A Translation/Interpretation of

Kai Sørlander's Philosophy

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Abstract

We translate[1] and interpret what we have chosen to be an essence of Kai Sørlander's works in metaphysics [37, 38, 40, 44, 45, 1994–2022]. We have, in a few places, inserted material from elsewhere.

Contents

[1] Kai Sørlander's works [37, 38, 39, 40, 41, 42, 43, 44, 45, 1994–2022] are only published in Danish.

1 Introduction

Kai Sørlander's Philosophy

Definition: 1 . **Philosophy** [2] is the study of general and fundamental questions, such as those about existence, reason, knowledge, values, mind, and language[3] ▪

In philosophising questions are asked. One does not necessarily get answers to these questions. Questions are examined. Light is thrown on the questions and their derivative questions.

Philosophy is man's endeavour, our quest, for uncovering the necessary characteristics of our world and our situation as humans is that world.

We shall focus on the issues of existence, i.e., metaphysics.

The treatment in this paper is based very much on the works of the Danish philosopher **Kai Sørlander** (1944) [37, 38, 40, 44, 45, 1994–2022] both in contrast to and inspired by the German philosopher **Immanuel Kant** (1724–1804) [15].

The reason why I, as a computer scientist, am interested in philosophy, is that philosophers over more than 2500 years[4] have thought about existence: why is the world as it is – and computer scientists, like other scientists (notably physicists and economists), repeatedly model fragments of the world; and the reason why I focus on Kai Sørlander, is that his philosophy addresses issues that are crucial to our understanding how we must proceed when modelling domains – and, I think, in a way that helps us model domains with a high

[2] From Greek: $\phi\iota\lambda o\sigma\phi\iota\alpha$, philosophia, 'love of wisdom'

[3] Many of the 'definitions' in this are in the style used in philosophy. They are not in the 'precise' style commonly used in mathematics and computer science. You may wish to call them **characterisation**s. In mathematics and computer science the definer usually has a formal base on which to build. In domain science & engineering we do not have a formal base, we have the "material" world of natural and man-made phenomena.

[4] – starting, one could claim, with:

assurance that our models are reasonable, can withstand close scrutiny. Kai Sørlander thinks and writes logically, rationally. The area of his philosophy that I am focusing on here is metaphysics.

1.1 Metaphysics

The branch of philosophy that we are focusing on is referred to as metaphysics. To explain that concept I quote from `[Wikipedia]`:

"Metaphysics is the branch of philosophy that studies the fundamental nature of reality, the first principles of being, identity and change, space and time, causality, necessity, and possibility.[5] *It includes questions about the nature of consciousness and the relationship between mind and matter,*

- *Thales of Milet* 624–545 [everything originates from `water`] [30];
- *Anaximander* 610–546 [`'apeiron'` (the 'un-differrentiated', 'the unlimited') is the origin] [11];
- *Anaximenes* 586–526 [`air` is the basis for everything] [29];
- *Heraklit of Efesos* 540–480 [`fire` is the basis and everything in nature `is in never-ending ''battle''`] [4];
- *Empedokles* 490–430 [there are four base elements: `fire, water, air` and `soil`] [50];
- *Parminedes* 515–470 [everything that exists is `eternal and immutable` [19]];
- *Demokrit* 460–370 [all is built from `atoms`] [1];
- the Sophists: Protagoras, Gorgias (fifth and fourth centuries BC),
- *Socrates* (470–399) [2],
- *Plato* (424–347) [14],
- *Aristotle* (384–322) [5],
- etcetera.

After more than 1800 years came

- *René Descartes* (1596–1650) [13],
- *Baruch Spinoza* (1632–1677) [46],
- *John Locke* (1632–1704) [28],
- *George Berkeley* (1685–1753) [7],
- *David Hume* (1711–1776) [22],
- *Immanuel Kant* (1724–1804) [25],
- *Johan Gottlieb Fichte* (1762–1814) [24],
- *Georg Wilhelm Friedrich Hegel* (1770–1831) [17],
- *Friedrich Wilhelm Schelling* (1775–1864) [6],
- *Edmund Husserl* (1859–1938) [23],
- *Bertrand Russel* (1872–1970) [35, 47, 34, 36],
- *Ludwig Wittgenstein* (1889–1951) [48, 49],
- *Martin Heidegger* (1889–1976) [18],
- *Rudolf Karnap* (1891–1970) [32],
- *Karl Popper* (1902–1994) [32, 33],
- etcetera.

(This list is "pilfered" from [44, Pages 33–127].) [44] presents an analysis of the metaphysics of these philosophers. Except for those of Russel, Wittgenstein, Karnap and Popper, these references are just that.

[5] www.encyclopedia.com/philosophy-and-religion/philosophy/philosophy-terms-and--concepts/metaphysics

between substance and attribute, and between potentiality and actuality.[6] *The word "metaphysics" comes from two Greek words that, together, literally mean "after or behind or among [the study of] the natural". It has been suggested that the term might have been coined by a first century CE editor who assembled various small selections of Aristotle's works into the treatise we now know by the name Metaphysics (μετα τα φυσικα, meta ta physika, lit. 'after the Physics', another of Aristotle's works) [10].*

Metaphysics studies questions related to what it is for something to exist and what types of existence there are. Metaphysics seeks to answer, in an abstract and fully general manner, the questions:[7]

- *What is there ?*
- *What is it like? ?*

Topics of metaphysical investigation include existence, objects and their properties, space and time, cause and effect, and possibility. Metaphysics is considered one of the four main branches of philosophy, along with epistemology, logic, and ethics" `en.m.wikipedia.org/wiki/Metaphysics`.

1.2 Transcendental Deductions

A crucial element in Kant's and Sørlander's philosophies is that of *transcendental deduction*.

It should be clear to the reader that in ***domain analysis & description*** we are reflecting on a number of philosophical issues; first and foremost on those of *ontology*. For this paper we reflect on a sub-field of epistemology, we reflect on issues of *transcendental* nature. Should you wish to follow-up on the concept of transcendentality, we refer to [15, Immanuel Kant], [21, Oxford Companion to Philosophy, pp 878–880], [3, The Cambridge Dictionary of Philosophy, pp 807–810], [9, The Blackwell Dictionary of Philosophy, pp 54–55 (1998)], and [44, Sørlander].

1.2.1 Some Definitions

Definition: 2 . **Transcendental:** By **transcendental** we shall understand the philosophical notion: **the a priori or intuitive basis of knowledge, independent of experience** ▪

A priori knowledge or intuition is central: By *a priori* we mean that it not only precedes, but also determines rational thought.

[6] Metaphysics. American Heritage Dictionary of the English Language (5th ed.). 2011.

[7] What is it (that is, whatever it is that there is) like? Hall, Ned (2012). "David Lewis's Metaphysics". In Edward N. Zalta (ed.). The Stanford Encyclopedia of Philosophy (Fall 2012 ed.). Center for the Study of Language and Information, Stanford University.

Definition: 3 . Transcendental Deduction: By a **transcendental deduction** we shall understand the philosophical notion: **a transcendental "conversion" of one kind of knowledge into a seemingly different kind of knowledge** ∎

1.2.2 Some Informal Examples

Example 1 Transcendental Deductions – Informal Examples: We give some intuitive examples of transcendental deductions. They are from the "domain" of programming languages. There is the syntax of a programming language, and there are the programs that supposedly adhere to this syntax. Given that, the following are now transcendental deductions.

The software tool, ***a syntax checker***, that takes a program and checks whether it satisfies the syntax, including the statically decidable context conditions, i.e., the *statics semantics* – such a tool is one of several forms of transcendental deductions.

The software tools, ***an automatic theorem prover*** and ***a model checker***, for example `SPIN` [20], that takes a program and some `theorem`, respectively a `Promela` statement, and proves, respectively checks, the program correct with respect the theorem, or the statement.

A ***compiler*** and an ***interpreter*** for any programming language.

Yes, indeed, any ***abstract interpretation*** [12, 8] reflects a transcendental deduction: firstly, these examples show that there are many transcendental deductions; secondly, they show that there is no single-most preferred transcendental deduction.

A transcendental deduction, crudely speaking, is just any abstraction that can be "linked" to another, not by logical necessity, but by logical (and philosophical) possibility !

Definition: 4 . Transcendentality: By **transcendentality** we shall here mean the philosophical notion: "the state or condition of being transcendental" ∎

Example 2 Transcendentality: We[8] can speak of a bus in at least three *senses:*

(i) The bus as it is being "`maintained, serviced, refueled`";

(ii) the bus as it "`speeds`" down its route; and

(iii) the bus as it "`appears`" (listed) in a bus time table.

The three *senses* are:

(i) as an **endurant** (here a *part*),

(ii) as a **perdurant** (as we shall see, a *behaviour*), and

(iii) as an **attribute**[9] ∎

The above example, we claim, reflects *transcendentality* as follows:

(i) We have knowledge of an endurant (i.e., a part) being an endurant.

(ii) We are then to assume that the perdurant referred to in (ii) is an aspect of the endurant mentioned in (i) – where perdurants are to be assumed to represent a different kind of knowledge.

(iii) And, finally, we are to further assume that the attribute mentioned in (iii) is somehow related to both (i) and (ii) – where at least this attribute is to be assumed to represent yet a different kind of knowledge.

In other words: two (i–ii) kinds of different knowledge; that they relate *must indeed* be based on *a priori knowledge*. Someone claims that they relate! The two statements (i–ii) are claimed to relate transcendentally.[10]

1.2.3 Bibliographical Note

The philosophical concept of *transcendental deduction* is a subtle one. Arguments of transcendental nature, across the literature of philosophy, does not follow set principles and techniques. We refer to [3, *The Cambridge Dictionary of Philosophy*, pages 807–810] and [9, *The Blackwell Companion to Philosophy*, Chapter 22: Kant (David Bell), pages 589–606, Bunnin and Tsui-James, eds.] for more on 'transcendence'.

2 The Philosophical Question

Sørlander focuses on the philosophical question of **"what is thus necessary that it could not, under any circumstances, be otherwise ?"**.

To study and try answer that question Sørlander thinks rationally, that is, *reasons*, rather than express emotions. The German philosopher Immanuel

[8] I first came across this example when it was presented to me by Paul Lindgreen, an early Danish computer scientist (1936–2021) – and then as a problem of data modelling [26, 1983].

[9] – in this case rather: as a fragment of a bus time table *attribute*.

[10] – the attribute statement was "thrown" in "for good measure", i.e., to highlight the issue!

Kant (1724–1804) suggests that our philosophising as to the philosophical question above must build on *"something which no person can consistently can deny, and thus, something that every person can rationally justify, as a consequence of be able to think at all"*. Kant then goes on to build his philosophy [25] on *the possibility of self-awareness* – something of which we all are aware. Sørlander then, in for example [44], shows that this leads to solipsism[11], i.e., to nothing.

3 Three Principles

3.1 The Possibility of Truth

Instead Sørlander suggests that **the possibility of truth** be the basis for the thinking of an answer to the highlighted question above. *The possibility of truth* is shared by all of us.

3.2 The Principle of Contradiction

Once we accept that *the possibility of truth* cannot be denied, we have also accepted **the principle of contradiction**, that is, that an assertion and its negation cannot both be true.

3.3 The Implicit Meaning Theory

We must thus also accept *the implicit meaning theory*.

Definition: 5 . The Implicit Meaning Theory implies that there is a *mutual relationship* between the (α) *meaning of designations* and (β) *consistency relations between assertions* ∎

As an example of what "goes into" the *implicit meaning theory*, we bring, albeit from the world of computer science, that of the description of the **stack** data type (its endurant data types and perdurant operations).

Example 3 The Implicit Meaning Theory.: Narrative:

α The Designations:

1 Stacks, s:S, have elements, e:E;

2 the empty_S operation takes no arguments and yields a result stack;

[11] Solipsism: the view or theory that the self is all that can be known to exist.

3 the is_empty_S operation takes an argument stack and yields a Boolean value result.

4 the stack operation takes two arguments: an element and a stack and yields a result stack.

5 the unstack operation takes an non-empty argument stack and yields a stack result.

6 the top operation takes an non-empty argument stack and yields an element result.

β The Consistency Relations:

7 an empty_S stack is_empty, and a stack with at least one element is not;

8 unstacking an argument stack, stack(e,s), results in the stack s; and

9 inquiring the top of a non-empty argument stack, stack(e,s), yields e.

Formalisation.

The designations:

type
1. E, S

value
2. empty_S: **Unit** → S
3. is_empty_S: S → **Bool**
4. stack: E × S → S
5. unstack: S $\xrightarrow{\sim}$ S
6. top: S $\xrightarrow{\sim}$ E

The consistency relations:

axiom
7. is_empty(empty_S()) = **true**
7. is_empty(stack(e,s)) = **false**
8. unstack(stack(e,s)) = s
9. top(stack(e,s)) = e ■

3.4 A Domain Analysis & Description Core

The three concepts: (i) *the possibility of truth,* (ii) *the principle of contradiction* and (iii) *the implicit meaning theory* thus form the core – and imply that (a) *the indispensably necessary characteristics of any possible world, i.e., domain,* are *equivalent* with (b) *the similarly indispensably necessary conditions for any possible domain description.*

4 The Deductions

4.1 Assertions

Definition: 6 . **Assertion:** An assertion is a declaration, an utterance, that something is the case ■

Assertions may typically be either propositions or predicates.

4.2 The Logical Connectives

Any domain description must necessarily contain assertions. Assertions are expressed in terms of negation, $\sim$, conjunction, $\wedge$, disjunction, $\vee$, and implication, $\Rightarrow$.

4.2.1 $\sim$: Negation

Negation is defined by the principle of contradiction. If an assertion, a, holds, then its negation, $\sim a$, does not hold.

4.2.2 Simple Assertions

Simple assertions, i.e., propositions, are formed from assertions, f.x. a,b, by means of the logical connectives.

4.2.3 $\wedge$: Conjunction

The simple assertion $a \wedge b$ holds if both a and b holds.

4.2.4 $\vee$: Disjunction

The simple assertion $a \vee b$ holds if either or both a and b holds.

4.2.5 $\Rightarrow$: Implication

The simple assertion $a \Rightarrow b$ holds if a is *inconsistent* with the negation of b.

4.3 Modalities

4.3.1 Necessity

Definition: 7 . Necessity: An assertion is *necessarily true* if its truth (''true'') follows from the definition of the designations by means of which it is expressed. Such an assertion holds under all circumstances ■

Example 4 Necessity: *"It may rain someday"* is necessarily true.

4.3.2 Possibility

Definition: 8 . Possibility: An assertion is *possibly true* if its negation is not *necessarily true* ■

Example 5 Possibility: *"it will rain tomorrow"* is possibly true.

4.4 Empirical Assertions

Definition: 9 . Empirical Knowledge: In philosophy, knowledge gained from experience rather than from innate ideas or deductive reasoning is empirical knowledge. In the sciences, knowledge gained from experiment and observation rather than from theory is empirical knowledge ■

Example 6 Expressing Empirical Knowledge: There are innumerable ways of expressing empirical knowledge.

a. There are two automobiles in that garage.[12]
b. The two automobiles in that garage are distinct.[13]
c. The two automobiles in that garage are parked next to one another.[14]
d. That automobile, the one to the left, in that garage is [painted] red.[15]
e. The automobile to the right in that garage has just returned from a drive.[16]
f. The automobile, with Danish registration number `AB 12345`, is currently driving on the `Copenhagen area` city `Holte` road `Fredsvej` at position `'top of the hill'`.[17]
g. The automobile on the roof of that garage is pink.

The pronoun 'that' shall be taken to mean that someone gestures at, points out, the garage in question. If there is no such garage then the assertion denotes the **chaos** value ! Statements (a.–g.) are assertions. The assertions contain *references* to quantities "outside the assertions" — 'outside' in the sense that they are not defined in the assertions. Assertion (g.) does not make sense, i.e., yields **chaos**. The term 'roof' has not been defined ■

*I : **The Object Language.** The language used in the above assertions is quite 'free-wheeling'. The language to be used in "our" domain descriptions is, i.e., will be, more rigid* ■

[12] *The automobiles are solid* endurants*, and so is the garage, that is, they are both* parts.
[13] *Their distinctness gives rise to their respective, distinct, i.e.,* unique identifiers.
[14] *The topological ordering of the two automobiles is an example of their* mereology.
[15] *The red colour of the automobile is an* attribute *of that automobile.*
[16] *The fact that that automobile, to the right in the garage, has just returned from a drive, is a* possibly time-stamped attribute *of that automobile.*
[17] *The automobile in question is now a* perdurant *having a so-called* time-stamped progammable event attribute *of the Copenhagen area city of Holte, "top of the hill".*

Definition: 10 . **Empirical Assertion:** The domain description language of assertions, contain **references**, i.e., *designators*, and **operators**. All of these shall be properly defined in terms of names of *endurants* and their *unique identifiers*, *mereologies* and *attributes*; and in terms of their *perdurant "counterparts"* ∎

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From Possible Predicates to Conceptual Logic Description Framework. The ability to deduce which type of predicates that a phenomena of any domain can be ascribed is thus equivalent to deducing the conceptual logical conditions for every possibly possible domain description.

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By a so-called *transcendental deduction* we have shown that simple empirical assertions consist of a **subject** which **refers** to an independently existing entity and a **predicate** which ascribes a **property** to the referred entity [44, π 146 ℓ 1–5].

The world, or as we shall put it, the domains, that we shall be concerned with, are *what can be described in simple assertions*, then any possible such world, i.e., domain must *primarily consist of such entities* [44, π 146 ℓ 5–7].

We shall therefore, in the following, explicate a system of **concepts** by means of which the entities, that may be referred to in simple assertions, can be described [44, π 146 ℓ 8–11].

$\mathcal{I}$: *These* ***concepts*** *are those of* entities, endurants, perdurants, unique identity, mereology *and* attributes. ∎

4.5 Identity and Difference

We can now assume that the world consists of an indefinite number of entities: Different empirical assertions may refer to distinct entities. Most immediately we can define two interconnected concepts: **identity** and **diversity**.

4.5.1 Identity

Definition: 11 . **Identical:** "An entity referred to by the name A is *identical* to an entity referred to by the name B if A cannot be ascribed a property which is incommensurable with a property ascribed to B" [44, π 146 ℓ 14-23] ∎

4.5.2 Difference

Definition: 12 . **Different:** "A and B are *distinct*, differs from one another, if the can be ascribed incommensurable properties." [44, π 146 ℓ 23-26] ∎

• • •

"These formal definitions, by transcendental deduction, introduces the concepts of of **identity** and **difference**. "They can thus be assumed in any transcendental deduction of a domain description which, in principle, must be expressed in any possible language". [44, π 147 ℓ 1-5]

Definition: 13 . **Unique Identification:** By a *transcendental deduction* we introduce the concept of manifest, physical entities each being uniquely identified ▪

We make no assumptions about any representation of unique identifiers.

4.6 Relations

4.6.1 Identity and Difference

Definition: 14 . **Relation:** "Implicitly", from the two concepts of *identity* and *difference*, follows the concept of **relation**s. "*A* identical to *B* is a relational assertion. So is *A* different from *B*" [44, π 147 ℓ 6-10] ▪

4.6.2 Symmetry

Definition: 15 . **Symmetry:** If *A* is identical to *B* then *B* must be identical to *A*. This expresses that the *identical to* relation is *symmetric*. And, If *A* is different from *B* then *B* must be different from *A*. This expresses that the *different from* relation is also *symmetric* ▪

4.6.3 Asymmetry

Definition: 16 . **Asymmetry:** A relation which holds between *A* and *B* but does not hold between *B* and *A* is *asymmetric* [44, π 147 ℓ 25–27] ▪

4.6.4 Transitivity

Definition: 17 . **Transitivity:** "If *A* is identical to *B* and if *B* is identical to *C* then *A* must be identical to *C*. So the relation *identical to* is *transitive*" [44, π 147-148 ℓ 28-30,1-4] ▪

The relation *different from* is not transitive.

4.6.5 Intransitivity

Definition: 18 . **In-transitivity:** If, on the other hand, we can logically deduce that a relation, $\mathcal{R}$ holds' from *A* to *B* and the same relation, $\mathcal{R}$, holds from *B* to *C* but $\mathcal{R}$ does not hold from *A* to *C* then relation $\mathcal{R}$ is *intransitive* [44, π 148 ℓ 9–12] ▪

4.7 Sets, Quantifiers and Numbers

4.7.1 Sets

The possibility now exists that two or more entities may be prescribed the same property.

Definition: 19 . Sets: The "same properties" could, for example, be that two or more uniquely distinguished entities, $x, y, ..., z$, have [at least] one attribute kind (type) and value, (t, v), in common. This means that (t, v) distinguishes a set $s_{(s,v)}$ – by a *transcendental deduction*. A fact, just t likewise distinguishes a possibly other, most likely "larger", set s_t ∎

From the transcendentally deduced notion of set follows the relations: equality, $=$, inequality, $\neq$, proper subset, $\subset$, subset, $\subseteq$, set membership, $\in$, set intersection, $\cap$, set union, $\cup$, set subtraction, $\setminus$, set cardinality, **card**, etc.!

4.7.2 Quantifiers

By a further *transcendental deduction* we can place the *quantifiers* among the concepts that are necessary in order to describe domains.

Definition: 20 . The Universal Quantifier: The universal quantifier expresses that all members, x, of a set, s, possess a certain $\mathcal{P}$roperty: $\forall x : S \bullet \mathcal{P}(x)$ ∎

Definition: 21 . The Existential Quantifier: The existential quantifier expresses that at least one member, x, of a set, s, possess a certain $\mathcal{P}$roperty: $\exists x : S \bullet \mathcal{P}(x)$ ∎

4.7.3 Numbers

Numbers can, again by *transcendental deduction*, be introduced, not as observable phenomena, but as a rational, logic consequence of sets.

Definition: 22 . Numbers: Numbers can be motivated, for example, as follows:

- Start with an empty set, say $\{\}$. It can be said to represent the number zero.[18]
- Then add the empty set $\{\}$ to $\{\}$ and You get $\{\{\}\}$ said to represent 1.
- Continue with adding $\{\}$ to $\{\{\}\}$ and You get $\{\{\}, \{\{\}\}\}$, said to represent 2.
- And so forth – ad infinitum ∎

[18] Which, in the decimal notation is written as 0.

In this way one[19] can define the natural numbers. We could also do it by just postulating distinct entities which are then added, one by one to a an initially empty set [44, π 150 ℓ 8-13].

We can then, still in the realm of philosophy, proceed with the introduction of the arithmetic operations designated by addition, **+**, subtraction, , multiplication, $*$, division, $\div$, equality, **=**, inequality, $\neq$, larger than, $>$, larger than or equal, $\geq$, smaller than, $<$, smaller than or equal, $\leq$, etcetera !

From explaining numbers on a purely philosophical basis one can now proceed mathematically into the realm of *number theory* [16].

4.8 Primary Entities

We now examine the concept of *primary objects*.

The next two definitions, in a sense, "fall outside" the line of the present philosophical inquiry. They will be "corrected" to then "fall inside" our inquiry.

Definition: 23 . **Object:** By an *object* we, in our context, mean something material that may be perceived by the senses[20] ▪

Definition: 24 . **Primary Object:** By a *primary object* we[21] mean an object that exists as its own *entity* independent[22] of other objects ▪

In the last definition we have used the term *entity*. That term, 'entity', will be used henceforth instead of the term 'object'.

We have deduced the relations *identity, difference, symmetry, asymmetry, transitivity* and *intransitivity* in Sects. 4.5–4.6. You may ask: *for what purpose ?* And our answer is: *to justify the next set of deductions.* First we reason that there is the possibility of there being many entities. We argue that that is possible due to there being the relation of asymmetry. If it holds between two entities then they must necessarily be ascribed different predicates, hence be distinct.

Similarly we can argue that two entities, B and C which both are asymmetric wrt. to an entity A may stand in a symmetric relation to one another. This opens for the *possibility* that every pair of distinct entities may stand in a pair of mutual relations. First the asymmetry relation that expresses their distinctness. Secondly, the possibility of a symmetry relation which expresses the two entities individually with respect to one-another. *The above forms a transcendental basis for how two or more [primary] entities must necessarily be characterised by predicates.*

[19] https://en.wikipedia.org/wiki/Set-theoretic_definition_of_natural_numbers
[20] www.merriam-webster.com/dictionary/object
[21] help.hcltechsw.com/commerce/8.0.0/tutorials/tutorial/ttf_cmcdefineprimaryobject.html
[22] Yes, we know: we have not defined what is meant by 'as its own' and 'independent' !

4.9 Space and Time

The asymmetry and symmetry relations between entities cannot be *necessary* characteristics of every possibly reality if they cannot also posses an *unavoidable rôle* in our own concrete reality. Next we examine two such *unavoidable rôles*.

4.9.1 Space

One pair of such rôles are *distance* and *direction*. *Distance* is a relation that holds between any pair of distinct entities. It is a symmetric relation. *Direction* is an asymmetric relation that also holds between pair of distinct entities. Hence we conclude that **space** is an unavoidable characteristics of every possibly reality. Hence we conclude that entities exist in space. They must "fill" some space, have *extension*, they must *fill* some space, have *surface* and *form*. From this we can define the notions of spatial point, spatial straight line, spatial surface, etcetera. Thus we can philosophically motivate geometry.

4.9.2 Time

Primary empirical entities may be accrue predicates that it is not logically necessary that they accrue. That is, it is logically possible that primary entities accrue predicates that they actually accrue. How is it possible that one and the same primary entity may accrue incommensurable predicates ?

That is only possible if one and the same primary entity can exist in *different states*. It may exist in one state in which it accrue a certain predicate. And it may exist in another state in which it accrue a therefrom incommensurable predicate.

What can we say about these states ? First that these states accrue different, incommensurable predicates. How can we assure that ! Only if the states stand in a asymmetric relation to one another. From this we can conclude that primary entities necessarily may exist in a number of states each of which stand in an asymmetric relation to their predecessor state. So these states also stand in a *transitive* relation.

This is a necessary characteristics of any possible world. So it is also a characteristics of our world. That relation is **time**. It possesses the *before*, *after*, *in-between*, and other [temporal] relations. We have thus deduced that every possible world must "occur in time" and that primary entities may exist in before or after states.

From the above we can derive a whole algebra of temporal types and operations, for example:

- $\mathbb{TIME}$ and $\mathbb{TIME\ INTERVAL}$ types;

- addition of TIME and TIME INTERVAL to obtain TIME;
- addition of TIME INTERVALs to obtain TIME INTERVALs;
- subtraction of two TIMEs to become TIME INTERVALs; and
- subtraction of of TIME INTERVALs to obtain TIME INTERVAL.

4.10 The Causality Principle

But what is it that *cause* primary entities to undergo *state changes* ? Assertions about how a primary entity is at different times, such assertions must necessarily be logically independent. That follows from primary entities necessarily must accrue incommensurable predicates at different times. It is therefore logically impossible to conclude from how a primary entity is at one time to how it is at another time. How, therefore, can assertions about a primary entity at different times be about the same entity ?

We can therefore transcendentally deduce that there must be a *special implication-relationship* between assertions about how a primary entity is at different times. Such a *special implication-relationship* must depend on the *empirical circumstances* under which the primary entity exists. That is, we must deduce the conditions under which it is, at all, possible to consistently make statements about primary entities going from one state in which it accrues a specific predicate to another state in which it accrues a therefrom incommensurable predicate. There must be something in the empirical circumstances which implicates the state transition. If the the empirical circumstances are *stable* then Thebes is nothing in these circumstances that imply entity changes. If the primary entity changes, then that assumes that there must have been a prior change in the circumstances – with those changes having that consequence. . . . [23] We name such a change of the circumstances *a cause*. And we conclude that every change of a primary entity must have a cause. We also conclude that *equivalent cause* imply *equivalent effects*.

This form of implication is called the *causality principle*. It assumes logical implication. But it cannot be reduced to logical implication. It is logically necessary that every primary entity – and therefore every possible world – is subject to the *causality principle*. In this way Kai Sørlander transcendentally deduce the principle of causality. Every change has a cause. The same cause under the same circumstances lead to same effects.

[23] We skip some of Sørlander's reasoning, [44, Page 162, lines 1–12]

4.11 Newton's Laws

Sørlander then shows how Newton's laws can be deduced. These laws, in summary, are:

- **Newton's First Law:** An entity is at rest or moving at a constant speed in a straight line, it will remain at rest or keep moving in a straight line at constant speed unless it is acted upon by a force.
- **Newton's Second Law:** When an entity is acted upon by a force, the time rate of change of its momentum equals the force.
- **Newton's Third Law:** To every action there is always opposed an equal reaction; or, the mutual actions of two bodies upon each other are always equal, and directed to contrary entities.

4.11.1 Kinematics

Above we have deduced that primary entities are in both space and time. They have *extent* in both space and time. That means that they must change with respect to their spatial properties: place and form. The change in place is the fundamental. A primary entity which changes place is said to be in *movement*. A primary entity in movement must follow a certain geometric route. It must move a certain length of route in a certain interval of time, i.e., have a *velocity:* speed and direction. A primary entity which changes velocity has an *acceleration*. That is, we have deduced he basics of *kinematics*.

4.11.2 Dynamics

When we to the above add that primary entities are in time, then they are subject to causality. That means that we are entering the doctrine of the influence of *force*s on primary entities. That is, *dynamics*. Kinematics imply that an entity changes if it goes from being at rest to move, or if it goes from moving to being at rest. An entity also changes if it goes from moving at one velocity to moving at a different velocity. We introduce the notion of *momentum*. An entity has same momentum if at two times it has the same velocity and acceleration.

4.11.3 Newton's First Law

When we combine kinematics with causality then we can deduce that if an entity changes momentum then there must be a cause in the circumstances which causally implies the change. We call that cause a *force*. The force must be proportional to the change in momentum. This implies that an entity

which is not subject to an external force remains in the same momentum. This is **The Law of Inertia, Newtons First Law.**

4.11.4 Newton's Second Law

That a certain force is necessary in order to change an entity's momentum must imply that such an entity must provide a certain *resistance* against change of momentum. It must have a *mass*. From this it follows that the change of an entity's momentum not only must be proportional to the applied force but also inversely proportional to that entity's mass. This is **Newtons Second Law.**

4.11.5 Newton's Third Law

Where do the forces that influence the momentum of entities come from? It must, it can only, be from primary entities. Primary entities must be the source of the forces that influence other entities. Here we shall argue one such reason. The next section, on universal gravitation, presents a second reason.

Primary entities may be in one an other's way. Hence they may eventually collide. If a primary entity has a certain velocity it may collide with another primary entity crossing its way. In the mutual collision the two entities influence one another such that they change momentum. They influence each other with forces. Since none of the two entities have any special position, i.e., rank, the forces by means of which they affect one another must be equal and oppositely directed. This is **Newtons Third Law.**

4.12 Universal Gravitation

But[24], really, how can primary entities be the source of forces that affects one another? We must dig deeper! How can primary entities have mass such that it requires force to change their momentum? Our answer is that the reason they have mass must be due to mutual influence between the primary objects themselves. It must be an influence which is oppositely directed to that which they expose on one another when they collide. Because this, in principle, applies to all primary entities, these must be characterised by a mutual universal attraction. And that is what we call *universal gravitation*. That concept has profound implications.

• • •

We shall not go into details here but just, casually, as it were, mention that such concepts as speed limit, elementary particles and Einstein's theories are "more-or-less" transcendentally deduced!

[24] This section is from [44, Pages 168–173]

4.13 Purpose, Life and Evolution

We shall briefly summarise Sørlander's analysis and deductions with respect to the concepts of *living species: plants* and *animals*, the latter including *humans*.

Up till now Sørlander's analyses and deductions have focused on the physical world, "culminating" in Newton's Laws and Einstein's theories.

If[25] there is to be language and meaning then, as a first condition, there must be the possibility that there are primary entities which are not locked-in "only" in that physical world deduced till now. This is only possible if such primary entities are additionally subject to a *purpose-causality*, one that is so constructed as to *strive* to *maintain* its own *existence*. We shall refer to this kind of primary entities as *living species*.

4.13.1 Living Species

As living species they must be subject to all the physical conditions for existence and mutual influence. Additionally they must have a form which they are *causally determined to reach and maintain*. This development and maintenance must take place in a *substance exchange* with its surroundings. Living species need these substances in order to develop and maintain their form.

It must furthermore be possible to distinguish between two forms of living species: (i) one form which is characterised only by *development, form and substance exchange*; and (ii) another form which, additional to (i), is characterised by *being able to move*. The first form we call *plants*. The second form we call *animals*.

4.13.2 Animals

For animals to move they must (i) possess *sense organs*, (ii) *organs of movement* and (iii) *instincts, incentives,* or *feelings*. All this still subject to the physical laws and to satisfy motion.

This is only possible if animals are **not** built (like the elementary particles of physics) but by special physical units. These cells must satisfy the *purpose-causality* of animals. And we know, now, from the *biological sciences* that something like that is indeed the case. Indeed animals are built from cells all of which possess *genomes* for the whole animal and, for each such cell, a proper fraction of its genome controls whether it is part of a sensory organ, or a nerve, or a motion organ, or a more specific function. Thus it has transcendentally been deduced that such must be the case and biology has confirmed this.

[25] We now treat the material of [44, *Chapter 10, Pages 174–179*].

4.13.2.1 Humans We briefly summarise[26], in six steps, (i–vi), Sørlander's reasoning that leads from animals, in general, see above, to humans, in particular.

(i) First the concept of ***level of consciousness*** is introduced. On the basis of animals being able to *learn* from *experience* the concept of *consciousness level* is introduced. It is argued that *neurons* provide part of the basis for *learning* and the *consciousness level*.

(ii) Secondly the concept of ***social instincts*** is introduced. For animals to interact social instincts are required.

(iii) Thirdly the concept of ***sign language*** is introduced. In order for animals to interact some such animals, notably the humans, develop a sign language.

(iv) Fourthly the concept of ***language*** is introduced. The animals that we call *humans* finally develop their sign language into a language that can be spoken, heard and understood. Such a language, regardless of where it is developed, that is, regardless of which language it is, must assume, i.e., build on the same set of basic concepts as had been uncovered so far in our deductions of what must necessarily be in any description of any world.

We continue summarise[27] Sørlander's reasoning that leads from generalities about humans to humans with knowledge and responsibility.

(v) Fifthly the concept of ***knowledge*** is introduced. An animal which is *conscious* must *sense* and must react to what it senses. To do so it must have *incentives* as causal conditions for its specific such actions. If the animal has, possess, language, then it must be able to express that and what it senses and that it acts accordingly, and why it does so. It must be able to express that it can express this. That is, that what it expresses, is true. To express such assertions, with sufficient reasons for why they are true, is equivalent to *knowing* that they are true. Such animals, as possess the above "skills", become persons, humans.

(vi) Sixthly the concept of ***responsibility*** is introduced. Humans conscious of their concrete situation, must also know that these situations change. They are conscious of earlier situations. Hence they have *memory*. So that can formulate *experience* with respect to the *consequences* of their actions. Thus humans are (also) characterised by being able to understand the consequences of future actions. A person who considers how he ought act, can also be ascribed *responsibility* – and can be judged *morally*.

• • •

This ends our eposé of Sørlander's metaphysics wrt. living species. That is, we shall not cover neither non-human animals, nor plants.

[26] [44, *Chapter 11, Pages 180–183*]
[27] [44, *Chapter 12, Pages 184–187*]

5 Philosophy, Science and the Arts

We quote extensively from [38, Kai Sørlander, 1997].

[38, pp 178] "Philosophy, science and the arts are products of the human mind."

[38, pp 179] "Philosophy, science and the arts each have their own goals."

- **Philosophers** seek to find the inescapable characteristics of any world.
- **Scientists** seek to determine how the world actually and our situation in that world.
- **Artists** seek to create objects for experience.

We shall elaborate. [38, pp 180] "Simplifying, but not without an element of truth, we can relate the three concepts by the **modalities:**"

- ***philosophy*** is the **necessary**,
- ***science*** is the **real**, and
- ***art*** is the **possible**.

... Here we have, then, a distinction between philosophy and science. ... From [37] we can conclude the following about the results of philosophy and science. These results must be consistent [with one another]. This is a necessary condition for their being *correct*. ... ... The **real** must be a *concrete realisation* of the **necessary**.

6 A Bibiographical Note

Of the 30 citations given in Footnote 4, Pages 3–4 I have not read 20 of then, but have studied some of Kant's, Russel's, Wittgenstein's and Popper's writings. The dictionaries [3, 9, 21], as well as [27], have followed me for years.

7 A Word of Caution

The present paper represents an attempt to give an English interpretation of Kai Sørlander's Philosophy. I will "mull" over this interpretation for a while. Then I will present it to Kai Sørlander for his comments. We shall see.

8 Bibliography

8.1 Bibliographical Notes

Of the 30 citations given in Footnote 4, Pages 3–4 I have not read 20 of then, but have studied some of Kant's, Russel's, Wittgenstein's and Popper's writings. The dictionaries [3, 9, 21], as well as [27], have followed me for years.

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9 Indexes

9.1 Definitions

9.2 Concepts