mentre gli sperimentatori si concentrano sul dato fenomenico, sul quale avanzano ipotesi, per i logici si pone ancora una volta il problema di trarre il *diverso* dall'*identità*. E soltanto un tal tipo di derivazione spiega obiettivamente il processo logico-operativo.

Le tappe di queste derivazioni sono le seguenti: "dall'*identico* si giunge al *diverso* e dal *differente* all'*identità*" [4].

Tale movimento costituisce il carattere autogeneticamente produttivo della nuova logica, a differenza di quello formale, dogmatico della tradizione.

Dialettica e logica appaiono, cosí, nella concezione di Spisani, come ricerca unica, di fondo. L'investigazione stessa che vuole spiegare la fisica non meramente sperimentale, deve muoversi in uno spazio logico, metodicamente depurato da dati empirici. Il microcosmo, il mondo delle particelle elementari, rappresentano già uno spazio in cui la possibilità classica dell'esperienza — che presuppone un osservatore utilizzante strumenti di misura che influenzano il corso dei fenomeni — è annullata. Esiste un mondo che non è piú sperimentale. Consta di un 'vuoto' di fenomeni che rimandano al concetto dell'oggettività, privata di ogni *multiplo*, staccato, separato dal nostro *reale*, natura ridotta all'esser fuori dall'empirico, *conceptus sui*, *automorfia*, e che suscita anche la necessità di abbandonare i modelli che funzionano in schemi classici di connessione,

[4] F. Spisani, « Fondamenti di Logica Produttiva. La Differenza dell'Identico e le Logiche Dogmatiche », in *International Logic Review*, nr. 2, 1970, p. 119.

strutture eteromorfe, sostituite all'esperienza (modi di essere separati di *spazio* e di *tempo comune*) [5].

Il problema di fondo per la ricerca dello spazio sperimentale è quello della determinazione della 'misura' reale, cioé del ritrovamento di un 'metro', valore determinativo, che non sia legato e condizionato dallo sperimentatore; ciò che abbiamo di fatto, se si tiene conto della dipendenza nei confronti di valori autodeterminativi, con la rinuncia ad ogni concetto classico di misura, legato alla concezione puramente empirica dello spazio.

Questa ricerca dello spazio fisico, depurato dalla dimensionalità consueta, si chiama, per Spisani, *endometria*: l'endometria permette di guardare all'esperienza ed allo spazio vuoto d'esperienza; per l'esperimentatore s'indirizza al determinabile, cioè al *dato*, che concepisce come realtà autoidentica. Egli deve riconoscere che questa realtà è fondamentalmente complessa. Per ottenerne una rappresentazione adeguata, bisognerebbe allontanarsi dall'esperienza superficiale e approfondire la comprensione dell'oggetto fino ai suoi fondamenti dialettici. Questo fatto si realizza con una ricerca metasperimentale, e. per poter fare una simile ricerca è necessario, poi, uno strumento di misura che sia extraempirico. Perché? Perché il significato dell'oggetto si trova al di là dell'esperienza, anche se la scienza e la filosofia attuali non sono completamente sciolte da significati empirici, come sono suggeriti dal senso comune.

Proprio per superare una tale situazione, bisogna prendere a considerare gli infrafenomeni, la cui esistenza ci obbliga ad una penetrazione oltre il significato dell'empirico. Cosí la ricerca rimanda al determinarsi extraempirico del reale, ad una conoscenza che si estende al di là di una comprensione intuitiva [6].

[5] F. Spisani, *Significato e Struttura del Tempo*, Bologna, 1972, p. 8.

[6] Si va oltre i principi della geometria classica, rinunziando, così, a questi ultimi: l'esperienza non può né infirmare né confermare una qualsiasi geometria, fra tutte quelle che sono possibili.

La definizione metrica non coincide, in modo assoluto, con la determinabilità empirica. L'idea della coincidenza dev'essere respinta perché assolutizza in modo arbitrario la misura, senza alcun fondamento, facendo sí che idee valide in fisica sembrino tali anche in microfisica; e ciò non è. La misura è, per Spisani, l'elemento normalmente considerato fisso a causa del quale la microfisica è andata incontro alle piú gravi difficoltà (come quella di determinare, con la misura, la posizione e la velocità di un elettrone). Nel campo subatomico, un tale sistema di misura, è intrinsecamente inesatto e generante relazioni di incertezza.

Quando scopre le leggi della meccanica quantica, Heisemberg osserva che queste nuove leggi non possono essere coerenti. E di conseguenza l'esistenza di un principio di incertezza condiziona la consistenza del sistema meccanico quantistico.

La struttura logica del tempo e dello spazio diviene un problema centrale della scienza. Ma non si tratta di uno spazio e di un tempo misurabili alla maniera consueta; sono uno spazio ed un tempo visti con le proprietà intrinseche autoproduttive. Cosí, lo spazio è concepito come uno spazio neutralizzato (nei confronti della misura empirica) la cui determinazione non si ottiene quindi attraverso la consueta misurabilità, bensí attraverso proprietà autodeterminanti, endomisurative.

In questo spazio saranno primordiali le relazioni puramente logiche, non quelle empiriche, e cioè quelle relazioni che si definiscono, nella logica produttiva, come capaci di autosintesi. In altre parole, la pretesa di rendere valido il geometrismo galileiano-cartesiano nella sfera extra-fenomenica, microcosmica, viene allontanata.

Nello spazio naturalizzato e proposto nella sua dialettica logicità, non abbiamo piú la *geometria*, ma l'*endometria*, che studia la variabilità autosintetica dei valori logici (interni al dato numerico considerato) e ciò non si può fare che con l'aiuto di strumenti operativi superiori a quelli classici.

La spazialità che deve considerare la fisica moderna è quindi la dimensione depurata dai fatti empirici, che trascendono l'empiria. Questa spazialità non appartiene al mondo fenomenico, ma è extra-empirica. Per questa ragione lo spazio è, nella sua pura identità logica, depurato dalla presenza del fenomeno. Non significa che, per questo, lo spazio divenga astratto, cioè privo dei suoi momenti costitutivi; al contrario, esso è inteso come modo essenziale della realtà di questi oggetti.

Come spiega, in una conferenza, il fisico Richard Feynman (*op. cit.*

La critica della meccanica quantistica sollecita, insomma, l'atto radicale della rinuncia all'esperienza nelle situazioni in cui le possibilità di quest'ultima d'essere la fonte privilegiata della conoscenza, sono esaurite per l'incapacità, degli strumenti di misura, di superare le soglie della sensibilità (Cfr. R. FEYNMAN, *La Nature des Lois Physiques. Une Vision Claire et Actuelle des Structures de l'Univers*, Verviers, Marabout, Université, 1971, p. 174).

La previsione dei processi genetici delle particelle-onda e la descrizione dell'autogenesi, aprono la prospettiva per la costruzione di una nuova teoria matematica del microcosmo, che rinunzi al concetto classico di misura, piú esattamente ai modi di verifica empirico-derivata, in favore di una logicizzazione del reale.

Il problema ritorna cosí ad una classificazione degli elementi fondamentali con cui si costruisce la scienza matematicizzata, al di fuori dei dati empirici variabili. Una nuova costruzione della scienza viene fondata non sulla misura empirica, bensì sulle proprietà strutturali del tempo e dello spazio; ecco ciò che propone Spisani e che egli cerca di realizzare con la *logica produttiva* e l'*endometria.*

p. 64), crediamo normalmente che le leggi della fisica abbiano un carattere locale. Non possiamo tuttavia essere sicuri di questo.

La teoria di Spisani conferma l'idea del carattere locale (autosintetico) delle leggi fisiche, pur sostituendo al principio della sovrapposizione quantica dei microstati, la loro produzione, nel tempo, con l'eliminazione dell'assioma, affermante la possibilità estrinseca della misura.

Per riassumere, alla base dell'intera concezione endometrica, si trova un oggetto neutralizzato: lo spazio cui si aggiunge, con procedimento analogo, la funzione operativa del tempo. Lo spazio ed il tempo sono strutturati da relazioni logiche (produttive) che, nella concezione di Spisani, appaiono come entità derivabili autogeneticamente. Cosí la determinazione logica cessa d'essere quella che era: staticità di alcuni termini meramente presupposti. L'identico, divenendo capace di produrre il diverso, afferma la possibilità di superare, metodicamente, dialetticamente il dato fenomenico. E questa è la genesi della produttività delle relazioni logiche, che deve rimanere alla base della teorizzazione. La concezione di Spisani, risultato di un pensiero tutto originale, presenta un carattere dialettico incontestabile. Come si è visto, la sua concezione si sviluppa nelle seguenti fasi:

— una logica nuova, che sia produttiva, esprime l'essenza dell'atto di autogenesi;
— una tale logica non può essere una logica dell'*identico* immobilizzato, che non avrebbe carattere produttivo, ma dev'essere effetto della relazione dialettica tra l'*identico* ed il *diverso*;
— la logica parte da quelle relazioni in continua costruzione, che si fondano sul *diverso* che nasce dall'*identico*;
— una tale logica starà alla base della microfisica medesima, rimandando intrinsecamente al concetto di spazio libero da rilievi empirici. In questa maniera lo spazio non è piú lo spazio immediato del fenomeno, ma quello dei prodotti delle relazioni logiche, prodotti espressi numericamente, suscettibili di essere internamente misurabili per il processo posto in atto dall'autocontraddizione. L'intelligibilità dell'esperienza dei fenomeni della fisica — se qui di fenomeni si può parlare — deriva allora dalla intelligibilità logica dello spazio neutralizzato, che è il supporto di questa autocontraddizione [7].

4) *La crisi della meccanica quantistica e la struttura del tempo.* La considerazione della determinazione logico-genetica della strut-

[7] Sicuramente la concezione di Franco Spisani è originale e interessante, anche se lascia aperti alcuni problemi: ad esempio la dimensione estensiva endometrica come la topologia, sostituisce lo spazio di relazione con lo spazio-

tura spaziale, permettono l'elucidazione della funzionalità operativa della struttura del tempo, dimostrazione dell'esistenza di un tempo obiettivo T_n, indipendente da qualsiasi osservatore, neutralizzato, cioé, in rapporto ad ogni canone temporale empirico (tempo quest'ultimo, che in generale non ammette, se non approssimativamente, di essere quantificato).

La logica produttiva conduce verso un nuovo concetto di tempo quando è applicata alla realtà microggettuale: gli 'empasses' cui arriva l'interpretazione quantistica, sollecitano intanto l'introduzione dell'endometria e, correlativamente a questa, la fondazione di una logica che esprima il carattere autogenetico del sostrato dei fenomeni.

Spisani teorizza e sviluppa su molti piani, sfruttando la 'crisi' della meccanica quantica, un'idea che già incontriamo, in una forma meno elaborata, in C.I. Meakișev [8], autore che sviluppa la dialettica del rapporto statico-dinamico. Secondo Meakișev, il processo della conoscenza ha registrato nella sfera della scienza l'emergere della descrizione strutturale in termini di alcune leggi dinamiche e sulla scorta di descrizioni in rapporto ad alcune leggi statistiche; è un processo che continua con il superamento del momento 'statico', attraverso la scoperta di leggi piú profonde [9].

Per Spisani, il mondo, che chiama non sperimentale — poiché diviso abissalmente, per la natura delle cose, dai mezzi di osservazione di cui disponiamo —, impone la scelta di nuovi strumenti di ricerca, attraverso la ridefinizione di misura. Di conseguenza devono venir costituiti nuovi strumenti di pensiero che eliminino i pre-

luogo e la sua incidenza, nel quadro risolutivo della descrizione dei processi micro-oggettuali, sarebbe da definire empiricamente. L'idea è ingegnosa ed ha il merito di sottolineare l'importanza che raccorda il pensiero contemporaneo al problema autosintetico dello spazio. Si incontra, intanto, con l'idea secondo la quale la spiegazione della genesi dello spazio e del tempo non sarebbe un problema di epistemologia, ma soprattutto un problema cosmologico. Si tratterebbe in sostanza, di un problema privilegiato (Stancovici). L'eliminazione dell'estensibilità misurabile dello spazio equivale all'eliminazione dell'idea di spazio ideale e anche di spazio *a priori*, portandosi in discussione la spazialità empirica, risultato dell'impatto dell'oggetto con il soggetto.

[8] G. I. Meakișev, *Raportul dintre Legitătile Dinamice și cele Statistice și Mecanica Cuantică*, in *Probleme de Filosofie*, 1958, n. 6.

[9] Calina Mare, *Determinismul și Fizică Modernă, Rolul lui Metodologic*, București, Ed. Politica, 1966, pp. 192-202.

La critica a questo punto di vista, intrapresa da Călina Mare, parte dall'osservazione che la realtà deve essere concepita simultaneamente sia dinamicamente sia statisticamente. Nello stesso tempo, l'autrice accetta, fondandosi sul fatto che l'attuale tappa della conoscenza umana non può essere assolutizzata, che le leggi dell'universo non possono essere ridotte a leggi statistiche.

supposti di una logica che si dimostra valida nel mondo dei fenomeni, ma che "si spegne a causa di un vuoto di esperienza che ne sopprime il senso" [10].

La realtà, se respingiamo le tesi dell'agnosticismo e del neopositivismo, non può essere definita solo come totalità di fenomeni, perché include anche il sostrato di questi, la loro matrice genetica, "il vuoto dei fenomeni", su cui possiamo indurre in una certa misura delle informazioni attraverso la ricerca sui fenomeni stessi, ma che impone d'essere esaminato in sé, dall'interno ('endo') rinunciandosi alla presenza perturbatrice del soggetto ed alla sua precarietà nel giudizio sui fatti.

Come aveva asserito anche Husserl, "dal principio una cosa naturale, (*ein Dingreales*), un'entità dotata di un tal senso, non può apparire che *inadeguatamente* nei limiti finiti dell'apparenza. Al principio precedente si collega dunque anche il seguente: *una posizione razionale che si fonda su un'apparenza che si dà inadeguatamente, non può essere mai definitiva*" [11].

Per Husserl, solo nell'attitudine a penetrare intuitivamente nel mondo può esser visto l'extrafenomenico. Spisani si allontana con decisione da questo critismo dell'apparenza e del naturale.

Neppure la meccanica quantistica può d'altra parte raggiungere un tale obiettivo intuitivamente perché, come testimonia Spisani, lo stesso principio quantistico della sovrapposizione di due stati (*A, B*) i cui risultati iniziali (specifici per ciascuno e diversi l'uno dall'altro) sarebbero *a, b*, comporta l'*indeterminazione* dei risultati finali (*a* o *b* *b* o *a*) *nel tempo dell'osservatore* t_n e l'invalidità del nesso disgiuntivo *vel-vel* (o in un modo o in un altro o in ambedue i modi). Si constata, con l'evidenziazione del principio d'indeterminazione, il fatto che anche nel campo della teoria quantistica resta un residuo fenomenico, e ciò dimostra che la logica classica entra in crisi. La disgiunzione e l'implicazione materiale che rappresentano le strutture di base di questa logica non sono piú utilizzabili. La teoria quantistica non è capace di separare totalmente dalle modalità (classiche) del calcolo le presupposizioni empirico-intuitive di questo. Non riesce, cioè, a definire la corrispondenza temporale esatta dei microfenomeni in un tempo obiettivo, perché non può calcolare sul microsistema senza perturbare le condizioni obiettive del suo svolgimento [12].

[10] F. Spisani, *op. cit.*, p. 6.

[11] Cf. *Ibidem*, p. 12.

[12] Questa situazione sconcertante che esiste nella microfisica e che conduce a processi di calcolo artificiale e ad asserzioni indeterminate può essere allon-

La concezione di un tempo atomico e di un tempo nucleare denota una tendenza a considerare l'*endo* dei microstati, ma essendo tributaria ai metodi classici del calcolo, fondati sul tempo dell'osservatore t_n, conduce ad una struttura assolutamente discreta dello spazio e del tempo che non può essere giustificata, se non artificialmente con l'interpolazione. Con il respingere l'identità statica delle particelle elementari, Spisani afferma la loro autodifferenziazione temporale, cioé l'autoproduzione degli stati attraverso i quali si hanno il passaggio e la loro successione genetica. Deriva di qui la costruzione di un nuovo concetto di tempo, come misura della realizzazione della differenza che si produce in rapporto all'*identità iniziale* delle particelle.

Ecco la misura del ritmo e dell'espansione dell'autodifferenziazione in *rapporto alla nuova identità verso cui tende l'autogenesi.* Nell'universo microfisico, la localizzazione di una particella, di un punto (α), in un *tempo* ed in uno *spazio* propri, non rimangono "indecisi" perché non si sappia se è "vero" o "falso" che (α) si pre-

tanata soltanto con la costruzione di una teoria algebrica della meccanica quantistica che, eliminando l'algebra e la logica tradizionali, introduca nel calcolo per valori di posizione quegli stati che dimostrano come il microggetto si sposti in un *continuo* spazio-temporale e simultaneamente si autotrasformi modificando la zona in cui agisce. Si può allora dimostrare che porre fra parentesi lo strumento logico-matematico superato del linguaggio naturale e la sfera percettiva, conduce ad una concezione dello spazio e del tempo 'depurata' dall'idea di un primato della verifica sperimentale, pragmaticamente intesa.

Ciò implica l'introduzione di una *misura della differenza nel quadro dell'identità microggettuale.* Questo intervento si giustifica a maggior ragione, se prendiamo a considerare le scoperte piú recenti nel campo microfisico; le quali hanno implicato la revisione delle teorie quantistiche in questo senso. Cosí, le *particelle di risonanza,* chiamate anche « stati di risonanza », scoperta questa dovuta alla loro durata estremamente breve, in rapporto col tempo nucleare, evidenziano il loro comportamento specifico, che potremmo chiamare « produttivo ». Le *particelle di risonanza* appaiono in seguito all'interazione di alcune particelle elementari, come sono i mesoni o gli iperioni K e si manifestano inizialmente come se costituissero una sola particella secondo la quale si scompongono in particelle multiple. La durata degli stati di risonanza non ha potuto essere determinata sperimentalmente, ma solo teoricamente, dimostrandosi estremamente piccola. La necessità di misurare tali intervalli ha condotto all'introduzione delle nozioni di tempo nucleare (quantità di tempo) equivalente a 10^{-24}s. La quantificazione del tempo ha condotto all'asserzione che non esisterebbe intervallo di tempo piú piccolo di un intervallo minimo determinabile, e ciò ha creato nuove difficoltà teoretiche. Per spiegarsi queste cose, si è ricorsi ad una nuova nozione: quella del raggio gravitazionale delle particelle elementari e si è cercata in questo senso la quantificazione dello spazio attraverso l'introduzione di una lunghezza elementare che va sotto il nome di 'lunghezza Fermi' ($= 10^{-13}$ cm).

Cfr. T. Roșescu, *Timpul si Măsurarea lui,* București, ed Stiințifică, 1964, pp. 109-111; F. Spisani, op. cit., p. 30.

senti in una determinata corrispondenza spazio-temporale. L'incertezza rimane in quanto non si dà l'esatta localizzazione (misura della posizione) del punto (α) in (T_n); e questo non è il problema di una semplice verifica sperimentale del tempo di (α) in t_n. Sicuramente, considerando il punto quantico (α) bisogna distinguere il trasferimento in (T_n) della sua apparizione nel campo dell'osservatore e della sua misura attraverso (t_n), poiché si è postulato l'indipendenza della struttura (T_n) da (t_n). In questa situazione, il *punto quantico* dev'essere pensato — il pensiero è modo d'*identificazione* come si presenta e si autodifferenzia. Dev'essere stabilito nel modo in cui si *puntualizza* e cambia nel tempo.

Se [(R) $\alpha \leftrightarrows \alpha$] rappresenta l'autoriflessione del punto (α) in (α), l'autodifferenziazione in T_n può essere descritta cosí:

1) $\alpha = \alpha$ cioè [α (R=) α]; ciò sta ad indicare:
2) la differenza di (α) da (α); per $\{\alpha \supset \{\alpha \leftrightarrows [(R=)\ \alpha\ \alpha]\}\}$ si ha:
3) $\alpha \in \alpha\alpha$, cioè ($\alpha \in \sim \alpha$), dove, '$\sim$' indica non la negazione, ma la differenza.

L'identità del *punto* significa, di conseguenza, nel tempo oggettivo, la differenza da sé. Si tratta della realizzazione della diversità dell'*eguale*, ma di un *eguale* che deriva da se stesso, con un processo di endomorfia, la *misura della differenza*. Questa misura non è fissata poi dai ritmi interni del tempo, ma determinata dagli endoritmi del tempo e dello spazio, insieme [13].

5) *Il tempo oggettivo e la diversità nello spazio.*

In seguito alla denuncia dei limiti impliciti nei canoni offerti dalla teoria quantistica, concernente il mondo infrafenomenico, Spisani critica l'assimilazione del tempo allo spazio (misurativo) nei procedimenti di calcolo tradizionale. Si avrebbe, come conseguenza di quei canoni, la geometrizzazione del tempo e la sua messa a punto come quarto parametro della realtà obiettiva. Ora, se è valido il principio d'incertezza, di localizzazione delle particelle in rapporto all'osservatore, che garantisce la validità dell'identificazione strutturale del tempo con lo spazio — e se questa identificazione è corretta — come sarebbe possibile distinguere l'individualità del tempo in rapporto a quella dello spazio? E se questa identificazione è corretta, come risulta possibile la distinzione dell'individualità puntuale nel tempo correlata all'individualità puntuale nello spazio?

Il tempo oggettivo non deve presentare — per Spisani — né

[13] Il risultato di uno *stato quantico* che, del resto, non sarebbe prevedibile con la considerazione di meri fenomeni, diviene calcolabile per mezzo dell'autodifferenziazione dell'identico in uno spazio e tempo che si sviluppino obiettivamente. L'autoriflessione diviene cosí, contemporaneamente, anche modo d'identificare il tempo e lo spazio oggettivi.

proprietà geometriche, né fisiche: dev'essere non-intuitivo, extra-empirico, diverso, cioé, da quello in uso nella comune attività gnoseologica. Non avendo, esso, nulla a che fare con la determinazione essomorfica, cioè consuetamente misurabile, degli oggetti distinti (che si trovano nel campo fisico).

Non si deve concludere necessariamente, di qui, con l'accettazione di un isomorfismo strutturale del tempo e dello spazio; tuttavia, poiché l'esistenza di una simile analogia possiede un significato proprio, la sua considerazione equivale ad un avanzamento dell'ipotesi che spazio e tempo degli infrafenomeni sviluppino una funzione di convergenza, diversa da quella incontrata nella fisica ordinaria (senza tuttavia che siano chiarite le modalità e il significato delle loro coimplicazioni). Per cui, se il ricercatore rinuncia all'intuitività dello *spazio* e del *tempo* normali, può ammettere che i processi operativi — inerenti all'infinitamente piccolo — siano traducibili nell'indifferenza del rapporto spazio-temporale. Occorre però, chiarire come, da un tale tipo di indifferenza, si possa derivare una distinzione di misura.

La corrispondenza spazio-temporale di valore *n*- puntuale nella sua forma di realizzazione è cosí stabilita da Spisani [14]:

T	S	
1	1	2
2	3	4
n	(2*n*-1)	(2*n*)

Si osserva che a due situazioni (*luoghi*) nello spazio corisponde un valore di posizione nel tempo. Si può enunciare la formula: la differenza di (α) nel tempo oggettivo (T') è il prodotto dell'identità (α) come autodistinzione di (α) in S, con la condizione che ogni valore di (T) rimandi a due valori di (α) nella struttura seriale di S.

Questo enunciato permette un'adeguata definizione di quello che intende Spisani per differenza posizionale-endometrica: viene proposta, qui, una definizione oggettiva, che non dipende da alcun criterio esteriore di verifica, ma solamente dal rapporto autofunzionale della misura. La differenza microgettuale è il prodotto dell'identità (α); identità autoriflessa come misura differenziante l'identico, che, automisurandosi, promuove i risultati operativi [15].

Di conseguenza il trasferimento temporale di un *punto* consta nel fatto che il *punto* medesimo si differenzia nel tempo oggettivo, in rapporto alla bipolarità di due posizioni nello spazio; e ciò conduce al risultato di un'identificazione nel quadro della differenza di

[14] Cfr. F. SPISANI, *op. cit.*, p. 54.

[15] Cfr. *ibidem*, p. 64.

posizione. L'identità-differenza di α è la forma originale del rapporto misurativo fra il tempo e lo spazio del calcolo di posizione. La bipolarità di α con α corrisponde ad uno stato del tempo.

Correlativamente, un punto temporale considerato in relazione alla propria asse, rimanda a due punti nello spazio. Il punto temporalizzato implica una variazione bipolare dello spazio, una differenza posizionale nei confronti di se stesso, e viceversa.

Questo è, di fatto, il modo di realizzare l'identità concreta nella situazione microfisica, contro lo schematismo di alcuni fenomeni di movimento intesi in modo classico, cioè sulla base di astratte identità.

Atomo, molecola, cellula, come le altre particelle elementari, sono fenomeni complessi e non semplici oggetti di riferimento.

L'identità, che presuppone il *punto che si muove,* non si riduce alla tautologia. Poiché esiste, si annulla parzialmente (si differenzia) e si ricrea nel tempo e nello spazio. Piú esattamente il tempo si definisce come funzione dello spazio nel modo fondamentale dell'autoriferimento e dell'auto-identificazione della microparticella.

Il punto nel suo rapporto con il tempo, produce la variante numerica α-puntuale; piú esattamente è correlativo a questa variazione. Deriva da essa e ne reca la misura.

Un'intuizione geniale, che anticipa questa definizione del tempo oggettivo s'incontra già, nel secolo scorso, in J. Marie Guyau (1854-1888) [16]. Guyau, pur non distinguendo sufficientemente fra tempo oggettivo e soggettivo — e pur presupponendo l'esperienza come inerente alla definizione di tempo —, intende il tempo come una delle forme di differenziazione che scorrono dallo sviluppo evolutivo, come concausa della eterogeneità dei risultati. Il tempo è una conseguenza del passaggio dall'*omogeneo* all'*eterogeneo,* è una differenziazione introdotta nei *luoghi spaziali;* è la riproduzione di effetti diversi in un medesimo *ambiente* [17].

Il tempo — scrive Guyau — non è una forma *a priori* che imponiamo ai fenomeni; è un insieme di rapporti che l'esperienza stabilisce. Non è archetipo presupposto in cui entrerebbero le sen-

[16] Cfr. J. M. Guyau, *La Genèse de l'Idée de Temps,* Paris, F. Alcan, 1890, p. 119.

[17] In questa concezione, come precisa anche Guyau, il tempo è la formula astratta dei cambiamenti dell'universo. Non è una causa del progresso, ma è causato dal progresso, come forma di sua automisurazione. Il passaggio dall'*omogeneo* all'*eterogeneo,* processo fondamentale in rapporto al quale si definisce il tempo — o si regionalizza, diremmo noi —, non è che l'equivalente, sul piano ontico, del processo logico del passaggio dall'*identico* al *differente* (cfr. *Ibidem*).

sazioni, ma alveo segnato da quelle medesime (corso spontaneo preso da quelle).

Si osserva immediatamente che le formulazioni "insieme dei rapporti che lesperienza stabilisce" tra fenomeni e "alveo che le esperienze stesse tracciano", sono definizioni estremamente attuali e plastiche [18].

6) *La temporalità oggettiva.*

Spisani definisce la temporalità come una successiva collocazione dei numeri α-puntuali in due ordini numerici, rispettivamente dispari (Ω) e pari (Φ). L'ordine di successione nel quadro della serie ordinale è data dalla realizzazione della corrispondenza biadica fra valori aritmetici α-puntuali. Il principio che costruisce la base di corrispondenza è il seguente: ad ogni punto nel tempo corrispondono due punti nello spazio. Di conseguenza, ogni valore numerico è l'indice di una posizione di α, come risulta dalla relazione stabilita fra il tempo e lo spazio determinato attraverso il rapporto parametrico interno ad α.

I valori ordinari della temporalità (Ψ) possono essere indicati in questo caso, nella loro successione, con la corrispondenza biunivoca fra Ω e Φ. Si ottiene in tal modo una struttura di valori di posizione, nel quadro della quale Ω e Φ stanno a significare i punti dello spazio matematico in una successione temporale, da definire nel tempo oggettivo T dei valori di Ψ [19].

Spisani, a differenza di Heidegger, distingue diversi ritmi tempo-

[18] La definizione citata, qualora si consideri nell'unità delle due formulazioni, offre un'idea unitaria ed estremamente generale del tempo, senza annullare l'individualità dei tipi di temporalità. E' maggormente evidenziata, poi, come risulta dalla formulazione riferentesi al tempo del soggetto, come *oggettività del tempo*. Si tratta di una obiettività generata dalle condizioni concrete dell'esperienza, dai rapporti di differenziazione fra i fenomeni. La definizione infrafenomenica del tempo — proposta da Guyau — rimanda dunque alla definizione infranomenica avanzata da Spisani con l'introduzione del tempo, quale forma di automisura della dimensione extraempirica.

[19] Il concetto di temporalità, che si cerca di mettere a punto nell'indagine del microcosmo deriva, in un certo senso — ci sembra —, dalla continuazione di alcune preoccupazioni di Heidegger circa la necessità di indagare, nella prospettiva del *Dasein*, che è pura temporalità oggettiva (senso dell'esistenza del *Dasein*), il *Sein*, l'essere che è abissalmente diviso, sia per la struttura della sua temporalità che per altre strutture, consecutive, dall'esistenza umana. Heidegger, che ha posto il problema del tempo come uno dei problemi fondamentali della filosofia, forse il piú importante, considera la definizione della temporalità oggettiva come equivalente allo svelamento del senso dell'essere. Fin dal suo *Der Zeitbegriff in Geschichtswissenschaft*, Heidegger ha accentuato la distinzione fra tempo proprio del soggetto (umano e storico) e tempo con cui operano le scienze della natura. Il tempo fisico è considerato una sequenza di istanti, dotata di una direzione, cioè semplicemente orientata. Tale tempo

rali nel quadro del tempo fisico; sottolinea, cioè, il carattere oggettivo e fondamentale del tempo autogenetico della microfisica; e, pur stabilendo uno scorrere autonomo di questo tipo di tempo, nega la possibilità della sua determinazione sulla scorta di una misura prefissata, guardando alla specifica automisura dei ritmi autodiversificanti e autodifferenzianti. Heidegger insiste sul fatto che il tempo fisico (T_n) — per adoperare le indicazioni simboliche di Spisani — non può essere sorpreso nella sua natura ex-statica, se non in una prospettiva costruita da (t_n), cioé nel quadro della struttura temporale del soggetto (senza che la possibilità di apertura di un tal tipo di prospettiva sia per altro dimostrata). L'apertura all'essere preconizzata da Heidegger, risulta perciò un salto della conoscenza, un'intuizione. A differenza di Heidegger [20], che guarda ad una fisica pensata nel prisma dei principi logici solo intuitivi, lo sforzo principale si concentra qui verso la concezione oggettiva di T_n, nel processo della sua determinazione, nel rapporto, cioé, di dipendenza operativa tipica delle entità microfisiche.

Ora, conformemente alla concezione di Motru, la distinzione fra tempo fisico e tempo storico è decisiva [21].

Il tempo fisico è facilmente individuabile sotto la forma di direzione lineare, che diviene numerica (di qui i ragionamenti fisico-matematici), ma sotto questa forma non è un fatto vissuto; è un fatto convenzionale, astratto [22].

In Spisani, quest'ordine — sia per il nuovo tempo di successione, sulla base di corrispondenza fra le serie che caratterizzano il medesimo, sia per l'apparato matematico inedito — diviene difficilmente comprensibile, se non si tiene conto del carattere autosintetico del suo formalismo. Spisani, per descrivere la struttura del tempo, introduce nuovi strumenti operativi. Pone il calcolo per valori di posizione che consta nel fatto che gli elementi α-positivi e negativi

costituisce un ordine omogeneo di situazioni, una loro scala in cui ciascun momento si determina in rapporto con un momento iniziale, sulla base del luogo che occupa nella successione. In opposizione a questo tempo, c'è la temporalità storica, sentita come una serie incommensurabile, mancante di omogeneità.

[20] Cfr. AL. BOBOC, *Existență și Limbaj în Conceptia lui Martin Heidegger*, in *Existentă, Cunoaștere, Acțiune*, București, ed. Stiințifică, 1971, p. 117.

[21] Cfr. C. MOTRU, « Noi Cercetări asupra Timpului », in *Analele de Psihologie*, Vol. IV, București, 1973, p. 3.

[22] Nella concezione di Motru, l'uomo possiede un'intuizione del tempo grazie alla quale funziona il tempo psicologico. L'intuizione del tempo è una costruzione di rapporti, strutturazione operata dall'attivtà umana nel campo speculativo. (Cfr. C. MOTRU, *Timp și Destin*, București, 1940, p. 109).

sono determinati sia in corrispondenza con la serie numerica dei cosiddetti *valori di base* del tempo oggettivo di successione (della temporalità) Ψ, sia rispetto alla condizione che tutti i valori α numerici indichino un trasferimento, relativo al tempo ed allo spazio, di un identico valore di base [23].

L'idea che fonda questo calcolo poggia su procedimenti diversi da quelli tradizionali; consta, quindi, nell'ammettere come prodotto logico il risultato dell'autodifferenziazione d'identità di uno stesso valore α puntuale. L'identità con se stessa della particella — nel quadro temporale — presuppone la differenza da sé nel quadro spaziale. Sia il quadro temporale che quello spaziale sono determinati regionalmente dalla rispettiva particella, come espressioni del modello di movimento di quest'ultima. L'analisi del movimento di α implica un complesso calcolo delle posizioni successive della microparticella medesima, piú esattamente una correlazione in rapporto con il valore posizionale di base. A questo scopo, Spisani si serve delle operazioni fondamentali di addizione, sottrazione, moltiplicazione e divisione, operazioni che si effettuano, anche, fra indici posizionali decimali dei valori α-puntuali, ma in maniera da ricostituirne totalmente i procedimenti. Le operazioni si effettuano fra due punti nello spazio microfisico attraverso la determinazione nel quadro della corrispondenza temporale oggettiva, che presuppongono come termine mediatore.

Si procede come segue: viene stabilita la corrispondenza fra i valori aritmetici α-puntuali delle rispettive posizioni. Si svela l'incidenza effettiva della serie ordinale della temporalità Ψ. In rapporto al termine mediatore, sulla base di alcuni processi operativi, si cerca il risultato delle correlazioni. Il calcolo attraverso i valori di posizione evidenzia che, in generale, nello spazio di struttura Ψ, Ω, Φ, a due valori puntuali α, corrisponde un numero nel tempo Ψ che, determinandosi come valore posizionale intermediario, ne dà il risultato.

Un'importante conseguenza di questo calcolo è la constatazione che nella struttura posizionale operativa Ψ, Ω, Φ esiste un annullamento della funzione diretta del tempo nelle situazioni in cui si passa a valori α-puntuali negativi a valori α-puntuali positivi, e ciò segna i limiti della struttura Ψ, Ω, Φ medesima.

[23] Si deve tener conto di quanto, al riguardo, precisa Spisani: « se si intende per entità numerica (o valori di base) qualsiasi numero reale, razionale o relativo, valore algebrico sarebbe la significazione algebrica di base che gli corrisponde ». Parimenti, occorre menzionare che per « stato si intende un solo valore di base inerente alla struttura operativa » (Cfr. F. SPISANI, « Fondamenti di logica produttiva », in *Rassegna Internazionale di Logica*, Bologna, 1971, n. 3, p. 8).

L'annullamento del tempo implica l'idea dell'esistenza di una 'zona' dello spazio matematico in cui la funzione diretta operativa del tempo T_n sia soppressa. Spisani dimostra il conservarsi, in questo caso, di un ritmo posizionale, pur sembrando questo ritmo attenuarsi progressivamente.

Il carattere locale del tempo, il fatto che la sua omogeneità sia sottolineata dall'esistenza di alcuni punti di annullamento — piú esattamente di cristallizzazione ritmica (poiché l'atemporalità è inconcepibile) — sono evidenziati cosí in modo particolarmente convincente.

7) *Endometria dello spazio e del tempo.*

Il concetto di spazio, preso in considerazione nell'endometria [24], sembra consentire una spiegazione deterministica di tutte le traiettorie di particelle, rispettando il modo del loro movimento, senza che per questo, s'introduca un'indeterminazione locale. La necessità dell'ammissione di uno spazio microfisico non-euclideo (K_n) dotato di una struttura endometrica (F) s'impone, essendo richiesta dalla struttura dello spazio in rapporto ai caratteri temporali del microcosmo.

Il rapporto complesso fra spazio e tempo microfisico dev'essere analizzato, cioé, partendo dal fatto che, pur non potendosi parlare di un *isomorfismo strutturale*, tuttavia spazio e tempo presentano una serie di proprietà analogiche, nello stesso modo della loro funzione specifica: ad esempio in rapporto alla neutralizzazione nei confronti di canoni misurativi empirici. Può essere sbagliato respingere l'idea di una struttura unica dello spazio e del tempo avanzata da Aristotele, che parte da questa tesi per spiegare i paradossi di Zenone [25], ma considerare che, nel quadro di detta struttura, lo spazio ed il tempo rappresentino sottoinsiemi isomorfi, simmetrici, ed omologare il tempo come una quarta dimensione spaziale — come fa del resto anche Einstein — significa, per Spisani, non considerare l'individualità di queste forme fondamentali: è questo un' *empasse* grave, messa in evidenza nel quadro della meccanica quantistica, ed è un' *empasse* che discende proprio dal fatto che quando lo spazio è quantificato, non riesce la quantificazione correlativa del tempo [26] (qui si dimostrerebbe l'impossibilità di quantificare nello

[24] Cfr. F. Spisani, *Neutralizzazione dello Spazio per Sintesi Produttiva*, Milano, 1968.

[25] Cfr. I riferimenti e le vaste bibliografie di W. Gent, *Das Problem der Zeit, eine Historische und Systematische Untersuchung*, Frankfurt am Main, G. Schulte-Bulmke, 1934. Si veda inoltre H. Pohl, *L'Homme à la Poursuite du Temps*, Paris, Plon, 1957, *passim*.

[26] Cfr. J. L. Rigal, *Timpul şi Gîndirea in Fizica Contemporană*, Bucureşti, Ed. Enciclopedică Română, 1972, p. 20.

stesso contesto lo spazio ed il tempo). L'analisi di Spisani tende ad evidenziare, come abbiamo visto, il carattere generalmente improprio, soggettivo, della quantificazione empirica.

Se si prendono in considerazione le relazioni di generazione dello spazio e del tempo — e la dipendenza della loro natura dal sostrato dei fenomeni che s'identificano e si differenziano — si può concludere che queste relazioni di generazione presentano fino ad un certo punto, similitudini di funzionamento che si riflettono, anche, nell'esistenza di alcune analogie parziali fra le strutture dello spazio e del tempo.

Il calcolo endometrico deve tener conto, però, sia della particolarità del tempo, sia di quelle caratterizzazioni dello spazio che sono forme fondamentali d'identificazione, sostituendo il carattere discreto della meccanica quantistica con quello della continuità puntuale, che consta nella possibilità di riduzione (istantanea) della posizione dei punti in una regione dello spazio dimensionale (K_n), ad un solo punto-durata, momento di differenziazione della stessa struttura puntuale.

Dovremmo quindi considerare lo spazio ed il tempo nel loro rapporto, come rappresentanti di una dualità correlativa, per utilizzare un termine usato espressamente dal pensatore rumeno I. Eliade Rădulescu. In altre parole, queste forme si completano attraverso le strutture e proprietà in un quadro autogenetico della dimensione micro-operativa [27].

8) *La figura endometrica e il suo valore metodologico.*

Lo sviluppo di queste idee — che Spisani formula in una nuova teoria della temporalità — sulla base di metodi efficaci di calcolo, implica la determinazione di *tempo nullo* nello spazio (K_n) e l'introduzione, in riferimento a questo punto, delle cosiddette figure endometriche.

La loro necessità può essere giustificata dal fatto che la rappresentazione di n valori α-puntuali in uno spazio estraneo alla successione Ψ, non genera relazioni che permettano l'evidenziazione del ritmo costante di spostamento. La figura endometrica dipende, in ultima analisi da valori di quantità trascelti arbitrariamente, indipendenti dal tempo. Lo spazio come struttura è inteso, qui, come un sotto-insieme, strutturalmente fondato dalla microentità che si

[27] Cfr. *op. cit., passim.*

Come dimostra O. Costa de Beauregard, la teoria della relatività palesa qui l'esistenza di una complementarietà di natura spazio-temporale; mantiene, tuttavia, una distinzione categorica, preconcetta (cfr. O. Costa De Beauregard, *Principiul Relativităţii şi Echivalenţa dintre Spaţiu şi Timp*, in *Timpul şi Gîndirea în Fizica contemporană*, p. 140).

trova in fase di autodifferenziazione dialettica. Correlativamente, nella sua congiunzione con lo spazio, occorre considerare, però, il tempo come una grandezza intimamente legata allo spazio; per cui esistono tanti tempi diversi quanti sono i movimenti e quanti sono i luoghi [28], con la precisazione che la riducibilità dei movimenti a forme di base come luoghi "esistenti fra", spinge a riflettere sulla struttura del tempo.

Una proprietà specifica, risulta, qui, dalla figura endometrica: è il fatto che essa non può essere assimilata alla figura geometrica. Le sue diagonali non hanno dimensioni e di conseguenza non hanno un'area in K_n (essendo quest'ultimo lo spazio neutrale). La figura endometrica individualizza, perciò, una serie di rapporti *n*-puntuali e non si costruisce conformemente al modello geometrico; è quella che dà origine ad un processo di costruzione in K_n sulla base di diagonali di misura nulla (e sui lati che corrispondono, invece, alla differenza α-puntuale). La figura si automisura costruendosi e si trasforma in un punto [29]; la struttura puntuale varia e diviene non-puntuale. In una figura endometrica il tempo interviene nelle operazioni che ingenerano linee diagonali e le tolgono. Una tale figura, poiché non ha superficie (ed il tempo oggettivo viene annullato nel punto d'incontro delle diagonali) è una non-figura, piú esattamente un *punto-figura*. Una moltitudine di *punti-figura* non realizza, allora, né uno spazio né un tempo empirici. Non esiste un tempo oggettivo, nell'ambito della fisicità fenomenica. L'oggetto s'identifica, invece, nel punto (che si chiama *figura-punto*) in K_n, la cui fisionomia è solo indirettamente essomorfica. La sua proprietà è tale da caratterizzare la sovrapposizione delle varietà degli stati endometrici nella meccanica autogenetica. La sovrapposizione non è che identificazione dei punti-figura in K_n.

Certo, sul piano autoperativo non è possibile raccogliere, per giustapporla, una molteplicità di punti. Però è possibile fissare la misura interna di uno solo di essi; e molti punti endometrici formano un punto solo o, se si vuole, una *figura-punto* che è la stessa cosa. Questo punto soltanto è il risultato della trasformazione indagata. Occorre perciò tener presente il doppio carattere puntuale e non puntuale delle figure endometriche come risulta dai calcoli per valori di posizione. Poiché la figura non ha superficie, può essere concepita sia come *punto*, sia come *linea* lateralizzata. Il fatto che questa linea è considerata nella meccanica quantistica come una curva — come una successione delle linee di curvatura —, cioé

[28] Cfr. R. Lennuier, *Ideea de Timp în Fizică Modernă*, in J. L. Rigal, *Timpul și Gîndirea in Fizică Contemporană*, p. 185.

[29] Cfr. F. Spisani, *Significato e Struttura del Tempo, cit.*, p. 128.

definita come onda, non è che una conseguenza della struttura percettiva del soggetto che capta i fenomeni quantici in modo discreto.

La figura endometrica si presenta, invece, nel campo dell'osservatore, come *punto* e come *onda* nello stesso tempo. Si esprime come unità estrinseca e necessità alternativa, sulla quale si è soffermata, in altro modo, l'attenzione di Louis de Broglie, che però concepisce lo sdoppiamento dell'identità microfisica come propria della natura medesima del *quanto*. Poiché intende il movimento come identificazione e diversificazione contradditoria, Spisani non si allontana dalla tesi della doppia natura delle entità microfisiche (particelle-onde) e precisa che nell'endometria, la struttura puntuale deve essere concepita come qualcosa di piú di un punto, ma anche come qualcosa di diverso da un'onda.

La spiegazione endometrica dell'alternativa punto-onda dimostra, quindi, che l'utilizzazione del criterio sperimentale incide sull'affermazione scientifica almeno marginalmente. Il tempo soggettivo (t_n) è definito come tempo di visualizzazione della figura endometrica, intendendosi per 'visualizzazione' la riduzione della struttura di questa figura a semplice corrispondenza in t_n di ciò che si evidenzia nell'atto d'osservazione.

L'osservatore inclina a credere nella possibilità della 'corrispondenza' tra il tempo oggettivo e il tempo soggettivo. Egli introduce una concezione probabilistica della temporalità, prendendo in considerazione un rapporto statistico, proprio perché la fisica quantistica non fornirebbe una definizione di T_n operante nella struttura Ψ, Ω, Φ. Per converso, la struttura (T_n), proposta dall'*endometria*, si dimostra indipendente dalle interferenze del soggetto e inconcepibile sulla base della logica classica, con mezzi tradizionali di calcolo, i quali, conducono, infatti, l'osservatore al paradosso dell'*indeterminato*.

L'annullamento del tempo oggettivo nella zona della struttura duale (*puntuale-non puntuale*), effetto dell'indeterminazione recata dal tempo soggettivo e dall'utilizzazione di questo, sottolinea l'inizio della dualità di linguaggi microfisici (puntuale e ondulatorio), in un modo del tutto nuovo. Spisani ammette la possibilità di una correlazione di 'corrispondenza' parziale tra i due tipi di struttura e con questo segna di fatto un'apertura all'esperienza, cioé una possibilità d'interpretare quest'ultima, dopo che, anteriormente — nella fondazione dell'endometria — per ragioni metodologiche, l'esperienza era stata posta fra parentesi.

L'*essomorfía* è una proprietà estrinseca, manifesta per la presenza dell'osservatore, ma nello stesso tempo, è correlativa all'endomorfia. Deriva da essa. Le ipostasi particella-onda (l'osservatore non le può pensare che in un quadro spazio-temporale preesistente eppure permanentizzato), si hanno attraverso l'automovimento e si

annullano nel momento della loro inversione; ma l'osservatore capta come effetto dell'interferenza della sua struttura spazio-temporale anche l'entità microfisica dualizzata. Poi, nella misura in cui l'osservatore fa astrazione dal suo modo di captare la relazione α-puntuale ed applica il metodo endometrico, può determinare correlazioni tra i due tipi di struttura, poiché l'endometria rende possibile una traduzione essomorfica delle figure automorfiche ed esplica cioé la loro doppia natura con l'intervento di regole determinate (non classiche) di trasformazione.

La traduzione non è generalmente biunivoca — avverte Spisani —, per cui parlare in senso classico di corrispondenza ($T_n \leftrightarrows t_n$) in una qualsiasi situazione di microevoluzione è inammissibile [30].

Quello che si può aggiungere alle regole di trasformazione fornite dall'endometria, per quanto riguarda la 'traduzione' delle determinazioni spazio-temporali delle figure automorfiche, è il ritrovamento di un equivalente relativo (costruito con la matematica e la geometria classiche) della struttura K_n, nello spazio-tempo dell'osservatore. Ciò sarà possibile soltanto per mezzo della visualizzazione (essomorfica) matematicizzata, essendo esclusa, in generale, la via analogica.

9) *Verso un determinismo genetico e dinamico.*

La nuova impostazione fonda teoreticamente il processo neodeterministico sulla base della logica produttiva. Supera la concezione dello spazio e del tempo della fisica relativistica nell'endometria. Descrive la struttura e le relazioni del processo generale di autoidentificazione — che comprende anche il momento della diversificazione —, e sostituisce, alla meccanica quantistica, una meccanica genetica fondata su leggi dinamiche.

Le concezioni indeterministiche e deterministico-statistiche, che sono state presupposte dai teorici della meccanica quantistica, sono cosí allontanate in nome di un autodeterminismo dinamico, genetico. Viene respinta l'ipotesi di una semplice assimilazione della struttura obiettiva da parte del soggetto e si fonda la tesi di quelle relazioni complesse, fra soggetto ed oggetto, nel quadro delle quali i rapporti tra i tempi di struttura spazio-temporale potranno svolgere un ruolo nuovo.

L'*endometria* constata come certe forme si automisurano nel tempo in cui si costruiscono. Esse rappresentano un campo di ricerca

[30] Già C. Radulescu Motru aveva respinto l'idea di una struttura temporale unitaria che inglobasse t_n e T_n, perché, nel tempo, la freccia cambia spesso di direzione, sicché annulla l'idea di successione irreversibile (Cfr. C. Motru, *op. cit., passim*).

che si estende gradualmente, assumendo carattere propedeutico anche per l'investigazione empirica.

Per il fatto che l'*endometria* riesca a restaurare un determinismo dinamico e a definire piú coerentemente il sostrato logico della microfisica — senza che ci sia bisogno d'introdurre alcuna realtà d'incertezza —, essa rappresenta una teoria coerente costruita sul principio dell'adeguazione contestuale. L'*endometria*, cioé, modifica profondamente le concezioni relativistiche della fisica contemporanea e, attraverso un criticismo peculiare, predispone ad una mediazione piú approfondita dei fondamenti della fisica.

L'*endometria* considera la struttura α-spaziale come unità sintetizzata dalla diversità, e il tempo proprio della dinamica dell'atomo come risultato di una totalizzazione degli elementi ad essa interni [31].

Come annota Spisani, distinguendo fra *endometria* e fisica matematica, i processi differenziali delle figure α-puntuali possono rimanere ipotesi di lavoro per il fisico teorico. Eppure non sono semplici ipotesi per il matematico, che traccia i modi di trasformazione con regole e procedimenti. La verifica sul piano sperimentale può anche mancare, senza che sia infirmato il carattere coerente (determinista-non classico) delle costruzioni endometriche [32].

L'*endometria* di Spisani, vòlta alla descrizione dell'autogenerazione delle particelle microfisiche, nel complesso spazio-temporale in cui esse si evolvono, partendo da procedimenti differenziali della logica produttiva, passa alla realizzazione di un programma che introduce procedimenti neo-deterministici di 'auto' o 'endo' misura. Si rinuncia, per questo, a procedimenti misurativi in cui si conservi l'incertezza o siano fissate regole statiche di corrispondenza.

Le relazioni d'incertezza di Heisemberg non trovano piú, in tale situazione, giustificazione alcuna. L'*endometria* lascia presumere, inoltre, una critica esplicita della teoria della relatività, perché rifiuta l'inclusione delle leggi della microfisica nell'accordo fra diversi osservatori. L'*endometria* elimina tutti i sistemi soggettivi di riferimento in favore della concezione di un sistema autogenetico, che si riferisca a sé come 'misura' del processo prodotto dall'autocontraddizione.

La rinuncia ad una 'misura' compiuta dal soggetto e la neutralizzazione dello spazio empirico trovano qui la loro giustificazione; la teoria della relatività giunge alla contraddizione proprio perché accetta i classici metodi di misura ed un corollario addizionale dello spazio e del tempo.

31 Sulla dinamica dell'atomo Cfr. R. LENNUIER, *loc. cit.*, pp. 187-188.

32 Cfr. F. SPISANI, *op. cit.*, p. 148.

Spisani non contesta la modalità quantica in cui siamo determinati a concepire la realtà, ma il fatto che questa realtà sia nella sua essenza semplicemente quantica. Egli è d'accordo con Marx Planck nel riconoscere che la logica coincide con le leggi che governano la successione, ma non ammette che questa logica — cosí come è oggi strutturata — possa fermarsi alla successione di mere impressioni sensoriali.

Non a caso, anche R. Lennuier precisa che il tempo delle equazioni della meccanica ondulatoria e il tempo dell'osservatore, del fisico che esperimenta, e che cerca in fondo di rapportare gli elementi del mondo atomico al proprio quadro spazio-temporale, è un tempo diverso da quello delle equazioni di onda, non permettendo, quindi, in nessun caso, di lasciar prevedere quale sarà il tempo effettivo vissuto dai corpuscoli della microfisica, anche se tale tempo esiste [33].

Ora, proprio l'esistenza di un tempo oggettivo per le entità microfisiche offre la possibilità di localizzare, anche temporalmente, le definizioni di misura.

10) *Nuovi argomenti ed osservazioni critiche.*

Portiamo un argomento proprio alla tesi di Spisani con riguardo al carattere dinamico del determinismo microfisico, invocando il terzo principio della termodinamica. Alludiamo al teorema di Nerrnst. Sulla base di questo principio, allo zero assoluto, l'entropia di qualsivoglia sistema può essere considerata sempre uguale a zero. Questo è possibile perché l'entropia (S) si definisce attraverso il rapporto:

$$d_S = \frac{d\,Q}{T},$$

che dev'essere cosí interpretato: la variazione dell'entropia al momento del passaggio reversibile del sistema fra due stati è uguale alla variazione del calore.

In altri termini, l'esistenza di un'entropia del sistema presuppone l'esistenza delle entropie rispettive per ciascuna delle componenti del sistema medesimo. Ciò insegna che la nozione fisica di entropia non implica necessariamente il procedimento statistico nella sua definizione, osservazione estremamente importante, poiché, riferendosi alle condizioni di possibilità dell'esperienza, l'entropia è considerata come misura del grado di indeterminazione di un sistema,

[33] V. e J. L. Synge, *Relativity, The Special Theory*, Amsterdam, 1956, *passim*; Cfr. anche G. Thomson, *Inspirație și Descoperire*, București, Ed. Enciclopedică Română, 1973, p. 179; R. Lennuier, *loc. cit.*, p. 185.

come risultato della ripartizione delle probabilità in un campo dinamico.

Nel caso del sistema formato da un sola entità o del sistema con un numero piccolo di componenti, l'entropia è proprio una misura del grado di determinazione, indicando, essa, l'energia necessaria da spendere per restituire lo stato iniziale del sistema. Ora, dimostrare che il tempo dei microggetti non ammette una definizione statistica, dimostrare che il carattere 'locale' del tempo esclude la sua natura statistica — e sono queste le idee diffuse da Spisani — presuppone implicitamente di ammettere la possibilità dinamica dell'entropia, cioè l'esistenza di una entropia dell'universo microfisico.

L'irreversibilità è una conseguenza del fatto che nel processo d'auto-identificazione, la tendenza del *diverso* nei confronti dell'*identità* implica la creazione di una nuova identità di movimento: di conseguenza, non essendo nessuna identificazione tale da esser chiamata perfetta o definitiva, identica con le rimanenti identificazioni (perché presuppone un diverso), ed essendo il tempo una misura locale d'identificazione, la crescita dell'entropia esprime l'accumulo di un'assenza interna di energia che rende irreversibile la trasformazione.

La critica del carattere statistico e discreto della meccanica quantistica implica un nuovo concetto di entropia: una nuova teoria sul tempo involge la necessità di dimostrare l'esistenza — o la non esistenza — di un ritmo e di una direzione del tempo, di evidenziare, cioé, la correlazione fra tempo ed entropia. La critica del procedimento 'statistico' deve portare ad una nuova fondazione della termodinamica, e, quindi, ad una fondazione microdinamica.

Per ritornare al teorema di Nerrnst, osserviamo che, in rapporto a ciò che definisce la variazione dell'entropia, allo zero assoluto, si ottiene una non determinazione della forma $\frac{0}{0}$

Come dimostra Fermi — che porta alle ultime conseguenze il metodo statistico della termodinamica —, il teorema di Nerrnst afferma che, ad uno stato termodinamico di un sistema a zero assoluto, corrisponde un solo stato dinamico con la piú piccola energia compatibile e con la struttura cristallina data (o con lo stato di aggregazione del sistema).

Non permette, forse, questa interpretazione il passaggio in modo univoco da uno stato termodinamico, statistico, ad uno stato dinamico, avendosi l'entropia zero? E questo non significa che l'aspetto statistico costituisce una modalità in cui sono rappresentati i fenomeni dinamici (microfisici) dinanzi all'osservatore? Di conseguenza se lo stato primario (zero assoluto) del sistema delle entità microfisiche è uno stato dinamico caratterizzato con la minima energia

compatibile con la natura fisica del sistema, diviene chiaro che la struttura (per quella rete di relazioni che la determina) non può divenire disordine con l'evoluzione del sistema, rilevandosi piuttosto come ordine piú complesso. L'entropia appare in questo caso come una grandezza energetica che caratterizza in modo determinato l'evoluzione degli stati del sistema.

Queste supposizioni, sviluppate dal terzo princípio della termodinamica, conseguono un grado di certezza nella misura in cui possono essere colte dalla teoria matematica unitaria del microcosmo, proposta da Spisani.

THE BUCHAREST SYMPOSIUM ON PRODUCTIVE LOGIC

Foreword

The idea of introducing the Rumanian public to the logico-philosophical position of Franco Spisani seems to me particularly noteworthy. Those familiar with the works of the Italian thinker will know that, over the last few years, he has developed a whole series of highly interesting personal ideas, which may now be grouped within the theoretic system known as *productive logic*. His aim has been to develop a logic strictly connected with present-day scientific thought (especially micro-particle physics and Neo-Deterministic tendencies of a dialectic kind), and to apply this, furthermore, to the problem of solving certain scientific conundra to which both observation and experiment are practically of no assistance.

Spisani sets out to propound a structure of logic that can bear on various aspects of *time* and *space* that lie beyond the grasp of the experimental method; in this way a whole series of gaps and difficulties are avoided in microphysics which used to derive from the application of customary logical systems based on the principle of static identity, the *true-false* dichotomy and a concept of tautology (hence improductivity) in the traditional principles of logic and mathematics.

The pages that follow aim to give a faithful presentation of the ideas behind *productive logic* as expressed at the Bucharest Symposium. This testifies to the thorough knowledge of Spisani's works enjoyed by Rumanian authors. Nonetheless, Professors Stancovinci and Lucian Stanciu have not confined themselves to a simple exposé of Spisani's ideas, but have tried to explain and draw out the significance of his contribution to contemporary logic and science. They have attempted, that is, to insert his thinking into the history of logic and to enlarge on this new departure with a wealth of modern scientific facts.

Particularly fascinating, it seems to me, is the recall to Hegelian and Marxist logic, the picking out of points of convergence between these references, and the highlighting of certain common ideas (and differences) in the thought of Spisani and Leibniz, Kierkegaard, Husserl, Heidegger, Radulescu Motru and others.

There is also a remarkable comparison of the Italian thinker's ideas and those of the great physicists (Einstein, de Broglie, Feyn-

man), and, in this context, the upholding of works by Rumanian and other writes such as Meakișef, Guyau, Rigal, G. Thomson, A. Dumitriu, Rosescu and Călina Mare.

One is bound to appreciate the way in which the authors of the work have highlighted the value and originality of Spisani's *productive logic*, whilst at the same time subjecting it to critical analysis designed to bring out the sides which are not yet fully worked out. Thus, for example, further attention in given to the problems of entropy and of the irreversibility of time — ideas which, independently of Spisani's theorizing of *endometry*, the authors most ably develop themselves.

Costantin Grecu

V. STANCOVICI - L. STANCIU

THE STRUCTURE OF SPACE AND TIME IN FRANCO SPISANI'S PRODUCTIVE LOGIC *

Franco Spisani is the author of works of great note in contemporary logic. Amongst these we recall: *Logic and Experience* (1967), *Logic of Dissent* (1968), *Neutralization of Space* (1968), and *Meaning and Structure of Time* (1972). As editor of the *International Logic Review*, he has published numerous articles presenting his logical and philosophical position.

President of the Centro Superiore in Bologna, which numbers some of the most distinguished modern thinkers among its members, Franco Spisani is one of the most redoubtable representatives of the Italian logical school, whose founders are Padoa and Peano. Whilst his general stance lies within this school, at the same time Spisani adds his own strikingly personal contribution.

1) *The Concept of Productivity.*

Alongside Annibale Pastore and Pietro Mosso, Spisani stands in the category of those logicians who have in recent times faced the question of whether logic admits of one form alone or of formal diverseness. With Bogdan V. Sesic [1], he is in this sense too, one of the most serious continuers of dialectical logic. Standing at the junction of various evolutionary curves in modern philosophical thought, *productive logic* begins with a triple distinction among logical systems:

I.: *dogmatic logical systems*, in which *thuth* and *falsehood* stand as rigid, peremptory criteria (these systems are those adopted by authoritarian ideologies, and offer no chance of differentiation, but only opposition or juxtaposition).

II.: *Formal logics*, in which *truth* and *falsehood* depend on extra-logical discrimination and are never in themselves transcended, since these two terms are interchangeable.

III.: *Productive logic*. As its logical basis, this places, not *truth* and *falsehood*, but *identity* and *difference*. Within these limits, even *truth* and *falsehood* are justified as "differences". On closer

* Address delivered in the Institute of Philosophy of the Rumanian Academy of Political and Social Sciences, forming part of the section devoted to logic and epistemology. The address underwent certain modifications after discussion by those present.

[1] B. ŠEŠIC, *Logic of Change*, Ed. C.S.L.S.C., Bologna 1972.

inspection, Spisani maintains, these are not two properties, but one. The *identical* is equal with itself since it produces the *different*, and the *different* is *different* because it posits itself as *equal*, converges towards the *identical* and realizes it. *Identity* and *difference* are two aspects of the same determinable reality on the plane of *mathesis*.

Hegel considers that, for the functioning of the principles of identity and contradiction, both the synthesis and the analysis are distinct and yet admits their intrinsic state of correlation. In its formula, the *principle of contradiction* contains not only a simple, empty equality with itself, nor a simple *otherness in general* either, but *absolute inequality*, too, which is contradictory in itself.

However, the very *principle of identity* contains a reflex motion in its removal of the mode of being something other. Upon the foundation of self-differentiated identity — that is different from Hegelian principle that admits a hypostatic plurality of opposites — Spisani outlines a "productive logic", the basic rules of which rest on a more than competent formalism. Thus, parallel with formal classical logic, the reader is presented with the ideas of double difference, of a product existing between the *identical* and the *different*. Logic is "productive" when it does not confine itself to asserting the presence of "variables" and "constants" in the discourse, but aims to extract anew (or produce) the "variability" out of universe and which, in the field of mathematics, amount to the reaction of addition, subtraction, multiplication and division (and in formal logic, implication, conjunction, disjunction and so forth) [2].

The new form of logic does away with the purely analytical nature of the science as well as its subservience to the empirical criterion. It is *productive* in the sense that logical — and consequently scientific — truths emerge from the intrinsic development of the logical process. Productive logic in this way proclaims itself to be antidogmatic, antidiscriminatory and autogenetic.

Spisani hastens to point out that, by *productivity in logic*, we must not mean anything that can be included under the heading of mechanistic, technological , economic, functional or practical logic in present-day society. In this he draws a line of demarcation between himself and A. Pastore or P. Mosso, whom he criticises

[2] F. Spisani, « Foundations of Productive Logic », in *International Logic Review*, No. 1, May 1970; see also A. Dumitriu, « Productive Logic », in *Revista de Referate şi Recenzii*, vol. VIII.

for not having insisted in clarifying the productive nature of the tautology (confining themselves to a mere 'unmasking' of the tautological error). Franco Spisani comes much closer to A. Dumitriu in this criticism which turns the tautology into an instrument of logical and mathematical definition. Tautology, he maintains, amounts to nothing but a circular definition, at loggerheads with the rules of definition.

Among the basic landmarks in logic, intuitionism had considered already the analytical method as a natural function of the free human intellect. In this it seems that intuitionism marks a step forward compared to *formalism* and *logicism*, in that it takes mathematical invention and logical operations as a product of the human mind. Nonetheless, intuitionism cannot be held to be the keystone of productive logic: the latter must have autonomy of construction.

From the standpoint of *productive logic*, states Spisani, we may consider an arbitrary entity (*a, b, c, d . . .*), concerning which we propose to deduce all the possible differences, by the aid of the relations of addition (R+), multiplication (R ·), subtraction (R—) and division (R :). In place of *a*, differences may be drawn from *b* or *c*, or any other numerical entity (*n*), so as to return to the *identity* with the measure of the *difference*.

Let us for instance take a number *n* and place it in any relationship with itself $n\,(R)\,n$, writing, that is:

$$n+\ (n—n)\ =\ n \qquad\qquad n : (n \cdot n^{-1})\ =\ n$$
$$n—\ (n—n)\ =\ n \qquad\qquad n \cdot (n : n)\ =\ n$$

In point of fact, the basic relations in the annotations of *mathematical logic*, reduce to four, so that we may write:

$$a\ (R+)\ a \qquad\qquad a\ (R \cdot)\ a$$
$$a\ (R—)\ a \qquad\qquad a\ (R :)\ a$$

whence it follows that, by varying the term of relation we obtain propositions which serve to give precise determination of quantity, in arithmetics, and precise determination of position, in logic.

In this way, the tautology is not just a simple expression which tells us nothing because it has said all at the outset, but opens up an immense area of thought.

Productive logic is precisely this way of extracting the *difference* from the *identity* (on the basis of the identity) and making the latter the general fount of all equality and inequality. So it is that the *true-false* criterion of dogmatic and formal logic gives way to measurement of the *differentiated-identical.*

The consequences are important. For *productive logic* the principle of *static identity* (or tautology) has no value. The only valid identity is that in motion (self-differentiation of the identity). The

distinction between *truth* and *falsehood* disappears as a logical criterion, while the autosynthetic yardstick of *identical-different* comes to the fore.

Presented in this light, *productive logic* has clear analogies with dialectical logic. Weighed down by its metaphysical content, Hegelian logic suffers in expressiveness as against the purity of the logical act and the clarity of expression in mathematics. The productive quality of Hegel's logic expresses a state of thinking which self-differentiates by constructing the world demiurgically but abstractly. In its upside-down form the dialectic historically generates the conception that most adequately refers to the concreteness, a conception according to which the ontic order expresses itself.

2) *The principle of concrete identity.*

Productive logic does not proclaim thought as the *Logos* in itself, nor history as pure contradiction of opposites (where dialectical appearances could compromise themselves with the tendencies of Pragmatism), but maintains that every event in the universe must be taken as a movement of identity self-differentiating itself. The logic of movement means differentiation from the self.

Productive logic provides mathematical demonstration of the possibility of diversifying the identity relation, in the four basic dimensions of arithmetic operations, in this way manifesting the autogenetic, analytico-dynamic concept of thought.

There is no need to separate the principles of *abstract* and *concrete* identity in order to make this an instrument of dialectical cognizance; or at any rate, if this course is adopted, one should start by proving it, and not just stating it as an axiom.

Between the tautology A and A and the concrete identity A and W, which takes on the structure of the flux in which the elements of the conceptual universe move, no logical difference may be defined except as the result of argument and demonstration. Such a difference could at most be maintained as an assumed, and not a defined, point of view. Any demonstration can begin from the same identity principle as is formulated in Aristotelian logic: $A=A$. But the demonstration of $A=A$ must, in its turn, start with a preliminary dialectical moment, by means of an analysis which will end by determining the difference that is produced. This is apparent if we attempt — like Poincaré in his time, and now Spisani — to bring out the multiple values in which the identity principle may be understood, amonst which its productive value.

Beyond the simple tautology, which would express a truth independently of experience, this principle then stands as the expression

of experience itself, the basic act in human knowledge, the experience, that is to say, which gives sense to the act of *knowing*.

This is where the whole process springs from: the symbol *A* denotes every object or the object in general. In the identity relationship, *A* (it may seem curious, but this is the actual situation) denotes what is *other, different*. Different from what? From the second *A*? No: different from itself, from the subject (object) in connection with which *A* stood in relationship to begin with. *A* is identical to *A*, but *A* is also different from itself. The difference is established and expressed as a result of the equality relationship. This 'equality' is the cognitive function affirming the existence of object *A* and confirming it as identical to itself. This confirmation takes place through an act of experience, which attests the equality or identity, though neither equality nor identity are object states that derive independently of the modes of relationship. The confirmation of the equality is hence the result of self-reflection, which also implies the immediate relationship of the object with the object. This relationship of object with object denotes, in the first place, an intensive exploration of the object by the subject itself. It means that thought is at grips directly with reality. This enables the logical expression of the identity principle to fill the role of a dialectical foundation stone, whose first characteristic is to provide the basis for a logic of reality, seen as a logic of movement.

Geared intensively or vertically towards the content of the object, the logical expression $A=A$ represents quite simply the basic step in knowledge, the way in which subject correlates with object in their passage through the cosmic trajectory, the stage for common existence [3].

Nothing could be easier than to delude oneself and convince other people that it is the identity of the whole of reality which is considered, leaving aside the differences.

As a cosmic reality, however, the universe indicates its presence at every moment; and it is a noteworthy, non-static reality. At

[3] The idea of founding the principles of logic on the basis of identity was subtly pointed out by Kierkegaard, who grasped the limitations latent in a continuing abstract approach to identity, to which Hegel too remained fettered. Identity is merely an abstraction, a horizon line shutting out the view as long as we conceive the unity in isolation from its differences, disregarding the differences produced in it and by it, its capacity for self-differentiation, in short. That the principle of identity dominates that of contradiction and serves as its foundation — Kierkegaard thinks — is something we discover without difficulty. Yet it is only a limit to human thinking, the blue hills in the distance, the line the painters call horizon.

(Cf. S. KIERKEGAARD, *Journal* (Extraits), vol. I, 1834-1846, Paris, 1963, p. 327).

every moment, the placing of universe $\mathfrak{U}$, which is characterized by synthetic parameters P, is fixed by signals S. Meanwhile, it is detected by the subject through messages m, which correspond to signals S. One may thus write:

$$\exists\, \mathfrak{U}\ p\ S - M$$

Between S and $\mathfrak{U}$ a logical identity relation must be established in order for what one knows to have sense. What we *can* establish is a relation of equivalence or correspondence, if S has an object, and m a subject, derivation. Experience confirms a bi-univocal correspondence, but not an $S=M$ identity as well. On the level of equivalence, the definition remains ambiguous. Ambiguity is not removed except as a consequence of equivalence in the identity $S=m$. To effect such a transformation one needs an induction process guaranteeing that, if S_1, S_2, $S_3 \ldots S_n$ appear as consecutive signals in the placing of a cosmic universe, messages m_1, m_2, $m_3 \ldots m_n$, always correspond to them. That is to say, S lies in a causal relationship to m, S_1 to m_1, S_2 to m_2, S_3 to $m_3 \ldots S_n$ to m_n. It is clear that every time S appears, a whole series of signals follows up to S_n, so that, on close inspection, a serial situation of messages is expressed.

From the logical point of view one may state that the identity principle is based exclusively on the moment of experience $S=S$ and $m=m$, seen as a bi-univocal corespondence between $S_1=S_1$ and $m_1=m_1$, $S_2=S_2$ and $m_2=m_2$, and so on. The equivalence $S=m$ changes in this way into two identities, $S=S$ and $m=m$. But we must observe that in both identities the same relational factor is at work, affirming and confirming the existence of the differentiating relationship.

Now although there appears to be a common factor of relationship, mathematically it transpires that the two identities may be reduced to one single otherness obtainable from each term being equal to itself. It is clear that only in this way can equivalence transform into identity, equality into otherness, proposed not simply in formal tautology, but also in concrete heterology. This brief sample throws light on the role of identity which, once the self-defining capacity of the *equal* is affirmed — and its mechanism of relationships established at the same time — builds up a logic of self-production on operative lines.

From this follows the idea that, in order to be taken as the concrete assumption of thinking about reality, the dialectic must be brought to the limits of self-transforming potential of the concept which expresses it.

3) *The foundations of endometry and the structure of space.*

In his search after the operative modes of equality, Spisani realizes that the autogenetic identity, which we can follow in its manifestation as an identity that is produced, is an immense reser-

voir of reality, in a state of continuous differentiation. Clearly any object *A* or *B* or *C* and so on is identical to itself, which causes a productive relationship to arise between *A* and *A*, *B* and *B*, and so on.

Every empirical fact obtained in scientific research presents itself, no longer as simply identical with itself, but in a gradually differentiated image which proceeds to determine itself. This is due to a process of continuous transformation inside things (as Heisemberg, amonst others, maintains). Consequently it is no longer possible to indicate the point at which subject and object may meet from time to time: the empirical object represented in the act of ascertainment as identical to itself, appears differentiated in epistemological practice (the act of analysis undoubtedly does go beyond experience and provides the explanation of the identical which is different from itself). Hence for productive logic, there is no value in the "principle of static identity" (tautology), but in "identity of motion" (or dynamic identity, self-differentiation of the identical).

In such a form of logic the peremptory distinction between "true" and "false" does not obtain. The symbol '~' takes on the meaning of "differentiating" instead of "non-true".

In the new logic, the relations of identity and implication begin to be meaningful as methods of determining the difference.

The tendency to identify the *different* with the *identical* accordingly interests logic. While the experimenters concentrate on the phenomenal fact and the hypotheses concerning it, for logicians the problem once again centres round obtaining the *difference* from *identity*. This kind of derivation alone explains the logical-operative process objectively.

The stages of such derivation are the following: "from the identical one arrives at the different and from the different at the identity" [4]. This movement distinguishes the autogenetically productive quality of the new logic, as opposed to the formal and dogmatic qualities traditionally found.

In Spisani's view, then, dialectic and logic appear as one and the same basic line of research. All investigations aiming to explain other than strictly experimental physics must be conducted in a logical space, methodically cleansed of empirical data. The microcosm, the world of elementary particles, already represent a space where the classical potential of experience — which presupposes an

[4] F. Spisani, « Foundations of Productive Logic. The Difference of the Identical and Dogmatic Logics », in *International Logic Review*, No. 2, 1970, p. 119.

observer using measuring instruments that influence the course of phenomena — is invalidated. A world exists which is no longer experimental. It consists in a void of phenomena referring to the concept of objectivity deprived of every *multiple*, detached and separated off from our *reality*, a nature reduced to existence outside the empirical world, *conceptus sui, automorphy*; and this raises, amongst other things, the need to abandon models working along classical patterns of connection, *heteromorphic structures, substituted for experience* (separate modes of being of *common time* and *space*) [5].

The main problem facing researchers into experimental space is posed by the question of defining the real 'measure', which is to say, finding a 'yardstick', a defining value, which is not linked to and conditioned by the experimenter. This we achieve, in fact, if we bear in mind the use of self-determining values, abandoning all the traditional concepts of measurement, tied to a purely empirical consideration of space.

Such investigation of physical space, once rid of its customary dimensions, is called, in Spisani's term, *endometry*: endometry enables one to look at experience and at space devoid of experience. For the experimenter it tackles what is determinable, namely the *datum*, which it envisages as a self-identical reality. One must recognize that this reality is fundamentally complex. To get any adequate picture of it, one would have to stand back from surface experience and deepen one's understanding of the object down to its dialectical roots. This is achieved through meta-experimental investigation, to carry out which it is necessary to find in turn a measuring instrument of extra-empirical conception. Why? Because the meaning of the object lies beyond experience, even though science and present-day philosophy are not completely free from empirical content, in the same way that they are still prompted by common sense.

To overcome precisely this state of affairs, one should turn to a consideration of infraphenomena, the existence of which compels us to penetrate beyond the empirical level. So it is that research is led to an extra-empirical determining of reality, to a knowledge extending further than the limits of intuitive understanding [6].

The logical structure of space and time becomes a central

[5] F. Spisani, *Meaning and Structure of Time*, Bologna, 1972, p. 8.

[6] One passes beyond the principles of classical geometry, which are hence discarded. Experience cannot shake or confirm any geometry at all, out of all those possible.

Metrical definition by no means coincides with empirical determinability.

problem in science. However, one does not mean a time and space that can be measured in the normal way. They are a time and space seen for their intrinsic autoproductive properties. Thus space is conceived as a neutralized space (with regard to empirical measurement): determination of it is accordingly not attained by normal systems of measurement, but via self-determining, endo-measurative qualities.

In this form of space ,the prime relations are those which are purely logical, and not empirical, which is to say those relations which are defined in productive logic as capable of autosynthesis. In other words, the claim to find validity in Galilean and Cartesian systems of geometry is set decidedly on one side.

When space is neutralized and propounded in its dialectical and logical sense, we no longer have *geometry* but *endometry;* this studies the autosynthetic variability of logical values (inside the numerical datum under consideration), which can only be done by the aid of operative instruments of a much higher calibre than those traditionally employed.

The type of space under examination by modern physics is a

The idea of the coincidence is to be rejected as it arbitrarily and groundlessly turns measurement into something absolute, making ideas that are valid in physics seem equally so in microphysics; which is not the case. In Spisani's view, measurement is the element, normally taken to be fixed, over which micro-physics has met with its gravest difficulties (as, for instance, that of measuring the position and speed of an electron). In the subatomic field, such a measurative system is intrinsically inexact and bound to lead to uncertainty of relationship.

On discovering the laws of quantum mechanics, Heisenberg remarked that these new laws could not be coherent. Consequently the existence of an uncertainty principle conditions the consistency of quantum mechanics and its system.

Criticism of quantum mechanics, in a word, provokes the radical step of abandoning experience in those situations where its chances of being a privileged source of knowledge have ebbed through the inability of measuring instruments to cross the frontiers of sensibility. (Cf. R. FEYNMAN, *La nature des lois physiques. Une vision claire et actuelle des structures de l'univers,* Verviers, Marabaut, Université, 1971, p. 174).

The forecasting of genetic processes in wave-particles and the description of autogenesis open the way for a freshly constructed mathematical theory of the microcosm departing from the classical concept of measurement, or to be more precise, from empirico-derived methods of verification, in favour of a logicizing of reality.

The problem thus once more becomes one of classifying the basic elements that go to form the mathematicized science, apart from variable empirical data. A new structure of science is founded, not on empirical measurement, but on the structural properties of space and time. This is what Spisani proposes and what he tries to achieve by productive logic and *endometry*.

dimension purified of empirical facts, which thus transcend the empirical sphere. This degree of space is extraempirical, and has nothing to do with the phenomenal world. For this reason, in its pure logical identity, space is purified of the presence of the phenomenon. This does not mean that space becomes abstract, or devoid of constitutive moments. On the contrary, it is seen as an essential mode of the reality of these objects.

As the physicist, Richard Feynman, explains in one of his lectures (*op. cit.* p. 64), we normally believe that the laws of physics have a logical character. Nonetheless, we cannot be sure of this.

Spisani's theory confirms the notion of the local quality (autosynthesis) of physical laws, whilst replacing the principle of quantum superposition of microstates, and their production in time, by the elimination of the axiom which asserts the extrinsic possibility of measurement.

To sum up, at the heart of the whole conception of endometry lies a neutralized object: space, to which, by an analogous process, one may add the operative function of time. Space and time are structured by (productive) logical relations which, in Spisani's view, appear as entities that may be autogenetically derived. Thus logical determination ceases to be what it once was: a static arrangement of several merely assumed terms. By becoming able to produce the different, the identical can claim to be able to transcend the phenomenal datum, methodologically and dialectically. This is the origin of productivity in logical relations, which must remain at the root of theorization. Spisani's standpoint, the result, as it is, of an entirely original line of thinking, presents an unchallengeable dialectical front. As has been seen, his position develops through the following phases:

— a new, and productive, logic expressing the essence of the autogenetic act;
— such a logic cannot be a logic of the fixed *identical*, which would have no productive potential, but must be the effect of dialectical relationship between the *identical* and the *different*;
— logic starts from those continuously forming relationships, which stem from the *different* being born out of the *identical*;
— such a logic will lie at the base of micro-physics itself, and lead intrinsically to the concept of space free from empirical findings. In this way, space is no longer the immediate space of the phenomenon, but that of the products of logical relations, products which are expressed numerically, and are open to internal measurement through the process set in motion by self-contradiction. Physical phenomena — if one can still speak of phenomena in

this context — derive their intelligibility from the logical intelligibility of neutralized space, on which self-contradiction rests [7].

4) *The crisis of quantum mechanics and the structure of time.*

Consideration of logico-genetic possibilities for determining the structure of space lead one to elucidate the operative functionality of the structure of time. This affords proof of the existence of an objective time T_n, independent of all observers, or that is, neutralized with respect to all the laws of empirical time (which in general admits but approximately of being quantified).

Productive logic brings one to a new concept of time when applied to the reality of micro-objects. The 'impasses' reached by quantum interpretations bring about, in the first place, the introduction of endometry and, side by side with this, the foundation of a logic expressing the autogenetic quality of what lies beneath phenomena.

Spisani develops his theories on many planes, exploiting the 'crisis' of quantum mechanics, an idea which has already been found in a less elaborate form in G.I. Meakișev [8], an author who develops the dialectic of the statistico-dynamic relationship. According to Meakișev, in the sphere of science the knowledge process has witnessed the rise of structural description in terms of various dynamic laws following in the wake of descriptions concerning certain statistical laws; it is a process which carries the transcending of the 'statistical' moment a stage further, through the discovery of deeper laws [9].

It is the world called by Spisani non-experimental — since in the

[7] Franco Spisani's position is undoubtedly original and interesting, despite leaving certain problems open. For example, the extensive, endometric dimension, like topology, replaces relational space by space-place while its effect in the decisive context of micro-object processes and their description would need empirical definition. The idea is ingenious and has the merit of stressing the importance of the connection between contemporary thinking and the autosynthetic problem of space. At the same time, it comes up against the idea that the explanation of the origin of space and time is not a problem for epistemology but primarily a cosmological question. In practice, this would make it a privileged problem (Stancovici). To eliminate the measurable extensibility of space amounts to removing the idea of ideal space and ideed *a priori* space, throwing into question the empirical space conception, which is the result of collision between subject and object.

[8] G. I. Meakișev, *Raportul dintre Legitățile Dinamice și cele Statistice și Mecanica Cuantică*, in *Probleme de Filosofie*, 1958, n. 6.

[9] Calina Mare, *Determinismul și Fizică Modernă, Rolul lui Metodologic*, București, Ed. Politica, 1966, pp. 192-202.

The criticism of this point of view which is undertaken by Călina Mare starts from the observation that reality must be conceived both dynamically

nature of things, a gulf separates it from the means of observation available to us — which, in his view, makes it imperative to select new research instruments, through the redefinition of measurement. Consequently, new instruments of thought must be fashioned, eliminating the assumptions of a logic which holds in the world of phenomena, but now becomes "extinguished by a void in experience which deprives it of all sense" [10].

If we reject the viewpoints of agnosticism and Neo-Positivism, reality cannot be defined quite simply as the sum of phenomena, since it also includes what lies below them, their genetic matrix, "the void of phenomena", about which we can induce information up to a point by research into phenomena themselves, but which demands to be examined in itself from within ('endo'), relieved of the disturbing presence of the subject, with its precarious judgements on facts.

As Husserl stated, a natural thing (*ein Dingreales*), an entity endowed with such a sense, cannot but appear *inadequately* in the finite limits of appearance. The foregoing principle thus has the following rider: *if a rational position is based on an appearance which presents itself inadequately, it can never be definitive*" [11].

To Husserl, the extra-phenomenal can only be seen by an intuitive approach in penetrating the world. Spisani decisively breaks with this criticism of nature and appearances.

On the other hand, quantum mechanics too fails to attain the desired result intuitively. As Spisani testifies, the quantum principle itself, with its superposition of two states (*A, B*) the initial results of which (specific to each and different from each other) would be *a, b,* involves *indeterminacy* in the final results (*a* or *b, b* or *a*) *in the observer's time,* t_n, as well as invalidating the disjunctive connection *vel-vel* (either in one way or in another, or in both). Any stressing of the indeterminacy principle makes one aware how, in the field of quantum theory too, there remains a phenomenal residue, evidence that classical logic is in a state of crisis. Disjunction and material implication, which are the basic structures of this logic, are no longer usable. The quantum theory fails to make a clean distinction between the (classical) forms of calculus and its empirico-intuitive assumptions. It fails, that is, to define the exact temporal correspondence of micro-phenomena in an objective time,

and statistically at the same time. Relying on the fact that the present stage of human knowledge can never become absolute, the authoress meanwhile accepts that the laws of the universe cannot be reduced to statistical laws.

[10] F. Spisani, *op. cit.*, p. 6.

[11] Cf. *Ibidem,* p. 12.

since it cannot perform any calculations upon the micro-system without disturbing the objective conditions in which it works [12].

The notion of an atomic and a nuclear time shows a trend towards considering the *endo* of micro-states. A slave to classical methods of calculus, however, founded on the observer's time, t_n, this tendency arrives at an utterly discrete structure of space and time which cannot be justified except by artificial interpolation. In rejecting the static identity of elementary particles, Spisani urges the case for their temporally self-differentiating, or that is, producing states on their own through which occurs their genetic succession and movement. Hence stems a newly constructed concept of time. seen as a measure of achievement of the difference produced in respect to the *initial identity* of particles.

Hence, too, the measuring of rhythm and expansion of self-differentiation in *relation to the new identity towards which autogenesis is tending.* The micro-physical universe [13], and the locating

[12] This disconcerting state of affairs existing in microphysics and leading to artificial processes in calculus and indeterminate assertions, may only be removed by constructing an algebraic theory of quantum mechaincs which supplants traditional algebra and logic and introduces into the calculus for positional values those states which show how the micro-object moves in a space-time continuum whilst at the same time modifying the area in which it acts and thus self-transforming itself. One can then show how « if one puts a parenthesis round the outmoded logico-mathematical instrument of natural language and the perceptional sphere, one may be led to the conception of a space and time 'purified' of the notion of precedence attaching to experimental verification taken in a pragmatic sense.

This implies introducing a *measure of difference into the framework of micro-object identity.* Such a step is all the more justifiable if we pause to consider the most recent discoveries in the microphysical field, which have necessitated a revision of quantum theories in this connection. Thus, *resonance particles,* also called « resonance states », the discovery of which is due to their extremely short duration in respect to nuclear time, show a specific behaviour of their own, which we might call « productive ». *Resonance particles* appear following the interaction of several elementary particles, like mesons and K hyperions, and at first seem to form one single particle, from which they break down into multiple particles. The duration of resonance states has not been possible to establish experimentally, but only theoretically, on account of its extremely small size. The need to measure these intervals has led to notions of nuclear time (time quantities) being introduced equivalent to 10^{-24}s. The quantifying of time has caused it to be asserted that no time interval exists smaller than the smallest interval determinable, which has given rise to new theoretical difficulties. To explain these things, recourse is had to a new notion: that of the gravitational radius of elementary particles. Along these lines the quantification of space has been sought by introduction of an elementary length which goes under the name of the 'Fermi length' ($=10^{-13}$ cm).

[13] Cfr. T. Roșescu, *Timpul și Măsurarea lui,* București, ed. Stiințifică,

of a particle or point (α), in a space and time of its own, do not remain 'undecidable' owing to a failure to know whether it is 'true' or 'false' that (α) appears in a determinate spatio-temporal correspondence. Uncertainty remains in so far as the exact location (or positional measurement) of point (α) in (T_n) is not given; and this is not a problem of simple experimental verification of the time of (α) in t_n. Certainly, in considering the quantum point (α) one must distinguish the transference of (α) into (T_n) from its appearance in the observer's field and from its measurement through (t_n) since it is postulated that T_n should be independent in structure of t_n. In this situation, the quantum point must be considered — thought being a way of identifying — for the way in which it presents itself and self-differentiates. It must be established in the way it *punctualizes* and changes in time [14].

If $[(R)\ \alpha \leftrightarrows \alpha]$ stands for the self-reflection of point (α) in (α), its self-differentiation in T_n may be described like this:

1) $\alpha = \alpha$ that is $[\alpha\ (R=)\ \alpha]$; which stands for:
2) the difference of (α) from (α) from which, via
   $\{\alpha \supset \{\alpha \leftrightarrows (R=) \alpha\dot{\alpha}\}\}$
3) $\dot{\alpha} \in \alpha\,\alpha$, that is ($\alpha \in \sim \alpha$), where '$\sim$' stands not for negation but for difference.

Consequently, the identity of the point in objective time means its difference from itself. It is a question of obtaining the otherness of the *equal*, but of an *equal* which derives the *measure of difference* from itself, through a process of endomorphy. This measure is not then fixed by inner time rhythms, but determined by the endorhythms of time and space together [15].

5) *Objective time and difference in space.*

Following up his exposure of the limitations implicit in the rules put forward by quantum theory concerning the infraphenomenal world, Spisani goes on to criticize the way in which traditional calculus assimilates time in (measurative) space. As a result of these rules, one would arrive at the geometrizing of time and the restatement of it as the fourth parameter of objective reality. Now, if the principle of uncertainty and location of particles in relation to the observer holds good, what guarantees the validity of the structural identification of time with space — and if this

[14] F. Spisani, *op. cit.*, p. 30.

[15] The result of a quantum state, which would anyway not be foreseeable by consideration of mere phenomena, becomes something calculable by means of self-differentiation of the identical in an objectively developing space and time. In this way, self-reflection becomes at the same time a way of identifying the objective space and time.

identification is correct — how could one distinguish the individuality of time in connection with that of space? And if this identification is correct, how is it possible to distinguish punctual individuality in time correlated with punctual individuality in space?

Objective time — Spisani thinks — must not have geometric or physical properties: it must be non-intuitive, extra-empirical, different, that is, from the time used in common gnosiological activities. For it has nothing to do with exomorphic determination, i.e. the normal measurability, of distinct objects (found in the physical field).

It is unnecessary to jump from here to the conclusion of accepting a structural isomorphism of time and space. Nonetheless, as the existence of such an anology contains at least a degree of sense, to consider it amounts to advancing the hypothesis that infraphenomenal space and time develop a function of convergence, unlike what is found in ordinary physics (without any explanation of the course and meaning of their co-implications). Hence, if the researcher abandons the intuitiveness of normal *space* and *time*, he may admit that the operative processes inherent in the infinitely small object are translatable into the indifference of the space-time relationship. What does remain to be cleared up is how such a kind of indifference can lead to the deriving of a measurement distinction.

The space-time correspondence of an α-point value is worked out by Spisani in the following form [16]:

T	S	
1	1	2
2	3	4
n	$(2n\text{-}1)$	$(2n)$

It will be seen that one positional value in time corresponds to two situations (or *places*) in space. The formula may be stated: the difference of (α) in objective time (T') is the product of identity (α) as the self-distinction of (α) in S, with the condition that every value for (T) will refer to two values of (α) in the serial structure of S.

This statement makes it possible for adequate definition to be reached as to what Spisani means by endometric-positional difference: here the definition put forward is objective, not depending on any outside criterion of verification, but simply on the auto-functional relationship of measurement. The micro-objectual diffe-

[16] Cf. F. SPISANI, *op. cit.*, p. 54.

rence is the product of identity (α); an identity that is self-reflected as the differentiating yardstick of the identical, which measures itself and sets the operative result in motion [17].

Consequently, time transference of a *point* lies in the fact that the point itself differentiates in objective time, in relationship with a bipolarity of two space positions; and this leads to the result of an identification in the context of positional difference. The identity-difference of α is the original form of the measurative relationship between time and space in positional calculus. The bipolarity of α with α corresponds to a state of time.

By way of correlation, a temporal point considered in relation to its own axis, links up with two points in space. The temporalized point implies a bipolar variation of space, a positional difference towards itself, and *vice versa.*

This is actually the way to achieve concrete identity in the situation of micro-physics, as opposed to the schematism of some phenomena of movement taken in a classical sense, which is to say on the basis of abstract identities.

Atoms, molecules, cells, along with other elementary particles, are complex phenomena and not simple reference objects. When identity assumes the *point* to be *in motion,* it does not reduce to tautology. Since it exists, it partially cancels itself out (self-differentiation) and reforms in time and space. To put it more precisely, time is defined as a function of space in the basic sense of self-reference and self-identification of the micro-particle. In its relationship with time, the point produces the numerical α-point variant, or more precisely, it is correlative with this variation. It derives from it and brings about its measurement.

An intuition of genius, anticipating this definition of objective time, is to be found in the last century in J. Marie Guyau (1854-1888) [18].

Though he did not distinguish sufficiently clearly between objective and subjective time, and though he assumed that experience was inherent in the definition of time, Guyau saw time as one of the forms of differentiation flowing from the evolutionary development, one of the causes of heterogeneity in results. Time, for him, was a consequence of passing from the *homogeneous* to the *heterogeneous,* a differentiation introduced into *spatial places,* the reproduction of different effects in one and the same setting [19].

Time — writes Guyau — is not an *a priori* form which we impose

[17] Cf. F. Spisani, *op. cit.*, p. 64.

[18] Cf. J. M. Guyau, *La Genèse de l'Idée de Temps,* Paris, F. Alcan, 1890, p. 119.

[19] In this conception, as Guyau himself makes clear, time is the abstract

on phenomena. It is a group of relationships set up by experience. It is not a pre-supposed archetype in which the sensations are said to be enclosed, but a channel scored by them, the course they spontaneously take.

It will immediately be noted that the formulation "a group of relationships set up by time" among phenomena, and "a channel scored by experience itself", are extremely up-to-date and plastic definitions [20].

6) *The objective time dimension.*

Spisani defines the concept of time as a series of correlating α-point numbers in two numerical orders, odd (Ω) and even (Φ) respectively. The order of sequence in the framework of the ordinal series is arrived at by striking upon the bi-adic correspondence between α-punctual, arithmetic values. The principle on which the basis for correspondence is built is as follows: to every point in time there corespond two points in space. Consequently, each numerical value is the pointer to a position of α, as emerges from the relationship established between space and time determined via the parametric relation around α.

The ordinary values for the time dimension may in this case be indicated as a succession by the bi-univocal correspondence between Ω and Φ. One thus obtains a structure of positional values in the framework of which Ω and Φ stand for points of mathematical space in a temporal sequence, which is to be defined in the objective time T of Ψ values [21].

Unlike Heidegger, Spisani distinguishes various time rhythms in

formula for the changes in the universe. It is not a cause of progress, but is caused by progress as a form of self-measurement of that universe. The passage from *homogeneous* to *heterogeneous*, a basic process in relation to which time is defined — or regionalized, as we would say — is simply the equivalent on the ontic plane of the logical process in passing from the *identical* to the *different* (cf. *Ibidem*).

[20] If one takes the two formulations together, the definition quoted gives an overall and extremely general idea of time, without cancelling the individuality of the types of time concept. The definition clarifies later as *objectified time*, as emerges from the formulation referring to the time of the subject. We here have objectivity generated by the concrete conditions of experience, by the differentiating relationships between phenomena. The infraphenomenal definition of time — advanced by Guyau — links up, therefore, with the infraphenomenal definition put forward by Spisani with his introduction of time as a form of self-measurement of the extra-empirical dimension.

[21] The concept of time which this investigation of the microcosm seeks to clarify, in a certain sense derives — it seems to us — from a continuation of Heidegger's thinking. He is concerned with the need to research, in the context of the *Dasein*, which is pure objective time (the sense of existence

the context of physical time. He stresses, that is, the objective and fundamental nature of the autogenetic time in microphysics. Whilst establishing an independent course for this kind of time, he denies all chance of it being possible to determine this along lines of a pre-established measure, and looks to the specific self-measurement of self-differentiating and self-diversifying rhythms. Heidegger insists on the fact that physical time (T_n) — to use Spisani's symbols — cannot be surprised in its ex-static nature, except in a framework established by (t_n), that is, inside the temporal structure of the subject (without there being any indication, however, that such a prospect is likely to materialize). The opening up of this access to the being which Heidegger foresaw thus emerges as a jump on the part of knowledge, an intuition. Unlike Heidegger [22], for whom physics is seen through the prism of purely intuitive logical principles, the main interest here concentrates on the objective conception of T_n and the process of determining it: the relationship, that is, of operative dependency which is typical of micro-physical entities.

In keeping, now, with Motru's viewpoint, the distinction between physical time and historical time is decisive [23]. Physical time is easily identifiable under the form of linear direction, which becomes numerical (thus giving rise to the physico-mathematical reasoning processes), though under this guise it is not an experienced fact, but conventional, abstract [24].

In Spisani, on account both of the new time sequence based on

of the *Dasein*), into the *Sein*, the being that is separated by an abyss, both through the structure of its time scheme and on account of other subsequent structures, from human existence. Heidegger, who ranked the problem of time as one of the main, indeed perhaps the most fundamental problems of philosophy, considers the defining of objective time as equivalent to revealing the sense of being. From the time of his work, *Der Zeitbegriff in Geschichtswissenschaft*, Heidegger stressed the distinction between the time of the (human and historical) subject and that in which the natural sciences operate. Physical time is considered as a sequence of instants, possessing a direction, or that is, simply orientated. This time represents a homogeneous order of situations, a scale between them in which each moment is determined in relation with the initial moment, according to the place it occupies in the sequence. In opposition to this time stands historical time, which is felt as an immeasurable series lacking homogeniousness.

[22] Cfr. Al. Boboc, *Existență și Limbaj în Conceptia lui Martin Heidegger*, in *Exisitentă, Cunoaștere, Actiune*, Bucureşti, ed. Stiințifică, 1971, p. 117.

[23] Cfr. C. Motru, « Noi Cercetări asupra Timpului », in *Analele de Psihologie*, Vol. IV, Bucureşti, 1973, p. 3.

[24] According to Motru's conception, man possesses an intuition of time thanks to which psychological time can function. This intuition of time is a

correspondence between the series that characterize it, and of the novelty of the mathematical mechanisms, this order is hard to grasp, unless one bears in mind the autosynthetic nature of its formalizing. In order to describe the structure of time, Spisani introduces new operative instruments. He posits a calculus for positional values consisting in the fact that the α-positive and -negative elements are determined at once in correspondence with the numerical series of so-called base-values for the objective time of succession (or time scheme) Ψ, and with respect to the condition whereby all the numerical α values indicate a space-time transference of an identical base-value [25].

The idea beneath this calculus rests on procedures that differ from those traditionally used. Thus it consists in admitting the result of self-differentiation of identity by one and the same α-point value to be a logical product. The particle's identity with itself in the time sense presupposes its difference from self in a spatial sense. Both the time and the space contexts are determined regionally by the respective particle, as expressions of the latter's pattern of movement. Analysis of α's movement involves complex calculation of the successive positions held by the micro-particle itself, or more precisely a correlation in connection with the positional base-value. To this end, Spisani makes use of the basic operations of addition, subtraction, multiplication and division, which are performed, among other things, between decimal positional indices of the *α-point values*, but in a way which radically re-forms and reconstitutes their behaviour. The operations are carried out between two points in micro-physics via determination in the sphere of objective time correspondence, which they assume as their middle term.

One proceeds as follows: a correspondence is set up between the arithmetic α-point values for the respective positions. The actual effect of the ordinal series belonging to time scheme Ψ is revealed. By various operative processes one seeks the result of the correlations, in connection with the middle term. Calculus by way of positional values brings out the fact that, in general, two α-point values in the space of structure Ψ, Ω, Φ, correspond to one number

construction of relationships, a structuring performed by human activity in the speculative field (Cf. C. MOTRU, *Timp şi Destin*, Bucureşti, 1940, p. 109).

[25] One must here take into account what Spisani says on the matter: « if by numerical entity (or base-value) one means any real, rational or relative number, the algebraic value would be the basic algebraic concept corresponding to it ». Likewise, one should mention that « by state one means one single base-value inherent in the operative structure » (Cf. F. SPISANI, « Foundations of Productive Logic », in *International Logic Review*, Bologna, 1971, No. 3, p. 8).

in time Ψ which fixes itself as the middle positional value and produces the result of the values.

One important consequence of this calculus is the realization that in the operative positional structure Ψ, Ω, Φ there is a cancelling out of the direct function of time in situations where one passes from negative α-point values to positive α-point values, and this marks the limit of the whole Ψ, Ω, Φ structure.

The cancelling of time implies an idea of the existence of a "zone" in mathematical space where the difect operative function of time T_n is eliminated. Spisani demonstrates how, in this case, a positional rhythm is retained, despite its seeming to fade gradually away.

The local nature of time, and the fact that its homogeneousness is stressed by the existence of several points of annulment — or more exactly, of rhythmic crystalization, seeing that atemporality is inconceivable — are points that are thus brought home in a particularly convincing manner.

7) *Endometry of space and time.*

The concept of space as considered in endometry [26] seems to allow of a determinatory explanation of all particle trajectories with respect to their manner of movement, without this bringing about any local indeterminacy. The need to admit a non-Euclidean micro-physical space (K_n) possessing an endometric structure (F) is a pressing one, and demanded by the structure of space in connection with the time characteristics of the micro-cosm.

The complex relationship between micro-physical space and time must be analyzed, that is, beginning from the fact that, whilst one can hardly talk of structural isomorphism, nonetheless space and time present a series of analogous properties, after their specific function: for example, in connection with their neutralization towards the rules of empirical measurement. It may be wrong to reject the idea of a single structure for space and time put forward by Aristotle, who starts from this viewpoint in order to explain the paradoxes of Zeno [27], but to consider space and time, in respect of that structure, as representing isomorphic, symmetrical subgroups, and to acknowledge time as a fourth dimension of space — as Einstein does, incidentally — is to Spisani the same as failing to

[26] Cf. F. Spisani, *Neutralizzazione dello spazio per sintesi produttiva*, Milan, 1968.

[27] Cf. the references and vast bibliographies of W. Gent, *Das Problem der Zeit, eine Historische und Systematische Untersuchung*, Frankfurt am Main, G. Schulte-Bulmke, 1934. See too H. Pohl, *L'Homme à la Poursuite du Temps*, Paris, Plon, 1957, *passim*.

consider the individuality of these fundamental forms. This serious *impasse*, brought out by quantum mechanics, is due to nothing but the fact that when space is quantified, the corresponding quantification of time does not come out [28] (which would seem to demonstrate the impossibility of quantifying space and time in the same context). Spisani's analysis tends to highlight the generally subjective and inappropriate nature of empirical quantification.

If one turns to consider the generating relations of space and time — and the way, by their very nature, they depend on a deep structure of phenomena identifying and differentiating themselves — one may conclude that, up to a point, these generating relations present similarities in functioning which are mirrored in the existence of certain partial analogies between the structures of space and time.

Endometrical calculations must however take into account both the particular nature of time and those qualities of space which are basic forms of identification, substituting the discrete character of quantum mechanics by that of punctual continuity, which consists in the possibility of instantly reducing the position of points in a region of dimensional space (K_n) to one single point-duration, the moment of differentiation in the point structure itself.

We ought thus to consider space and time in relationship, as representatives of a correlative duality, to use a term expressly employed by the Rumanian thinker I. Eliade Radulescu. In other words, these forms find their completion through their structures and properties in an autogenetic framework of the micro-operative dimension [29].

8) *The endometric figure and its methodological value.*

The developing of this ideas — formulated by Spisani in a new concept of time — grounded on efficient methods of calculus, involves determining a *zero time* in space (K_n) and introducing, in reference to this point, the so-called endometric figures.

The need for these may be seen in the fact that by representing n α-point values in a space outside the Ψ sequence, we fail to generate relations that bring out the constant rhythm of displa-

[28] Cf. J. L. Rigal, *Timpul şi Gîndirea in Fizica Contemporană,* Bucuresti, Ed. Enciclopedică Română, 1972, p. 20.

[29] Cf. *op. cit., passim.*
As is shown by O. Costa de Beauregard, the theory of relativity makes plain the existence of a complementary link between space and time. At the same time, however, it retains a categorical, preconceived distinction (Cf. O. Costa de Beauregard, *Principiul Relativităţii şi Echivalenţa dintre Spaţiu şi Timp,* in *Timpul şi Gîndirea iñ Fizica Contemporană,* p. 140).

cement. In the last analysis, the endometric figure depends on arbitrarily selected quantity values, independent of time. As a structure, space is here taken to be a sub-set structurally based on the micro-entity in a phase of dialectical self-differentiation. By way of correlation, in its conjunction with space, time must be taken as a measure intimately bound up with space. There therefore exist as many different times as there are movements and places [30], though one must make it clear that the reducibility of movements to underlying forms in the sense of "existing between" causes one to reflect on the structure of time.

One specific property here emerges from the endometric figure: this is the fact that it cannot be assimilated in the geometric figure. Its diagonals have no dimensions and accordingly have no area in K_n (the latter being neutral space). The endometric figure hence individualizes a series of n-point relationships while not being constructed along geometrical lines. It is this figure that gives rise to a process of construction in K_n on the basis of diagonals of zero measurement (and upon sides which conversely correspond to the α-point difference). The figure measure itself as it constructs itself and turns into a point [31]. The point structure alters and becomes non-punctual. In an endometric figure time intervenes in the operations which create and remove diagonal lines. Since such a figure has no surface area (and objective time is annulled at the meeting point of the diagonals) it is a non-figure, or more precisely, a *point-figure*. In this case, a whole host of point-figures do not amount to empirical space or time. There is no objective time in the context of phenomenal physics. The object is identified on the other hand, in the point (called a point-figure) in K_n, whose physionomy is only indirectly exomorphic. Its property is that of representing the superposition of the variety of endometric states in autogenetic mechanics. Superposition is quite simply the endometric identification of point figures in K_n.

Admittedly, on the self-operative plane it is not possible to collect and juxtapose a whole host of points. Nonetheless it is possible to fix the inner measurement of a single one of them; and many endometric points form one single point or, if one prefers, a point-figure, which is the same thing. This point alone is the result of the transformation being investigated.

It is hence important to bear in mind the double nature, punctual

30 Cf. R. Lennuier, *Ideea de Timp în Fizica Modernă*, in J.L. Rigal, *Timpul si Gîndirea in Fîzica Contemporană*, p. 185.

31 Cf. F. Spisani, *The Meaning and Structure of Time, cit.*, p. 128.

and non-punctual, of endometric figures, as emerges from positional value calculations. As the point has no surface area, it may be conceived either as a *point* or as a lateralized *line*. The fact that this line is considered by quantum mechanics as a curve — as a succession of curving lines —, that is to say, defined as a wave, is nothing but a consequence of the subject's perceptive structure as it detects the quantum phenomena in its discrete way.

On the contrary, the endometric figure presents itself in the observer's field as a *point* and a *wave* at one and the same time. It is expressed as an extrinsic unity and an alternative necessity, something which, in a rather different way, Louis de Broglie dwelt on, though he took the split in micro-physical identity to be part and parcel of the *quantum* nature itself. In so far as he sees movement as contradictory identification and differentiation, Spisani does not depart from the thesis of the double nature of micro-physical entities (wave-particles) explaining that in endometry the point structure must be seen as something more than a point, but also something different from a wave.

The endometrical explanation of the point-wave alternative thus shows how use of the experimental criterion affects at least marginally the scientific assertion. Subjective time (t_n) is defined as the time of visualizing the endometric figure, "visualizing" being taken as the reducing of this figure's structure to simple correspondence in t_n of what emerges from the act of observation.

The observer tends to believe in a possible "correspondence" between objective and subjective time. He introduces a probabilistic notion of time, concentrating on a statistical relation precisely because quantum physics would not provide any definition of T_n, operating as it does in the structure Ψ, Ω, Φ. Conversely, the structure of T_n proposed by *endometry* is clearly independent of the subject's interference, a thing inconceivable along the lines of classical logic with its traditional means of calculus, which actually lead the observer to the paradox of *indeterminacy*.

The eclipsing of objective time in the zone of the dual structure (punctual-nonpunctual), stemming from indeterminacy produced by subjective time and the exploiting of this, marks the beginning of duality in micro-physical interpretations (point and wave varieties) of an entirely new kind. Spisani admits the possibility of a partial "correspondence" correlation between the two types of structure. In so doing, he in fact unbends towards experience, granting a possibility of interpreting it after having originally — in the foundation of endometry — placed all experience between parentheses for methodological reasons.

Exomorphy is an extrinsic property, manifested through the

presence of the observer. At the same time, though it is correlative with endomorphy. It derives from this. The wave-particle hypostases (the observer cannot help thinking of them in a pre-existing and yet permanentized space-time context) are obtained by self-movement and cancel out the moment they are reversed. But, as an effect of interference by his own space-time structure, the observer also detects the dualized micro-physical entity. Then, to the extent that the observer stands back from his own way of picking up the α-point relation and applies the endometrical method, he will be able to fix the correlations between the two types of structure. For endometry makes it possible to translate automorphic figures exomorphically, explaining, that is, their double nature by the aid of special (non-classical) rules of transformation.

This translation is not generally bi-univocal — Spisani warns us — so that to talk in a classical sense of correspondence ($T_n \leftrightarrows t_n$) in any situation of micro-evolution is out of the question [32].

What one might add to the rules of transformation provided by endometry, concerning the "translation" of space-time determinations for automorphic figures, is the re-discovery of a relative equivalent (constructed by classical mathematics and geometry) for K_n, in the observer's space and time. This will only be possible via (exomorphic) mathematicized visualization, as in general it is not admissible to proceed by analogy.

9) *Towards a genetic and dynamic determinism.*

This new approach looks to productive logic for a theoretical foundation to the Neo-deterministic process. The conception of space and time offered by relativistic physics is superseded by endometry. Structure and relations of the general process of self-identification — which also includes the element of differentiation — are described and, in place of quantum mechanics, we are offered a genetic mechanics founded on dynamic laws.

In the name of dynamic, genetic self-determination, we see a departure from the indeterministic and statistico-deterministic standpoints put forward by the theoreticians of quantum mechanics.

The hypothesis of simple assimilation by the subject of the objective structure is rejected and a theory founded of those complex relations between subject and object, in the framework of which the relations among times of a space-time structure are enable to play a new role.

[32] C. Radulescu Motru had already rejected the idea of an overall time structure embracing t_n and T_n, since in time the arrow often changes direction, thus destroying the idea of an irreversible sequence (Cf. C. Motru, *op. cit.*, *passim*).

Endometry notes how certain forms measure themselves in the time they take to construct themselves. They represent a gradually enlarging field of research, which takes on a propaedeutic character, amonst other things, for empirical investigation.

Owing to the fact that endometry manages to restore dynamic determinism and give a more coherent definition to the logical " deep-structure " of micro-physics — without needing to introduce any factor of uncertainty — it represents a consistent theory built upon the principle of contextual adaptation. *Endometry*, that is to say, profoundly alters the relativistic views of modern physics and, with its own peculiar critique, prepares the way for a deeper mediation of the foundations of physics.

Endometry considers the α-space structure as a unity of the synthesized difference, and the specific time of the dynamics of the atom as the result of a totalizing of the elements inside it [33].

As Spisani notes, in distinguishing between *endometry* and mathematical physics, the differential processes of α-point figures may remain as working hypotheses for the theoretical physicist. Yet they are not simple hypotheses for the mathematician, who plots the course of transformation by rules and procedures. Verification on the experimental plane may also fail to emerge, without any weakening of the coherence (of a deterministic and non-classical kind) of endometrical costructions [34].

When applied to describing the self-generation of micro-physical particles, in the space-time complex in which they evolve, Spisani's *endometry* starts from the differential procedures of productive logic and goes on to carry out a programme introducing Neo-deterministic processes of "auto" and "endo" measurement. For this one abandons measurative processes that retain uncertainty or contain fixed, static rules of correspondence. In such a situation, Heisemberg's relations of uncertainty no longer hold any justification. Furthermore, *endometry* allows one to assume an explicit criticism of the theory of relativity, since it refuses to include among the laws of micro-physics any mere agreement between different observers. *Endometry* does away with all subjective systems of reference in favour of the idea of an autogenetic system, referring to itself as the "yardstick" of the process produced by self-contradiction.

This abandoning of "measurement" carried out by the subject and the neutralizing of empirical space here find the justification:

[33] On the question of the dynamics of the atom, cf. R. Lennuier, *loc. cit.*, pp. 187-188.

[34] Cf. F. Spisani, *op. cit.*, p. 148.

the relativity theory arrives at contradiction precisely because it accepts the classical methods of measurement and an additional corollary of space and time.

Spisani does not challenge the quantum modality in which we are determined to conceive reality, but rather the fact that this reality is simply quantistic in essence. He agrees with Max Planck in recognizing that logic coincides with the laws governing succession, but does not admit of this logic — structured as it is today — stopping short at the succession of mere sense impressions.

It is by no means chance that R. Lennuier, too, states that the time of the equations in wave mechanics and the time of the observer, the physicist experimenting and seeking basically to relate the elements of the atomic world to his own space-time dimension, is a different time from that of the wave-equations. There is thus no chance of our foreseeing the actual time in which the corpuscles of micro-physics effectively live, supposing that such a time exists [35].

Now, the very existence of an objective time for microphysical entities offers a chance of localizing the definitions of measurement temporally too.

10) *New arguments and critical observations.*

Let us take an argument forming part of Spisani's thesis with regard to the dynamic nature of micro-physical determinism, calling upon the third principle of thermo-dynamics. We allude to Nerrnst's theorem. According to this principle, at absolute zero, the entropy of any system may be reckoned as always equal to zero. This is possible as entropy (S) is defined via the relationship:

$$d_S = \frac{d\,Q}{T},$$

which should be interpreted thus: the variation in entropy at the moment of the system's reversible passage between two states is equal to the variation in heat.

In other terms, the existence of an entropy for the system assumes the existence of entropies for each of the components respectively of the same system. This illustrates that the physical notion of entropy does not necessarily imply statistical processes in its definition. The observation is of extreme importance, for, referring to the conditions of potential for experience, entropy is taken

[35] V. & J. Synge, *Relativity, The Special Theory*, Amsterdam, 1956, *passim*; Cf. too G. Thomson, *Inspirație și Descoperire*, București, Ed. Enciclopedică Română, 1973, p. 179; R. Lennuier, *loc. cit.*, p. 185.

as the measure of the degree of indeterminacy in a system, the result of allotment of probabilities in a dynamic field.

In the case of a system formed of one single entity or a system with a small number of components, entropy actually becomes a measure of the degree of determination, indicating the energy which needs to be spent in order to revert to the original state of the system. Now, to show that the time of micro-objects does not admit of statistical definition, that the "local" quality of time rules out its having a statistical nature — and these are the ideas put out by Spisani — implicitly pre-supposes admitting the dynamic potential of entropy, that is, the existence of an entropy for the micro-physical universe.

Irreversibility is a consequence of the fact that in the process of self-identification, the tendency of the *different* towards the *identical* implies the creation of a new identity of movement. Consequently, since no identification can be called perfect or definitive, identical with the remaining identifications (as it pre-supposes a difference), and since time is a local measure of identification, the growth of entropy expresses an ever-greater internal absence of energy which makes the transformation irreversible.

The criticism of quantum mechanics for its statistic and discrete quality implies a new concept of entropy. A new theory of time involves the need to show the existence — or otherwise — of a rhythm and direction of time, bringing out, that is, the correlation between time and entropy. Criticism of the "statistical" process must lead to a new foundation for thermo-dynamics, and hence to the founding of micro-dynamics.

To return to Nerrnst's theorem, we would point out that, in connection with what he defines as the variation of entropy at absolute zero, one obtains a non-determination of the form $\frac{0}{0}$.

Fermi takes the statistical method of thermo-dynamics to its extremes, and shows how Nerrnst's theorem asserts that, to a thermo-dynamic state of a system at absolute zero, there corresponds just one dynamic state with the lowest compatible energy and a given crystal structure (or with the system's state of aggregation).

May it not be that this interpretation enables one to pass in a univocal way from a statistical, thermo-dynamic state to a dynamic state with zero entropy? And does this not mean that the statistical appearance constitutes a mode in which dynamic (micro-physical) phenomena are represented before the observer? Consequently, if the primary state (absolute zero) of the micro-physical entities' system is a dynamic state, characterized by the lowest energy compatible with the physical nature of the system, it is clear that, owing to the network of relationships determining it, the structure

cannot become a disorder with the evolution of the system, but turns out, rather, to be an order of a more complex kind. In this case, entropy appears as an energy size, characterizing the evolution of the system's states in a definite way.

These suppositions, developed out of the third principle of thermo-dynamics, attain a certain degree of certainty to the extent that they may be picked up by the overall mathematical theory of the microcosm, advanced by Spisani.

ROUMANIAN CONTRIBUTIONS TO LOGICAL DEVELOPMENTS

OCTAV ONICESCU, EUGEN RADU *

RESEARCHES IN MATHEMATICAL LOGIC AND IN THE FOUNDATIONS OF MATHEMATICS

1. The first systematic interest in mathematical logic and the foundations of mathematics in Romania go back to the year 1933 when the late Prof. Grigore C. Moisil (1906-1973) opened his course in *Logic and Proof of Theory* at the University of Jassy, where he also organized a seminar on the philosophy of science.

Moisil's interests had focused from the very beginning on non-classical (non-Chrysippian) logic [1] and, like Lukasiewicz, considered the appearance of this logic of major scientific moment having marked analogies with the moment of development of non-Euclidean geometries (as confirmed later by certain technical results).

With Moisil, the " branching out " of logic was not merely an unexpected broadening of the scope of logical-mathematical techniques but a fact full of epistemological significations as well.

We shall enumerate, in short, the contributions made by Grigore Moisil during the first ten years of his activity as logician: he interpreted the problematic hypothetical syllogism in Heyting's propositional calculus (interpreting the double negation as " possible ") and proved (in terms of this interpretation) that the forms of assertoric hypothetical syllogism in classical propositional formalisms are preserved. He constructed a theory of modal syllogism both in the trivalent Lukasiewicz predicates calculus and in Heyting's predicate calculus (in the light of the above interpretation). At the same time, however, he underlined that those theories could not be superposed over the traditional (logical-philosophical) theory of modalities. Starting from a "statistical theory of the concept" he built two classical-type syllogistic but over calculi with predicates whose non-classical attributes derive from their replacing standard quan-

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[1] The term belongs to J. Lukasiewicz and was subsequently taken over by Gr. Moisil. Lukasiewicz noted that it was not with Aristotle but with Chrysippus and the Stoic school that logic was accompanied by a strictly deterministic philosophical conception and it was they who staunchly supported the bivalent character of logic.

tifiers by "stochastic quantifiers", in which case *dictum de omini* and *dictum de nullo* do not work.

Moisil was one of the first logicians in the world to realise the importance of an in depth algebraic study of the models of logical systems. He tried to make an algebraic characterization of n-valued Lukasiewicz logics [n-valued L-algebras: distributive lattices with first and last element, biresidual lattices endowed with involutive duality (modelling negation) and with n-1 endomorphisms (modelling modal functors), satisfying certain axioms]. He also proved some representation theorems of a Birkhoff-Stone type for 3- and 4-valent L-algebras. He characterized algebraically Bocivar's trivalent logic and devised a theorem of representation for the models of this logic. He proved that the models of Lesniewski-Mihailescus' fragments of classical propositional calculus are second order Abelian groups.

Starting from the Hilbert-Bernays positive logic, Moisil buil a series of non-Chrysippian extensions: general modal logic and special modal logic which, in terms of a certain interpretation, proved to be intermediate logics (the first being a conservative extension of Heyting's propositional calculus), symmetric, modal logic, special intuitionist logic (in which the excluded middle works for negations), etc., examining in each case the structure of model-lattices as well as the capacity of the logical systems obtained for expressing non-formalized modal thinking.

In a series of papers published since 1937, E. Milhăilescu has investigated some remarkable fragments of the propositional calculus containing only the equivalence connector or equivalence and negation connectors — or equivalence and disjunction, or equivalence, disjunction and reciprocity, etc. — in each case attempting an approach to the corresponding problems of the metasystem (e.g. decision-making or completion).

Research in the foundations and in the philosophy of mathematics was strongly stimulated by the seminar on the philosophy of science led by O. Onicescu in the early fifties at the Faculty of Science of the University of Bucharest.

Worth mentioning are the series of books on mathematical logic by Prof. A. Dumitriu published in that same period.

2. In what follows we shall glauce at the results in mathematical logic and the foundations of mathematics achieved over the past three decades at the Faculty of Mathematics and the Institute of Mathematics (set up within the Romanian Academy in 1949).

(i) *Non-modal logical systems.* Starting from the idea of defining a propositional logical formalism without connectors whose de-

ductive schemata would be valid for both Chrysippian and non-Chrysippian logics, Grigore C. Moisil constructed, by means of Gentzen's technique, a higher-order sequential propositional calculus which he denominated "elementary logic". Investigating the models of this logic the author determined some sui generis mathematical entities, exploration of which (both algebraic and logical) seems hyghly promising.

Furthermore, Moisil defined and studied significant extensions of elementary logic.

As regards non-modal extensions, one of Moisil's guidelines seemed to be the establishment of some systems adapted to formalizing some physical theories whose nature imposes certain restrictions over a basic logic (this idea originated in Garret Birkhoff and J. von Neumann's attempt in 1936 at constructing a logic of quantum mechanics in which the propositional lattice was to be non-distributive (a prerequisite imposed, presumably, by the structure of the physical model). Moisil began to build the strictly positive logic with two connectors (disjunction and conjunction) whose models are non-distributive lattices (opposed to the models of Hilbert-Bernays positive logic which are residual lattices i.e. distributive); further, he extended this logical system to what he named the « logic of quantum mechanics » which is a propositional calculus with such connectors as disjunction, conjunction, negation and whose models are projective geometries. At the same time, in a work of research on the semantics of propositional logic, admitting partially ordered models, Moisil defined and studied other non-Chrysippian extensions (non-modal) of elementary logic (e.g. implicational fragments of Johansson's and Heyting's calculi).

Following another research line, Prof. O. Onicescu started constructing two non-negative propositional logics which he denominated "epistemological logic" and "ontological logic". In prof. Onicescu's view, eliminating negation from the logical systems devised to evidence the formal structure of mathematical approaches is justified by the remark that closed mathematical theories contain but true propositions.

Besides the technical distinctions between epistemological logic and ontological logic (e.g. in the latter case disjunction is not idempotent) differences are recorded also in their capacity to formalize various mathematical theories (thus by using an arithmetic example Onicescu pointed out that epistemological logic is non-constructive).

Other investigations of Moisil's into deductive theories refer to the completion of intuitionist logic (approached by both classical and constructive procedures), the properties of some extensions of

Johansson's minimal calculus and Heyting's propositional calculus. On these same lines too, yet often resorting to the techniques of the category theorem, came O. E. Căzănescu, Gh. Nadin and E. Radu.

(ii) *Modal logics.* Continuing his investigations which started in the early 1950 s on n-valent Lukasiewicz logics, Moisil obtained an adequate axiomatization of these logics in a higher-order sequential propositional calculus, as an extension of elementary logic [see (i)].

Noteworthy interest in n-valent Lukasiewicz logics (propositional logics) were supported and stimulated by the discovery of some empirical (technical) models of these logics (for certain values of n). We are referring in particular to the models provided by the (real) operation of contact and relay schemata whose algebraic-logical theorem found in Grigore Moisil one of its principal supporters and promoters.

In 1968 Moisil defined θ valued L-algebras, order Q-type of a totally random ordered set, and furthered their systematic study. A propositional calculus was devised which catered for these algebras as models, yet the problem of using them in the meta-mathematical study of some theories and in other scientific disciplines still remains open (Lukasiewicz and subsequently his follower Z. Zawirski approached ω-valent logics whose model is the set of rational numbers within the [0,1] interval — in the hope that these logics could be employed in the probability calculus. On the other hand, Skolem and Chang tried to build a set theorems taking as a basic logic a logic with an infinity of values. Meditating on what he denominated "nuanced concepts" Moisil stated that the extension of such a concept gives us a "fuzzy set" in Zadeh's acceptation. Hence the hypothesis that the fuzzy set theory, as a theory superposed over the θ valued Lukasiewicz logic, could help formalizing nuanced concepts thinking.

A series of young specialists from N. Popescu's algebraic school approached θ valent L-algebras by means of the category theorem. Thus, G. Georgescu, in a series of works on these algebras, classified centred L-algebras and injective objects and hulls within the category of L-algebras, proving a duality theorem of monadic and polyadic L-algebras and obtaining a semantic completion theorem for polyadic L-algebras.

Similarly, by applying the category theorem, Al. Brezuleanu, R. Diaconescu and Ioana Petrescu obtained some results on (possible) models of formal logical systems.

Moisil's works on L-algebras have been furthered also by numerous foreign logicians among whom: the Bahia Blanca group (Argentine) with Prof. Antonio Monteiro and his followers (L. Mon-

teiro, R. Cignoli, G. Coppola, a.s.), Prof. K. Iséki (Japan), J. Varlet (Belgium) and Z. Katrinak (Czechoslovakia)).

(iii) *The foundations of mathematics.* Proceeding from the well-known formal system of the set theory suggested by Bernays in 1958, C. Constantinescu constructed several years later a new formal system of this theory. Using Bourbaki's formalization method, Constantinescu's construction succeeds in overcoming some shortcomings (with regard to clarity) in Bernay's construction, whilst at the same time avoiding the great disadvantages of Bourbaki's formal system i.e. inclusion of the axiom of choice among symbol $\in$ axioms and (in what concerns the necessity for formalizing the concept of category), the absence of classes.

Speaking of formalizations, some of Moisil's and Onicescu's attempts at formalizing arithmetic deserve special attention. The former initiated the study of arithmetic fragments whose support is (2nd and 3rd order) elementary logic. Although in these fragments a series of fundamental arithmetic theories are inevitably non-derivable, to establish the validity of their metatheoretical properties is, nevertheless, an interesting undertaking (there are also other weak formalisms if referred to arithmetics as a whole, but their metatheoretical properties are very strong e.g. R. Robinson's system). O. Onicescu's aim is integral formalization of mathematics over ontological logic [see (i)] which, in his opinion, is possible because in this logic disjunction is quite open. It remains to be seen how the technical difficulties inherent in the element of negation (analogous to those in intuitionist mathematics when replacing Heyting's logical support by Griss-Glimore's) are to be surmounted.

Along other lines of research mention should be made of works on the application of model-theoretical methods to algebra (S. Basarab and I. Petrescu; the former has succeeded, among other things, in characterizing the elementary theorems of finite, profinite and torsion Abelian groups) and on the foundations of intuitionist mathematics, particularly Brower's technique of the "creative subject" (E. Radu).

In conclusion, we wish to say a few words about the participation of Romanian mathematicians in the philosophical reflexion on mathematics, a field which, as is known, has many points in common with research in mathematical logic and its foundations. This participation has been expressed by articles published in philosophical reviews or collections of philosophical studies, conferences, reports in colloquia and international congresses. Thus, it is to Al. Froda (1894-1973) that we owe the philosophical-mathematical meditations on the foundations of rational mechanics; Gr. Moisil analysed the

logical-mathematical antinomies, Poincaré's conventionalism, the question of identity (as a question of the philosophy of mathematics); the philosophical signification of mathematizing sciences; S. Stoilov (1887-1961), a reputed specialist in real and complex analysis, was concerned with the nature of axiomatic thought and the relationships between mathematics and the real; Prof. A. Dumitriu has devised a new solution to the problem of logical-mathematical antinomies and has studied the logical mechanism of mathematics refuting the neopositivist conception as to the nature of this science; Prof. O. Onicescu has elaborated a philosophical theory of mathematical objects — defining the types of processes generating them — analysing the functions of the mathematical infinite and an important class of antinomies, undertaking a philosophical approach to the foundations of probability calculus and theory of information. A series of mathematicians belonging to the younger generation have, in turn, tackled some major problems of the philosophy of mathematics (the nature of mathematical proof, the dialectic of the relations between mathematics and the other sciences, the philosophical signification of Gödel's results, a criticism of a formal approach to some traditional problems of the philosophy of mathematics, etc.).

The setting up of the Centre of Logic in 1964 meant for logic in general, and for mathematical logic, in particular, an opportunity to develop research in an academic, institutionalized frame, a privilege that Romanian logic had not benefited by in the past. Research in the filed followed some general trends but focused also on various specific problems.

We would refer to one such general trend promoted by the Centre of Logic: analysis of the various formal systems of mathematical logic. This research covers normal forms in various bivalent propositional systems pointing to a more rigorous classification of these forms in terms of the number of normal forms accepted by incomplete systems.

Other topics would be the problems posed by models in classical logic e.g. generalization of the logical square and the traditional theory of the syllogism with Aristotle and Theophrastus which all required a mathematical logical approach emphasizing thereby the connection between classical formal logic and mathematical formal logic. Making a distinction between the study of standard and non-standard mathematical logic, the investigations promoted by the Centre of Logic brought into focus the problem of decision-making as applied to a fragment with first-order predicates and to deontic and polyvalent modal logics. In the last two fields, there has been

elaborated a logistic system of modal assertoric logic — deontic, of addition, and order — a syntactic system with an infinite number of modalities and a semiconstructing and non-constructing syntactic theory, with cardinal connectors and operators, the domain of these connectors being transfinite. At the same time, models have been worked out for modal-deontic systems (dynamic systems) and axiological systems. On the same lines, one may record the results obtained in syllogistic modelling and the resolution of some older difficulties of deontic logic known under the name of "the paradox of duty-opposed imperative" a paradox whose solution involves the introduction of a various- order operating system. An attempt has also been made at axiomatizing infinitely valent polyvalent logic.

As part this first trend of research, studies have been undertaken by E. Mihăilescu, M. Tîrnoveanu, S. Vieru, Teodor Stihi and Vlad Boicescu.

Research, along the second trend, has focused on the proof theory reflected in studies of non-contradiction in certain mathematical theorems e.g. the theory of limits in topological unions, the theory of topological Boolean algebras and of a theory general enough to comprise ordinary algebraic structures. E. Seiler authored the main studies in this area.

The third research trend followed the algebraic and topological study of mathematical logic. Among substantive studies are those on the metric space of the sets of predicates, algebraic structure of propositional, intuitionist and polyvalent calculus, finalized research into albegraic results and the proof of some classical theorems of mathematical logic through such methods.

The there was the attempt at determining the notion of quantifier with emphasis placed on its algebraic character, and the elaboration of a rigorous definition of the propositional functions of truth and Boolean propositional functions whereby their interrelations could be elucidated. Research projects were carried out by Tudor Ristea and Vlad Boicescu.

As the problems of the set theory and non-standard arithmetic models are the object of world scientific research, our team, too, has been permanently interested in their study (see Th. Stihi's paper on the axiomatic set theory and applications of forcing in non-standard arithmetic models).

Drawing conclusions on each research area would, perhaps, be a difficult task given the briefness of our report, but some general conclusions could still be reached. It is obvious that mathematical logic enabled one to arrive at an in-depth exploration of reasoning, as is fully revealed by our team's research on standard and non-

standard formal systems. Besides, it has been proved once again that mathematical logic remains essentially a mathematical theory. Undoubtedly, logic in its broad sense, involving also mathematical logic, develops gradually in keeping with the evolution of the science whose instrument it is, so that the present fields of mathematical logic are expected to develop still further. In this light research into formal systems and the foundations of mathematics might be a premise for approaching new levels of mathematical logic.

WITH REGARD TO « PROBLEME DE LOGICĂ »

Probleme de logică, vol. V. București, Editura Academiei Republicii Socialiste România, 1973, 356 pp. (Academia de Științe Sociale și Politice - Centrul de Logică).

Despite the controversies affecting the functional unity of modern logic and the obvious opposition and hostility between the two main directions in logic viz. between traditional logic and non-traditional or mathematical-symbolic logic [1], the research conducted at the Centre of Logic of the Academy of Social and Political Sciences since its creation in 1964 has been intended to bring to light what is characteristic of the logical approach in the polyvalence of its expression. These research findings have been put together and published, starting with 1968, in the collection of studies entitled *Probleme de logică* (Problems of logic). The fifth volume of the collection came out in 1973.

This volume contains eleven studies [2] covering the problems of the history of logic and scientific thought, the logical foundations of science and philosophy, problems that arise in the various field of classical formal logic and of mathematical-symbolic logic. These studies are presented in the form of either theoretical expositions in which researchers give an account of their investigations or of systematic historical outlines using the apparatus of modern critical research and revealing, in general, a series of new logical-philosophical prospects of high topicality and originality.

Stress has frequently been laid on the importance and topicality of syllogistic for modern logic [3], yet classical syllogistic, *id est* Aristotelian logic, continues to generate new perspectives as is outstandingly shown in Acad. Ath. Joja's study *Tà metaxyka as an object of syllogistic investigation* (pp. 305-341). The author, one of the eminent contemporary Romanian logicians well-known by his modern interpretations of Aristotelian philosophy and logic, reveals, through the analysis of the text from Anal. Pr. a 27, the significance of the middle term (tà metaxy) for judgements and modern scientific investigations despite the nominalist, absolutizing interpretations in present-day logic by some representatives of neo-positivism. As

[1] Cf. M. Cohen and E. Nagel. *An Introduction to Logic*, London, 1963. Preface and chapter IX.

[2] The studies are published in Romanian.

[3] Cf. I. Lukasiewicz, *Aristotle's Syllogistic from the Standpoint of Modern Formal Logic.*

scientia est de universalis et per necessaria founded cum fundamento in re, the fact emphasized in Acad. Ath. Joja's study becomes obvious, namely, that by specifying the categories of concepts the demonstration in science according to things and truth becomes possible. Therefore, as maintained by the Romanian logician, the reason of the Stagirite's syllogistic seems to bear a sense which modern logic and science in general cannot ignore.

The above-mentioned study is part of a wider range of treatises by Romanian logicians on Aristotle's work which materialized in two other remarkable studies authored by Alexandru Surdu. These are: *Symbolic interpretation of the first chapters of Aristotle's Categoriae* (pp. 133-147) and *The problem of the universal with Aristotle in the light of his Categoriae* (pp. 291-304).

In our opinion, the first study is an interesting attempt at formalizing the entities referred to in chapters 2, 3 and 5, i.e. *substantia prima* also called *subject* as *substratum* which signifies the individual thing, and *substantia secunda* and the relations that can be established among them. According to Aristotle there are two types of relations: "to be in" (*inesse*) and it "is said about" (*dicitur de*) connected to their negations. The author considers that these relations are of a different nature from the predicative one and that they "can be called antepredicative or prejudicative" (p. 145) since they are anterior to and at the basis of predicative forms. It should be underlined that Alexandru Surdu, in his study, tackles a number of problems as yet unstudied in the context of modern logic and that he is making a valuable contribution in this field.

Al. Surdu's second study puts forward a very interesting solution to the problem of the universal in Aristotle starting from the considerations made in the previous study. In the author's view, Aristotle has not expressly advocated either realism or nominalism or conceptualism. A synthetic solution to this problem which in W. Stegmüller's opinion was reactivated in modern times « to the extent that one could even talk of a revival of the dispute of the universals »[4] can be formulated in the terms of admitting four different entities, a thesis that differs ostensibly from current interpretations and confers a note of originality on the solution advanced by Alex. Surdu.

Covering both the history of logic and the history of scientific thought and aimed at clearing up some problems related to the science of logic are Ath. Joja's studies, *Descartes and the mathematical model* (pp. 7-29) and *Prolegomena to abstract entities* (pp. 267-290).

[4] Günter Patzig, *Aristotelische Syllogistik. Methaphysik, Skepsis, Wissenschaft,* 1960, p. 49.

Underlining the theoretical importance of the mathematical model in the constitution of Cartesian rationalism, Ath. Joja points to the advantages of mathematical models for the elaboration of scientific theories in general and also the fact that they have a lesser impact on philosophy where probable judgements operate as well.

Prolegomena to abstract entities, a study which can be considered one of the most outstanding of theoretical investigations with a great many logical-philosophical implications for the scientific approach in its historical amplitude, focuses on the logical and epistemological status of abstract entities starting from the well-known fact that these fundamental concepts, viz. abstract entities are proper to any one science. The deep-going analysis of the different stands taken from Socrates until Descartes makes it possible for the author to outline a position towards which the results of the sciences converge, and which is the best guarantee for the rights of science: immanent realism, a position which is in agreement with the gnoseology of dialectical materialism, with the very reason of the modern scientific approach.

In line with current concern as to the logic of investigation, Crizantema Joja in her study *The fundamentals of the logic of investigation* (pp. 91-110) tackles the theoretical significance of the main contemporary directions in substantiating this new philosophical and scientific discipline whose major aim is to determine the logical-philosophical and historical fundamentals of the investigating approach.

In the evolution of the concept of the *logic of investigation* the author distinguishes the three principal moments of logical syntax, logical semantics and logical structures which all reveal their limitations and shortcomings yet playing an overriding part in the formulation of problems as such. All these allow the author to reach some conclusions: e.g.g. deduction and induction, the two fundamental methods complete each other in a dynamic and fecund unity based on signification; the logic of investigation becomes *noematology,* that is, the doctrine of concepts and scientific conceptions implying the very investigation of logical structures; the ideal of scientific unity is based not on the unity of the scientific language or of empirical data but on the deep rationality of science, on the intelligibility of the universe.

A similar historical and systematic openness in restoring the role of supposition in the ensemble of mediaeval terministic logic but also in some of the fields of modern logic characterizes Valeriu Streinu's study, *The theory of supposition. Historical attempt on a chapter of mediaeval logic* (pp. 111-131). The author reassesses

the historical and logical meanings of this property of terms, the study gaining in value through an erudite research and method that combine historical with logical reflection in the modern perspective of the philosophy of language.

Whereas the above-mentioned studies felicitously blend the historical and the theoretical, the classical and the modern approach to the problems of logic, the studies of Mircea Tîrnoveanu, Eduard Seiler, Vlad Boicescu and Th. Stihi are, through the formalism and symbolism resorted to therein, the expression of the modern manner of logic. The authors align themselves in this way in what we could call the *via modernorum* of logic by the extension of the mediaeval meaning to the modern epoch.

Well-known for his works on modal and deontic logistic systems, Mircea Tîrnoveanu puts forward in his study *On some properties of* $S_{ad}^{2\,no}$ *transfinite assertoric deontic logical systems* (pp. 31-90) two transfinite and semiconstructive logistic systems. The study distinguishes itself by the novelty and originality of the problems raised, by the solutions advanced. It is, indeed, a well-known fact that the syntactic theory of logistic systems just like those analyzed by M. Tîrnoveanu has a great importance and wide-ranging application in general axiology and praxiology.

An ample, well-documented study rigorously conceived mathematically is Ed. Seiler's *On the non-contradiction of the theory of limits in topological unions* (pp. 149-239) in which the author demonstrates the non-contradiction of an essential fragment of the theory of limits in very general structures, in topological unions. The importance of this study lies in that it outlines a unitary outlook on the consistence of the theory of limits of very general topological structures by using a simple (non-branched off) theory of types and by replacing so-called deductive completeness by a deduction theorem.

A remarkable contribution is made by Vlad Boicescu in the study *On* θ*-valent logic* (pp. 241-255) where the author succeeds in constructing a polyvalent sentential calculus with an infinity of values quite different from the calculus proposed by Lukasiewicz. Boicescu also offers an interesting solution to the analysis of true sentences in a certain ordered structure and also to the formalization of "fuzzy" sets.

Th. Stihi, author of *A case of decidability in the first-order predicate calculus* (pp. 257-265), gives the following enunciation in the decision problem; a recurrent (algorithmic) computation procedure should be found, as when such a formula is given to which the procedure is being applied its validity could be decided upon,

and this the author succeeds in demonstrating by Herbrand's theorem.

The studies contained in this fifth volume of problems of logic testify to the highly theoretical level of research in logic within its wide and contradictory spectrum in Romania, some of the problems raised and solutions advanced by the authors bearing the sign of undisputed originality and scientific expertise.

V. S.

Probleme de logică, vol. VI. București, Editura Ecademiei R.S.R., 1974, 597 pp. (Academia de Ştiinţe Sociale şi Politice a R.S.R. Centrul de Logică).

The sixth volume of "Problems of Logic" (started in 1968) contains the results of the research activities conducted by the members and collaborators of the Centre of Logic in Bucharest. The volume covers problems of history and philosophy of logic, logic of science, formal logic, classical and modern (modal logic, deontic logic, etc.) and logical-mathematical theories. The ten studies in the volume are the following:

1. *Ath. Joja*: "Apophantic logic and symbolic logic".

Examining the relationship between apophantic logic and symbolic logic the author points out the fact that whereas the former is categorical-deductive, the latter is hypothetical-deductive. The field of apophantic logic is made up of *objective products* (*ens rationis*, les êtres de raison: concept, proposition, inference, etc.) of the subjective activity of the intellect, the latter's activity being the object studied by psychology. Symbolic logic presupposes the existence of apophantic logic but retains out of it only those aspects likely to be turned into a special instrument for the reconstruction and substantiation of mathematics.

Symbolic logic deliberately ignores the comprehension of the concept, treating only its extension. Symbolic logic considers the fundamental principles of thinking (identity, contradiction and the excluded middle on the same plane with the other logical principles: commutativity, associativity, transitivity).

Yet, the principle of identity is the fundamental principle of thinking, of the logical concept and mathematical equality. Identity makes it possible for the concept, the class, the set theory, the number, logic and pure mathematics to develop progressively.

2. *Mircea Tîrnoveanu*: "On some syntactic properties of the transfinite logical-assertoric-deontic systems of the $S\alpha^{210}_{adm}$, $S\alpha^{2no}_{adm}$ form".

Two O-order semi-constructive logistic systems are defined starting from alphabets of three categories of constant symbols: assertoric, deontic and modal. These systems are transfinite because their type is a cardinal $\alpha \geqslant \mathcal{N}$ The constant symbols therein represent connectors (assertive, deontic and modal) whose field of action is constituted by a transfinite sequence of length $\leqslant \alpha$ or well-ordered classes of formulae. Some of the syntactic properties of these systems are demonstrated in the work.

3. *Constantin Noica*: "Six predicative functions".

The author establishes six predicative functions representing as many types of judgement: 1) substantival judgement or substance judgement (with predicate variations); 2) predication judgement (with subject variations); 3) judgement of species (with subject-limited and predicate-unlimited variation); 4) integration or system judgement (with predicate-limited and subject-unlimited variation); 5) evolution judgement (with both subject and predicate limited variation) and 6) creation judgement (with infinite subject and predicate variation). In this typologization, based on the functional variation, the concept of propositional function in modern logic appears as a mere particular case.

4. *Petre Botezatu*: "Assertoric-problematic syllogistic".

The main objective of this study is to find how and if probable consequences can be derived from assertoric premises, an examination being made of those situations — rather frequent in science — in which the structure of assertoric premises does not lead to assertoric conclusions. The author builds up a logical square on the basis of equivalence and disjunction alone expressing its structure through the theorem (Maba ≡ MIba) v (MEba ≡ MOba) where M is the functor of modality. The form of the problematic conclusion is determined on the basis of this theorem. With regard to the conditions to be met by the group of assertoric premises to generate a problematic conclusion, the author introduces the concept of syllogistic couples, i.e. conjunctions of two syllogistic propositions with a common term. The thesis is demonstrated according to which every such syllogistic group allows for a problematic conclusion.

5. *Crizantema Joja*: "The theory of abstraction", I.

The study is intended to define the characteristics of a present-day theory of abstract thinking by evolving two fundamental theses of traditional noetics: meaning and constructiveness. Taken as the theory of the intellect's activity, noetics equally implies discursive thinking and intuitive thinking. The author discusses the viable characteristics of traditional dialectic (starting with Plato's dialogues "Cratylus" and the "Sophist") looking at them in the perspective of such fundamental problems of present-day thought as the origin and nature of language. Emphasis is placed on the analogies between Plato's cosmos and Boole's universe of discourse. The classical notion of dialectic, interpreted in the sense of the universe of discourse, looks like a premise of present-day dianoetics.

6. *Sorin Vieru*: "Deontic logic and the theory of modalities".

Following a detailed examination of the relationship between deontic logic and modal logic the discussion is centred on such problems as: the object of deontic logic, the reduction of deontic

logic to alethic modal logic, the semantics of standard deontic logic and "the paradox" of the imperative opposed to duty (Chisholm). Concluding, the author advances a solution to Chisholm's paradox within the framework of a modified system of deontic logic.

7. *Alexandru Surdu*: "Logistic, formalist and intuitionist problems in Greek philosophy".

The study opens with an analysis of Pythagorean mathematism analogous to the Cantorian modern period. A review is made of the contribution by Eleatic philosophers and analogies are established with the stages of modern logicism. After analyzing Plato's formalist conception in relationship with Hilbert's formalism, the author dwells at length on Aristotle's intuitionist-type ideas. Parallels are drawn between Aristotle's criticism of Pythagora's conception and the intuitionist criticism of Cantor's conception, between the criticism of Plato's formalism and the intuitionist criticism of modern formalism, etc. The author also takes up elements of constructivism in the Aristotelian theory of intuition and demonstration.

8. *Valeriu Streinu*: "Formal logic in the philosophical culture of 19th century Romania".

The author spells out the changes wrought in Romania's philosophical education and more precisely in the teaching of logic at the beginning of the 19th century, following the replacement of the Aristotelian unique authority by a plurality of influences coming from authors trained in the conception of Wolff and Baumeister, French sensualism and Kantianism. This revival experienced by Romanian philosophical culture was reflected in textbooks and courses of lectures conceived and translated in Romanian after works by authors under the above-mentioned influences and also in the efforts made to formulate a logical-philosophical terminology suited to Romanian.

9. *Eduard Seiler*: "On the non-contradiction of limits in topological unions". II.

The article is the final part of a more comprehensive study the first part of which was published in *Problems of Logic*, vol. V 1973 (pp. 149-239). The author demonstrates the non-contradiction of an essential fragment of the theory of limits in very general structures, viz. the topological unions. This fragment is exposed under the form of a semiformal system. The most important theorems are presented under the form of syntactic deductions. The consistency of the theory obtained in this way is demonstrated on the basis of the syntactic consistency of the semiformal system.

10. *Tudor Ristea*: "Distance in the set of predicates".

The purpose of the article is to introduce a distance in the set of predicates defined on finite sets and countable sets. This purpose

is achieved in paragraphs 2 and 3. In paragraph one the author shows that a Boolean algebra can be structured as vectorial space and that in this special vectorial space notions fitting the general vectorial space can be transposed.

The studies contained in this volume illustrate the major preoccupations of the research workers at the Centre of Logic in monographs whose chapters are subsequently to be published in the present annals.

Volumes VII and VIII of this collection are under way.

Călin Candiescu

G. BRĂTESCU

NOESIS, A ROMANIAN PERIODICAL OF HISTORY AND PHILOSOPHY OF SCIENCE

The Romanian Committee for the history and philosophy of science has initiated the publication of the review *Noesis* designed to make known to the international public the works of Romanian specialists in the history, logic and methodology of science. To this end, all the articles are published in one of the wide-circulation languages.

The first volume (382 pages) published in 1973 contains the papers delivered at the Colloquia on the philosophy and history of science held in Bucharest in April and May 1972.

A wide debate was organized at these Colloquia on the specific status of abstract entities in the various fields of science. The first volume contains the report of M. Nicolescu on *Abstract etities in mathematics* with special reference to the essential role of abstraction in the existence and development of mathematics. The late logician Ath. Joja presents a series of *Prolegomena to the status of abstract entities.* R. Rădulet tackles *The status of abstract concepts and relations specific to the technical sciences.* S. Marcus distinguishes between *Conceptual hypostases and contextual hypostases of abstract entities.*

A very interesting debate took place on the correlation between national and universal in the scientific creation. S. Ghiță discusses the relationship between *Universal and national in the development of science* and V. Săhleanu examines *Modalities of the specific national character in science.*

As regards the history of science in Romania, some of the papers concentrate on the cultural institutions before 1866, the foundation year of the Romanian Academic Society which in 1879 turned into the Romanian Academy. Șt. Bărsănescu focuses his interest on *Attempts and projects of academies in the Romanian Lands* starting with the much-heralded "Academy of Suceava" linked to the name of Alexander the Good (Alexandru cel Bun), prince of Moldavia between 1400 and 1432. Em. Pop lists the *Romanian cultural and scientific societies of Transylvania before 1866,* the oldest of which dates from 1795. Al. Dima deals with the *Societies prior to the Academy of the Socialist Republic of Romania.* The oldest institution of higher learning in the Romanian language

viz. *The St. Sava College* (opened in 1818) is presented by St. Stoian. Adina Arsenescu reviews the activity of the *Iași Society of physicians and naturalists* founded in 1830-1832. I. Spielmann recalls the *First academic institutions of Transylvanian Saxons and Magyars.*

The section devoted to Romanian anthropological thought opens with V. Săhleanu's paper on *Orientations in the investigation of the human phenomenon in Romanian science.* G. Brătescu analyses the Romanian physician's *Conception on anthropology in the first half of the 19th century.* I. Oprescu looks at *Anthropological preoccupations in the journals "Convorbiri literare" and "Contemporanul".* Șt. M. Milcu presents *Fr. Rainer's anthropological thought (1874-1944).* M. Popescu-Spineni and I.F. Georgescu-Vîște concentrate on *S. Mehedinți's anthropological concerns* (1869-1962) and R. Tomoioagă discusses *M. Ralea's philosophical anthropology* (1896-1894).

With regard to technical developments on Romanian territory, A. Beleș examines *Aspects of the revolution of technical thought in Romania* in the latter half of the 19th century. R. Rădulețt presents the *Beginnings of Romanian energetics.* Șt. Bălan deals with *Prefab reinforced concrete in Romania at the end of the 19th c. A Romanian history of building materials* is outlined by Șt. Bălan and I. Ivanov. A review of the *First Romanian workshops for metric weights and measures* is made by I. Ivanov and Gh. Ivanovici.

In the section devoted to the history of Romanian mathematics S. Teleman authors an *Incursion in the development of functional analysis in Romania.* Cabiria Andreian Cazacu is doing the same in the field of *Complex analysis.* R. Cristian concentrates on *Romanian researches into ordered linear spaces.* R. Miron, V. Cruceanu and I. Vaisman are the authors of *Geometry at Iași in the 1944-1947 period.* S. Marcus distinguishes *Five development stages in the theory of real functions in Romania.* Gh. Mihoc makes a historical presentation of the Romanian school of *Probability, mathematical statistics, operational researches.* O. Onicescu writes about *Tomorrow's Mathematics.*

The second volume of *Noesis* (299 pages) was published in 1974. It opens with the study of R. Rădulețt, on *Nicolaus Copernicus Five hundred years since his birth.*

The work of philosopher and logician *Athanase Joja* (1904-1972), former president of the Romanian Committee for the history and philosophy of sciences, is presented by Șt. Bărsănescu.

In connection with the status of abstract entities in the various fields of science Șt. M. Milcu tackles *Biological evolution as abstract entity;* Șt. Bărsănescu deals with the *Status of abstract entities in the educational science.* Șt. Bălan presents *Two important abstract entities in the field of classical mechanics*: "impetus" and "gravitas

secundum situm". Florica D. Câmpan approaches the problem of *Abstraction in mathematics* with reference to the concepts of "number", "algebra", "geometry" and "function". L. Sofronea looks at *Possibilities and implications of a mechanics based on the concept of invariant*. S. Marcus examines *Abstraction degrees in present-day science* laying stress on the distance process separating us from directly observable objects.

A number of articles refer to certain particular aspects of applied psychology. Thus, C.I. Botez dwells on the correlations between *Fundamental and applied psychology;* Gh. Neacșu and S. Marcus embark on *Researches of art psychology concerning the diagnosis of scenic talent;* E. Fischbein examines the specific role played by *Intuition and intelligence in learning mathematics.*

A separate section of the volume is devoted to the organization of scientific research in Romania. Șt. Bălan looks at the problem of *Science transfer among countries* and I. Goliat concentrates on *Science policy in the social sciences in Romania.* Adina Arsenescu presents *People and ideas in the history of scientific research in Romania* with emphasis on the conceptions and achievements of biologists Gr. Antipa and Em. Racoviță, geologist L. Mrazec, historian V. Pârvan and sociologist D. Gusti.

In the section referring to measuring instruments and devices in Romania's past, Gh. Ivanovici and Carmen Ivanova underline the role of *I. Ghica - Forerunner of the metric system in Romania,* a system adopted in 1884. I. Spielmann and Graziella Baicu present *The Old pharmaceutical weighing system* in the Romanian Lands beginning with the 16th century. G. Brătescu and C.I. Bercuș deal with *Measuring devices in Romanian medicine* and Gh. Ivanovici reviews the *First verification of metric measuring instruments in Romania* after 1884. Gh. Anghel presents the *Medieval measures of contents used in Transylvania* kept in the Alba Iulia history museum. I. Ivanov and Gh. Ivanovici spell out the *Major moments in Romania's adhesion to the metric convention.*

I. Ivanov and Florica Stamatiu's bibliographical study *Problems of physics in 19th c. Romanian journals* (213 titles) opens up the section devoted to the development of physics and mechanics in Romania. N. Rădulescu and I. Ivanov present the work of *O. Bungețianu (1860-1932) the first Romanian acoustician* and that of *C. Stătescu (1878-1950) the pioneer of physics teaching in Romania.* I.C. Sîngeorzan underlines the role of V. Anestin in the setting up in Bucharest in 1907 of *The First Romanian Astronomical Society* which took the name of C. Flammarion. A. Dankanits sheds light on the *Interest in astronomy in 15th-16th c. Transylvania.*

On the centennials of Romanian mathematicians D. Pompei (1873-1954) and G. Ţiţeica (1873-1939) the following studies were published: D. Pompei - *A mathematician of strange facts* by S. Marcus; *Notes on the amplitude of D. Pompei's work* by Eliza Noian; *G. Ţiţeica's life and activity* by Florica D. Câmpan and *The Echo of G. Ţiţeica's work* by Eliza Roman. Some letters are also reproduced addressed to G. Ţiţeica by H. G. Forder, P. Montel, E. Picard, W. Sierpinski and E. Bompiani.

Particular interest is raised by the *Bibliography of the history of mathematics in Romania* (1841-1932; 130 titles) edited by Eliza Roman. From among the authors cited therein mention should be made of I. Ionescu, G. Ţiţeica, T. Lalescu and more especially the well-known science historian P. Sergescu.

BOOKS AND REVIEWS

A. DUMITRIU, *Teoria Logicii*, Editura Academiei Republicii Socialiste România, Bucarest, 1973, pp. 389.

Le livre est dédié à la démonstration de l'idée que la logique ne peut être une science déductive. Pour arriver à cette conclusion, l'Auteur montre que la logique actuelle s'est transformée en un 'système' formel.

Russell, ainsi que les autres logiciens formalistes, sont partis des idées et des axiomes choisis conventionnellement comme tels et ont déduit comme « théorèmes » le principe du tiers exclu, de contradiction, de la double négation; mais ces principes — écrit l'Auteur — étaient déjà impliqués dans le point de départ, et il sera suffisant de montrer que, partant de ces principes, supposant les notions de variable propositionnelle, de disjonction, de négation, on en peut obtenir directement les axiomes de Russell. L'Auteur montre qu'on peut reconstruire d'une manière naturelle le système de Russell.

Cette conclusion permet de faire un pas en avant et de montrer qu'il y a une nécéssité absolue d'avoir, dans le développement d'une science, des principes. Des observations historiques confirment ce point de vue et infirment la conception conventionnaliste des principes, choisis comme tels d'une façon arbitraire.

Pour examiner de plus près la nature de la logique, l'Auteur passe à l'examen des idées de forme et de matière chez Aristotle, et à l'idée de logique formelle chez les scolastiques: cette analyse lui permet de tirer la conclusion que la logique mathématique est légitime mais ce qu'elle gagne en surface elle le perd en profondeur.

L. E. J. BROUWER, *Collected Works* (I, *Philosophy and Foundations of Mathematics*), ed. by A. Heyting, North-Holland / America Elsevier, Amsterdam-New York, 1975, pp. 628.

According to Heyting, Brouwer's scientific publications concern two almost disjoint parts: the first on philosophy and intuitionism, the second on no-intuitionistic mathematics, mainly topology. This volume contains the thesis of 1907 and the papers on philosophy and intuitionistic mathematics. The thesis is still an important and interesting document for understanding the line of Brouwer's thought. Brouwer unfolded his program for the construction of mathematics. Here is the germ of much of his later work in foundations as well as in the development of mathematics itself.

Mathematics can be *built up* from units of perception. This program is the basis of all his work on foundations. Brouwer chose subjects of

fundamental importance: the application of group theory to arithmetic and to geometry; non-Archimedean geometry; foundations of set theory, and here Brouwer deviates completely from the classical theory.

His main point is that mathematics as a mental construction ought not to be confused with its linguistic expression. Further a severe criticism is directed against Cantor's theory of transfinite numbers, against the logistic of Russell and against Hilbert's formalistic approach. It is certain that Hilbert was influenced by discussions with Brouwer when he conceived his Beweistheorie of 1922.

For Brouwer, since continuity and discreteness occur as inseparable complements, both having equal rights and being equally clear, it is impossible to avoid one of them as a primitive entity. Having recognised that the intuition of continuity, of 'fluidity', is as primitive as that of several things conceived as forming together a unit, the latter being at the basis of every mathematical construction, one is able to state properties of the continuum as a 'matrix of points to be thought of as a whole'.

Brouwer's idea underwent a pronounced evolution, expressed in consecutive papers. Heyting has inserted all these papers, taking into the bargain some repetitions, and clarifying their connections by a system of cross-references. Brouwer's papers on philosophy and foundations of mathematics are ranged in chronological order. References with author's name refer to the list of literature at the end of the volume. This list contains only papers which are directly connected with Brouwer's work; formal intuitionistic logic, metatheory and purely philosophical considerations are excluded.

E. CASSIRER, *Scientific Knowledge and the Concept of Man*, by Seymour W. Itzkoff, Univ. of Notre Dame Press, Notre Dame-London, 1971, pp. 286.

Seymour W. Itzkoff's interest in the Kantian philosophical tradition began with a study, written under the direction of Ernest Nagel of Columbia University, of the scientific philosophies of Pierre Duhem and the French neo-Kantian Emile Meyerson. Eventually this led to Cassirer and an abiding fascination with his writings.

Ernst Cassirer determined to learn from the historic state of affairs. His writings reflect a deep and continuing sensitivity to the fact that every philosophical position is itself eventually judged as history. The metaphysical reification of mathematics reflects Galileo's reaction to the sterile formalism inherent in the hierarchy of qualitatively unique substances in Aristotelianism. He reacts by substituting its metaphysical antithesis — the qualiatively neutral mathematical Platonism of Kepler. Thomas's naturalism led him to postulate sensation as the starting point of all knowledge. Galileo, Cassirer noted, could not admit sensation into his system. « None of these concepts is derived from experience; the mind takes them 'from itself' in order to apply them to sense perceptions ». If man lived completely within the world of common-sense processes, events, and things, he could not be encompassed by the mathematical laws of bodies in motion.

Galileo, Cassirer stated, introduced sharp distinctions between things that had been confused and he united natural phenomena that hitherto had been regarded as disparate and heterogeneous.

With Spinoza and Leibniz the rationalistic tradition continued its involvement with the implications of physical science for man. Leibniz's monadology is a step backwards from the rationalist identification of mathe-

matical law with real substance. Leibniz recognized that without the use of mathematical signs we could not develop our views concerning the mechanical character of nature. As part of this programme, Leibniz attacked the Cartesian conception of material substance as extension. By the standards which Descartes himself laid down — intelligibility and clarity — Leibniz claimed that extension in an illegitimate concept, permeated as it is, in its geometrical representation, by a host of intuitive and imaginative characteristics.

It was Leibniz's symbolic and idealistic conception of knowledge that provoked the famous correspondence with Clarke, Newton's protagonist, concerning the nature of space, time and gravity. Leibniz argued against the realistic and absolutistic views of the Newtonians. Space and time cannot be considered as real and absolute. Space is no more than the ideal condition of order in coexistence and time the condition of order in succession.

With Locke the empiricist tradition was turned to the problem of the origin and derivation of knowledge from experience. The problem of achieving determinate knowledge is resolved by the postulation of an inner tendency in our mind that would allow sense data to embody a trend toward universality. If there are inherent difficulties in the epistemology of both rationalism and empiricism, they occur because, as Cassirer stated, both rationalism and empiricism seek to explain the metamorphosis by which the phenomenon develops from a mere datum of consciousness into a content of reality of the outside world. They fail because neither theory can explain that a phenomenon already points to an 'objective reality'.

Kant, like Galileo before him, wrestled with the problem and the necessity for integrating these two diverse intellectual strands of science and philosophy. The status of knowledge, mind, and sensation hinged on the solution. When about 1763 Hume's writings became available in translation and, as Kant confessed in the preface to the *Prolegomena* (1783), « roused him from his dogmatic slumbers », the solution became possible through a redirection of his enquiries into the area of speculative philosophy. Establishing the logical conditions for building up scientific knowledge as it takes place within human experience was to Kant but a first step. Next would come examinations of a diverse company of kinds of knowing.

As a philosophical tool the theory of knowledge would be used to sweep away the traditional Hegelian pretensions of « reaching to the heart of absolute being ». Zeller denied the Hegelian claims that all knowledge could be encompassed in one vast metaphysical gulp. Helmholtz and Zeller were under the influence of what might be called « the deficiencies of the empirico-physiological interpretation of Kantian *a priorism* ». In contrast to Helmholtz, Mach stated that « sensations are not signs of things; but on the contrary, a thing is a thought symbol for a compound sensation of relative fixedness. Properly speaking the world is not composed of 'things' as its elements, but of colours, tones, pressures, spaces, times, in short what we ordinarily call individual sensations ». The object of science, in Mach's view, is « to replace, or save experiences, by the reproduction and antipation of facts in thought ». This economical office of science, which fills its whole life, is apparent at a first glange; and with its full recognition all mysticism in science disappears. Perhaps Mach's greatest failure, according to Cassirer, in addition to his metaphysical reification of sensations and the failure of his nominalism to advance the progress of physical theory, was his departure from his own canons. In Mach's *Erkenntnis und Irrtum*, the process of

idealization in the conception of theories was discussed. The resultant views, according to Cassirer, were in direct conflict with Mach's conviction that physical law has « absolutely no more factual validity than the individual facts combined ».

The first scientist to turn from a copy theory of knowledge to a purely symbolic theory, according to Cassirer, was Heinrich Hertz. The images we utilize in theory do not denote a similarity between image and real things, but a logical relation. Thus such concepts as mass and force have no ultimate validity; they are fictions or *innere Scheinbilder* (inner illusions) created by the logic of science and subordinate to the requirements of logic. As constructs, their ultimate validity or significance would be that their consequences agree with observable data. In addition, Hertz disagreed with Mach's conception of the status of theories. Theories are not a « catalogue of isolated facts »; they exist on a different level than our sensations. Cassirer states, « Thus for Hertz the fundamental concepts of theoretical physics were patterns of possible experiences, whereas for Mach they were copies of actual experiences ».

Like Hertz, Henri Poincaré followed a line of thought which differed from Mach's. To Poincaré, physical theory was more than a mere transcription of experience.

Pierre Duhem's thought represented to Cassirer the final step in the evolution toward a symbolic or critical conception of scientific theory. Conceptual factors such as space and time were reinterpreted in Einstein's general theory of gravitation so that the *a priori* character of Euclidean geometry, as it is found in Newtonian science, was rendered obsolete for relativity theory and a new integration of space and time was constructed.

The utility of using a concept such as the *a priori* invariants of experience, Cassirer implied, is that it allows us greater critical awareness of the character of the theory, thus opening up the possibility for a unity within knowledge based upon a synthesis of the different perspectives within the various realms of knowledge. Philosophy, he felt, owed a responsibility to scientists and science to aid in preventing the kinds of metaphysical hypostatizations which had plagued science since the seventeenth century and which had been repeated in differing guises with every new and radical advance. Of course, Cassirer was aware that experimental scientists were not alone in their metaphysical propensities towards « explanations ». Yet, even considering the high risks which any philosopher ran in falling into the same error as the scientists, the involvement was both an obligation and a natural function of the philosopher.

By the time his next work in the philosophy of science had appeared (*Einstein's Theory of Relativity*, 1921), Cassirer's already rich humanistic interests had broadened into the area of cultural thought. *Freiheit und Form* (1916) was a wide-ranging survey of German cultural history from Luther through Schiller and Goethe to Fichte and Hegel. In 1917, in a manner reminiscent of a similar creative moment in Poincaré's life, on entering a streetcar Cassirer became aware of the conception ultimately realized in the *Philosophy of Symbolic Forms*. Henceforth his views on science were developed in the context of the larger issues of a theory of knowledge which would include such concerns as language, myth, pathological thought, art, etc.

The important lessons to be culled from Kantian *Critique* were not concerned with the substance of Newtonianism, nor the form of the Newtonianism, nor even Aristotelian categories. The important lesson lay in an awareness of the active, synthetic, but logical role of mind in the building up of knowledge.

In Kant, Cassirer noted, permanence, i.e., spatial and thing constancy, is a necessary condition for the determination of phenomena as objects. Substance is supreme among the concepts of pure relations. It is through this concept that a totality of sensory phenomena can be unified. Kant makes the logical demand that phenomenal nature consist entirely of permanent and lasting relations which are fixed out of the flow of change through certain universal invariants. When Einstein stated that the theory of relativity took from space and time the last vestige of physical objectivity, it coincided with critical idealism in its purest form. The boldness and the high philosophical significance of Einstein's doctrine consists in that it clears away the traditional prejudice of one time valid for all systems. The general theory of relativity represents the most encompassing postulate of dynamics in its establishment of the invariance of certain magnitudes and laws with regard to all transformations of systems of reference. It is perhaps the culminating theory in a long historical process, so Cassirer concluded, during which the unifying tendencies within the physical sciences have always been evident. « All physical, field phenomena are expressions of world metrics », stated Cassirer, expressing again how close modern physics is to the geometrical method of Descartes. All spatial and temporal values are now interchangeable in this continuum; temporal values of past and future are cancelled out by arbitrary spatial directions established by definition. Sensuous intuitive concepts of space and time are absorbed into a uniform and homogeneous mathematical system. By eliminating qualitative imagery, by surpassing the most extreme demands of Galileo, physics fulfills itself by being enveloped in the pythagorean garment of number. The older objectivity — where, given a body moving through space and time, any future time might be predicted and measured — could no longer exist in quantum mechanics as a standard of experimental and theoretical enquiry. Only probabilities could now be inserted into the description of the action of large numbers of electrons.

Cassirer's death in 1945 ended his plans to add a chapter that would bring the argument into focus with recent research. His analysis of the themes purveyed by the philosophical detractors of quantum theory, as well as the defence he proposed, are completely consonant philosophically with what has taken place intellectually since its publication. That the concepts — position, velocity, mass — of an individual electron no longer have empirical meaning, they may have to be excluded from theoretical physics, Cassirer argued, important and fruitful as their function in the history of science may have been.

In replying to the realists, Cassirer proposed that the answers given to us by nature are determined not only by nature but also by our particular instruments and the kind of observations we engage in. It is thus impossible to draw a sharp line between nature and our knowledge of nature, « the two are inseparably interconnected ». « Nature » has no characteristics which have not in some way been subsumed to science. Further, we have no right to assert that nature contains in itself a measure of inscrutability which sets permanent limits on the capacity of science to penetrate the knowable unknown.

M. Bunge, *Philosophy of Physics*, D. Reidel Publishing Company, Dordrecht-Boston, 1973, pp. 248.

The contemporary physicist, no matter how sophisticated and critical he may be on technical matters, usually espouses dogmatically what may be called the Credo of the Innocent Physicist. The hypotheses and theories of physics are but condensed expe-

rience, i.e., inductive syntheses of experimential items.

Physical theories are not created but discovered: they can be discerned in sets of empirical data, such as laboratory tables. Speculation and invention play hardly any role in physics. Nothing is explained by saying that something is a fact of experience, or by making sure that a statement is a package of experiential items. Experience is something to be explained, and explanation is a task for theories. In particular physical theories, rather than being units of canned experience, allow us to account for one side of human experience, itself a minute part of reality. Theories are not photographs: they do not resemble their referents but are symbolic constructions built in every epoch with the help of the available concepts. Scientific theories, far from being inductive syntheses, are creations — subject to empirical test to be sure, but not any less creative for that. A wrong philosophy may prevent a correct understanding of physical theory and experiment. It may even delay progress in research by banning whole research programmes incompatible with that philosophy or by fostering superficial or even sterile programmes. If the guide (or misguide) is a narrow empiricist philosophy — Bunge writes — research will be limited to data gathering and to phenomenological or black box theories covering those data without explaining them. On the other hand if a more liberal philosophy is adopted then no limitations wll be imposed on the depth of the theory nor on the dependence of experiments on theories.

The physicist who refuses to let himself be chained to an anachronistic philosophy and is willing to regard philosophy as a possible field of exact inquiry may expect a lot from such an approach. The reading of imaginative philosophers may suggest to him new ideas. The study of logic will raise his standards of clarity and rigour. The habit of semantic analysis will help him discover the genuine referents of his theories. A familiarity with professional doubters will protect him against dogmatism.

The Author asks himself: is time really equivalent to a spatial dimension? What if any are the limits of spatio-temporal localisation? Does quantum mechanics concern individual microsystems or only statistical ensembles of such, or even ensemble-apparatus pairs?

When an enthusiast of '$E^2 / c^2 = m_0 c^2 + p^2$' speaks about the photon mass, one can remind him that this is a phoney predicate, as it fails to occur among the basic concepts of electromagnetic theory: the above formula belong to relativistic particle *mechanics* — and mechanics, however refined, is not competent to account for photons. Moreover, that formula is but the consequent of an implication with the antecedent: « A particle has a mass m, linear momentum p and energy E ». Concepts must be characterised by one or more axioms rather than by pseudo-philosophical or heuristic remarks. Any rigourous analysis requires that the theory be there, fully and well ordered as far as its foundations are concerned.

The foundations of physics, and particularly the axiomatic reconstruction of physical theories, are a suitable field for the cooperation of theoretical and mathematical physicists, applied mathematicians, logicians, and philosophers of physics. Hypotheses go beyond a mere description of observable situations: they are conjectures about matters of fact, whether or not these situations are partially observable. Whatever its status, a physical formula is a *statement* expressed by a *sentence* belonging to some language. (Sentences are linguistic objects. Statements are conceptual objects. One and the same statement can often be expressed by

quite different sentences). A statement is treated, for purposes of logical processing, as if were true or false. As regards its correspondence to fact, we may not know what the truth value of the statement can be; at other times we rate it low but not minimal, and occasionally we give it a high mark but not maximal. This is mistaken. All of the quantum theories utilise ordinary mathematics, which has ordinary logic built into it.

A factual concept need not be empirical, i.e. it need not concern an observational or experimental situation. Moreover, to qualify as a physical concept, a concept must not revolve around an observer: it must concern a possible physical system, situation, or event.

A physical theory must accept some actual data as inputs and must be able to generate from them another set of possible data (the output) in such a way that both input and output match the assumptions of the theory-laws, constraints, etc. Data can stimulate the creation of theories. Data can test theories. Blind data are as useless as stray ones. Theories have not observational content. Consequently theories cannot be inferred from data and physical theories cannot be interpreted in empirical terms, but they must be interpreted in objective physical terms, i.e. with reference to observer-free physical systems. No model object is the exclusive property of a given theory. Any general theory can be adjoined alternative model objects.

According to Bunge, theoretical physics has been in an impasse for at least two decades. In particular, no breakthrough has been made in the domain of 'particle' physics: there are no general theories with a predicative power in this field. A number of formidable technical difficulties stand in the way, but there are also certain philosophical obstacles that could easily be swept aside. Every theory about microsystems is about an object-apparatus-observer block that cannot be further analysed.

The most common pragmatic interpretations found in the physical literature of our century are adventitious rather than strict. Adventitious interpretations, even when legitimate, cannot replace semantic interpretations.

Empirical tests — Bunge concludes — are not always conclusive and they do not enable us to dispense with non-empirical ones. To the extent to which all this is true, the dominant philosophies of science are inadequate.

N. ROTENSTREICH, *Philosophy, The Concept and its Manifestations*, D. Reidel Publishing Company, Dordrecht, 1972, pp. 258.

Knowing is an event within a totality of events that defies definition. We have therefore not set ourselves the task of defining it but merely to elucidate the modes of its activity as implicit and as explicit knowledge. The philosophic object is the phenomenon of knowledge. In dealing with knowledge we explicitly attempt to clarify its characteristics as a phenomenon and at the same time stress the fact that it is an object from the standpoint of the knower. Philosophy as the knowledge of unity and totality is an interpretation based on a common ground. The Author examines the ethical nature of philosophical knowledge.

M. SPECTOR, *Methodological Foundations of Relativistic Mechanics*, Univ. of Notre Dame Press, Notre Dame-London, 1972, pp. 174.

One of purposes of the Author is to serve a clear account of the methodological foundations of the theory. He introduces the appropriate mathematical ideas as they become necessary or useful. The first half of the

book deals with the methodological foundations of classical mechanics. The next stage in preparing the ground for the theory of relativity is a presentation of classical electrodynamics. In presenting relativistic mechanics, much of what was said with regard to the methodological foundations of classical mechanics can be taken over without change. The science of classical mechanics deals with the various types of motion that massive bodies undergo when subject to various types of forces. Briefly, motion is change of *position* with time.

We need not have used the Cartesian coordinate system as a basis for referring to, measuring, and recording the positions of bodies. A Geocentrist might find spherical coordinates « more natural ». If a body is at position P_1 (or r_1) at time t_1 and at position P_2 (or r_2) at time t_2, it must have *moved* from P_1 to P_2 during the time interval. There are, of course, various way in which a body can get from P_1 at t_1 to P_2 at t_2. It may move along differently shaped trajectories and it can move in different ways along any given trajectory.

The instantaneous velocity of a body may itself change as it moves along its trajectory. The Newtonians laws of motion can be recovered from the more abstract formulations, and a clear understanding of the nature and use of *these* laws is sufficient as a foundation for understanding the nature and significance of relativity theory. A large part of problem solving in classical dynamics consists in the following procedure: examine the system of bodies; combine the force laws with Newton's second law of motion; solve the resulting system of differential equations. The forces acting on a body depend upon various factors present in the situation. Newton spoke of « the Attractions of Gravity, Magnetism and Electricity ». The only work in this area left for physicists in the eighteenth and nineteenth centuries was the detailed application of Newton's laws to the complex motions of the bodies of the solar system. But Newton had no similar success with the « Attractions » of electricity and magnetism.

In Chapter II the Author emphasizes that the *law of conservation of energy* plays a key role in both classical and relativistic dynamics. This observation, plus the fact that this law also applies to non-mechanical domains, should prompt one to ask whether classical and relativistic dynamics could be reformulated — and generalized — in such a way that the concept of *energy* would occur in the *postulates* of these theories rather than being introduced in the elaboration of the theory on the basis of the concept of *force*. A reformulation of this kind has two advantages. The first is that the foundations of mechanics can then dispense with the concept of force as a primitive concept. The second — Spector writes — derives from the fact that the energy concept transcends dynamics. Thus, the reformulations under consideration are *not merely* rearrangements of the statements of dynamics (either classical or relativistic) such that postulates and theorems reverse their roles, but they yield, rather, much more general physical schemes in which the elementary mechanical theories appear as instances. The Author would suggest that those who seek a « deeper explanation » of force (and mass- or energy, for that matter) are asking for a *deeper physical theory* within which $F = m_0 a$, or $F = d/dt (m_0 v/ \sqrt{1 - v^2 / c^2})$, would appear as *theorems*. They are not asking a question which can be answered within (either classical or relativistic) dynamics. The advantage of using the *first* law to define the concept of an inertial frame lies in the fact that the definition is neutral with respect to possible dynamical theories that can be erected on its basis.

A. J. AYER, *The Central Questions of Philosophy*, Weidenfeld & Nicolson, London, 1973, pp. 243.

This book reproduces the series of Gifford lectures which Ayer delivered at the University of St. Andrews in 1972-73. The bulk of the book, as its title indicates, is more strictly philosophical. It begins with an attempt to explain what philosophy is. Various theories of meaning are examined and an account is given of the range of problems which philosophical analysis may be taken to cover and the different methods which have been used to deal with them.

What is philosophy? A possible answer is that, being a subject with many branches, philosophy has not one but many objects of study. Logic, indeed, is a special case. As a formal science it ranks with mathematics, from which it is hardly now distinguishable. Descartes and Leibniz, like Plato, were mathematicians, and Spinoza shared with them the belief that a methaphysical system should exhibit the deductive reasoning and the logical necessity that are characteristic of mathematics. If the system is logically rigorous, we can be assured that if any objects satisfy its premisses, they also satisfy its conclusions; but that there are objects which do satisfy the premisses is something that cannot be known *a priori*: it has in the end to be discovered by observation.

The conclusion which philosophers have just reached is that the concepts which we apply to the world, since they have to conform to the laws of logic, must at least be self-consistent: they must not issue in contradictions. This seems a modest requirement, but it was contended by the neo-Hegelians that almost all our concepts fail to meet it. If a concept is self-contradictory it necessarily has no applications, and no appearances can fall under it. A proposition which seems clearly to be necessary is that everything is identical with itself. Indeed, the theory of identity is commonly treated as a part of logic. It is developed from axioms of which the first is that for all x, $x = x$. A second axiom which would seem to be equally acceptable is that if x and y are identical they have the same properties. What is required is that the names should be synonymous, in the sense that they both have the same references and are associated with the same descriptions.

W. LAWNICZAK, *Teoretyczne Podstawy Interpretacji Dziel Sztuki Plastycznej*, Poznan, 1975, pp. 104.

The work is an attempt at answering the question: What assumptions do we make when we subject works of art to humanistic logical interpretation? Humanistic logical interpretation in the form adopted in the present study aims at determining: a) what is the goal of a specific acticity undertaken by a given individual or why the product of this activity is provided with particular features, b) the knowledge of the individual who treats this goal as the predicted output of the undertaken activity, or as the predicted output resulting from giving the product its inherent characteristics. The subject of an interpreted activity is said to fulfill the assumptions of rationalism.

The author tries to discriminate more fully between the spheres of a work of art. These constituents are discussed as a) presentational structure, b) represented structure, and c) communicated structure, respectively. The author attempts to interrelate these structures.

He underlines the cognitive primordiality of communicated structure in relation to the other two structures, and the primordiality of represented structure compared with presentational structure. The author gives an exegesis of the opinions, frequently expressed by art scholars, that works of fine art or presentational structures,

are analogous to linguistic utterances. The author has attempted to prove that these intuitive statements are well justified, since elements of presentational structure can be studied by means of the same sort of general terms which are used in the syntactic and semantic analysis of language utterances.

The author shows that the humanistic interpretation of a given activity or its product, is an analysis of this activity or product, augmented by the humanistic coefficient; the last notion is a certain modification of a well-known conception worked out by F. Znaniecki.

The suggested assumptions should be treated either in terms of some rationalized model of convictions which are hypothetically ascribed to the author whose works are interpreted as a theoretical characteristics of this aspect of reality to which these convictions refer. Since a work of fine art is a complex product of a rational activity, the features of its elements must be also subjected to the interpretation. Thus the humanistic coefficient of a work of fine art can be divided into simpler units, corresponding to its particular elements.

GR. C. MOISIL, *Essais sur les Logiques non Chrysippiennes*, Ed. de l'Académie de la République Socialiste de Roumanie, Bucarest, 1972, pp. 820.

Suivant les recherches de Lukasiewicz, le calcul des propositions correspond à la logique de l'école des Stoiciens. Moisil appelle 'non chrysippiennes' les logiques dans lesquelles certains principes du calcul des propositions ne sont pas valables. La logique intuitionniste de Kolmogoroff n'admet aucun des principes qui ne sont pas admis par la logique de Heyting, mais les formes «(p et non-p) entraîne toute proposition q », et « p entraîne que non-p entraîne toute proposition q » du principe de l'implication du vrai par le faux ne sont pas valables dans cette logique. Johansson a construit une autre logique dans laquelle le principe « (p et non-p) entraîne toute proposition q » n'est plus considéré comme valable. Les énoncés mathématiques répresentent, au point de vue intuitioniste de Brouwer, des problèmes.

La logique de Heyting est un exemple de logique dans laquelle quelques-uns des principes classiques ne sont pas valables. Avant l'apparition des travaux de Heyting, Lukasiewicz avait donné un autre exemple de logique non classique. Lukasiewicz a étudié un calcul logique qui a les caractéristiques suivantes: le principe d'identité, le principe de la double négation, les lois de contraposition, le principe de l'implication du vrai par le faux sont valables. Ne sont pas valables le principe d'exhaustion, le principe du dilemme, le principe d'exclusion, ni le raisonnement par réduction à l'absurde. L'idée de problématique dans la logique de Lukasiewicz contient en elle la possibilité du vrai et du faux. D'ailleurs, le terme de méta-logique, comme celui de méta-mathématique et en général celui de méta-discipline, introduits récemment, désignent certaines disciplines créées afin d'élucider certains problèmes intimement liés aux recherches formant l'objet du livre de Moisil.

Après presque cent ans de recherches intenses, le domaine de la logique formelle a été si elargi, les découvertes ont été si nombreuses, les discriminations si fines, les idées nouvelles si riches que la logique formelle n'a pas été obligée de faire plusieurs pas en avant; la logique est redevenue une science vivante qui croît continuellement.

Elle a cessé d'etre isolée, en gardant le contact avec d'autres branches de la science positive. La logique contemporaine s'est dévéloppée en tant que science déductive. Si, dans les traités classiques, les normes du rai-

sonnement correct sont justifiées une à une, la logique moderne a choisi une voie différente qui, tout en ayant été inaugurée par Aristote, avait été quittée. La logique moderne a un caractère purement formel. Elle a exclu de ses préoccupations les recherches sur la vérité matérielle. La signification du terme 'formel', dans l'emploi qu'il a dans les recherches de mathématiques et de logique, est aujourd'hui plus précise qu'auparavant.

Il y a plusieurs logiques différentes. Mots comme nécessaire, absurde, contingent, possible, problématique, sont équivoques dans la langue quotidienne. Constater que maintenant on reconnaît comme valables *plusieurs logiques différentes*, c'est une constatation qui dépasse les cadres où se développe la recherche du logicien. Après Moisil, le pluralisme logique contemporaine consiste dans cette possibilité de concevoir la validité de plusieurs logiques différentes.

Les logiques lukasewicziennes ne constituent pas toutefois la totalité des logiques non chrysippiennes, c'est-à-dire des logiques qui ne sont pas fondées sur le principe de la bivalence. Le problème de l'unité de la pensée humaine — écrit Moisil — est toutefois différent de celui de l'unicité de la logique. Le pluralisme logique est un fait historique.

Moisil se pose la demande suivante: existe-t-il quelque chose d'analogue à l'opposition entre la logique chrysippienne et celle non chrysippienne concernant les fondements aristotéliciens du jugement? On peut combiner le caractère aristotélicien avec celui chrysippien, mais on peut aussi bien construire des logiques aristotéliciennes non chrysippiennes. En logique chrysippienne les deux jugements « il y a un S qui a la propriété P » et « je nie qu'aucun S n'ait pas la propriété P » sont équivalents, c'est-à-dire sont en même temps vrais ou faux, car dire que « je nie qu'aucun S n'ait pas la propriété P » signifie qu'« il existe un S tel qu'il soit faux que S n'a pas la propriété P ». Donc, en utilisant le principe de la double négation, on tire « il existe un S qui a la propriété P ».

Dans une logique non chrysippienne qui ne contiendrait pas le principe de la double négation, la justification donnée ne serait pas valable. On peut donc avoir des logiques aristotéliciennes non chrysippiennes tout comme on peut avoir la logique classique qui est chrysippienne et aristotélicienne. L'assertion du pluralisme logique peut effrayer l'homme non prévénu. Mais l'un des théorèmes essentiels de la métalogique est justement ce théorème de la non-contradiction des systèmes logiques susmentionnés. Le problème de l'intelligibilité sort des cadres scricts de la logique et est même en dehors du problème épistémologique. Il y a une difference entre penser sur une chose et penser à notre pensée sur cette chose, toutefois les même règles logiques apparaissent dans le deux cas. En pensant on a la même liberté d'adopter une logique non chrysippienne ou une logique non aristotélicienne. On contate que la métalogique, semblablement à la logique, est pluraliste dès qu'elle est formalisée. La récurrence qui passe de la logique à la métalogique, n'est pas opposée au pluralisme logique. Le pluralisme logique est l'un des aspects de ce que Moisil appelle la liberté axiomatique.

On peut construire plusieurs théories exactes. La logique mathématique trouve son application dans le chapître de la linguistique mathématique où Moisil étudie la traduction automatique, ainsi que la théorie des codes. Les algèbres lukasiewicziennes ont été définies à l'aide de deux endomorphismes fondamentaux. Moisil montre qu'on peut les définir à l'aide d'un seul automorphisme fondamental.

Moins étudiée, quoique promettant d'heureuses applications, est la 'logique de la théorie des quanta'. Pour ce qui concerne les logiques positives de Hilbert et Bernays, elles consti-

tuent le cadre général de tous les calculs de propositions; la logique intuitionniste de Kolmogoroff et Johansonn en dérive par l'adjonction du foncteur 'négation' et du principe de contradiction.

Pour conclure, Moisil affirme que la situation historique de la logique est en tous points semblable à celle où se trouvait la géométrie à la suite de la création des géométries non euclidiennes. Les axiomes de la géométrie sont de pures conventions et non pas des formes a priori ou des résultats de l'expérience individuelle ou ancestrale. Ces conventions ne sont toutefois pas arbitraires; elles nous ont été suggérées par l'expérience, par les propriétés des corps solides et elles sont dominées par une idée a priori: l'idée de groupe. Le choix de la géométrie, quand on l'applique à la physique, est dominé par un principe d'économie. Pour adapter le calcul logique à la pensée logique des différents philosophes, il faut que ce calcul ne soit pas figé dans les formes de la logique classique, mais qu'il puisse se développer librement en des calculs parallels. La philosophie classique ne connait qu'un seul type de jugement: celui de prédication. La prédication porte sur un élément substantivisé, le sujet. L'idée de relation nous fait comprendre que le type n de a_n n'est pas une caractéristique de a_n: c'est seulement la différence n-m des types de a_n et de a_m, qui a une signification. Le concept de relation nous fait comprendre le principe de relativité; il rend nécessaire une pluralité de sujets connaisseurs. Moisil appelait 'interidéaliste' une recherche du type: quelles conclusions peut-on tirer du fait qu'on admet l'existence de plusieurs sujets connaisseurs qui communiquent entre eux. Moisil a mis en évidence le rôle joué par l'idée d'enchaînement en logique, en mecanique et en physique mathématique. La théorie des chaînes lui a donné plusieurs « connecteurs-implication », quoiqu' elle ne lui fait pas comprendre pourquoi l'implication-résiduation joue un rôle prépondérant. Toutefois la « logique élémentaire » se réduit à l'étude de l'enchaînement des raisonnements.

F. B. Fitch, *Elements of Combinatory Logic*, Yale University Press, New Haven-London, 1974, pp. 162.

The system of combinatory logic presented by F.B. Fitch, called the system Q, contains not only the usual combinatory operators and sentential connectives, but also completely unrestricted quantifiers. System Q is a sufficiently strong system to serve as a foundation for elementary arithmetic. Q contains all of elementary arithmetic and not merely a truncated part of it. Q is also sufficietly strong to serve as a foundation for a substantial part of mathematical analysis.

Quantifiers over the real numbers can be provided for by use of the concept D of Chapter 6. The system Q can be employed for representation of sequential circuits and computers. This is shown for sequential circuits in Section 18, and previously in the writer's paper « Representation of Sequential Circuits in Combinatory Logic », and for computers in two papers by R. J. Orgass and F.B. Fitch, *A Theory of Computing Machines* and *A Theory of Programming Languages*.

System Q can be used in formulating and analyzing fundamental philosophical concepts. The concept of truth could be defined for the system Q in a way that avoids the difficulties pointed out by Tarski. Another important aspect of the system Q is the presence in it of unrestricted quantifiers. The system Q and the extension of it introduced in Chapter 6 appear to be well suited for representing salient features of the deep structure of English. The writer has research interests in this direction at present.

A. NAESS, *The Pluralist and Possibilist Aspect of the Scientific Enterprise*, Allen & Unwin, London, 1972, pp. 148.

Recently, the great physicists, who were active as recently as the twenties, have been asked to 'tell their own story'. Needless to say, their memories do not furnish any exact, detailed, or coherent account of 'what really happened', and the historians try to construct a survey or picture that is of a higher historical quality than that of any actors. Thus if scientist A has declared T refuted, one modern historian, B, may find that T was not refuted (in the sense intended by A) but merely weakened, or perhaps even strengthened, or that the test did not affect T. The Author *deduces* that the expressions Ax_1 & Bx_1 and $\sim Ax_2$ & $\sim Bx_2$ refer to equally weighty positive instances. There is nothing in formal logic to prevent us from taking them equally seriously as confirmations of (x) $(Ax \supset Bx)$. The result, if negative, may completely undermine the status of the theory within the scientific community for even as long a period as a generation or two, but a revival is not for ever out of the question.

There are no crucial experiments in the sense of experiments not only furnishing a set of negative instances, but automatically furnishing decisive and definite refutation in the strong sense of furnishing rational justification for rejection. If there is prolonged, diverse, and successful testing within the practicable field, however small, a theory tends to be unanimously accepted. But only among those tending towards dogmatism is it considered to be *true*.

Let H_1 be a hypothesis that the Author intends to test, and $H_2 \ldots H_n$ hypotheses assumed true or valid when H_1 whether forming part of the same theory or not. Let the letter 'O' symbolize a directly testable observational consequence ('methodological predication'). The Author can then illustrate verification and falsification of the hypothesis H_1 as follows, if S stands for H_2 & ... & H_n:

(1) $(S_1 \;\&\; S \cdot \supset \cdot O) \;\&\; O$
(confirmation)

(2) $(H_1 \;\&\; S \cdot \supset \cdot O) \;\&\; \sim O$
(disconfirmation)

By (1) we shall say — Naess writes — that hypothesis H_1 gets *confirmed*. But this does not, of course, rule out that H_1 is false. And the confirmation is, if we ignore the intention of the experiments, not only of H_1, but of a group of hypotheses. In its actual use among researchers, the term 'confirmation' and similar, more idiomatic words are used in relation to H_1 even if the users themselves are perfectly aware of the role of some or all of $H_2 \ldots H_n$. Formula (2) illustrates an instance of disconfirmation. According to current usage among researchers it is disconfirmation of H_1, not of H_1 & ... & H_n.

That is, the definiteness of intention relative to the use is not sufficient to declare that the users clearly would reject (or accept) the suggestion that the disconfirmation is of *all* the hypotheses $H_1, \ldots H_n$. From (2) we may conclude that H_1 and S cannot *both* be true, that is, that not *all* $H_1 \ldots H_n$ are true.

The action to be taken on the part of active researchers in the face of this complex situation cannot easily be one of simple acceptance or rejection, but must be considered within a long-range research strategy, with distant moves dependent on feed-back from previous moves.

A very weak disconfirmation instance may, under certain circumstances, be a *conclusive or decisive* factor in rejecting a theory. The scientist decides to *stop working with it*. In the background of the simple words 'He rejected the theory', there is a complicated *praxis*. It is of course an important goal to arrive by rational discussion at one single set of rank-dimensions as the supremely adequate

one in a particular historical research situation within a particular field. The best thing to do at present — Naess writes — is to clarify discussion on criteria, connecting up the disconnected strings of argumentation, to make keyterms more precise in various directions. Theories help us 'solve problems'. This means first of all that we get understandable, integrated answers covering sets of burning questions — it is primarily the *kind* of answers we think of when we find the theory good. And in speaking of the scientific enterprise, it is research, not knowledge, that is crucial. These conclusions are important in supporting the pluralist and possibilist views of the Author.

D. Bostock, *Logic and Arithmetic. Natural Numbers,* At the Clarendon Press, Oxford, 1974, pp. 219.

If numbers are classes then we should surely be able to say *which* classes they are, and yet this is in principle impossible. If numbers *are* sets, then one and only one of these correlations will be the identity-correlation. In that case, *which* one? If it is not *numbers* that we are talking about, then why should we suppose that what we have deduced is *arithmetic*?

Benacerraf said that 'arithmetic is the science that elaborates the abstract structure that all progressions have in common merely in virtue of being progressions'. According to Bostock, arithmetic should *not* be regarded as a science treating of objects at all.

Original definitions of identity and succession between numbers are no more satisfactory. According to the Author, numbers should not be taken to be objects, since numerical quantifiers applying to objects would presumably be defined with the help of a different definition of identity. Consider the commonly accepted definition of identity

'$a=b$' for '$(\forall f)\ (f a = f b)$'.

This definition has the result that any monadic predicate of the form '$\ldots = b$' is defined by means of a quantification over all monadic predicates, and Russell accordingly prescribes it as illegitimate.

'$a=b$' for

'$(\forall x)\ (x = a \equiv x = b)$'

would presumably lead us to reject this as a definition. On the other hand the definition of '$=$' is completely successful.

A. Bressan, *A General Interpreted Modal Calculus,* Yale Univ. Press, London, 1973, pp. 327.

The book is written by a professor of physics working in Padua. Bressan's ML^{ν} is a many-sorted logic (where many = ν), which is a useful feature: ML^{ν} is uniquely among modal logics a complete type theory, with no upper limit on its types, which is extremely important.

Bressan's semantics is based on Carnap's Method of Extension and Intension, so that every meaningful expression is conceived as having both an extension and an intension. Paradigmatically, the extension of a sentence is a truth-value, while its intension might be called a 'proposition', and the extension of an individual constant is an individual in some preselected domain, while its intension might be called an 'individual concept'. Bressan considers the three chief categories of expressions of the type of individuals: individual constants, individual variables, and definite descriptions; according to the principle of uniformity, since individual constants are assigned an intension (an individual concept), exactly the same should hold true of variables and of definite descriptions. The tradition, however, does not treat variables and definite descriptions uni-

formly with constants. He considers the principle of uniformity too: treat expressions of the three categories alike, letting each have an individual concept as its intension.

'Relative possibility' relations can be built into ML^{v}. Bressan's identity is everywhere contingent: regardless of whether Δ_1 and Δ_2 are variables, constants, or definite descriptions, $\Delta_1 = \Delta_2$ is true in γ only provided Δ_1 and Δ_2 have the same extension in γ. If x and y both fall under the same absolute (substance) concept, *then* they are either necessarily identical or necessarily distinct.

One of the most exciting aspects of Bressan's work is its potential in providing a rigorous foundation for certain parts of physics.

AA.VV., *Recherches sur le Discours et l'Argumentation,* sous la direction de J.-B. Grize, Neuchâtel, Centre de Recherches Sémiologiques, 1974, pp. 200.

Les différents auteurs se rattachent tous, d'une façon ou d'une autre, au Centre de Recherches sémiologiques de Neuchâtel. Tous se connaissent pour avoir travaillé ensemble, échangé leurs idées, confronté leurs points de vue. Cela ne signifie nullement qu'ils partagent une « doctrine » commune. Les problèmes qui touchent au discours sont encore trop peu élaborés pour qu'un accord puisse s'établir sans arbitraire sur la façon de les aborder. La diversité des voies d'approche est même, en la matière, le meilleur garant d'une démarche fructueuse. C'est dire que, si une certaine unité se dégage peut-être de cet ensemble de textes, chacun d'eux reste l'expression de la personnalité de son auteur et de sa position propre.

Charles Ridoux marque la place spécifique qu'occupent les sémioticiens soviétiques. Yanouchka Oppel aborde le problème de l'énonciation à partir d'une réflection critique des travaux de Benveniste et de Weinrich et compare le rôle de « je » dans *Histoire* et dans *Triptyque* de Claude Simon. Jean-Luis Galay met en évidence le caractère absolument premier du texte par rapport à toute autre manifestation du langage. Marie-Jeanne Borel fait voir que les principaux courants de recherche sur l'argumentation font éclater l'objet d'étude en deux domaines non articulés, l'analyse formelle du raisonnement et l'étude empirique des relations interpersonnelles.

Marianne Ebel et Pierre Fiala consacrent une première étude à degager certaines difficultés propres au structuralisme saussurien, tel qu'il se présente notamment chez E. Benveniste. Ils s'interrogent sur les fondements de la théorie de la présupposition de O. Ducrot et montrent que, bien qu'étant l'une des plus cohérentes et des mieux fondées, elle manque finalement son projet de rendre compte de la nature sociale du language, encore qu'elle procède initialement à une critique de la définition limitative de la langue comme code de communication.

Albert Morf pose les bases d'un modèle théorique qui puisse servir de cadre aussi bien à l'étude des stratégies didactiques qu'à celle des stratégies d'argumentation. Aldo Licitra développe l'idée que, à côté de l'aspect statique que constitue le matériau linguistique, l'analyse des discours exige de prendre en compte les phénomènes de continuité et de choésion au niveau d'unités assez larges (les paragraphes), phénomènes qui agissent alors comme élément dynamique.

Georges Vignaux montre qu'il est légitime d'étudier les phénomènes de argumentation en soumettant le texte à une analyse, dans la mesure où elle vise à décrire et à définir la représentation construite par l'auteur ou plutôt les différents aspects qu'il fait jouer. Il propose un système d'opérations pour y parvenir. Enfin Jean-Blaise Grize propose d'utiliser la notion de schématisation pour aborder l'étude de l'argumentation et celle de la logique naturelle.

CHARLES MACCREERY, *Psychical Phenomena and the Physical World*, Hamish Hamilton, London, 1973, pp. 138.

In the first part of his book Charles McCreery discusses a number of philosophical questions in relation to various psychological rather than logical problems. But some logical conclusion could be derived from Mc Creery's volume. The second part of the book is empirical. In Chapter VI, Mr. McCreery summarizes the result of the English Institute of Phychophysical Research's experiments in the field of birth order and extra-sensory perception.

The next three chapters constitute valuable additions to the data already published by the Institute of Psychophysical Research on lucid dreams and out-of-the-body experiences.

How is one to decide whether one is dreaming or not? McCreery says that pinching oneself is not an adequate criterion. It is important to realize that *all* the senses may be represented in lucid dreams; they are not purely visual.

It would therefore have been impossible for one to decide whether one is waking or sleeping merely from examining the quality of one's sensations. Bertrand Russell claims that he experienced 'about a hundred' successive false awakenings on coming round from an anaesthetic (Bertrand Russell, *Human Knowledge: Its Scope and Limits*, Allen and Unwin, London, 1948, p. 186).

Perhaps there is a subjective difference between seeing the external world in the normal state and seeing it in the out-of-the-body state? Some do not perceive the world normally as we do. Some could have hallucinatory experiences that corresponded to the world. There is not something that can 'prove' direct experience. An apparition can be completely life-like. In some apparitional cases the subject does not realize *at first* that he is seeing an apparition. Only occasionally are empirical facts good support for logical extensions, of thought's determinacy. True and false are often delusions.

OCTAV ONICESCU, *Principes de Logique et de Philosophie Mathématique*, Editions de l'Académie de la Republique Socialiste de Roumanie, 1971, pp. 229.

Pour Onicescu lier la Logique mathématique à l'ensemble des propositions d'une doctrine mathématique établie, oblige à limiter le champ de cette Logique à une seule valeur, celle de la vérité. Le faux n'y a pas de place. C'est un premier pas vers une *logique de l'identité differentiée*. Ces logiques affirment déjà la fonction fondamentale de la determination de l'*objet*.

L'objet nombre naturel est de caractère ontologique par son aspect de nombre ordinal, lié à la réalisation des successions et de caractère épistémologique par son côté cardinal.

Pour l'Auteur un élément qui ne contient aucun autre élément de l'ensemble est appelé *primitif* ou *irréductible* ou *point*.

Espace est un ensemble dont tous les éléments sont irréductibles. Un espace étant un ensemble, il doit être pris avec l'ensemble de tous ses sous-ensembles.

Un grand progrès obtenu avec le concept d'espace a été réalisé quand, au lieu des points géométriques ou numériques, on a considéré les espaces d'éléments d'un caractère plus complexe et pourtant irréductibles.

Si la théorie mécanique de Newton ne semble pas étendre son application au-delà de certaines distances qui rendent l'attraction gravitationnelle inefficace ce qui veut dire qu'elle ne tient pas tous les corps de L'univers sous son empire, ni la Mécanique de New-

ton, ni la Mécanique invariantive ne sont de modèles. Ce sont des théories, indispensables pour la création d'eventuels modèles de l'Univers.

Les lois de la pensée logique on constitué ici la base et en même temps la justification des théories mathématiques.

Dans la Logique $P \vee P$ ne se réduit plus à P, mais reste ce qu'il est et qui peut encore être noté symboliquement P. La Logique peut devenir constructive, en échange du fait qu'elle laisse perdre le contenu de connaissance des propositions respectives. Il est nécessaire de donner aussi un espace fonctionnel dans lequel on puisse choisir l'application $x \longrightarrow f(x)$.

On aura donc à construire deux Catégories logiques: intrinsèque ou prédicatif. Les objets de la Catégorie logique C seront les propositions qui constituent un système S, susceptibles des opérations que nous indiquons plus loin et considérées au point de vue intrinsèque.

Si P, Q, $R \ldots$, sont des propositions de la catégorie C, les expressions $P \vee Q$, $P \wedge Q$, $(P \vee Q) \wedge R$, $(P \wedge Q) \vee R$ sont aussi des propositions de C.

Une proposition P d'une Catégorie épistémologique C est simple ou atomique si l'implication $P \rightarrow Q$ n'est compatible qu'avec l'égalité $Q = P$.

Toute Catégorie épistémologique atomique possède un atome unique ω. Si ω est l'atome de C alors $A \wedge X = \omega$ quel que soit X.

Toute proposition P de C implique ω. Une Catégorie logique C est déductive si toute partie θ non vide de S possède au moins une proposition indécomposable dans θ.

Une Catégorie logique C est *inductive* si toute partie Ω non vide de C possède au moins une proposition *maximale* dans le sens suivant: P est maximale dans Ω si tout Q appartenent à Ω est tel que $Q \rightarrow P$ est identique à P.

L'induction intégrale peut être, au point de vue mathématique, comme une extension de l'induction complète. La nature du processus aléatoire nous fait passer de n à $n + 1$.

Il existe un élément commun, imposé par l'expérience, un élément qui, dans le language intuitif, qualitatif, s'appelle événement aléatoire.

Les modalités expérimentales concernant l'aspect corpusculaire d'un phénomène nous conduisent à une interprétation apparemment contradictoire — par les notions employées — aux modalités expérimentales concernant l'aspect corpusculaire ou ondulatoire de ce même phénomène. Celà ne signifie pas qu'un objet est en même temps corpuscule et onde, mais seulement que ces deux notions intuitives correspondent partiellement seulement à l'objet auquel elles se réfèrent, qu'aucune des deux descriptions n'est complète et, enfin, que les deux sont nécessaires pour sa compréhension. La syntaxe à laquelle Onicescu se réfère devrait comprendre des procédés rendant possible, entre autres, la correspondance entre la Géométrie d'Euclide telle que nous la concevons et toute autre Géométrie axiomatique à laquelle on fournit un corps et une réalité selon le modèle de cette antique discipline. Onicescu considère l'univers de ses relations avec les ressources d'une théorie qui est capable de constituer le fondement d'un système qui puisse considérer les formes de la connaissance, comme unitaire en est la base.

J. L. Mackie, *The Cement of the Universe. A Study of Causation*, Oxford at the Clarendon Press, 1974, pp. 329.

Causation as we observe is really in 'objects'? Of any kind-physical processes, mental processes, the transition from willing to bodily moviment, or anywhere else — Mackie writes — is something that we wight roughlt describe as regular succession.

The experience of constant conjunction does not provide materials for any *rational* inference from cause to effect (or vice versa).

Logical necessity is in the mind, not in objects.

This experience neither reveals nor produces any necessity in the objects.

Causal knowledge is acquired in cases where we experience logical constant conjunction.

If we accepted Hume's conceptual framework, and assumed that all kinds of thinking, or mental life generally, consisted simply of having certain perceptions, certain impressions and ideas in various combinations and sequences, then it would be plausible to equate believing with having a lively idea.

Hume's argument is that if it were *reason* that leads us, after the experience of a constant conjunction, to infer a cause from an effect in a new like instance, reason would be relying on the principle of the uniformity of nature.

Unobserved instances must resemble observed ones. But this principle cannot be established either by 'knowledge' — because its falsity is conceivable — or by 'probability' — because that would be circular.

According to Mackie, reasonable but probabilistic inferences have not been excluded by Hume's argument, for the reason that Hume did not consider this possibility.

An initial analysis of our causal concepts could be given in terms of certain conditional statements, especially certain counterfactuals. In asserting singular causal sequences we are talking, not only about what has occurred, but about what would or would not have occurred had things been different.

It is not true that one effect must be connected with only one cause, or assemblage of conditions; that each phenomenon can be produced only in one way. Some disjunction or conjunction of factors, some of which may be negative, is both necessary and sufficient for the effect in the field in question.

One does not always require that an individual cause should be sufficient as well as necessary in the circumstances for its effect.

Since we can often infer, with probability, an effect from a cause, we can similarly infer the absence of a cause from the absence of an effect.

We ordinarily suppose both that there are some such regularities underlying many of the sequences that wa take to be causal and that in scientific inquiries, at least in the physical and the biological sciences, we make progress towards fuller formulations of them.

Whether these suppositions are correct can still be questioned. The methods examined for establishing them rest upon assumptions of uniformity which those methods cannot themselves establish: to ask wheter such success as they seem to have achieved can be taken to have confirmed their assumptions, or whether those assumptions can be justified or vindicated in some other way, is to raise the fundamental philosophical problem of induction. Those who find regularity theories inadequate commonly insist on some intrinsic necessity in causal relations, or suggest a 'genetic' view of causation, according to which causes produce or generate their effects and are not merely followed by them, or both. [For example, A. C. Ewing, *Idealism* (pp. 151-87); W. Kneale, *Probability and Induction* (pp. 70-103); R. Harré, *The Principles of Scientific Thinking* (Chapters 4,10 and 11)].

But it is not enough to reiterate such words as 'necessity' and 'production' and 'generation'. We need some clear account of what this necessity is, or of what producing or generating can be. In Chapters 5 and 8 the Author tries to resolve these problems, by both borrowing from and criticizing the work, in particular, of Du-

casse and Kneale, while in Chapter 7, he investigates that other essential supplement to regularity, the direction of causation. Kneale has said that 'attempts are... made to specify the hypothetical entities of the system in such a way that any connexions between them required for the purposes of the theory are intrinsically necessary' (*Probability and Induction*, p. 97).

But even if any distinction of this sort could be drawn firmly, it would be no more than a distinction between 'transeunt' and 'immanent' causation, that is between what is ordinarily called causation and the sort of self-maintaining process for whose inclusion, in an extended notion of causation.

Mackie has found no objective processes which are in themselves teleological in a way that preclude their being instances of efficient causation. According to him causation is not something *between* events in a spatio-temporal sense, but is rather the way in which they follow one another. It involves regularities (universal or statistical ones). In particular what Mackie has distinguished are pure laws of working; but it is not exhausted by them; it includes also the spatio-temporal continuity (the qualitative or structural continuity, or partial persistence).

All basic causal knowledge should be in effect applications of the method of difference in structural continuity. Really according to *productive logic*, it depends on the measure of an *internal difference* of *identity*. From A^n to $\sim A^n$, therefore derives B^n, where n is a measure of A revealing itself as causation of $\sim A \equiv B$.

Becquerel, for istance, discovered that the radium he carried in a bottle in his pocket caused a burn by noticing that the presence of the radium was the only possibly relevant difference between the time when the inflammation developed and the earlier time when it did not.

The Popperian principle that hypotheses are corroborated by being subjected to severe tests is illustrated by the methods of agreement and difference. The hypothesis that A is necessary from P in F is severely tested by looking for instances of P which fall within the field F but otherwise differ widely in all conceivably relevant ways, and seeing whether A is present in them all.

JONAS SEPETYS, *The Revelation of Humanity*, Philosophical Library, New York, 1974, pp. 221.

It seems curious that the logical and phenomenological constituents of existence are expelled from microphysics as not necessary.

Man's vision, affected by phenomenon, turns into the space-time. Phenomena are interrelated with the sensual objects.

There was no logical problem on space-time until the theory of relativity. The quarrel began when the universal static space and absolute time were recognized as being wrong and excludable from the science of physics. The innovators thought they were rejecting what was not existing. Now, according to Sepetys, time and space have to be the prime elements of the human being.

No phenomenon can reveal itself without a temporal and spatial origin. The relation of life with physics expands life into the outside of body. It is not a man in the world, but is man within his own world in the time and space. Life and concepts are result of it.

Life manifests itself by the vital action, multiplication, self-sustenance, growth, and development. The vital force reveals itself in response to the physical, material and radiant, stimuli.

The living beings have an ability to receive the sensual stimuli from environment. Outside is not such as we see it, but as our sight makes it. According to Sepetys the world is a

pure product of man's sensation. Man is enclosed in his sensual scope. The origin of mind, is on the outside of man. The vital part is a conscious phenomenon: a concepts producer of. The mind and reality are only the grades of the evolution. A living being obviously is not a passive cosmic device but an active body with the inherent will to live. The substance of logical consciousness is *the knowledge of environment*, constituted by remembrance-recognition.

The notion about man should be cardinally changed. He is neither an individual nor independent creation, but a 'cosmic spot' wherefrom *the universal essence* reveals itself. Man always stays in the middle of his personal space.

Assuming the imprint as a certain energy aroused in the memory brain, its relation to the outer energy can be expressed by $IMt = \sum^t \Delta e$.
The memory imprint is a result of the momentary impacts of energy per t time. The logical elements comprise *the stock of knowledge* of individual man.

Man's vital center produces a space-time scope with man himself in the middle, as the reference of all occurrences in the scope. The dimensional space can never be separated from the conscious space-time scope.

What is the objectivity? The objective plane — Septys thinks — in constituted by the agreed symbols of speech.
The observation can occur in no other other way than through the humanization of the portion of the universe. Truth in itself does not exist, Falsehood does not operate. Truth is one of the moods of the human projections representing the existence of a universal entity. Names then become the pure subjects of communication. The objectification is only *opinionable* and *evaluable*. The individual truths become relative to the collective truth. The collective truth does not form by itself but is established, on agreement, by the members of the collective.

The products expressing oneself are real and true only with relation to the collective. The substantiation of space and time and the interchange of their objective-metrical categories are the main causes of the misinterpretation of space and time.

Mathematics is nothing more than one of the communicative means of man. On the contrary, *the qualities of objects* — the Author concludes — *are nothing, but sensual effects of the objects upon man.*

The substance of number is thus the retrospective knowledge acquired through experience. Individual concepts thus imply collective achievements. The lifetime cycles of individuals and generations are positively interrelated, following one after the other in a causal-lawful sequence. Lawfulness even signifies the succession of evolution. The violation of the natural laws harms the carriers of evolution and thus evolution itself.

But here it is possible to ask: evolution of what, if logical elements, through the effect of material objects, ignore the root of their internal, dialectical process?

RECENT PUBLICATIONS

D. Ault, *Visionary Physics. Blake's Response to Newton*, The University of Chicago Press, 1974.

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M. Cotlar-R. Cignoli, *An Introduction to Functional Analysis*, North Holland-American Elsevier, 1974.

F. Cunnigham, *Objectivity in Social Science*, University of Toronto Press, 1973.

G. De Ockham, *Opera Philosophica*. I. *Summa Logicae*, Instituti Franciscani, Universitatis S. Bonaventurae, New York, 1974.

A. Dumitriu, *Philosophia Mirabilis*, Editura Enciclopedica Romana, Bucarest, 1974.

J. P. Ferrier, *Spectral Theory and Complex Analysis*, North-Holland Publ. Company, Amsterdam-London, 1973.

B. Fischer, *The Human Exile*, Philosophical Library Inc., New York, 1974.

S. Golab, *Tensor Calculus*, Elsevier Scientific Publ. Comp. - PWN, Warsawa, 1974.

J. J. Jacobson, *Perspectivism in Art*, Philosophical Library Inc., New York, 1973.

F. S. Johnston Jr., *Fundamental Relationships and Their Logical Formulations*, Philosophical Library Inc., New York, 1974.

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Yu. I. Manin, *Cubic Forms, Algebra, Geometry, Arithmetic*, North-Holland, America Elsevier, Amsterdam-London-New York, 1974.

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S. Salbany, *Bitopological Spaces, Compactifications and Completions*, in « Mathematical Monographs of the Univ. of Cape Town », n. 1, 1974, Univ. of Cape Town.

G. F. Sefler, *Language and World*, Humanities Press, New Jersey, 1974.

A. Tarski, *Logique Sémantique, Métamathématique*, ed. A. Colin, Paris, 1972.
A. M. Turing, *¿Puede Pensar una Máquina?*, Universidad de Valencia, 1974.
P. Vendres, *Vers la Théorie de l'Homme*, P.U.F., Paris, 1973.
R. Wojcicki, *Metodologia Formalna Nauk Empirycznych*, Polska Akademia Nauk Instytut Filozofii i Socjologii, 1974.
Ph. F. Wooby, *Lucretius: About Reality*, Philosophical Library Inc., New York, 1973.
J. Woods, *Proof and Truth (Mathematical Logic for Non-Mathematicians)*, Peter Martin Associates Limited, 1974.
Acta Matematica, t. XXV, fasc. 3-4, 1974, Academia Scientiarum Hungaricae, Budapest.
Analele Stiintifice ale Universitatii « A. I. Cuza » Din Iasi, t. XX, fasc. 2, sect. 1, 1974, Iaşi, Romania.
Acta Universitatis Carolinae, n. I, 1974, Universita Karlova, Praha.
Annali della Scuola Normale Superiore di Pisa, s. III, vol. IV, n. 2, 1974, Pisa.
Annali della Facoltà di Lettere e Filosofia, vol. XVII, 1974, Università di Bari.
Aquinas, a. XVII, n. 1-4, 1974, Univ. Lateranense, Roma.
Archimede, a. XXVI, n. 5-6, settembre-dicembre 1974, Firenze.
Archives de Philosophie, t. 37, cahier 3, juillet-septembre 1974.
Australasian Journal of Philosophy, vol. 52, n. 2, August 1974.
Bollettino della Società Filosofica Italiana, nuova serie, n. 85, ottobre-dicembre 1973.
Bollettino Filosofico, a. IX, n. 2, febbraio 1975.
Bollettino di Storia della Filosofia, vol. I, 1973, Univ. di Lecce.
Babele, a. II, n. 5-6, ottobre 1974.
Collectanea Mathematica, vol. XXV, fasc. II, 1974, Seminario Mathematico de Barcelona.
Convivium, n. 42, 1974/II, Barcelona.
Conceptus, vol. VIII, n. 25, 1974, Innsbruck-Munchen-Salzburg-Graz.
Crisis, a. XXI, n. 84, octubre-Dicimbre 1974, Madrid.
Dialogue, September 1974, Montréal, Canada.
Dialectics and Humanism, autumn 1973, Polish Academy of Sciences.
Deutsche Zeitschrift fuer Philosophie, n. 9, a. 22, 1974, Berlin.
Dialectica, vol. 28, fasc. 3-4, 1974, Lausanne.
Diotima, n. 2, 1972, Hellenic Society for Philosophical Studies.
Educational Theory, Summer 1974, Baltimore, Maryland.
Estudios Filosoficos, 63-64, mayo-diciembre 1974, Valladolid.
Filosofia e Società, giugno 1974, Roma.
Filosoficky Casopis, n. 6, 1974, Ceskoslovenskà Akademie Véd.
Giornale Italiano di Psicologia - Italian Journal of Psychology, vol. I, n. 1, aprile 1974, ed. Il Mulino, Bologna.
Indian Philosophy and Culture, vol. XIX, n. 3, September 1974, Institute of Oriental Philosophy, Urindaban, India.
International Philosophical Quarterly, vol. XVI, n. 3, September 1974, Fordham University, New York.
Journal of Mathematics of Kyoto University, vol. 14, n. 2, July 1974, Kyoto.
JBSP, *The Journal of the British Society for Phenomenology*, vol. V, n. 3, October 1974.
Iqbal Review, July 1974, Academy of Pakistan.
Journal for the Theory of Social Behaviour, vol. 4, n. 2, October 1974, Oxford.
Logos, 2, 1973, Napoli.
Main Currents in Modern Thought, vol. 31, n: 2, November-December 1974.
Mathematics Colloquium, vol. IX, 1974, University of Cape Town.

Metaphilosophy, vol. 5, n. 4, October 1974, Basil Blackwell, Oxford.
Mind, vol. LXXXIV, n. 333, January 1975.
Notre Dame Journal of Formal Logic, vol. XV, n. 4, octobre 1974, Univ. of Notre Dame, Indiana.
Nuova Antologia, fasc. 2089, gennaio 1975.
Process Studies, vol. 4, n. 1, Spring 1974, Claremont, California.
Philosophical Studies, vol. XXII, The National Univ. of Ireland.
Philosophia, vol. 4, n. 2-3, April-July 1974, Bar-Ilan University.
Pensamiento, n. 120, vol. 30, octubre-diciembre 1974, Madrid.
Quaderni della Mathesis di Cosenza, a. II, n. 2, febbraio-maggio 1974, Sezione Mathesis di Corigliano Calabro e Cosenza.
Révue de Théologie et de Philosophie, IV, 1974, Lausanne.
Révue Philosophique de Louvain, t. 72, novembre 1974, Louvain.
Reports on Mathematical Logic, n. 3, 1974, The Jagiellonian Univ. of Cracow, Poland.
Révue de l'Université d'Ottawa, vol. 44, n. 4, octobre-décembre 1974, Ottawa.
Russell, 15, Autumn 1974.
Révue Roumaine de Mathématiques Pures et Appliquées, t. XIX, n. 5, 1974.
Ricerche Metodologiche, a. VII, n. 1, settembre 1974.
Rivista di Filosofia Neoscolastica, a. LXVI, fasc. II-IV, aprile-dicembre 1974, Università del Sacro Cuore di Milano.
Salesianum, a. XXXVI, n. 4, octobre-december 1974.
Sapientia, a. XXIX, n. 113, 1974, Univ. Catòlica Argentina.
Studia Philosophiae Christianae, n. 2, 1974, Warsawa.
Sophia, vol. XIII, n. 2, July 1974, Univ. of Melbourne.
Stromata, a. XXX, n. 3, Julio-Setiembre 1974, Univ. del Salvador, San Miguel, Argentina.
Studia Logica, XXXII, n. 3, 1974, Polish Academy of Sciences.
The Modern Schoolman, vol. LII, n. 3, March 1975, Saint Louis Univ.
The Journal of Critical Analysis, vol. IV, n. 4, Jan.-Apr. 1973.
Tecnika, n. 23, vol. 4, Univ. of Leningrad.
The Philosophical Review, October 1974, Cornell Univ. Ithaca.
The Journal of Philosophy, vol. LXXI, n. 20, November 1974.
The Journal of Symbolic Logic, vol. 39, n. 2, June 1974.
The Philosopher's Index, vol. VIII, n. 3, Fall 1974.
Teoresi, a. XXIX, n. 3-4, luglio-dicembre 1974, Università di Catania.
Teorema, vol. IV, n. 4, 1974, Univ. de Valencia.
The Humanist, November-December 1974, New York.
The Philosophical Quarterly, vol. 25, n. 98, January 1975.
The Southern Journal of Philosophy, vol. XII, n. 3, 1974, Memphis State Univ.
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Séminaires de l'Institut de Mathematique de l'Academie de la Republique Socialiste de Roumanie, *Espaces analytiques,* 1971, pp. 172.

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I. Nadejede, C Bergthaller, C. Zidaroiu, S. Sburlan, *Probleme de cercetare operatională. Programare matematică,* 1971, pp. 451.

N. Popescu, *Categorii abeliene,* 1971, pp. 313.

Séminaires de l'Institut de Mathematique de l'Academie de la Republique Socialiste de Roumanie, *Proceedings of the Romaninan - Finnish Seminar on Teichmüller Spaces and Quasiconformal Mappings,* 1971, pp. 308.

Gh. Vranceanu, *Opera matematică,* vol. II, 1971, pp. 575.

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