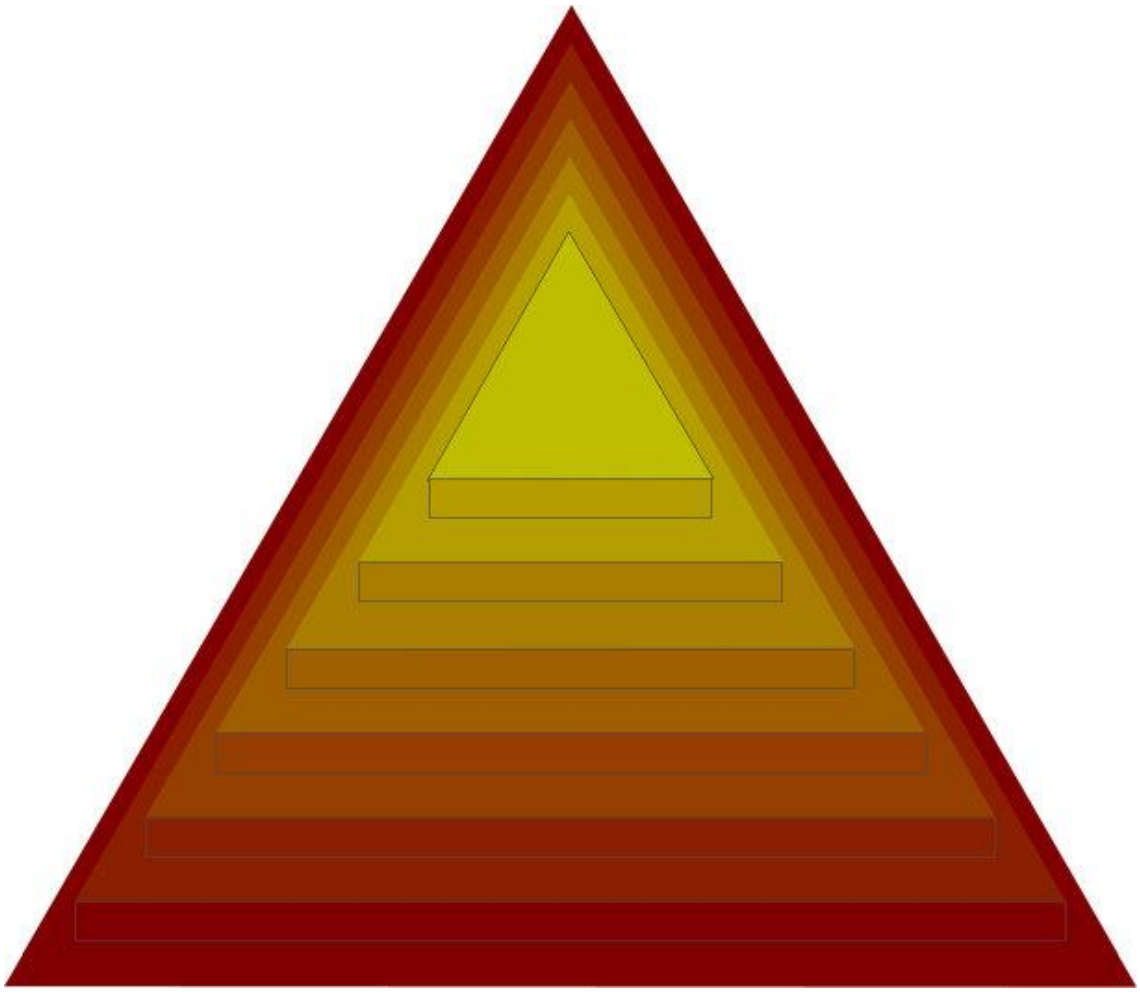
Design

beyond probability



Taeke M. de Jong 20200311

Content

"De gewoonten der menschen is zodanig, dat zy, zo dikwijls als zy enige gelijkheit tusschen twee dingen bemerken, van beide het geen oordeelen, 't welk zy van een van beide waar hebben bevonden, zelfs hier in, daar in zy verscheiden zijn." [a]

People have the habit, as soon as they recognize any equality between two things, to suppose that equality in everything in which those things differ.

"Er is geen ander zijn dan anders zijn" [b]

There is no other being than being different.

a Descartes(1684)Regulae ad directionem ingenii Regulen van de bestieringe des verstants(Den Haag 1966)Nijhoff
b Bruggen(1924)De grondgedachte van Prometheus(Amsterdam)Maatschappij voor goede en goedkoope lectuur

4. A STUDY ON SUPPOSITIONS OF DESIGN

§ 13 IMAGINATION IS BUILT UPON PRACTICAL CONDITIONS

The principles of Chapter 1 offer a design-relevant distinction in different design dimensions as below (***Fig. 46***).

modalities	**levels of scale**	**context layers**	**object layers**
true or probable	…	administrative	intention
possible	10m	cultural	function
desirable	3m	economic	structure
imaginable	1m	technical	form
	…	biological	content
		physical	

Fig. 46 Design dimensions: distinction between modalities, levels of scale, context layer and object layer

In these columns the *conditionality* fascinates me. The distinction between different forms of practical conditionality is further discussed in chapter 3 p43 on logic.

For the modalities in ***Fig. 46*** '**imaginable**' is a comprehensive basis. In ***Fig. 3*** on p11 that concept is not outlined, because for drawing its border you should be able to imagine the other side, the 'unimaginable'.[a] The imaginable then has no conceivable limit, but it increases by 'unbelievable' discoveries and design. Any desire must be imaginable, but it is not sure if all possibilities are also imaginable.

The limit of the **possible** is not determined here by what is currently possible at the moment, but what can ever be technically and practically possible. That limit is not certain. For now, I accept the limitations that are generally accepted by science such as the impossibility of a perpetuum mobile. However, you can also develop new possibilities that were previously unimaginable. Our imagination can be expanded in a learning process with conditions for new images.

Since science is a human design, it is itself limited by human imagination and underlying suppositions (conditions for imagination). In order to gain some insight of these limitations, I have described in detail some typical parts of the physical, biological and human sciences from my own limited knowledge (chapters 3 to 9).

The question remains whether this reconstruction of the existing reality ('science') also covers all technical possibilities. The instruments with which her exploratory capacity has been extended are themselves human constructions.

a A variant on Wittgenstein(1918)Tractatus logico-philosophicus(Berlin 1963)Edition Suhrkamp Vorwort

The mathematics considered as untouchable is such an instrument. Her limitation, however, is that she reduces differences and changes to equality and repetition (chapter 3). It is a generalizing instrument.

I do not share the Platonic idea that ideas are a practical condition for material existence. Even mathematics as a world of ideas does not escape its physical conditions, however much it helps us to get to know them. She makes the endless repetitions with which we are confronted manageable. Repetition of mathematical operations can lead to a variety that is reminiscent of biological forms, but they are limited to exact repetition (§ 24 from p115 onwards).

Whether the **scale levels** in ***Fig. 46*** (and their analogy in time) also have a conditionality, I do not yet have a clear idea. It is conceivable that the abiotic representations have to build their conditions from the largest scale to the smallest scale, while in the case of the biotic representations the reverse way must be walked. They meet in the cell membrane.

The layers of **context** and **object** are consecutive conditions for their imaginability (***Fig. 44*** and ***Fig. 45*** p50). The **context layers** in ***Fig. 46***, however, raise the question whether technology, economy and governance or management are not parts of culture in general, defined as 'set of shared (sub)positions and technical conditions'.

I take the scale paradox into account here. Some kind of technology and economics has been supposed in every local culture, but there are parts that, independently of that local culture, also exist globally, inescapable as practical conditions for every contemporary culture, comparable to inescapable biological conditions.

A local culture, such as in Silicon Valley, could produce technological innovations, but after that they started to live their own lives globally as a given context. They have offered all local cultures new conditions to explore new possibilities.

Something similar applies to a modal economic competitive structure that resembles the biological 'survival of the fittest' that no one can evade. In this way they must be distinguished as independent, underlying, design-relevant practical conditions for each local culture.

The **object layers** in ***Fig. 46*** are identifiable moments of presentation and attention in each design process. They also require a different imagination. Since an object can always be placed within a context, but not the other way around, the object layers should be part of each context layer. They stand, however, as a way of thinking, aspect, focus or 'approach' from different directions 'perpendicular' (see also p85).

SHIFTING BORDERS AND DISTINCTIONS ARE CONDITIONS FOR DESIGN

The first condition for our imagination is discernment, the ability to distinguish objects in a state of dispersion (form). For design that ability must be more mobile than for just using its result. You should not only be able to recognize familiar objects that already have a name. You must also be able to imagine objects with different contours (shifting borders) that have no name yet.

Constellations of stars have got a name. So you can remember and recognize them easily. The starry sky, however, has infinite possibilities to capture a collection of stars in a constellation. You can add or omit elements in your thoughts. If you add a third dimension to the image, then suddenly quite different groupings are possible. This has already caused the Copernican revolution in the current representation of the impression of a sky dome into the conception of an infinite universe.

The context layers in ***Fig. 46*** raise the question whether technology and economics should not be counted as 'culture'. The ABC model of ***Fig. 47*** is a simplification that avoids this question. It is a representation in which the order of cause and effect reverses without losing a causal basis.

The causal thinking that is anchored in our language (subject-verb-object), loses its direction from cause into effect in biology (chicken and egg). Through feedback, consequences interact with the causes (adaptation). That mechanism is followed in the technique ('cybernetics'). In the conceptual world of representations that direction can even turn completely around. We can first anticipate consequences and then cause them to be so.

The ideas of the ecologist Van Leeuwen shifts some crucial boundaries in conventional distinctions. My shortest summary of those ideas would be the following.

The only premise that no longer has any suppositions is the concept of 'difference'. Every other concept supposes a difference with other concepts. Everything differs. 'Equality' is only a special case of difference, an imaginary 'zero value', a limit that can only be approached.[a]

Also 'change' supposes difference (with 'now') and keeping it the same is also such an imaginary special case. Everything changes (panta rhei[b]), albeit to varying degrees.

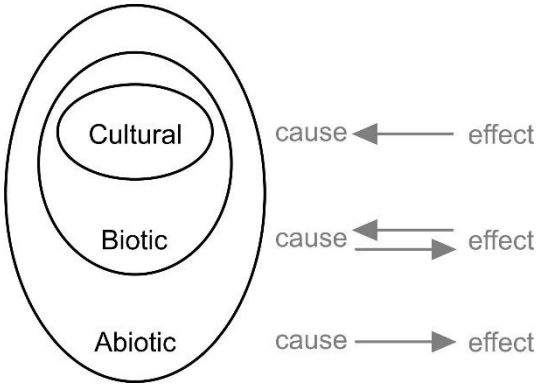


Fig. 47 ABC model

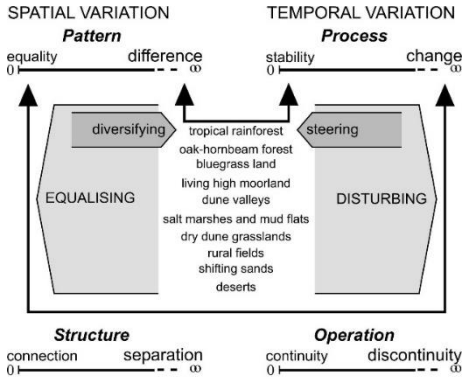


Fig. 48 Spatial and temporal variation according to Van Leeuwen

a You can already find this view at Cusanus(1440)De Docta Ignorantia II, 1 p92 and Leibniz (1663-1716) Kleine philosophische Schriften (Leipzig1879) Koschny p127 "... dass es niemals eine völlige Gleichheit geben wird." (Was zu einem meiner wichtigste Axiome gehört.) ". This is remarkable for a great mathematician. With regard to change, he also states on p221: "Streng genommen ist es richtig, dass kein Körper vollkommen und gänzlich in Ruhe ist, aber man sieht bei einer mathematischen Betrachtung der Sache davon ab.". In this way he puts the reality content of mathematics into perspective: nothing is really the same or the remaining equal, everything differs and changes. With him, just as with Van Leeuwen, time is no more than an "order of change" (p111): "…der Zeit, welche dem Geiste nur eine Ordnung in den Veränderungen darstellt, …".

b Attributed to Heraclites, among others by Plato.

According to Van Leeuwen, between this 'spatial variation' and 'temporal variation' there is a predominantly negative relationship (***Fig. 48***). Most likely is a relationship between increasing change and decreasing difference (equality). The reverse process is itself a change and is therefore implicitly opposed by that change ('disturbing') and process to equality ('homogenisation'). Making a difference is more difficult than making a difference equal.[a]

The concepts of 'difference' and 'change' are therefore more fundamental here than the abstractions of 'space' and 'time' derived from this. These abstractions are sometimes used as adjectives ('spatial' and 'temporal'), but only to distinguish between the two 'variations'. 'Variation' can be interpreted as 'difference in difference' and the difference between the two variations as a third degree difference: 'difference in difference in difference'.

The assumed negative relationship between the two variations is reminiscent of the second law of thermodynamics, the entropy law that states that every system inside or outside its borders always leads to more disorder (a higher entropy or probability). However, Van Leeuwen associates this disorder with more equality and change and the process towards more disorder with homogenisation and disruption (***Fig. 48***).

This coherence of pattern and process is repeated in structures and operations: connection makes discontinuity more likely than separation; separation gives a greater chance of continuity. However, connecting and separating are themselves operations that cause discontinuity. Separation is therefore more difficult than connecting.[b] This is an appealing elaboration for designers, because 'structure' is then a 'set of separations and connections'.

In different directions, for example 6 'degrees of freedom' for movement (two opposite per dimension), you can imagine separation in 6 directions as a box or cell from which you can not escape, in 5 directions as a bowl, in 4 directions as a tube (or as armchair), in three directions as a gutter or slide, in two directions as a wall, in one direction as a deck and in no direction as a void (***Fig. 49***).

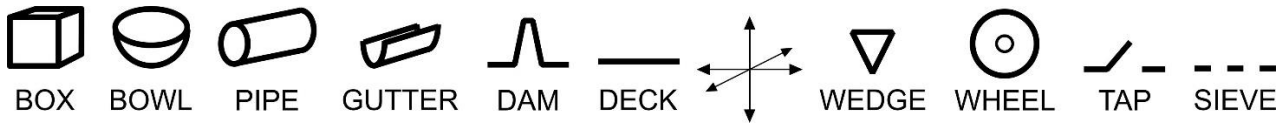


Fig. 49 Selectors

Van Leeuwen called these elementary structure components 'selectors'.[c] If you involve the temporal variation (sometimes separation, then connection) then a wedge (to make a separation), a wheel (rotation about one direction), or valve (door, tap, switch,

a Every child knows that if once it has built a sand castle on the sea front. That is always leveled by indifferent vandals or the sea.
b Jong(2007)Connecting is easy, separating is difficult In: Jong; Dekker; Posthoorn eds. Landscape ecology in the Dutch Context (Zeist) KNNV-uitgeverij p208. http://www.taekemdejong.nl/Publications/2006/Landschapsecologie/Onderdelen2/Connecting is easy.doc
c Leeuwen(1973)Ekologie(Delft)TUD Sektie Landschap p35

transistor) are also selectors. If a separation is selective with respect to size (or other differences in nature), then you have a sieve (filter, membrane).

The membrane is a foundation of living organisms. A cell is a selective enclosing membrane (box) that sifts input and output. This makes possible an internal arrangement, which can hold up against the ubiquitous, ever increasing external disorder ('entropy'). An organism nourishes its cells with tubes and also drains the superfluous substances outwards (with a higher entropy than previously admitted).

The terms 'organ', 'organism' and 'organization' already suggest that structures at different levels of scale (bounded by frame and grain) deserve their own interpretation. The structural concept is also crucial in technology. Each device is a set of selectors that work together or separate from each other.[a] I give some background to the ecological origin of these ideas that are important for the following chapters.

Boundaries suppose stabilized differences

A vague border is a sequence of consecutive differences that take up space ('gradient', ***Fig. 5*** p13). Van Leeuwen found more different and rare plant species in gradients than elsewhere.[b] After all, on a broad gradient, for example from high to low, more different species with different moisture requirements can find their own optimum (the widely accepted concept of 'ecological tolerance' ***Fig. 50***).

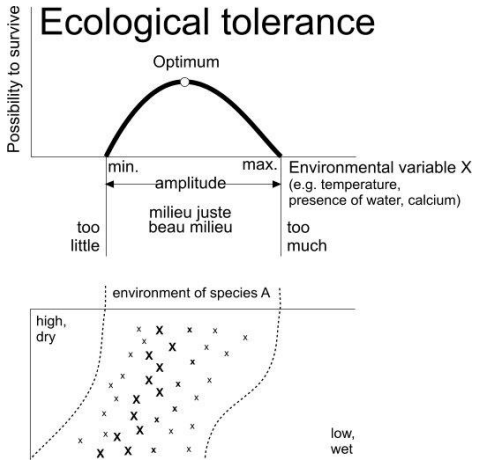


Fig. 50 Ecological tolerance

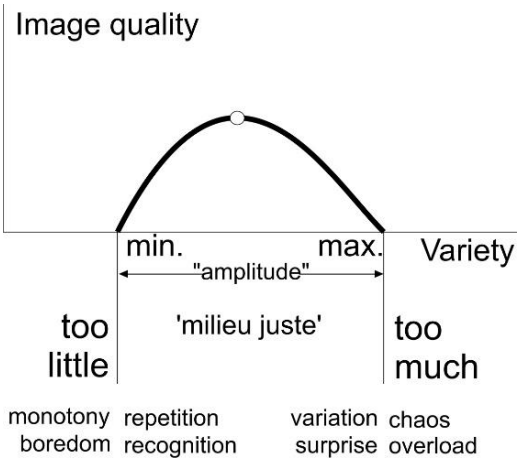


Fig. 51 Aesthetic quality perception

That difference has a stabilizing effect with external fluctuations. A species X flourishes at its optimal height, but is surrounded by languishing specimens x at slightly too dry or too wet locations. If, for example, it stays dry for a long time or starts to rain, these marginal specimens will flourish again: a risk coverage for the species. On the analogy with aesthetic quality experience (***Fig. 51***) I return to p57 and in § 43 p253.

a See Rodenacker(1976)Methodisches Konstruieren(Berlin)Springer.
b Leeuwen(1965)Over Grenzen en Grensmilieus(Amsterdam)Jaarboek 1964 van de Koninklijke Nederlandse Botanische Vereniging

A sharp border has fewer differences and less species in its environment, but as a front line also more competition and dynamics. Van Leeuwen therefore proposed to concentrate our nature policy on sustainable vague boundaries (gradients) and not on the categorization of ecosystems with 'target species' on either side of borders.[a]

Yet that *categorization* became the basis of Dutch nature policy. Ecological categorization is probably the most laborious and questionable form of scientific categorization[b]. She became outdated by accidental succession of environmental influences and climate change. The characteristic species composition must always be adjusted or further divided, but the landscape gradients still exist.

You could link a far-reaching consequence to this. Categories (sets) are primarily determined by external differences and boundaries and not primarily by internal generalization of equality.

Difference compensates change and the reverse

Van Leeuwen then assumed a compensatory relationship between spatial and temporal variation in the landscape (***Fig. 48***).[c] Where there is little change (with fully developed 'climax vegetation'), he found more diversity than where there is much change (with 'pioneer vegetation').[d] He left the causality direction in the middle (leads difference to stability or vice versa: does equality lead to change or the reverse?).

This 'relation theory' or perhaps better 'regulation theory' received a lot of criticism, for example from a mathematical point of view[e]. There are, however, mathematical indications that continuous repetition (a form of staying the same) of the same operation on the preceding outcome in time can yield spatial diversity (cellular automata[f] or iterations, see also § 24, p115).

Furthermore, this criticism is largely overcome by the scale paradox (***Fig. 6*** p14).[g] Van Leeuwen can be right on the odd scale levels, while equilibrium and stability are linked to the even scale levels without contradiction. The point is then, to determine the scale levels where the change of paradigms takes place by additional research.

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a This view was taken over in VROM (1966) Second Policy Document on Spatial Planning (The Hague) State publisher p109 and resulted in a 'gradient map'. For a short time this was the norm for nature policy in The Netherlands.

b This 'plant sociology' distinguishes vegetation in areas where the same composition of species is often found as 'societies' and gives it a Latin name. The distinction between very heterogeneous collections that have something in common yields complex methodological problems, see Schaminée (1996) The vegetation of the Netherlands (Leiden) Opuluspress. The plant-sociological vegetation categorization and mapping for the Netherlands, under the direction of Westhoff from 1942 with an admirable perseverance was established. A true monk's work. At least ten bulky folios filled with tables with field recordings saw the light. The system, generally known and accepted as the 'Westhoff-Den Held' system, was later regarded as unsustainable by Den Held in inventories in South Holland.

c Leeuwen(1970)Raumzeitliche Beziehungen in der Vegetation in: R. Tüxen Gesellschaftsmorphologie Strukturforschung(Den Haag)Junk 63-68 en Leeuwen(1971)Ekologie(Delft)THD 3404

d Change is a form of difference (fourth dimension). There is therefore some reason to propose the time dimension as perpendicular to space. In this case, between spatial and temporal variation, according to Van Leeuwen, a perpendicular paradox applies as a special case of the spatial paradox that equality appears perpendicular to difference. Thus, technical possibilities such as the selectors of ***Fig. 49*** p14 appear.

e Sloep (1983) Patronen in het denken over vegetaties: Een kritische beschouwing over de relatietheorie (Groningen) RUG. This dissertation appeared at the same university (Groningen) where Van Leeuwen had received an honorary doctorate for his relationship theory a few years earlier.

f Experiment with, for example https://mod-est.tbm.tudelft.nl/wiki/index.php/Bestand:GameOfLife.xlsx

g Jong(2003)Het belang van ecologie voor bouwkundig ontwerpen en omgekeerd (Zoetermeer) MESO http://www.taekemdejong.nl/Publications/2003/Het belang van de ecologie.htm

Here it is especially important that the abstract concepts of space and time can not be imagined without direct perceptible differences and changes. Vice versa they can. The intellectual constructions 'space and time' *suppose* 'difference' and 'change'.

Equality supposes difference

After this I accept Van Leeuwen's underlying insight of equality as a special case ('zero value' or limit) of difference, and stability as a special case of change. Differences can always be thought of more different, but not always less different. Less than the smallest observable or imaginable difference is called 'equality'.

With a microscope or telescope you can always see differences (even if it is only a place difference of details). The result is that 'equal' does not have to be in logical contradiction with 'different'. The idea that change itself is a special form of difference (with 'now') is for my account, as is the perpendicular paradox between spatial dimensions (**Fig. 5** p13) and between each spatial dimension with the time dimension

§ 14 DIFFERENCE IS THE LANGUAGE OF THE SENSES, EQUALITY OF THE MIND

YOU CAN NOT PERCEIVE, CHOOSE OR THINK WITHOUT A DIFFERENCE.

Difference is supposed in any modality of ***Fig. 3***, p11, both in our senses and in our minds and in my opinion the only required a priori category for both. Everything differs, but sometimes we *conclude* equality.

Every object we give our attention must first be chosen and separated from a formless multiplicity, before it can be thought of as a manageable unity. Our language, our limited imagination and memory force us to select with sharp boundaries[a] and to further reduction and generalization of data within it. Design, however begins with a vaguely limited object.

Our minds, our language and science reduce every unmanageable multitude in sets with a label. They generalize similarities in concepts, types, classes, categories. They reduce the variety of passing images into imaginary equalities, to find rules that can make our own actions (including thinking) effective within them.

But if everything is made equal, and suitable for repetitive operations, then we become 'bored'; our attention weakens. Then we want to be surprised by new impressions. We move between monotony and chaos, boredom and surprise (***Fig. 51*** p55). These limits and the optimum between them (aesthetic quality perception) is different for everybody.

a With that, Dick Bruna has helped millions of children in different cultures. See Linders(2006)Dick Bruna(Zwolle)Waanders.

A THIRD OBJECT IN THE REPRESENTATION MAKES THINKING IN SETS POSSIBLE

According to some biologists people distinguish themselves of animals by the ability to oversee a series of actions of which only the first is directly executable.[a] I would add 'and of which only the last has an outward function'. I call the intervening actions 'interfunctional'. They only have a function within that series.

Making tools, following a course, using language to coordinate actions are all 'interfunctional actions' that have a more distant 'purpose'. Inter-functional actions can also be found in animals (nest construction, partner search, hatching care) and even in biochemical processes (chemical pathways), but the criterion of Harrison et al. differs in the word 'oversight', the co-action (note hh p13) that accompanies or even precedes the successive actions.

You do not have to assume that birds building a nest oversee their reproduction cycle. Such a genetic program component is executed more directly by animals than by people planning intermediary actions. The 'free' input of animals is only variation on subroutines of the compulsory program. They are carried out differently according to circumstances (twig search, plaiting, twig search, plaiting).[b]

The 'overseeing' of actions in animals is probably no more than two actions that can be considered (flee or fight, chasing away or luring, nesting or eating) or following each other (hunting-eating). The urgency is determined by the state in which they find themselves. An 'unblocking stimulus'[c] from the environment triggers subroutines (the appearance of a prey or predator, the temperature of the approaching spring, the degree of concentration of chemical attractants).

People have a greater variation in their activities than repetitive processes or routines in animals. People may oversee more actions than animals, and three of them already can explain their variation of activities. If the overview (co-action) can contain three actions at the same time, then there is an interfunctional action in the representation available between the first and the last action.

If you take an action more generally as an object, then an 'action object' can be included in the representation between more static objects such as a start and end stage ('activity'). A verb (an operator between two variables) can be surrounded by nouns: a subject and a direct object (or result). The 'third object' makes language possible. Speaking itself is a 'series of actions of which only the first is directly executable'.

If the sequence is often performed, it is moved to another part of the neural system as a 'routine'. The series can also be interrupted by an incident in the environment. This

a A demarcation criterion between humans and animals according to Harrison;Weiner;Tanner;Barnicot(1964)Human biology(Oxford)The Clarendon Press

b Hall;Meddle;Healy(2015)From neurons to nests nest-building behaviour as a model in behavioural and comparative neuroscience(J Ornithol)156Suppl1p133–143

c Tinbergen(1965)Social Behaviour In Animals(London)Methuen discusses numerous examples of unblocking incentives. He argues that there is no way in which anticipated effects of behavior can play the role of the causes of behavior, as is the case in humans in a way that has been completely unexplained to date.

can come from outside, but it can also be a side effect of your own action. These are often creative moments that distract and open a new route. Their 'third object' gives people more space than animals to follow a different series of actions.

The 'third object' in the representation is evolutionarily a minor neural mutation with major consequences. A memory can not only be seen as educational experience from the past in addition to the sensory topicality, but in the same representation there is also room for a future. This third object thus makes conscious 'wanting' possible.
A third object can contain the sequence between two stages and develop into the abstraction of 'time'.

From two different objects one similar characteristic can be detached and presented as an adjective 'third object' (apple, egg, round): a first form of 'analysis' (separating a characteristic), 'abstraction' (conceptualization of roundness) and categorization.
Two equal objects can be summarized in a third object: their 'set' (round objects).
Two sets of actions (two objects) can be coordinated into 'cooperation'

'SET' SUPPOSES A BOUNDARY

Each concept, word or category refers to a set of objects (extension) that are 'equal', resemble each other in pairs. They are then summarized in one object (the set). Concepts are usually defined with equal 'properties'. That supposes, however, first difference with the rest. More precise: more different with the rest than with the other objects in the set ('elements').

So, sets can be more fundamentally defined with that difference at their border.
You also draw them that way in Venn diagrams, although you *describe* them with common characteristics ('properties'). This, I think, solves Russell's paradox that a set can not contain itself as an element.[a] The borders coincide, so that it contains itself on the outside, but not on the inside: a matter of view direction or definition.

After the similarities you discover differences within the set (for example isotopes of the same element, subspecies of what was first known as one species): subsets. With the 'years of discernment' the awareness of differences within a set grows, which was first considered as homogeneous. You learn to make a difference.
Science generalizes by nature. It can not easily deal with increasing diversity.

Biology is the most used to it. About one and a half million species are known, but new species are still being discovered and subspecies are distinguished. To our scientific annoyance we must then recognize that, moreover, every individual differs within each species (an insight that physicians only reluctantly accept[b]).

Further classification leads to ever smaller subsets. Statistics will get less and less grip on these subsets in the face of an increasing lack of sufficient cases. To make it

a Russell(1903)The Principles of Mathematics(Cambridge)University Press p101 WWW2016 http://fair-use.org/bertrand-russell/the-principles-of-mathematics/index

b A drug or therapy would then have to be tested per individual before it was prescribed, because the average effect for a group neglects many rare, but potentially dangerous, individual effects.

completely unmanageable, it turns out that every individual ends up in a different environment, and behaves differently in that context than can be understood by generalization.
What then remains of definitions, if you only have generalizing words available?

DEFINING SUPPOSES CONSTITUTING[a]

A definition (finis is latin for 'boundary') requires that the terms with which the definition is defined ('definientia') are not already included in the description or image of what has to be defined ('definiendum'). That would result in a circular definition floating in the air. If you then want to define the definitive concepts in their turn, then there are fewer and fewer concepts that you can use for those definitions. Where does that start?

Carnap (1928)[b] has worked out rules for a definition tree with which our personal ('eigenpsychische') experiences can be translated into symbolic logic ('Konstitution'). Our experiences are distinguished for this in numerous participations with all German names that you have to remember in order to understand the following paragraphs. Then they have to be assembled into logical symbols to form a long, branched staircase with definition steps.[c]

Later, in the foreword to a second edition in 1961, Carnap admitted "daß die Zurückführung höherer Begriffe auf niedere nicht immer in der Form von expliziten Definitionen möglich ist": you cannot build a constitution with explicit definitions.

Constituting is therefore something different than defining. You do not have to formulate any *necessary* conditions for a subsequent concept, but conditions of *possibility*. Otherwise you would never be able to make new representations.[d]
Such a backward constitution is unusable for designers.

Carnap leans heavily on Russell (1902), the forerunner of logical positivism.
That implies that the foundation of our thinking consists of propositions, classes and relationships. Russell (1902) claims in §26 p23: "Diversity is defined as the negation of identity.", and in §55 p50: "... difference becomes a class concept of which there are many instances as there are pairs of different terms; ... ". Then 'equality' is also a class, or should I just deny it via that 'negation'?

Carnap (1928 §75 p105) now finds that a constitution theory should not start with a class but with a relationship: "Relationen als erster Setzungen, da zwar von Relationen leicht zu Klassen übergegangen werden kann, das Umgekehrte jedoch nur in sehr beschränktem Maße möglich ist."

a I will use this term in somewhat modified sense as a 'constitution' and reserve the spelling 'Konstitution' for what Carnap means by it.
b Carnap(1928)Der logische Aufbau der Welt(Hamburg 1961)Felix Meiner.
c This shows that you first have to make distinctions (differences) before you can put them back in generalizations (equalities).
d Carnap(1928) only assembles the existing. He states explicitly in §144 p193: "… auf keiner Stufe des Konstitutionssystems, also auch nicht durch die Verwertung der Angaben der anderen Menschen, etwas elementar Neues in das System hineinkommt, …"

There is something in it[a], but in §108 p150 he chooses 'Ähnlichkeitserinnerung' as the lowest step of his staircase. Is 'Ähnlichkeitserinnerung' a relationship if difference (according to Russell) is a class? Perhaps that 'Erinnerung' is the relation and 'Ähnlichkeit' is the class you are remembered about.

In my opinion, he identifies 'Ähnichkeit' as a relationship between objects, and then put them in a class. Classes then have an internal 'equality', but they must differ externally, otherwise you do not know which class of 'Ähnlichkeiten' you have to remember. The distinction between 'relation' and 'class' then supposes 'relationship' itself and there are 'classes of relationships'. Relationships are therefore also objects and their set is again a class.
I do not like that whole distinction between relationships and classes. It is circular.

You just have to consider the scale paradox on two sides. If there are objects between which you find similarity, you give their set a name that distinguishes it from other sets. The comparison of objects supposes that these are mutually different objects, otherwise you could point out the same object ten times and find that they are 'equal' (or even worse: that there are ten objects).

An object must occupy a place or time that is not occupied by the other object, in order to compare them. That primary difference of place or time applies to objects that we have in mind as well as those that take place outside of us, so that we can 'place' and distinguish them sensory and in thought. That is a nice starting point to avoid metaphysical discussions about the duality between body and mind.

You can also think of something more global than Carnap (1928) and more global than anyone else who considers 'definitions' as the end of the story, wondering what prior representations you need, to be able to present you something new. In other words: which constructive set of suppositions offers the conditions to be able to make a new representation, and which can I omit or split to climb a new branch of the staircase? These are crucial questions for designers.

If you now reserve the term 'constitution' for the suppositions that make next representation *possible* a instead of *true* or probable ('definition'), then that is a nice replacement for 'definition'. It immediately prevents the suggestion that a next step with definitions only yields the same with other words.[b] It can open step by step new possibilities, building on the existing (provided they are not too shaky).

For such a constitution also applies, as in the case of definitions, that the constituents ('constituents') may not occur in the description or image of what is to be constituted ('constituendum'). By 'concepts' I mean not only words, but especially images.

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a Carnap(1928)151 p202 " Ein solches Gebilde (z. B. ein Stamm, eine Familie, ein Verein, ein Staat usw.) muß als Relation konstituiert werden, nicht als Klasse, weil die Ordnung der Glieder innerhalb einer soziologischen Gruppe zum Charakter der Gruppe gehört. Die Unzulässigkeit der Konstitution als Klasse folgt schon aus der Möglichkeit des Zusammenfallens der Personenbestände zweier verschiedener Gruppen."

b A suggestion against which Carnap (1928) §151 p203 still has to defend itself with art and flying work: " … daß die Konstitution eines Gegenstandes auf Grund bestimmter anderer Gegenstände ... nicht besagt, daß der Gegenstand mit den anderen gleichartig sei, sondern im Gegenteil: wenn die Konstitution … zur Bildung neuer logischer Stufen fuhrt, so gehören die konstituierten Gegenstände einer anderen Seinsart, … ". Then he has to explain what 'Seinsart' is. I think you're working on it for a while.

In constituing, the images with which you imagine something precede the words you make up for them.

Therefore, just as much as with definitions, fewer and fewer words or images remain, with which you can constitute something, if you want to constituate the constituent concepts in their turn. The question then of course is where that ends, or in other words: where starts our imagination? I want to answer that question here. Carnap thought it started with "memory of parable". I choose 'difference' because equality is a limit.

You can not derive anything new from equal equalities[a], from different differences you can, even a concept of 'equality'.
A number is also a difference: the difference from a object '1' repeated in two directions: one counts zero, another two.
In physics it is a difference from a physical unit, for example the meter that is kept in Paris, or a difference with the swing time of a 1 meter sling on earth according to Huygens (approximately one second).

§ 15 A STUDY OF PRACTICAL CONDITIONS

STARTING POINT, PROBLEM, PURPOSE AND HYPOTHESIS ARE DESIGNS

With the previous sections I hope to have provided sufficient insight into my **starting points**. The first principle is the assumption that every representation is built on suppositions. Those conditions for imagination are based on a long series of deeper preconditions that have been taught one by one in a conditional order.

The **problem** is: some suppositions are necessary, but others can block imagination. The question is, however, which tacit assumptions are strictly necessary for design (finding possibilities) and which are not, or even counterproductive. That is difficult to determine.

The suppositions that suppose each other have a sequence. To build a house you do not have to start with the roof, but with the foundation. The aim of this research is not to find out all the usual constructions. Some are instructive because they lead to limited representations that block realizable possibilities.
The **aim** is to broaden our practical imagination by removing such blockades.

However, this should not lead to unreal fantasies, but to improbable *and* realizable possibilities. The means for this is to construct a minimal set of suppositions which must pass in every real design process. For the time being I postulate a hypothetical ABC sequence from ***Fig. 47*** op p53 with which my previous attempt[b] ended:

	Abiotic	Biotic	Cultural
	⇑	⇑	
1	A1 **difference** is supposed**;**	B1 **metabolism** ⇓ difference in combination;	C1 **information** ⇓ metabolism of reproduction

a Carnap(1928)§110 p151 believes that to solve introducing 'Teilähnlichkeit' for a next step after the first 'Ähnlichkeitserinnerung'.
That subdivision of equality supposes secretly 'difference' in the total 'Ähnlichkeit'.
b Jong(1992)Kleine methodologie voor ontwerpend onderzoek(Meppel)Boom p41, repeated here with some changes.

2	A2 **change** ⇓ difference in difference;	B2 **regulation** ⇓ change in metabolism;	C2 **security** ⇓ regulated information;
3	A3 **coherence** ⇓ difference in change;	B3 **organization** ⇓ coherence in regulation;	C3 **affection** ⇓ organized security;
4	A4 **selection** ⇓ difference in coherence;	B4 **specialization** ⇓ selection in organization;	C4 **identity** ⇓ specific affection;
5	A5 **combination** ⇓ difference in selection;	B5 **reproduction** ⇓ combination in specialization;	C5 **influence** ⇓ reproduced identity.

Fig. 52 A hypothetical constitution

The structure of this table has a practical conditionality both vertically (1-5) and horizontally (ABC). The symbol ⇓ stands for the word 'supposes' or 'becomes imaginable by'. Horizontally, however, you must use reverse symbols: A⇑B⇑C reading Abiotic (sub)positions make Biotic ones imaginable, Biotic (sub)positions Cultural ones.

Fig. 52 is not the only possible constitution. The words also do not fully cover the content that I meant (the image), but they are the best covering ones I could find.
I want to test its potential for imagination. Does it unlock the usual scientific vocabulary without blocking the possible worlds of design? This list is linear, but roots and branches in any dimension are possible: an object can require more suppositions at the same time; the staircase can split into several directions.

I consider it a fundamental task for philosophy to clarify or (re)construct such structures. That task has been lying too long since Carnap(1928) when the classic logic failed to do so. Philosophy lacks design. It still consists mainly of history. Famous philosophers with assumptions that have long been overtaken by science are still ruminated. However, there is an extensive field of more urgent philosophical research outside.

Those physical (Abiotic, Biotic) and whether or not shared Cultural or Conceptual suppositions (the ABC of **Fig. 47** on p53), are our conditions for survival. To the best of my knowledge, I will describe some examples of scientifically often tested suppositions in chapters 3 tot 9 as brief and understandable as possible according to this alphabet: ABC. It can then be determined for each component whether the above series suffices.

This must also provide insight into the boundary where design has stopped and empirical science started. After that, in chapter 10 from p259 onwards, I will constitute and, to a limited extent, complete a summarizing provisional order of suppositions.

A more difficult task is to delete assumptions that are not strictly necessary for a feasible design, or even block the view on what is possible.
I will not be able to finish that work.

4 A STUDY ON SUPPOSITIONS OF DESIGN

KNOWING IS ASSUMING

If you want to know the order of Abiotic, Biotic and Cultural conditions for our imagination in detail, you will encounter a familiar circular argument. Those conditions are already supposed in the 'knowledge' of the conditions themselves.
A kind of culture therefore precedes the ABC of **Fig. 47** on p53.

Knowing ABC is then ... cABC .... That first c of concepts used in individual understanding is, however, a condition for the second C ('the *commonly shared* suppositions'). In order to distinguish them I call this first c 'conceptual conditions' and the second more comprehensive and commonly shared conditions for imagination, 'Cultural conditions'.

In each of us, these conceptual conditions have been developed step by step from birth to ever more learned assumptions: ... $_{cABC}ABC$… . The circular reasoning is then an empirical cycle.
If I first make a presentation of the child psychological development that every adult must have experienced, then you can judge from your own experience whether that representation is plausible.

If you agree with this, then a reasonable form of objectivity is created as the basis for the next steps.
Carnap (1928) called this foundation 'eigenpsychisch' and took that as the basis for his 'Konstitutionstheorie'.

I do not do that. I will start with A as if it were physical facts that exist outside of our consciousness, regardless of how or by whom they are described. We do get pictures of it from everyone's endless series of 'eigenpsychische Elementar-erlebnisse', but that is flawed. It is not a priori 'logical', but conditionally reconstructable.
Those pieces have to be rearranged and, as a jigsaw puzzle, produce a contiguous representation in more directions.

Our 'knowledge' of the outside world develops in parallel (co-agitating) as a reconstruction or simulation of what we have observed. We assume that this knowledge enables us to survive in that outside world.
The possibility or ability to know, however, supposes a preliminary development of imagination.
This development can be reconstructed from individual child's play and from general cultural history.

Cultural history begins with prehistory with preserved images, but without verbal remains.[a]
The verbal language is a revolutionary invention, a tool that can partially express our supposed 'knowledge' in a linear, action-oriented, generalizing form and also capture it in written form.

a Diamond(1997)Guns, Germs and Steel(New York)Norton gives a nice overview of her physically determined evolution.

Within this development 'logic' is created as correction of a limited number of connections in our language (logos), but not in the world outside. In our imagination, logic is not a priori, but a language tool for sets.
The same applies to mathematics: a logically correct language to be able to handle more equalities and repetitions than with which our thinking faculty is equipped without this tool.

IMAGINATION BEGINS WITH CHILD'S PLAY

That I must start with some primitive conceptual conditions, before I systematically reconstruct the suppositions of our imagination in ABC order, has another reason.
The child psychological development can itself be presented as a conditional series of assumptions that build on each other. With this, chapter 5 offers a pre-exercise for the systematic constitution.

The reasoning of Chapter 2 is roughly as follows:

You can not imagine:

an object without different directions;
a sequence without different objects (and directions);
a size without different sequences (, objects and directions);
a distance without different sizes (sequences, objects and directions);
a place without different distances (, sizes, sequences, objects and directions);
a quality ('attribute') without different objects in different places (,distance, ...);
a quantity without an equally repeating quality (variable).

These primitive layers of growing imagination are not congenital 'a priori' categories. In the long-term practice of the child's play, they have been demonstrably taught as conceptual conditions for adult life. They each in turn require increasing abstraction: detaching an object in all directions form a context, loosening the sequence from a set of different objects, disconnecting the size from different sequences, and so on.
You could call this 'discernment' with a limit ('zero point') of 'indifference'.

Once you reached the 'years of discernment', you can imagine differences of quality and quantity.
This is a condition to survive in different physical, technical, economic, cultural and administrative conditions.

For that reason, *reading* and *writing* is strictly not even necessary. There are illiterates who have brought it far.
In order to be able to coordinate actions, social life does require a *language* in which differences of quality can be put into words (actions as verbs, other objects as nouns and all sorts of additions).

Written language then dramatically expands the number of actions that can be summarized, memorized and exchanged in one image. The mathematical language in particular makes long repetitions manageable with variables and operators. This in

turn demands the precision of the everyday language in which logic (Chapter 3 from p34) provides.
In chapter 9 p236 I come back on the meaning of the language itself and its practical limitations for imagination.

These are minimum conditions to make further abstractions and to get to know their further developed, more or less generally accepted assumptions. I will pass some of this from Chapter 6 (p105) to the extent that I have understood them myself. These are examples in which science has replaced old 'incorrect' assumptions in an empirical cycle with design moments (hypotheses, instruments).

This very limited, but sometimes detailed overview of the scientific state of affairs is also an exercise in which I anticipate the assumptions of p62 that I want to test and elaborate. After I have finalized some cultural conditions in chapter 9 p236 (of course also very roughly), I can start the actual work with sufficient background: the attempt to systematically construct the conditional sequence of suppositions that are strictly necessary for the design.

In chapter 10 p259 this is just a sketch design, an illustration of the method.
This method should shed some light on generally accepted assumptions that are not strictly necessary to make really new representations. The designer can then free her- or himself from unnecessary ballast.

SUPPOSITIONS SUPPOSE A CULTURAL EVOLUTION

Child psychology has leads for a systematic sequence of primitive suppositions. Everyone has personally experienced that order. The historical sequence in which a culture (science in particular) replaced old assumptions with new ones[a], has some parallels with it. Yet the cultural-historical evolution gives a less clear picture of successive conditions and suppositions.

How difficult it is to abandon socially shared assumptions is evident from the old assumption that the earth is flat, or the center, around which stars spin and planets wander.
This was refuted by Pythagoras, Plato, Aristotle, Eratosthenes, Copernicus, Kepler and Galileï.

The parallel with child psychology is the difficulty to accept that not everything revolves around you, a crisis that every child experiences. Piaget called that 'decentralization' (p77). There are events that escape your will.

There are still cultures and religions that attribute everything a 'will'.
In principle children also do this: a ball 'wants' to fall.

a Dijksterhuis(1950)The Mechanization of the World Picture: Pythagoras to Newton(Princeton)University Press, gives a nice overview. All sorts of incorrect suppositions have held up the progress of science for a long time, but they have also been cleared by that same science.

It takes years to get out of the modality of the desirable and to make way for the modality of an intersubjective or even objective truth and probability. Even then you can still attribute everything to a 'divine will'.

To be able to place that modality within a much more comprehensive modality of the possible, apparently also takes a lot of effort. After Leibniz' 'possible worlds' it took again centuries before the truth logic was expanded with necessity and possibility-operators ('modal logic'). Modal logic, however, still defined the potential as a truth-based statement: 'not necessarily untrue' (p42).

The *practical* possibilities with which a child without language starts experimenting from the outset, testifies to a more comprehensive modality of the possible.

Stevin preceded Galileï

A nice example of incorrect assumptions that lasted for a long time is the illusion that a heavy bullet proportional to the weight falls faster than a light bullet. That has been assumed since Aristotle. It took almost two thousand years before Giambattista Benedetti[a] finally decided in 1553 that a bullet would not fall slower if you split it in two.

Stevin proved that in 1586 also experimentally, when he dropped two bullets, one ten times as heavy as the other, from the leaning tower in Delft.[b] They were heard on the floor at the same time. He could neglect the difference in resistance through the air at that distance. In any case, the 10x heavier ball was not 10 times as fast.

Galileo Galileï was professor in Pisa a few years later (from 1589 to 1592) and did similar experiments, probably also from the leaning tower on the spot, but the heavy bullet always appeared to catch up yhe light one.[c]

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a Benedetti(1553)Resolutio omnium Euclidis problematum(Venice)

b https://adcs.home.xs4all.nl/stevin/weegconst.html Stevin(1586)De Beghinselen der weeghconst(Leyden)Plantijn. The test is described in the 'Anhang' thereof (p66): "Laet nemen (soo den hoochgheleerden H. Ian Cornets de Groot vlietichste ondersoucker der Naturens verborghentheden, ende ick ghedaen hebben) twee loyen clooten d'een thienmael grooter en swaerder als d'ander, die laet t'samen vallen van 30 voeten hooch, op een bart oft yet daer sy merckelick gheluyt tegen gheuen, ende sal blijcken, dat de lichste gheen thienmael langher op wech en blijft dan de swaerste, maer datse t'samen so ghelijck opt bart vallen, dat haer beyde gheluyden een selue clop schijnt te wesen. S'ghelijcx beuint hem daetlick oock also, met twee euegroote lichamen in thienvoudighe reden der swaerheyt, daerom Aristoteles voornomde eueredenheyt is onrecht."

c Galileï took notes of it, known as Galileï(1592)De Motu Antiquiora, but he did not publish them. (See http://echo.mpiwg-berlin.mpg.de/ECHOdocuView?url=/mpiwg/online/permanent/archimedes/galil_demot_094_en_2000). In it he refutes Aristotle on numerous points with calculations and thought experiments, among other things on the speed of fall. But he is confused by the outcome of his own fall tests. On p84 he writes (translated):"Yet experience shows the contrary: for it is true that wood at the beginning of its motion is carried more speedily than lead; but a little later the motion of lead is so accelerated that it leaves the wood behind, and, if they are released from a high tower, the lead gets ahead of it by a large distance: and I have often put this to the test." This doubt adorns him.
The manuscript is only published after his death in 1687, because the inquisition made it dangerous for the author and Galileï was apparently not satisfied with that manuscript. The only place where you could publish that kind of heretical ideas at that time was Holland. Stevin could publish in Leiden safely, all the more because he did so in the Dutch language that was unreadable for the inquisition. Galileï eventually did so during his life: Galileï(1638)Discorsi e Dimostrazioni Matematiche Intorno a Due Nuove Scienze(Leida)Elzevir, but for safety's sake in the form of a dialogue, so that the heretical ideas seemed to come from a different mouth. In that, the fall tests are also discussed.Van Helden(1995)On motion(WWW)http://galileo.rice.edu/sci/theories/on_motion.html gives an explanation for Galileï's failed drop tests, but I do not like it. In my opinion, a wooden ball is overtaken by an equally large lead bullet, because the counterforce of the air resistance (increasing with speed) equals the weight of the wooden ball (its downward force) much more than the weight of the lead bullet. In the case of the wooden ball, the smaller mass basically means that after 160 m, (or even earlier if you count the acceleration acceleration in the partial velocities to calculate the partial air resistances) and with the lead ball only after 2.6 km. Until these points their acceleration decreases steadily to zero, after that the speed is constant. The wooden ball of Galileï lost within a 100m of a tower so much of its acceleration already visible earlier.
Stevin had less trouble with two lead bullets. The small bullet from Stevin (with half of the wind-catching cross-section it is 10 times as light as the big one) would only reach that point after 1.2km. With a tower of 100m you can hardly notice that difference in starting acceleration reduction.
In any case, both have proven that a 10 times heavier ball does not fall 10 times faster.

This was no impediment for historians of science worldwide to attribute Stevin's successful test and his conclusion to Galileo's failure.

The same is true for the Dutch invention of the telescope. Galileï bought such a telescope from Middelburg and made a few improvements, so that the invention could be attributed to him.
These are again two examples of widely quoted, incongruous, incorrect assumptions that persist for a long time, but this time to this day.

Useless conventions of printing, writing and publishing hamper reading
Another example of useless suppositions is the conventional way of publishing. I can be mistaken, but there are some absurd habits in scientific publications that make me doubt the minds of the authors or publishers.
They are based on illusory scientific assumptions that create annoying barriers to reading and understanding.

For example, there is a custom to divide a list of keywords into categories, such as 'Persons', 'Subjects' (even subdivided in 'Latin names' and 'English names'), 'Bibliography, 'Used symbols', 'List of figures'.
This results in unnecessary searching and browsing. It ignores the *alphabetical* function of an index.

Categorization is the task of the *chapter* names, summarized in the table of contents. The titles of the chapters should make clear at a glance what they are about. Instead, the author often invents poetically concealing titles that force you to read everything to come to the conclusion that it is known matter. Poetry offers a different perspective on the text, but it belongs to the end of a chapter or paragraph, otherwise you do not know what needs to be put into perspective.

The table of contents should be short and at the beginning of the publication or even on the cover to know what you are buying. A further division of the table of contents as a first *summary* per chapter saves unnecessary introduction and extension. If the titles are not a summary or conclusion, then it is belletry or concealment of ignorance. Start with a conclusion. I prefer to see firm assertions as a title, so that you become curious about how that can be defended.

Concealment in technical terms that can equally well be written in colloquial is pure fattening which I mistrust.
The author thinks it is interesting, but the reader drops out and has to go on the internet. If you want to prove learning, or give access to literature, put those terms in parentheses behind the normal description. New words ('neologisms') or new spellings are crimes against retrieval when proper words already exist.

I am tired defoliating in endnotes and literature (sometimes even categorized). I want footnotes, not numbered troughout the book, but again per page. Butter at the fish, otherwise I have to go to the kitchen every time to get the salt, one time to the literature (where is it?), the other time to pages full of endnotes that are also numbered

per chapter (in which chapter did I read?). That is how I already forgot what I was looking for.

Notes are useful, they create branches without interrupting the line of argument. Put them to the word they belong to and not according to that stupid convention at the end of a sentence. Do that with letters, because numbers are exponents. Einstein^2 leads away. One author (ten is pointless) with title makes a reference to literature already searchable with the c.s. but Einstein (1905) is a person different from Einstein (1916). I think that date should be at the forefront next to the author and not in the back.

The subdivision into chapters, subheads and paragraphs also allows branching, so that you can refer back to lines to which you want to reconnect. Please refer not only to a chapter number or figure number, but also to the page.
These page numbers must be large and appear on the outside of the page.
If you have to browse anyway, you do not have to search for that number on every page.

Branches are indispensable, but I dream of a language that allows itself a glance on all side streets, such as images.
Images can replace a lot of text. Learn to draw, how much time that costs. It saves the reader time and attracts attention. Some authors make me lose track of sentences and paragraphs that contain more than four lines. Give space, spaces, but no empty pages, no graphic decoration or lay-out that makes no sense.