CHILDREN'S KNOWLEDGE AT THE AGE OF 2 YEARS

Carles UDINA i COBO
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cucobo@gmail.com

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Summary of the document

The emergence of language in children is a phenomenon that is as well known and admired as it is unexplained. We know more and more about every field, but we do not know how this human knowledge can be produced and structured in our own psyche. It has already been said that this inconsistency is the biggest 'black hole' in our extensive scientific knowledge. The first steps of this cognitive and linguistic process, which is at the basis of human civilisation, are presented here.

With total ignorance of current science, at just 2 years old and intuitively, through the transfer of psychomotor faculties, children exercise their first two specific cognitive faculties, union and complement, which allow them to construct "Short Exact Algebraic Sequences" (SEAC) in their simplest conception and CAUCHY Sequences of three or more levels, which allow them to establish tree-like structures of exact concepts. BOOLE (and especially his wife Mary EVEREST) was more important as a psychologist than as a mathematician, by contributing three of these first steps, which are the most common producers of concepts. The **intuitive tree** implies two more faculties: belonging and inclusion.

Later, from the age of three onwards, contributions such as Freud's "Bahnungen," similarly ignored by linguistics, will add new specific faculties.

And the most extraordinary thing is that at the age of two, children intuitively manage mathematical structures that many years later university students learn with difficulty. These are the first links between language and mathematics —two disciplines that until now have been irreconcilable— such as the aforementioned mathematical concepts, which in turn involve an "Algebraic Extension" (from algebra to semantics), and others such as topology and limits, systems of n-equations with n unknowns, algebraic duality (at age 6), etc. Thus, we can begin to define an **intrinsic semantics** that underlies human language.

With the appropriate pedagogy, children should be facilitated and stimulated to build a tree structure of concepts (a structure analogous to the positional number systems). Never as isolated and unstructured concepts or groups of concepts (such as Roman numeration), which is the current teaching situation.

Tree structures are fully intuitive because they are integrated in all living beings, in their structures (anatomical, functional, ...), and previously in material structures in general. That is why positional numerical systems are intuitive and infinitely more efficient than others such as Roman numeration (numeration that until it was not replaced by positional numerical systems prevented the emergence of current mathematical thought, current science and technology, current economy, ...).

The concepts of such a tree structure they should be generated exactly from each other, as first-order logical propositions (by means of "Short exact algebraic sequences, which, as will be seen, are intuitive because of their tree effects).

On the contrary, the current culture represses these relational intuitions, generating the well-known problems of lack of understanding and school failure. More specifically, the two main problems that are most widely recognised (PISA, etc.), and which begin at the age of 2, are:

- difficulty in learning mathematics,
- deficits in comprehension among adults (verbal, written, etc., leading to functional illiteracy);

And due to:

- lack of stimulation of intuitive conceptual relationality (which is the basis of understanding) and
- repression of the remarkable mathematical intuition that children already have at this age, but which is ignored.

From this point onwards, at later ages, the decisive contribution of human perception can be correctly added (from the age of three). And later on, the progression in all possible relationality (the basis of the aforementioned understanding and comprehension), forming an efficient, compact and complete conceptual system. All this prevents the possible distortion of subjectivity in thought and the emotions, which can lead to a lack of criteria, to mental fragility, or to absurdity and stupidity.

All of the above is independent of the essential emotional, motivational and organisational environment provided by the family and education, but given this cognitive efficiency, the observation and explicit use of these early intuitions would lead to a dramatic increase in motivation and self-esteem in children.

Furthermore, this would enable us to begin to resolve the three-century-old challenge that LEIBNIZ intuited and advocated in his '*Caracteristica universalis*'.

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This series of documents on children's knowledge at 2, 3, 6, and 10 years of age is introduced by the document "Heuristics of number and conceptual systems"

1. INTRODUCTION

Talking to a friend about the learning process of young children, she remarked to me that her son, not even 2 years old, managed perfectly a set of concepts such as: "Mischa" (her cat), "Gato" (the rest of the cats), "Bicho" (the rest of the animals), ... To "manage perfectly" means that the child has conceptualised them correctly, so that he/she can apply and/or use them without error. It is not a simple memorisation that is not comprehensive and misleading.

For what I explain below I could not believe it. But it became evident as I noticed similar cases in other children of similar ages. This marks the beginning of the unexplained "emergence of language" in children, which is why I will begin to explain it. Shortly before (1996), I had just described in detail the cognitive processes that lead to the structuring of human knowledge, which is called "Knowledge Representation". Because of the importance of the work —given that it had not been achieved before, it was a "black hole" for psychology and pedagogy— I was trying to determine the usual ages of attainment of each step of the cognitive process, which would allow me to complete the model and at the same time validate it. In addition, I had a simulator (an "ICT" tool in MS-DOS programmed by P. SUST and G. LAFUENTE, and later in Windows by X. PUIG) which allowed demonstrations on the optimisation of learning if the model found was followed. It was a software that at the same time had allowed me to analyse the invariants of the language —that is, to analyse its intrinsic perspective, what is inherent/essential and immovable— in an innovative application to the language of geometric and algebraic mathematical criteria such as the aforementioned invariants, spaces and subspaces, endomorphisms and changes of base, etc.

On the challenge of his "Characteristica", LEIBNIZ himself stated that "I do not know whether I shall ever be in a position to carry out this project, which needs **more than one hand**, and it even seems that mankind **is not** yet **mature enough** to claim the advantages that this method could provide. "The "more than one hand" hints at the interdisciplinary nature of the solution, and the "not mature enough" is fully in line with the much later failures, such as the well-known failure of WITTGENSTEIN, who led people to believe that it was impossible to achieve. This unfounded belief also explains the abandonment for many years of this challenge, which a recognised expert on the subject, P. JAENECKE, noted in 1996: "the LEIBNIZ project is not [only] a question of logic but one of the **Representation of knowledge**, a **largely unexplored** field in today's logic-oriented epistemology and philosophy of science".

As Andreu VEÀ —Internet expert and historian ("Como creamos Internet" 2013, 576 pages; recently [2023] translated to English "Internet pioneers: How we created the Internet")— often explains, if anyone could have imagined phenomena such as the Internet or mobile telephony 50 years ago, and therefore tried to develop them quickly and in a planned way, he would not have been understood, nor would he have found support or funding:

- The Internet has been a totally spontaneous process of hundreds of supportive, selfless and, until this book, almost unknown expert scientists from all over the world.
- Mobile telephony progressively integrates thousands and thousands of cutting-edge scientific and technological researches, including some Nobel Prize winners, with the contribution of enormous economic resources from companies all over the world, at no time agreed between them (on the contrary).

But any young child today efficiently uses a mobile phone, totally ignoring this accumulation of highly advanced and complex scientific knowledge and technology. Still less would it occur to

anyone to question this new knowledge, given that, if its application works properly, it clearly cannot be wrong.

Similarly, it is not elementary to explain how it is possible to solve the LEIBNIZ challenge. Even at an informative level it would require a series of articles —to demonstrate it in detail would still take up much more space—, but the operation of its simulator (now supported by current Internet computer technologies by C. GONZALEZ VILELA), is the best demonstration, as it allows children (and adults) to learn more quickly, with more comprehension quality and, above all, enjoying it as if it were a toy (gamification). So as you can see, LEBNIZ got it all right: "It will be **very difficult to** form or invent this language or this Characteristica [universalis], but **very easy to** learn without any dictionary". And in those days, it was still much more than "very difficult", impossible if we think of the lack of knowledge of "Symbolic Information Systems", even if LEIBNIZ was the forerunner of computer science.

Beyond the tedious theoretical exposition, in this same first article the reader will find in the bibliography a link to a video ("Better a picture than ...") of the possible use by a child of this "ICT" simulator, which, as has been said about the Internet and mobiles, is the best proof that the tri-centenary challenge has been met, regardless of whether it is explained, or whether it is understood why and how it works. And by 2021 it will be available for use through any Internet Browser, with 4 levels: up to 5 years, up to 10 years, up to 15 years and by adults, levels that broadly reflect the gradual development of the cognitive process.

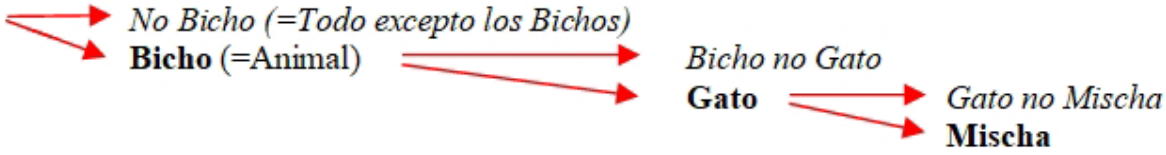
Today linguistics has been incorporating new perspectives/disciplines and resources: logical semantics, quantitative linguistics, semantic networks, neurolinguistics, neural networks, ... but without being able to fill this gap of the cognitive faculties on which it is based. Logic was also formalised a century ago with FREGE, and today we also have logics such as non-monotonic, probabilistic, fuzzy, ... but these do not solve the challenge either. Why? because the "language" sought by LEIBNIZ is based on the still little known most basic cognitive faculties derived from psychomotricity, which are precisely the "prequels" of these linguistic phenomena currently studied ("prequels", English neologism contrary to "sequels"), a field even prior to the sensory field of the most basic Freudian contribution. In other words, the same thing that made it possible to construct and simulate the "Characteristica universalis" in 1996, makes it possible to explain the results and the state of current linguistic research, both its successes and its errors, but which is not the place here to mention them in detail or to reference them. Neither are the half-dozen references dealing with these "prequels", although where appropriate in other possible articles, they will be referenced and linked to the relevant documents.

Therefore, it is necessary to know how to differentiate knowledge from language, but at the same time to relate them correctly, because the former is precisely the prequel of the latter: without the previous cognitive processes, language (a cultural phenomenon and therefore extrinsic) could not exist.

2. CONCEPT TREES

2.1. The trees. The BOOLE "psychologist". Sensitive concepts and virtual concepts. PIAGET

But let's take it one step at a time. The boy in question had built his first tree:



NT: "Bicho" is "Small animal", "Gato" is "Cat" and "Misha" is the name of her house cat. But what kind is this tree? Well, it is a PORFIRIO tree, in which each new conceptual hierarchy brings new abstracted characteristics to form the respective "child" concepts, so that the reality represented by them is more specific/reduced than the more generic realities represented by the higher/previous hierarchy.

Here comes the first surprise: the "Complement" of "BOOLE's Algebra" is already correctly managed by a 2-year-old child, obviously without anyone having explained it to him: "the set of cats excluding his own", "the set of animals except cats", ..., which leads me to insist that BOOLE was a psychologist rather than a mathematician, which should not be surprising if we remember that his famous book is entitled "The Laws of Thought" and not "Algebra". BOOLE has been denied for almost two centuries his most transcendent contribution: discovering some of the earliest psychic-cognitive faculties that make human thought possible.

Incidentally, in all cases these are sensory concepts, i.e. inferred directly from sensory images (the cats and animals he has seen, and which, with the help of his parents or himself, he assigns the corresponding name to them). It is therefore the result of sensitivations (cognitive processes of exclusively sensory origin), with the realisation of the abstractions that make it possible to differentiate between them. It should be noted that the term "abstract concepts" is incorrect, since all concepts are the result of abstractions. From cats, the child unconsciously and intuitively abstracts their characteristics, "gatez/ gatidad" (the adjective or abstractions: their shape, fur, eyes, nails, ...), in order to differentiate them from animals that are not cats. When we say "abstract concept" we usually refer to concepts that are not directly sensitive, i.e. the images that generate them are not sensitive/ real but originate from other already formed concepts and therefore "virtual" images, so we should say "virtual concepts" and not "abstract concepts". For example, "Organism", "Individual", "Thought", ... which are unaffordable for young children. They can also be called "composite concepts" because they result from "operations" (as PIAGET calls them) of other simpler concepts, be they sensitive or virtual.

2.2. The "Short Exact Algebraic Succession" (SEAC)

The surprise follows when observing that the use of the Boolean complement brings that, at each new partition, the domain of the fields represented by the "children" concepts coincides exactly with the field represented by the "mother" concept from which they are generated. It is so by its very definition/construction, which is the strongest possible proof. And the most unexpected thing appears when observing that there is a concept of algebra which faithfully represents this intuitive process of a child of only two years old, the "Short exact algebraic succession" and its associated canonical Application and canonical Isomorphism.

The "Short Exact Algebraic Succession" (SEAC) is a mathematical construction of the algebra —like many other concepts in this field— that in my time we studied it halfway through the physics (and matematic) degree, but that, except for memorising it for the exams, it was difficult to make "practical" use of it (because the interest is to pass, not to learn). This is not just an anecdote, because it turns out that a 2-year-old child manages it intuitively without being taught! On the contrary, the adult has already lost that precocious intuitiveness, and the rigid mathematical environment —not at all sensitive— makes it even more difficult for him to recover it. Something that in my opinion is frightening about the state of learning in general and mathematics in particular.

This mathematical structure must be detailed for those who want to know its structure, its components, and check its action in the definition of exact concepts, but as it is a very specific mathematical formulation in which the reader will not be used to, it is moved as Annex 1, and we will go directly to known examples.

2. 3. Known numerical examples of application of the SEAC.

The best known numerical example is that of the equivalence classes "Modulo 2" (classes of remainders when dividing by 2) in the natural numbers N or in the integers Z, from which two classes/children result, which are the even numbers {0, 2, 4, 6, ...} and the odd numbers {1, 3, 5, 5, 7, ...}. Thus we have the even numbers (see diagrams of Annex 1):

- which by injection f_{1a2} is an "Additive Subgroup" of A_2 as the sum of two pairs is even (A_2 of the diagram in Annex 1),
- at the same time that it is the "Ideal" of A_2 (in this case multiplicatively, since multiplying an odd by an even always results in an even),
- as well as the Ker "Core" (f_{2a3}), of the following, since it becomes the Neutral Element ("e") of A_3 which is the class of even numbers (the addition of an even number to any other, whether even or odd, does not modify its class/parity).

As explained in Annex 1, the "CoKer" in this case will be the unique class of two resulting elements {even, odd}, children of N (or Z).

It is clear that the "Union" (or sum) of the even and odd numbers is exactly all the Natural N (or Integers Z). Similar examples are obtained with the classes modulo 3, 4, 5, ... so that the number of elements/classes that result coincide with this modulus (2 classes for 2 [even with remainder zero and odd with remainder 1], 3 classes for 3, ...).

2. 4. Examples in the application of the SEAC to language

Now let's go to the concepts. A_2 is the concept "Mother" and A_3 the family of "Children" obtained by the "Criterion" (which we will call "Stepfather" for reasons of transparency), analogously to the function that "modulo 2" did in the numerical case. If we now use the colour as a criterion/"Stepfather", which criterion allows us to know to which kind of child belong the realities represented by the mother concept? Well, the concrete colour it has (as before the possible

remainders). Instead of the children {0, 2, 4, 6, ...} and {1, 3, 5, 7, ...} according to the different remainders, we will now have the different colours considered.

In any partition "according to colour", what would be the neutral element "e", well, obviously the class of the colourless colour (=no colour, A_2), given that if we add something colourless to any colour, it results in the same colour, it does not modify it. It would be the Nucleus "Ker" of the members that integrate the class "e" of the Neutral Element referred to the mother concept A_3 . Thus, the cars according to colour (according to the basic colours of the rainbow) would be the cars:

1) colourless (unpainted), 2) red, 3) orange, 4) yellow, 5) green, 6) blue, 7) Indian, 8) violet, and 9) white (the sum of all colours).

The same if the criterion were the RGB colours (but with 16 million different classes/children! because in the RGB palette there are that many differentiable colours); the class (of A_3) of the transparent/colourless colour (Alpha value) would be the neutral Element "e" as well as the corresponding Nucleus (of the members of the class, which belong to A_2). We see, then, that by way of the different possible remainders the Criterion determines the different children of the "Stepfather" applied to the mother, creating an analogy between the children of the Stepfather ("Colours of the Rainbow") and the classes of children of the Mother ("Cars according to the former colours of the Rainbow"), without these classes of children of (A_3) losing any of the characteristics (=abstractions) defining the Mother. Just the other way around, the child classes add to all common abstractions inherited from the Mother, the corresponding differentiating abstraction of the Stepfather's children (their different colours), which allows them to differentiate themselves from other colours of the siblings.

The example of colours has been chosen intentionally to avoid confusion as they are concepts with which, exceptionally, we can also carry out arithmetical operations as with numbers: colours can be mixed/added, as if we add them together, resulting in other colours combined, combined colour which is what results in reality. But this is not at all what interests us, "number" and "concept" are different things and with different operations but which, through algebra ("arithmetic" is not the same as "algebra" either, as can be understood from the Annexes), we can establish common structures which allow us to transfer and obtain this partitional exactitude and to be able to use it in linguistic "operations" (this is exactly what the "Algebraic extensions" aim at). That is to say, in the possibility that derives from improving syntax and making possible an exact logic to think more efficiently —including above all learning—, as LEIBNIZ advocated ("... **the advantages that this method could provide**."). For the time being, we have already managed to avoid linguistic ambiguity and to understand each other without equivocation ("Define and you shall not argue" BALMES).

So we continue. The chordate animals according to the existence of a skull ("no" - "yes") are the:

- a-cranial cordates (Neutral element "e" of the classes of the children, Nucleus "Ker" of their members in the mother concept), and the
- cranial chordates (vertebrates, etc.).

This is so because "Two elements belong to the same class of remainders if and only if ("sii", "iff") their difference is a multiple of two" (i.e. their difference belongs to the Neutral Element, which is the same as saying that it is zero), it is obvious that this is true for both classes:

- in the class of the non-skulled without doubt: they can't even differ, they have no skull;

- in the class of skulls, because the difference between two of them is zero skulls (1 -1 =0), they differ in one a-skull (= the Neutral Element).

The definitional method is as valid for coloured objects, animals, as for any virtual construction we imagine, such as "Man according to sympathy":

- Nice man,
- Man without sympathy ("Ker" and "e") (regardless of whether it is a concept in use, or not).
- Unfriendly man.

It is clear that the 2-year-old makes the simplest use of the SEAC, with sensitive concepts within reach, and two-by-two partitions, complementary to each other. It could not begin any other way, but it is a SEAC without any doubt. The concept "Cat" he assigns to percepts that meet the abstractions of "Cat" already mentioned, so he would say "Big Cat" to a Lynx, and even more so to a Panther or a Tiger. For the child "Cat" is equivalent to what, strictly speaking, in zoology, is a "Feline".

How would this process be expressed in ordinary, non-mathematical language? Well, that:

of the bugs according to "gatez" (the adjective of Cat), there are the cat-bugs and the non-cat-bugs.

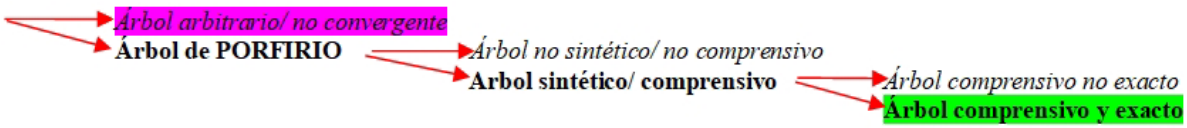
making it clear that a child is not aware of what "gatez" is, precisely because it is intuitive, it uses it without knowing it. What is interesting in this case is that, in addition, the child chains two of them together, retaining exactitude:

- the "bugs" are exactly the meeting of the "non-cat-bugs" and the "cats";
- the "cats" are exactly the "cats that are not Mischa" and her "Mischa".

So, combined, any "critter" belongs to one of the three generated classes ("Mischa", "non-Mischa cats" and "non-cat-critters") and only one of them. And no "bug" is left without belonging to any of them (exactitude).

Generalising, every linguistic process as elaborate as "Sedan according to number of rows of seats" involves a SEAC (to be seen in detail in Annex 2). In this case, and unlike the simpler example of the two-year-old above, the criterion of the partition is "number of rows of seats", a criterion/parent which is no longer within the reach of a two-year-old, and which —I insist— is a concept independent of the abstractions which have characterised the parent concept "Sedan".

If the PORFIRIO tree has been mentioned before, it can now be added that with the SEACs it results in a "comprehensive and exact PORFIRIO tree", exact because of the mathematical justification (see Annex 1) and comprehensive because of the established relationality (see Annexes 2 and 3):



Below we will look at a few more examples, using "Forma" as a stepfather.

2. 5. A process that is as common as it is overlooked

The problem is more serious. This exact process, ignored by teaching and linguistics, is the one most used in the conceptualisation process of the child, and of the adult. And it is what usually allows concepts to be endowed with their characterising abstractions. Let us look at just one concept, "Form" (= external appearance, visual and/or tactile abstraction of the outline/limits of an object), and its repeated usefulness as a "Stepfather" in processes of this type, for the formation of new concepts:

- Galaxy according to Shape: G. elliptical; G. lenticular; G. spherical; G. spiral; G. barred, ...
- Protein according to Shape: Globulin (balloon-shaped); P. fibrillar; P. membranous, ...
- Viruses according to Shape: Helical viruses; Spherical viruses; ...
- Iron and steel industry according to Form: Forging (= shaping iron).
- HydroCarbide according to Form: Open chain hydrocarbon; Cyclic/closed hydrocarbon, ...
- Rock according to Shape: Granular rock; Non-granular rock.
- Star according to Shape: Spherical star; Star with envelope.
- Object according to Shape: Tape, Thread/ Filament, Column, Plate, Grain, Foil, Disc, Ring, Chain, ... (these are objects that are defined differently from each other according to their different Shape).
- Document according to Form: Poster; Stub; Calendar; Card, Token, Label; Token; Book; Leaflet, ... (same as for Objects)
- Visual perception according to Form: Appearance (=Subjective perception of the Form of an Object).
- Temperament according to Form: athletic; asthenic/ leptosomic; picnic.
- Edible fruit according to shape: Infrutescence; bunch; ...
- Grammar according to Form: Grammatical morphology ("morpho-" is the etymological root of Form); Etc., etc., etc., etc.

It is also important to see that the process assigns to each child concept a new abstraction that does not exist in the concept "Mother": in the case of "Form", playing the role of "Stepfather", it defines the form that characterises it differently from the other "Siblings". In addition to guaranteeing exactitude between what the mother represents and the domain of what the children represent, it is guaranteed that all the abstractions of the mother are transferred to all the children: none are lost, nor do any abstractions appear that are not controlled by the resulting structure. The "Stepfather" is the criterion that "injects" these new abstractions, in this case those derived from the concept "Form". "Stepfather" and not "Father" because, as will be seen, each "Mother" concept can originate, with different "stepfathers", different families of "Children". Thus the children maintain the characteristics of the "Mother", adding the abstractions that can be derived from the "Stepfather" that corresponds in each case, thus resulting in more specific concepts, and as has been said, inferring analogies between the descendants of both concepts. The sons of Galaxia incorporate "elliptical", "circular", ... shapes. The children of HydroCarbide incorporate "closed" (cycles), "open", ..., etc. forms. Each partition (Galaxy, Star, Fruit, ...) has its own "CoKer".

The concept Form alone is used to define some thirty families of other concepts in this way. These are the most diverse objects that are presented in different shapes that are clearly distinguishable from each other. If the child is made aware that Shape is the criterion for defining the types of Galaxies, the concept Shape is reinforced by the examples of the types of Galaxies. And the types of Galaxies are related (better understanding), clearly differentiating them from each other by their shapes. Likewise with any other partition of stepbrothers of “Galaxy” mother: for example, it is immediately understood that a Lenticular Galaxy (the stepfather is Shape) should not be treated in

the same way as a Protogalaxy (the stepfather is Age) or a Radigalaxy (the stepfather is Brightness); we must make a "point and separation" (new paragraph) between them. We will see that understanding results from the quality and suitability of the established relations, so that such a system of concepts that we are forming implies an automatic improvement of understanding. By the way, "Form" is, as we have seen, one of the most prolific concepts in language, and also one with more relations with other concepts, more than two hundred. Why? Because "A picture is worth a thousand words". The discernment of different sensory images is a basic process, which leads to the defining abstractions that differentiate the derived concepts. And the Form can be seen, it can be felt (sensitivation).

Apart from Form, any concept can be used in this process, generating more specific children of an initial concept that we have called "Mother". For example: "Extreme", "Time", "Place", "Manner (= Extrinsic differentiation of the same process)", ... (see them in the video).

It is necessary to insist on the linguistic vacuum that fills this SEAC methodology, not only because of the "impossible" exactitude achieved, but also because of the ignorance of the most precocious —and therefore intuitive— and frequent process of generation of concepts that human thought makes. Worse, concepts in use such as "Merons", "Taxons", ..., and even "Semantic networks", are ambiguous and subjective in the face of this exact and non-manipulable algebraic methodology (if it is not done well, it is automatically established, as if it is said that "2 +2 =5"). This is why it will be stressed again in Annex 4.

3. ALGEBRAIC EXTENSION OF NUMERIC SYSTEM TO LANGUAGE

What have we achieved, then, is to make an "Algebraic Extension" by transferring the exactitude of positional number systems to all concepts, whether they have quantitative characteristics (such as colours) or not (including concepts as virtual and composite as you like). But the heuristic process was curiously the other way round: first (between 1983 and 1996) I defined exactly thousands of concepts with the aforementioned computer simulator (in its initial version in "MS-DOS"), and when I made it known and knew that it was considered "impossible" to achieve what I had already achieved, I analysed the mathematical criteria that I had used in an unconscious/intuitive way and that had made it possible*.

* In 1997, I made a proposal to a major publishing group to stay ahead of the expected technological evolution and replace their paper Corpus with computerised management assisted by the Conceptual System. After an hour-long demonstration with the computer, their response was that, as they did not know anything about computers, I, who knew so much, had given them a misleading demonstration, because what they had seen was impossible. And that was the end of the meeting.

Previously, in 1983, I had already set up a Documentation centre (within the UNESCO 'MAB' programme [Man And Biosphere] programme for the city of Barcelona Town hall, by UNESCO), which was the first computerised library in the Spain´s State (as a documentation centre, it integrated various libraries) and also incorporated a computerised relational thesauri that integrated the thesauri of the CDU, Pascal, Enviroline, NTIS, INSPEC, UNESCO, etc.) and was the precursor to the aforementioned Conceptual system. Once it was up and running successfully, it was closed down by the library authorities for not complying with the library regulations at the time. Twelve years later, all libraries began to be computerised... (See "Classificació i posterior recuperació de la informació". 2008, 35 pages in Catalan https://www.sistemaconceptual.org/pdf/Classificacio.pdf)

It is clear that, faced with the fact of having thousands of concepts defined exactly, the demonstration in this (or in other previous documents such as 5 and 7 of the Bibliography) that it is possible to do it, is merely aesthetic.

In this "Representation of knowledge" on the basis of a "Conceptual system (exact and intrinsic)" we have already explained the first "Relators" to represent the simplest knowledge —complement, union, intersection, belonging, inclusion—, 'Relators' between two concepts, triads 'a**R**b', which form first-order logical propositions and enable younger children to conceptualise and, therefore, relate them to other concepts. Here we have unintentionally and easily defined and/or related about a hundred concepts in parts 2.4 and 2.5. All this allows:

- generate an intrinsic coding analogous to number systems which will be discussed in Annex 3 (and which completes the above-mentioned "Algebraic extension");
- that concepts become "Metadata" because of the relatability implicit in the above coding;
- avoid the subjectivity of language (ambiguities, ambiguities, polysemies, demagogies, biases, ...) and that of traditional Thesauri;
- pose a useful computer simulation of Knowledge to aid and optimise our thinking (as shown in the video).

With this conceptual system, anyone can improve their knowledge and understanding to a level that would be unthinkable without it. We have achieved what, despite LEIBNIZ's brilliant intuition, has been considered impossible since WITTGENSTEIN: to transfer numerical exactitude to all concepts, whether numerical or not.

If John NAPIER had not known the positional number system (in his case, the decimal positional system), if he had had to start from Roman numerals like almost all his contemporaries, he would

have found it very difficult to introduce logarithms. Without his contribution and that of Simon STEVIN (who in 1675 extended this positional system to decimals), neither would Number theory exist today. Nor, possibly, would the theory of Bodies.

It is easy to understand that without positional number systems, civilisation today would not be what it is, nor would science, technology (including computing), or the global economy... A similar change, undoubtedly for the better, is that which would enable the use of the "Caracteristica universalis" or "Intrinsic and exact conceptual system" in our communication (learning, written and spoken language, etc.). Moving from arbitrary words, to unequivocal concepts and their intrinsic relationships.

4. WHAT IS, STRICTLY, KNOWLEDGE*?

Two concepts "a" and "b" correctly related by a "Relator" "**R**" form a simple knowledge, which we will write with the triad "a**R**b". The Mischa **is** a Cat. A Cat **is** a Bug, two simple knowledges, two "First Order Logical Propositions". And as we do with a "Lego", the simple knowledges can be related/operated with each other, composing them, resulting in more composite knowledges, and so on. These are exact logical "operations" because they are exact concepts and not ambiguous words. PIAGET studied some of these "operations" but without this logical-algebraic perspective, which was precisely what he wanted to find.

It should be clarified that we are referring to "Comprehensive knowledge", understanding by "comprehensive" the knowledge that explains the functioning of what surrounds us, material or virtual, and that is related by progressively higher quality, more specific and wider-ranging "Relators" (Level of understanding $=\sum_1^n$ [relation x quality], see video 8)) so we can say that we have formed a "Conceptual system (exact and intrinsic)". And also that they are unambiguously communicable. Not to be confused with other more trivial types of knowledge, which we can call descriptive-enumerative knowledges*:

- Factual knowledge", a very common type of knowledge in which we describe facts, such as historical facts (the analysis of these facts is another matter), news, etc..;
- sensitive, personal and face-to-face knowledge ("Acquaintance" in English).
- ideas";

* In "The Knowledge of Children at the Age of 3", from page 15 onwards, the confirmation is explained that the set of definitions of the faculties of the psyche, the mental faculties, is chaotic in many dictionaries, even the specialised ones that exist, because in no case do they allow us to know the limits of one faculty in relation to the others, nor an unequivocal use by the population, experts included. Nor their differences, as well as their relationships and implications. Hence the need for a "**global model of the psyche**" that defines unequivocally (exactly), relationally and structurally all these faculties. And this was one of the first things I did in 1996 when I reached the Representation of Knowledge and the derived Intrinsic and Exact Conceptual System (or Characteristica Universalis, or whatever you want to call it). For example, who is able to define by differentiating them unequivocally, and in turn relating them correctly, and structuring them genetically to faculties such as?Sense", "Feeling", "Perception", "Feeling", "Emotion", "Mind", "Psyche", "Memory", "Abstraction", "Idea", "Concept", "Knowledge", "Understanding", "Reasoning", "Use of reason", "Thought", "Intuition", "Intelligence", "Unconsciousness", "Consciousness", etc...., etc., etc.

This can be seen in references 6) and 7) and in the simulator in 8). The only debatable issue is whether one agrees with the names assigned to each concept, or agrees otherwise. Like the letter assigned to a variable in an equation, or in a computer program.

We will also differentiate here "Knowledge" from "to Understand", a close but lower level faculty and more linked to language and/or cultural skills: a child who already understands what they are told or what to do or even has criteria, does not necessarily have a (comprehensive) knowledge of what they are told or what they do or "why".

5. CONCLUSIONS

So we have a tree, but not just any tree like an agreed or arbitrary tree. It is a tree that in addition to its exactitude has intrinsically associated "First Order Logical Propositions", which are logically and automatic manageable.

We have only started this "Representation of knowledge". If we follow it, what can happen if we repeat this process of making exact partitions to structure all the concepts we know? Well, "CAUCHY sequences", "Topological limits", "Systems of n-equations with n-unknowns", "Diagonalisation of matrices", ... which will be discussed in the Annexes and in others articles.

Thus, later on, we will be able to discuss the intuitive application of phenomenological perception to language, which 3-year-olds do intuitively, and involves adding around twenty `Relators" or 'Relationship Managers'.. And at the age of 6, the maturation of abstract relationality also appears intuitively in children, consolidating a solid and extensive comprehension "network".

Significant differences between children appear here, a consequence of the different previous environmental and cultural circumstances, previous circumstances that could be called the "cognitive imprint". This study of relationality as a whole is also what makes it possible to break any knowledge, however complex, in simple knowledges, in order to explore the cognitive causes of school failure and to solve it.

And later, at age 10, the perception of the level of method, the last level of human thought, which provides the latest and most elaborate specific faculties (or 'Relators').

In this way, a new exact and objective logic can be proposed, replacing ambiguous words by exact/disambiguated concepts (in the image of the intrinsic approach to invariants, made by KLEIN with geometry). In ordinary life this would make it possible to avoid the problems of semantic conventions and conflicts due to the equivocations generated, and thus to be able to speak strictly the same language within each language.

And, finally, the complete representation of the whole faculty of human knowledge will lead us to a satisfactory and complete solution to LEIBNIZ's challenge in his "Characteristica universalis". We can advance, then, that being a semantic-logical resource, which also obviates the semiological, it is of special interest both for dyslexics and for immigrant children from cultures with distant languages (Chinese, Russians, Africans,...).

In the face of continuous educational reforms that focus on external aspects, such as the technological means that have appeared and/or the improvement of institutional organisation, the possibility of improvement appears:

- the same cognitive process —he acquisition of knowledge, learning—, which has not changed for centuries but is at the basis of learning;
- improving understanding, making it easier to apply knowledge in practice (technology), what is nowadays called "competences" to make people believe that they are innovating...

The persistence, year after year, of the well-known problems of teaching, proves the uselessness of the alleged hypotheses with which one tries to explain their causes. Would it not be more reasonable to reflect, to have the courage to be critical and to think that the solution must necessarily be found in some other perspective which is being ignored? At least CHOMSKY himself

already had the honesty to question his own work, which had earned him the nickname "Father of modern linguistics".

Unfortunately, however, the emphasis today is still on the neurological perspective of the brain, ignoring Freudian symbolic contributions. Neurology must know how to differentiate between the support (the brain, the nerves, the "hardware") and the signals of the psyche that circulate through it (the "software"), signals that have been known for more than 100 years, since the neurological research of the end of the 19th century by RAMON y CAJAL and FREUD, and even more so with the much more recent contributions on synapses (LLINAS' Law, see "The Knowledge of Children at 3 years of age"). It is possible to act on psychomotor signals because their coding is trivial (packets of simple and identical signals for each of the millions of sarcomeres of the same muscle), but it is totally ignored how the complex strict psychic language is coded, for example that of the signals transmitted by the optic nerve (sensory language), or others much more complex (instincts transferred from genetic coding to the psyche, reflexes, ..., consciousness, knowledge, ...).

ANNEX 1. The "Short Exact Algebraic Succession" ("SEAC")

With the SEAC's mathematical procedure, exactitude in the formation of each new hierarchy is guaranteed:

$$0 \longrightarrow \text{Kernel de } \mathbf{P}\ (=K_P) \longrightarrow x \xrightarrow{\mathbf{P}=\text{Criteri}} \{y_i\} \longrightarrow 0$$

Algebra has been built on the basis of calculation with numbers (initially arithmetic), resulting in structures (Group, Ring, A-module, Space, ...) on the basis of their operations, which allows real structures to be represented/modelled. Given the usefulness of algebra in the whole of civilisation (society, science, technology), the intention was to make an "Algebraic Extension" that would cover concepts, i.e. to transfer and use in concepts the maximum possible characteristics of numbers. And the first step is to transfer the exactitude of numbers to concepts by means of exact definitions, a challenge that has been considered impossible despite being proposed by LEIBNIZ more than 300 years ago with his "Characteristica universalis", without forgetting that they come from a much earlier contribution, by Ramon LLULL (1232-1316).

We will use Equivalence Class Partitioning by the canonical Application in a "Short Exact Algebraic Succession" (SEAC) to obtain "child" concepts (A_3) from a "mother" concept (A_2) and see what we can transfer from numbers to concepts despite their inherent differences. See A_1 A_2 and A_3 (be Algebraic groups, Rings, A-modules, ...):

$$0 \longrightarrow A_1 \xrightarrow{f_{1a2}} A_2 \xrightarrow{f_{2a3}} A_3 \longrightarrow 0$$ (in additive notation, in a Group, Ring, A-Module, ...)

is a SEAC with f_{1a2} injective [$\hookrightarrow$] and f_{2a3} [$\longrightarrow$] epijective), if:

Im (f_{1a2}) =Ker (f_{2a3}); where both Im (f_{1a2}) and Ker (f_{2a3}) $\in$ A_2 (where "Im" is the image, and Ker =Kernel =Nullifier/Anuller is the subset of A_2 which by f_{2a3} becomes the "Neutral Element" "e_3" $\in$ A_3)

or equivalently:

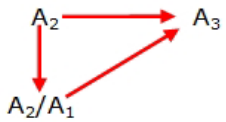
(f_{2a3} **o** f_{1a2}) (A_1) =f_{2a3} (f_{1a2} (A_1)) =e_3 (Neutral element of A_3), where "**o**" is a composition.

It follows from the above (Fundamental Theorem of morphisms between A-modules) that, in short:

0) $A_2 \xrightarrow{f_{2aH}} A_2/A_1$ es la aplicació canònica o projecció canònica

1) $A_2 \xrightarrow{f_{2a3}} A_3$ es pot factoritzar en $A_2 \xrightarrow{f_{2aH}} A_2/A_1 \xrightarrow{f_{Ha3}} A_3$

creant el diagrama commutatiu



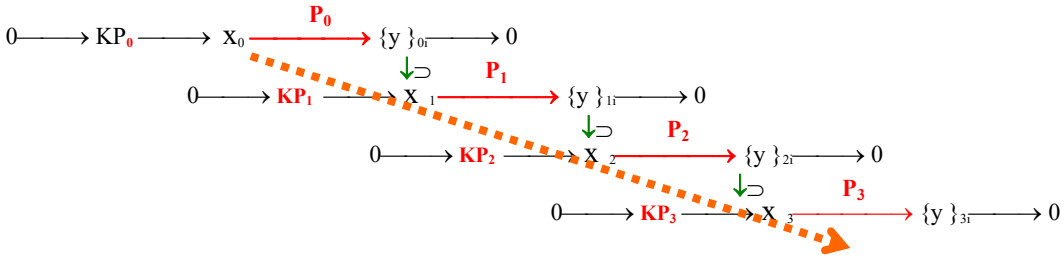
where f_{Ha3} **o** f_{2aH} =f_{2a3} ; and where f_{2aH} is the canonical projection/application, and f_{2aH} is the Canonical isomorphism. This factorisation or decomposition of f_{2a3} into f_{2aH} and f_{Ha3} , is what guarantees the exactitude conditions of A_3 ("child" concepts) with respect to A_2 ("mother" concept).

The "CoKernel" (CoKer) of f_{2a3} is defined as CoKer (f_{2a3}) =A_3 / Im (f_{2a3}), which is fully valid in our case of concepts, since it would be the unique class characterised by "being a child of (by means of the corresponding criterion)", which consequently differentiates these children from those of any

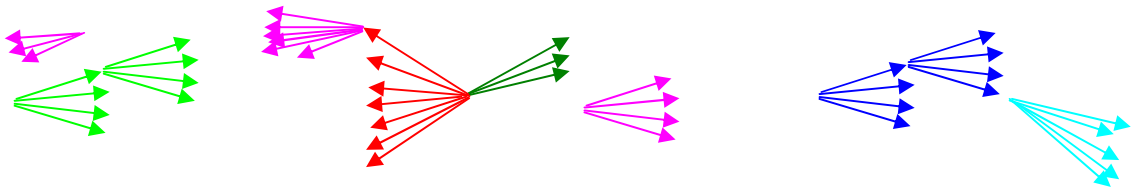
other partition, be from the same mother (stepbrothers) and/or from different mothers. The CoKer is important because it illustrates two historical errors: the absurd decimal option of DEWEY's CDU (Universal Decimal Classification), still in use, and the ignorance in all classification systems —the "Thesauri"— of the necessary multiple inheritance, to which I will return later.

ANNEX 2. Example of the 'sedan-coupé' concept

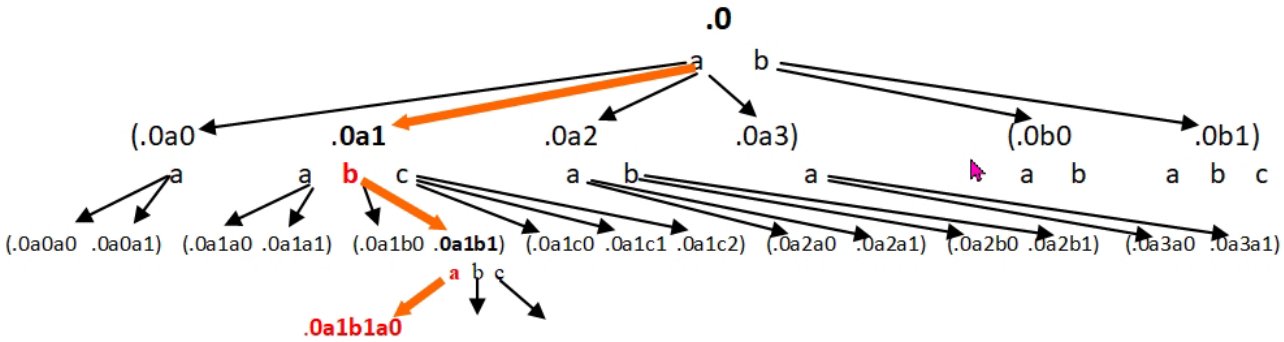
Following the SEAC methodology, successions are constructed to form a tree as large as desired that defines exact concepts, encompassing any desired concept (completeness and topological compactness).



In this way, a global tree structure can be formed, moving on from the many isolated saplings that we have been building since we were children, at great cost in terms of memory:



to a single exact, comprehensive and intuitive global tree (the "Intrinsic and exact Conceptual System", which is the basis of the "Characteristica universalis"):



As an example of one of its elements, the "Sedan-Coupé", a visual-sensitive concept for the better understanding of the reader, we will have as a consequence of the SEAC successions:

- A "Sedan-Coupé" **is** (equal to) a "Coupé" with two Rows of Seats (not one, not three).

- A "Coupé" **is** (equal to) a "Car" with one door on each side (neither two, nor ...).

- A "Car" **is** (equal to) a "Land Vehicle, Automobile and Driven with Paired Wheels on Each Axle" for the Transport of People (not for the transport of goods).

- A "Land Vehicle, Automobile and Driven with Paired Wheels on Each Axle" **is** (equal to) a "Land Vehicle with Wheels, Automobile and Driven" with Paired Wheels on Each Axle (neither a Tricycle, nor a Motorcycle, nor...).

- A " Land Vehicle with Wheels, Automobile and Driven" **is** (equal to) "Land vehicle with Wheels" auto and steerable (neither must be dragged, ..., nor goes on a railway, ...)

- A "Land vehicle with wheels" **is** (equal to) a "Land vehicle", with wheels (neither with skids, nor...).

- A "Land vehicle" **is** (equal to) a land "Vehicle" (neither maritime, nor...)

- A "Vehicle" **is** (equal to) a transport "Engine" (neither a computer, nor a clock, ...).

- An "Engine" **is** (equal to) a useful, engineered "Artificial Object" (if it were useless, it would be a simple Artefact).

- An "Artificial object" **is** (equal to) an "Object" made by the Man (neither natural, nor astronomical, nor...).

- An "Object" **is** (equal to) structured and/or formed matter (neither an amorphous substance, nor ...).

Besides having avoided an ambiguous "Blah-blah-blah" definition by replacing it with elementary (first order) logical propositions, the addition of "(equal to)" will remind the reader of the elegant process of substituting unknowns, to solve a system of "n" equations with "n" unknowns (CRAMER's Rule). How that of:

x = y +24
y = 3z +1/2
z = ...

"**is** (equal to)" is the "Relator" of all these cases of propositions, which as the reader imagines is the "Equality" relator.

So the "definitional system" corresponds in turn to a diagonalised JORDAN matrix. If we "substitute" all "equations" (according to the arrows ←) we will have the complete "solution" of the system of equations, or conceptual definition, in wich a "Sedan-Coupé" **is** (equal to):

> Engine structured and ingeniously formed by man, used to transport people over land; with self-propelled/automotive traction; with steerable wheels installed on axles in pairs; with a door on each side and two rows of seients.

where none of the abstractions that characterise it is missing or missing, and they are properly ordered (there is no commutativity, they cannot be permuted except for a few minimal exceptions, which correspond to the isomorphisms already mentioned). The traditional numerical solutions of the system: x, y, z, ..., are here the abstractions which define the concept exactly. The exact numbers are replaced by all the necessary abstractions.

At the same time, definitions such as the one described above prevent the semantic misunderstandings that are the most common cause of discussions ("semantic discussions", "nonsensical discussion"/ "cross purposes", ...). "Define and you will not argue" (Jaume BALMES). You can only disagree on the name used: "sedan-coupé", or "coupé-sedan", or "three-door car", or sports car, or ... And individually avoid unconscious traps, such as semiotic ones (polysemies, ...), favouring a more relational (comprehensive), efficient and correct thinking.

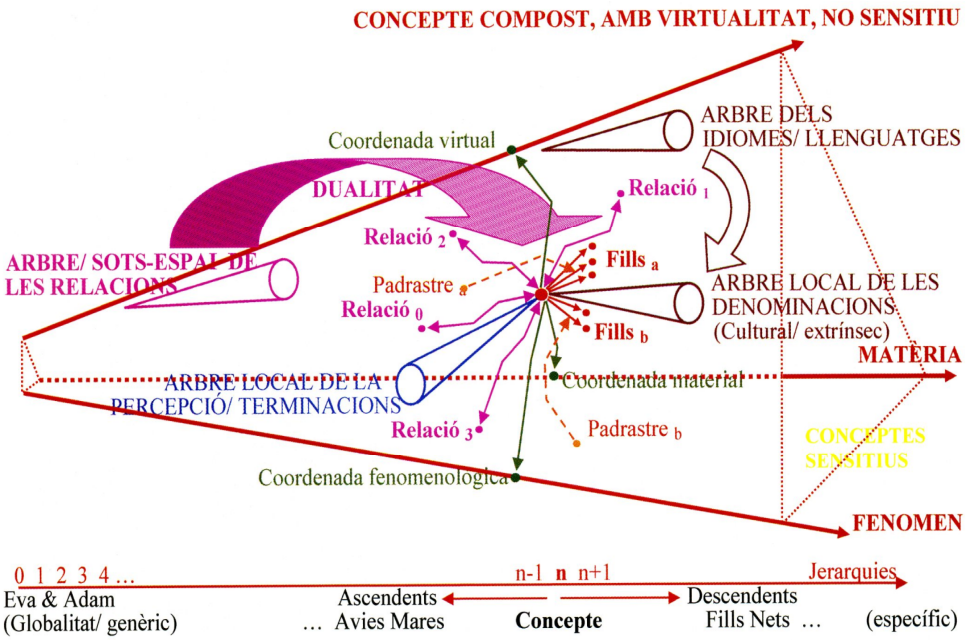
Let us also note the “CAUCHY sequence” created with 11 terms, which converges at the limit ‘Sedan-Coupé’, analogous to a number (exactitude).

It is difficult to find concepts that require more than 15 ‘terms’ to define them, except in some very specific scientific fields (species of living beings, molecules, proteins, etc.), and even fewer in the case of small geographical identifiers (a house in a village).

In the field of scientific journals, if it were mandatory to refer the terms used (hypertext) to concepts from this “Characteristica universalis” or “Conceptual system”:

- authors would be encouraged to significantly improve their writing (I have plenty of clear examples);

- these articles would be very easy to understand for people outside the very small field of specialists, enabling more applications;
- it would be immediately apparent that an article presents the same ideas as many others (equivalence), without innovating, but simply expressed in a way that seems different.



L'Espai del Coneixement, la Partició intrínseca, AutoAplicacions. ("Brief comments", C. UDINA 1998)

Original scheme in Catalan

In this way, the Conceptual Space (schematised in the attached diagram) can be formed, with exactly defined elements that guarantee the topological completeness and compactness mentioned above. Each element of the conceptual space has its associated "**CAUCHY succession**", which in turn has an associated system of equations, which can be represented by a diagonalised algebraic matrix, which is nothing other than a system of logical propositions of first order chained together, but not with ambiguous words but with exact concepts.

The conceptual space has a natural* three-dimensional representation which also helps the optimal transfer of the psychomotor faculties of man, faculties from which precisely the numerical and conceptual exactly systems are derived (see below "Codification").

* According to the three categories of concepts based on the progressive cognitive faculties required: Static sensory concepts (Matter), Dynamic sensory concepts (Phenomena), and Virtual non-sensitive concepts. What I have called 'Intrinsic Partition'.

In short, reunion, complement-exclusion (two BOOLE laws), membership-inclusion and partitioning into equivalence classes (SEAC), i.e. only four "R" "Relators", allow a normal two-year-old child to have the cognitive methodology that would enable him, with learning appropriate to his intuitive faculties, to construct a single tree incorporating all his possible future conceptualisations. A structure in turn based on first-order logical propositions, but with exact concepts (triads).

ANNEX 3: Codification

Even if the user is not aware of it, and does not need to know it, as a replica to the coding of the numbering system:

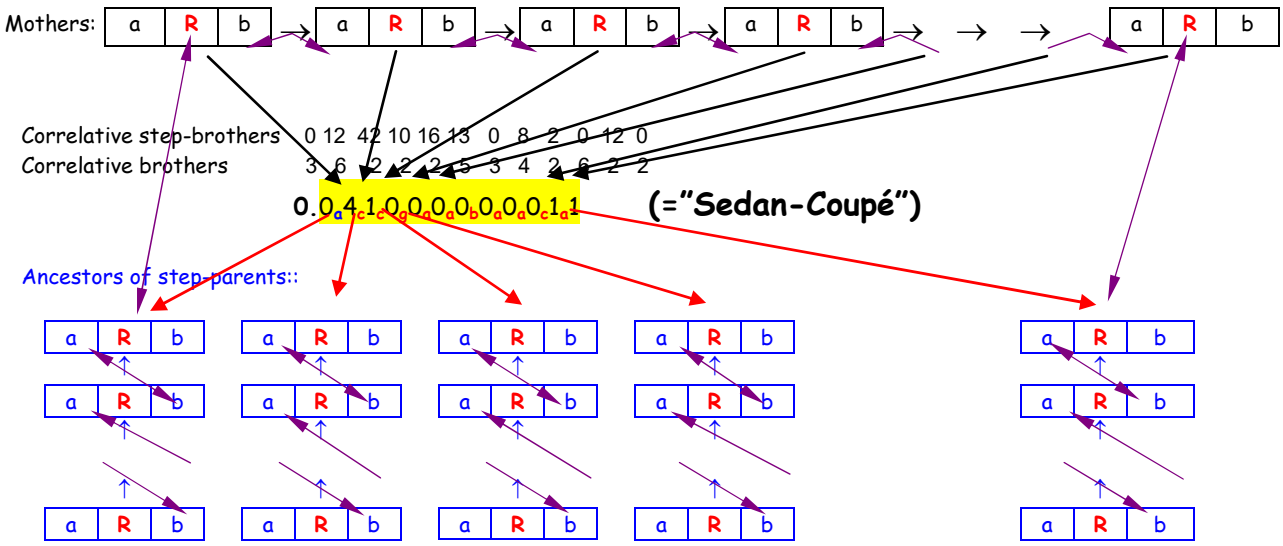
$$\mathbf{6}_{10}\mathbf{4}_{10}\mathbf{7}_{10}\mathbf{8}_{10}\mathbf{5}_{10}\mathbf{2}_{10}\mathbf{1}_{10}\mathbf{3} \quad (=\mathbf{6}_{x10\ 000\ 000} +\mathbf{4}_{x1\ 000\ 000} +\mathbf{7}_{x100\ 000} +\mathbf{8}_{x10\ 000} +\mathbf{5}_{x1\ 000} +\mathbf{2}_{x100} +\mathbf{1}_{x10} +\mathbf{3})$$

its analogue for the Conceptual System is:

$$.0_a4_c1_c0_g0_a0_a0_b0_a0_a0_c1_a1$$

which expresses the component elements of the successive SEACs, the subscripts (different colours according to different intuitive protocols) being the criteria of the successive partitions, different in each case and also multiple (a mother concept can be formed with different stepfathers, families of different siblings "a", "b", "c", ..., which with their related stepbrothers generate an even finer topology). It is not a question of constructing a new language to replace the current ones (like Esperanto), it is only an internal code that can be managed by computer, but which, with its use, will soon provide intuitive information on the position of each concept in relation to others in the cognitive space (we will see that this induces a metric). Like a "bellboy" in a hotel who quickly locates room 1203009 in a hotel, however big it may be (floor 12, section 3, ...). The same words in use, but exactly defined and correctly related.

If any number in a positional system is also a metadata that provides relations with all the other infinite numbers, then the SC code (in phosphorescent) implicitly carries a finite but very important relatability (and relatability induces comprehension):



From a single code such as that of "Sedan-Coupé", numerous first-order implicit knowledge aRb result, as many as the number of first-order logical triads-propositions that can be associated with this code in each case. But in turn, in each of these triads, its three constituent elements have their own code, generating with these codes the corresponding maps/graphs which are already second order relations, in a quantity which grows exponentially with respect to the previous code. And so on. As explained in "The knowledge of children at 3 years of age", the triads are the natural representation to be managed in the structure of the neuronal interconnections that are generated in the first vital period of the child by stimulation. And with a computerised, trivial management/simulation.

I insist, just with what a 2-year-old child is able to do intuitively, the same algebraic structures and methodologies are already available that are applied to numbers to calculate with them exactly, but

it is still ignored that they can also be used with concepts to operate with them exactly, efficiently, without error.

Whether or not the algebraic demonstration is understood, with this Annex 3 and 2 above, the reader can even see this "Algebraic Extension" of numbers (quantitative numerical concepts) to all concepts, numerical or not: instead of hierarchical numbers (the characteristic of Positional Number Systems) which define exactly a number, we have first order logical Propositions (the "Triads") which, chained together (i.e. through the underlying implicit network shown) define the exact concepts.

So at the complete opposite extreme to the equivocal polysemies and synonymies, we can even imagine a metric between any two concepts. It would be the minimum number of (exact) first-order logical propositions separating two concepts in such a structure.

It must be insisted that traditional logic on words, with all the limitations that its ambiguity entails (which forced the "formalisations" of a little over 100 years ago), and which prevents its evolution (unlike the extraordinary progress of algebra, geometry and topology), can be replaced by a logical-algebraic calculation based on the first-order logical Propositions with which exact concepts are composed, with an efficiency analogous to numerical calculation. This is what I called in 1996 "Vilassar's programme for logic", in the image of KLEIN's aforementioned "Erlangen programme for geometry" of 1872. It is a question of making possible an exact logic, hitherto unthinkable in mathematics and logic today, which makes it possible to equate its management and computer simulation with that of any numerical algebraic management/calculus (strict "Artificial Reasoning", and without 'hallucinations').

Insisting also that we are only in the faculties of children at the age of 2. These are two of the three faculties described by BOOLE in 1854 in his little appreciated book "An Investigation into the Laws of Thought" already cited. And it may be added that equal contempt has been shown for his wife Mary EVEREST BOOLE and her attempts to recognise the links between mathematics and psychology.

If we think that we are dealing with only two intuitive faculties of the human species, which in the Conceptual System are represented by two "Relators", we can think of what the total of "Relators" that appear progressively with age would allow, with which we could efficiently and unambiguously manage all knowledge (all of it expressible by "exact" first-order logical propositions). As all this is easily computable, we have the possibility of simulating Comprehension and achieving the "Artificial Reasoning". And in the field of the misnamed "Artificial Intelligence" (AI), i.e. "Automated Behaviour" according to AHARONIAN, or "Automation of repetitive intellectual tasks" according to THIERS, AI could already be endowed with understanding as claimed by DARPA:

> "Instead of crunching **gargantuan** datasets to learn the ins and outs of a language, researchers essentially want the tech to teach itself by observing the world, **just like human babies do**", "systems capable of **reasoning** and human-like communication"

Solving LEIBNIZ's tercentenary challenge of his "Characteristica universalis", in addition to its application to on-line learning and self-learning (and that of AI), would allow multiple other applications, such as solving once and for all the cognitive aspects of school failure, syntactic correctors, exact/unambiguous translations, search optimisation criteria ("Search"), ... today unthinkable with current "Corpus" of any kind (including Big Data). However complete these

Corpus are, they are enumerative (including Wikipedia, which, with this underlying support, could evolve to a much higher level of power and usefulness).

We have seen that this is the first basis for the acquisition of knowledge (any child is a living experiment that continually demonstrates this). And that this is how language can begin to be structured. Well, in addition to all the surprises that the previous exposition implies with the current "beliefs" that science has incorrectly adopted, we can even explain the "why" it is like this. Why is this process intuitive? In "What is consciousness(-raising)?" (C. UDINA, 2007), (TN: recently translated into English: https://vixra.org/abs/2507.0023) it is explained which are the bases of this faculty, which are symbolic/informational, also contrary to the current scientific beliefs that look for them uselessly in Biology or even in Quantum...

As explained in that document, consciousness, ultimately, mathematics, or knowledge, all of them result from recycling the structure of the information that psychomotricity manages, and this results from the very anatomical and physiological structures that it manages, and ultimately from structures inherited from the genetic information that has formed them. These are processes of methodological transfer of the underlying information between the different systems that have appeared with evolution, informational methodologies that are recycled to adapt to the corresponding conditions and needs in each case. The following table, which shows the structural analogies between all these systems, makes this clear:

The table of "Constructive strategies (=methodologies) of some complex structures".

	Exclusivity of the Base ("monogamy" or not)	**Variability of the Base Criterion**	**Number of Children**	**Types of Children**
Muscular structuring	**Exclusive** (each partition, a single family of descendants)	**Variable criteria**, predictably depending on molecular and cellular "availabilities"	**Variable and changeable** according to Level: about 1000, 2, about 500, about 60, about 6, about 60, about 24.	**Always the same**(all Sarcomeres are the same, all MyoFibrates are the same, ...)
Nerve	**Exclusive** (ditto)	**Variables** (as in "Muscular Structure")	**Variable and changeable** according to the Level	**Always the same**
Bone structure	**Exclusive** (ditto)	**Variables** (as in "Muscular Structure")	**Variable and changeable** according to the Level	**Almost the same** (small differences only in Form)
Positional numerical systems	**Exclusive** (only one, and moreover, fixed, always the same "father")	Criterion **fixed** (or 2, or 6, or 8, or 10, ..., but always the same)	**Fixed** (and matching with the value of the Base: 2, 6, 8, 10, ...)	**All different** among them (0, 1, 2, 3, ... in the case of Base 10), inductive (+1)
Exact conceptual systems (=LEIBNIZ "Characteristica universalis")	**Not exclusive**(there may be more than one "Stepfather"/ "Sibling Family"), and consequently with Multiple inheritance	**Totally variable**(any Concept can be Criterion/ "Stepfather")	**Totally variable**(between 1 and many). There is a dependency between the number of children and the diversification possibilities of the Criterion/Stepfather.	**Always semantically disjoint (=different), but contiguous (connected and compact)**

Original table in Catalan from "Què és la conscienciació?" (https://www.sistemaconceptual.org/pdf/Conscienciacio.pdf)

It is not surprising, then, that an algebraic extension is possible between positional numerical systems (not others such as Roman numeration) and the first cognitive conceptualisations of language: the positional numerical system or the exact conceptual system result from the same thing, they are like first cousins due to two analogous methodological transfers. Therefore, both are intuitive (inherent to the human faculties).

Finally, and still far beyond the scope of this document, this methodological-informational perspective is the one that allows to establish links between the different sciences in order to integrate/unify them according to another of LEIBNIZ's challenges, his "Mathesis universalis" (Universal science).

ANNEX 4. Neural and semantic networks, graphs, ontologies, merons, taxons, ...

4.1. Neural Networks and Graphs

Albert FERT, with the authority granted by his work in computer technology, awarded the Nobel Prize in Physics in 2007, questions the viability of Neural Networks ("eldiario.es", 2020-02-08), as well as the low efficiency of search engines ("Search"), only based on machinery and consumption (given that efficiency can only be provided by understanding and reasoning).

This is because it was a similar proposal to that of a remote Polynesian tribe who, during the Second World War, saw aircraft for the first time and built an analogous structure out of logs and branches, pretending to make it fly (without the requisite knowledge of the most basic fluids and aeronautics).

From "Children's knowledge at 3 years of age":

> What is important and basic in a "Network" is the "a**R**b" relationality it enables, which is consistent with the development of children's neural interconnections as a function of their stimulation. The "Network", or rather its extension, serves as a support for the accumulation of information (memory). And, as we have just said, for the agile transmission and availability of the information required on each occasion. The dynamic, the processes, are made possible by the availability of interconnections that allow relational processes, not by the "Network" itself. As if they were the crossings that characterise CPUs. And so, by means of the available relational devices as required by the versatility of the psyche, the information supported by the "Network" can be "completed" as unlimitedly as necessary.
>
> Moreover, and without being fully aware of it, the only useful thing that researchers and programmers of Networks end up executing is relational management. Put very crudely, the "Network" would be the static, or the quantitative; the interconnections would be what enables the dynamic, the processes, the qualitative.

The "ignored technology" of today's Networks is the information structure they can support, without which the Network alone is useless.

4.2. Semantic networks, ontologies, ...

Faced with the exactitude of a structure formed with SEACs, a few years ago, at the turn of the century (20th to 21st), great hopes were placed in the computerisation of semantic networks (Semantic Web, ontologies, ...), which over the years have been reduced.

And linguistics is still investigating with the ambiguous and unhelpful Merons and Taxons.

Finally, and as an anachronistic and incoherent example, the classifications of mathematics (such as the "Mathematical Subject Classification" [MSC], etc.) continue to be structures agreed by hand, without any thought being given to the methodological resources available to mathematics in order to create them.

ADDENDUM ON "AI" ("ARTIFICIAL INTELLIGENCE") 2022-12-14

These days, the appearance of OpenAI's "chatbot" (="conversational robot", interactive) "ChatGPT", based on "Artificial Intelligence", is being widely commented on at the beginning of December.

Before giving an opinion, first of all it can be said that ChatGPT has achieved what was intended for 1995 with the "Fifth Generation of Software" (5GL), according to which we could interactively address the computer in "natural language", and which was considered to be something typical of "Artificial Intelligence". Understanding that, as such, it already works quite satisfactorily today (and can be improved), it has taken 27 years longer than expected.

Voice recognition analogues, it is a matter of time before they work well enough, like ChatGPT, although the current ones marketed for telephone robots ("Virtual Operators") are still pitiful. Something much simpler and earlier, character recognition ("OCR"), the simplest sensitive recognition, was first marketed in 1986 (I bought one at work) and did not work. They still give errors today which, to fix them, would require some programme like ChatGPT to come up with valid alternatives to the errors.

Even before what may be considered "opinions", another observation is the extensive or enumerative methodology used, based on millions and millions of data (BigData), i.e. of almost zero efficiency. Thus, together with other similar applications, the "cloud" and its use on the Internet-WWW, already accounts for 25% of global energy consumption, when it has not even managed to curb the traditional pollution of industry, commerce and services in order to contain serious climate change. This is an unsustainable drift, and unsustainable even in the short term, given how climate change is progressing, if "everyone" is to use these technologies.

With the above, there would be no need to go into the usual "ethical" considerations of its use, especially by governments (and related institutions) that already use so-called "AI" technologies to recognise and control citizens.

In summary, it can be said that:

- The programme does not understand its answers, and that is why 'hallucinations' appears. Or more crudely, that it is functionally illiterate, a far cry from DARPA's aforementioned requirement to simulate the progressive understanding of young children; still less does it generate "knowledge" as conceptualised here; it is an understatement to say that it "reasons", which by the way are faculties still far removed from what should strictly be understood as "intelligence".
- Therefore, he does not know whether his answers are right or wrong, when, in principle, in an encyclopaedia (the traditional paper ones or today the virtual ones) his data are not wrong because of the guarantee of public knowledge, so he can be a dangerous generator of "bullsheet" (= "bluffs", deception);
- only re-elaborates data from the BigData at its disposal, which are the same as those that supply search engines (Google, ...), but in this case without even being able to access these original sources (encyclopaedias, articles, books, information, ...) and the serious possibility that they may be manipulated by the manufacturer or not be updated; in other words, it prevents analysis and criticism unless used by experts in the subject consulted, thus generating the defencelessness of the remaining normal users. And a danger to the intellectual maturity of the child. Etc., etc., etc., etc.

If you ask "What is the longest word in Don Quixote?" it does not provide it, but a long and totally useless text (although it will surely be incorporated in the future by the interaction of the same users), so Juan Ignacio PÉREZ SACRISTAN thought of asking his students at the University, who, by asking in Data Science in an edition of the book of 376,509 words, with a few lines of code, obtained it correctly:

```
# Encontrar la palabra más larga y su longitud
wordMax = "" # Valor por defecto
lenMax = len(wordMax)
for w in wordsQuijote:
    if len(w) > lenMax:
        lenMax = len(w)
        wordMax = w

print("La palabra más larga encontrada es:", wordMax, "\nSu longitud es:", lenMax)
```

```
La palabra más larga encontrada es:  bienintencionadamente
Su longitud es:  21
```

although, in the original edition with "Confirmation Bias" it turned out to be "inquietudinemotividad", but which in turn has zero results in Google (to date);
- etc., etc., etc., etc.

Nevertheless, this is one more development in the framework of what is unequivocally important: the "miracle" of technological advances such as the Internet-WWW and mobile "phones", which strictly speaking are powerful pocket computers connecting us to supercomputers (BigData), something totally unthinkable only 30 years ago.

Thus, we are only beginning to talk to computers in natural language as postulated for 1995, but here again it should be noted that our languages, "natural" as they are, are the most inefficient in relation to our psychic faculties, as we are seeing in this succession of papers on children. Languages have historically been formed and evolved in a totally haphazard and arbitrary way, obviously thousands of years before we began to have any knowledge of the workings of our psyche (I insist that until 1996 no "Representation of Knowledge" has been available).

Finally, the only way to provide computers with strict knowledge is not BigData and languages such as the one analysed here; the only way to obtain understanding and simulate strict reasoning is to simulate a correct "Representation of knowledge" (C. UDINA, 1996), i.e. to simulate the human faculties that allow it and which are being presented in this series of documents according to their appearance with age, a presentation that allows us to see that they are fully computerisable. In any case, I insist, they are all faculties that have little to do, much less, with a faculty such as strict human intelligence. AI experts can continue saying and doing whatever they want, but 2-year-old children all over the world will continue conceptualising, knowing and constructing their language as I explain in the 24 pages preceding this Addenda. And certainly without any statistical methodology or energetically ruinous supercomputers.

To close the circle, this "Representation..." of 1996 resulted from a work programme (C. UDINA, S. XAMBÓ) in the framework of the COMETT programme of the European Communities (today EU) which was proposed in June 1987 (9)), as an alternative to the foreseeable failure of the "IA" planned for 1995, which was rightly intuited at the time: 'computers that can be addressed in natural language.' It is well understood that language, that is, different languages, are not 'natural' but only "habitual" (since they were not formed on the basis of our natural psychic faculties but rather through arbitrary historical evolutions). (Translator note: 'natural' language, that is,

'habitual' language, which was sought in 1995, has been achieved 40 years later, in 2022, with the ChatGPTs of the misnamed 'Artificial Intelligence', which, as we have seen, is not 'Intelligent' either.)

BIBLIOGRAPHY

1) LEIBNIZ, Gottfried Wilhelm (1716). Zur allgemeine Charakteristik. Leibniz-Sozietät der Wissenschaften zu Berlin.

2) BOOLE, George (1854). The Laws of Thought. Prometheus Books (2003).

3) "Characteristica universalis" From Wikipedia, the free encyclopedia:
https://en.wikipedia.org/wiki/Characteristica_universalis

4) XAMBÓ, Sebastià (1972/ 73). Notes on geometric algebra. U. Barcelona; Fac. Matemàtica; Dep. de Álgebra i Fundamentals.

5) UDINA i COBO, Carles (1996). Intrinsic dictionary and natural language. RPI B-15987-96 1996-04-26.
https://www.sistemaconceptual.org/coneixement/

6) UDINA i COBO, Carles, (2007). El kerigma del pensament; l'estructuració del pensament i del coneixement. RPI Barcelona B-2074-07 2007-04-12.
https://www.sistemaconceptual.org/pdf/Kerigmapensament.pdf

7) UDINA i COBO, Carles, (2015). Bases matemàtiques del sistema conceptual (intrinsic and exact). https://www.sistemaconceptual.org/pdf/MatematicaSC.pdf RPI Barcelona B-1497-15 2015-05-21.

8) "Ludoteca, Botànica i Signatura" (Toy library, Botany and Topographical Signatura) Video of the "Conceptual system - Characteristica universalis".
First video (34' minutes, 300 MB)
https://www.sistemaconceptual.org/pdf/VideoCU-SC-A.mp4
or
https://vimeo.com/415106311?quality=720p
Second video (33' minutes, 200 MB)
https://www.sistemaconceptual.org/pdf/VideoCU-SC-B.mp4
or
https://vimeo.com/415104656?quality=720p
https://vimeo.com/415104656?quality=720p

9) C. UDINA, S. XAMBÓ "Training programme for Thechnicians in advanced programming applied to problem solving". 1987 juny, 15 pages