10. SOME CONDITIONS OF IMAGINATION

Our imagination is enriched and limited by the representations previously formed by others and transferred to us in the prevailing culture and language. This transfer is sometimes unconscious and compelling, sometimes handed down to good, wrong or free interpretation. Obedient to conventions, you can become rich and content, but a designer has to explore the space beyond the probable to the limits of what is possible.

'Avoid clichés, collect images, put them in a different context and adjust them' is the shortest and most concrete recommendation I know for designers.[a] Existing categories, generalizations, clichés may block imagination. Words are basically clichés, but they can evoke new images in an unusual context ('poetry'[b]).
That is no more than combinatorics, but it is a first step to make a difference in their meaning.

Images differ more than words, but advertising images prove that images may be not more than variants of clichés ('the happy family', 'the highest quality for the lowest price', 'ultimate enjoyment').
They leave little room to make a difference in meaning. The possible is limited to a compelling desirability with the appearance of probability. The imagination is narrowed down to futile detailed alternatives.

Designing is making a difference. What you can not speak about, you should *not* be silent about. If language fails, you have to draw. What you can compare with nothing you have to imagine. Do not immediately reject unlikely representations. A design is no more of the same. Do not reject representations too quickly as unrealizable.
What seems impossible, may be realizable under certain conditions.

Design those conditions. Replace restrictive conditions in order not to lose sight of the possibility.
Choose '*productive* conditions' on which you can build. Choose only '*restrictive* conditions' to stay within the possible. You have to stay real, choose direction in all these possibilities and put restrictions again.

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a Hertzberger(1999)De ruimte van de architect: lessen in architectuur 2(Rotterdam)010 Publishers; Hertzberger(1999)Space and the architect: lessons in architecture 2(Rotterdam)010 Publishers; Hertzberger(2002)Creating space of thought, opgenomen in: http://www.taekemdejong.nl/Publications/2002/Jong(2002)WaysToStudy(Delft).pdf als hoofdstuk 42, p 389: http://www.taekemdejong.nl/Publications/2002/42%20CREATING%20SPACE%20OF%20THOUGHT%20from%20Jong(2002)WaysToStudy(Delft).pdf

b Jong(2012)Diversifying environments through design(Delft)TUD thesis p282

10 SOME CONDITIONS OF IMAGINATION

In a manner of speaking, you have developed the explosives to increase the space of imagination, but possibilities far-away require to concentrate in one direction like a cannon closing other directions for expansion.
Perhaps you should alternate expansion and compression breathing the possibilities in and out.
The amplitude and frequency of that alternation are different for each designer

In the previous chapters, I critically explored some conceptual, Abiotic, Biotic and Cultural territories of science.
They seem to restrict our imagination to actual reality, but they also show vistas still beyond any human concept.
In this chapter I try to distract the minimal conditions of imagination, sufficiently serving understanding and design.
That supposes that we can know and describe those conditions. I doubt, but let me try.

§ 46 CONCEPTUAL CONDITIONS

OBJECT

Some conceptual ('eigenpsychische' p60) conditions precede any understanding and design: to perceive and distinguish an object, to imagine, represent and handle it as an 'internal object', to hold that representation ('memory'), and to adapt it to new observations ('learning ability').
'Designing' supposes in addition that you can make objects that you have not seen before, that you can imagine, develop and implement such objects in a given context.

A *definition* of the word 'ob-ject' is difficult to give without becoming complex and circular. For example 'an object is upon which a subject can focus its attention, able to perceive, represent, display, describe, design or make it'.
After all, every noun or verb in such a definition (subject, focus, attention and so on) is itself an object.
A *constitution*, an enumeration of *conditions* with which an object is only *possible* or *imaginable*, is easier.

The constitution ('supposes' instead of 'is') could be: 'an object *supposes* difference in all directions' (***Fig. 5*** p13).[a] The magic word 'difference' avoids the complex psychology of an attentive subject as an observer for the time being.
However, some suppositions remain: 'in all directions' and tacidly 'from one point'.

Subject, direction, movement, object suppose 'difference'

A subject as an observer (or inhuman 'sensor') and as an actor supposes a (frontal) gaze or action direction.
In the plane perpendicular to that direction (lateral), it can observe *differences* in all other directions (§ 17 p75).

a 'Context' then assumes 'difference of an object', ie 'non-object'. The negation 'not' is therefore immediately available as a third object (p15).

Even without observation, you must also suppose directions in order to *imagine* something.

Are *directions* then supposed in (a practical condition for) any observation of difference? Is 'direction' a subjective 'a priori' *preceding* any difference? Should 'direction' then be the very beginning of a conditional sequence, a constitution?
I do not *see* any directions in the outside world, but only differences. From this I 'choose' a point object ('point of interest') and a 'direction' to steer my movements (or reasoning).

In analytical geometry, 'direction' *is* a difference with respect to another direction ('angle'), for example with respect to the directions of a random coordinate system (p113). Direction then supposes a difference (of direction).
The plural form of two directions already supposes difference. However, the expression 'the direction of difference' would show the possibility that 'difference' can only be observed in a predetermined direction.

Direction and difference seem to be closely linked. That is made imaginable in ***Fig. 5*** p13 at the border of an 'object'. 'Perpendicular' on that border you see most difference. In ***Fig. 5***, however, you have to take a central viewpoint first and then choose a direction before you can establish difference or equality from that first viewpoint in a 'context' of 'all directions'.

This 'viewpoint assumption' has also remained unspoken in my constitution of 'object'. The starting point for 'in all directions' is a point somewhere *within* the object. Only from there the boundary of the object is recognized as 'difference in all directions'. But that object just had to be constituted, before it could be referred to in its constitution. A newborn child repeatedly chooses its viewpoint by chance, until it discovers an surrounding object different in all directions.

An infinitely small, directionless object (the 'point' in ***Fig. 57*** p107) differs from its context itself in 'all directions'.
This proves that 'difference' can be presented without any idea of direction beforehand.
So difference is conceivable 'without direction' or, if that amounts to the same thing, 'in any direction'.
Perhaps linear language puts us on the wrong leg.

Different expressions in our language tacitly conceal a supposed conditionality between difference and direction:

Expression	**Hidden suppositions**
1 'the difference in this direction';	difference supposes a direction;
2 'the direction of this difference';	direction supposes difference;
3 'difference of direction';	direction supposes difference;
4 'different from direction';	direction supposes difference;
5 'A differs from B';	direction does not seem to play a role.

Fig. 258 Hidden suppositions of difference and direction in linear language[a]

With expression 1 you point to a direction to make someone aware of a difference.
With expression 2 you point to a difference, to make someone aware of a direction.
With expression 3 you specify a certain kind of difference.
With expression 4 you observe different directions, for example between two straight lines.

With expression 5 you only distinguish A and B. Direction seems to play no other role than as a result of the distinction.
The difference between A and B is a prerequisite to be able to represent a direction at all.
If A and B are points, then they can only differ from place. That is a minimal condition for determining a 'direction'. After all, without a second point, no direction can be imagined (the 'second point' in ***Fig. 57*** p107).

I have neverteless not yet managed to construct the concept of 'direction' simply from 'difference'.
For this you probably have to construct the 'point' and its plural (second, different point) first (***Fig. 57*** p107).
Then you still have to find a way to release the concept of 'direction' from it. The use of language already supposes an addressed. I may therefore suppose that a second point is already supposed in every linguistic representation.

This would also mean that in any communication conceptual conditions are subjective (not possible without a subjectively presumed 'direction') even if they are shared by everyone to a large extent. *How* they are consecutively constructed from impressions can be different for each subject. So you can only assume that they *can* be constituted

a The prepositions 'of', 'with', 'from' also have various suppositions that must be apparent from the context (difference of, different from). The common logic clarifies the use of conjunctions. There should also be a 'logic' of prepositions that can, among other things, solve the ambiguity of the word 'of'. This seems a nice task for real linguists. I will only deal with a few distinctive symbols.

in a sequence (and not vice versa), but you cannot suppose that it happens this way with everyone else.

I suppose, that the conditional sequence remains reconstructable (constitutable), even without assuming a successive build up in human subjects. 'Direction' then lies in any subject as a notion that in every description or assertion with a 'viewpoint' you can transfer 'invariant' (p112) to another subject.

In Chapter 5, a primary human integral experience of 'movement-difference-direction' (not yet distinguished in these components) made it possible to construct consecutively object, sequence, size, distance, place and quality.
It is assumed that these objects develop succesively as co-action through movement.
If 'movement' were the common physical foundation, the conceptual conditions would have a simple abiotic basis.

However, 'movement' can only be presented as 'difference of movement', apart from the direct experience (0 p164). The whole series then must be reconstructed as a difference: 'difference of direction', 'difference of object', 'difference of sequence', 'difference of magnitude', 'difference of distance', 'difference of place' or 'difference of quality' in order to present these objects in plural and in a fourth dimension (a seventh direction) as 'change' (a special kind of difference).

The 'multitude' of the plural form forces people to divide subjective 'attention' (orientation) between different objects.
I assume that their representation can not cover all cases at the same time.[a]
I also assume that the subject constructs a representation summarizing objects in one concept and then handle that concept as one object between other objects again in a summarizing representation.

Even without that construction, attention again only requires 'difference'. Difference in direction also makes difference in attention possible. Attention always 'concentrates' into a 'viewpoint' without losing sight of 'the rest' ('case').

CONDITIONAL ROUTES

'Supposes' or 'becomes imaginable with a prior representation of' I give the symbol ⇓.
'Supposed by' or 'makes a representation possible of' I give the symbol ⇑.
'Different *from* A' I abbreviate as ΔA (not immediately supposing quantity).
'Difference *between* A and B' I note as AΔB.

Chapter 5 reads as 'conditional *synthesis*': Δdirection ⇑ Δobject ⇑ Δ sequence ⇑ Δ size ⇑ Δdistance ⇑ Δplace ⇑ Δquality.
However, this constitution of conceptual conditions is far from complete. There are

a You also always observe 'case by case', 'from case to case', before you define an object that attracts your attention. If a 'case' supposes an object *with* its context, then you belong to that context yourself, but you also place yourself as an observer outside the case that you perceive. That paradox is solved by the fact that your perception is perpendicular to the flat scene that you perceive. The term 'context' must then be distinguished in the 2D context you perceive, and a 3D context that you construct in order to be able to involve yourself as an observer.

missing intermediate steps, there are ramifications and crossings. More conditions are always required at the same time to make a representation possible.

It is also beyond my limited imagination to complete the constitutions. I just want to make a start and clarify some lines with crucial suppositions (not all). In the first three steps, for example, practical conditions that have been mentioned above are missing. This is striking when you reason back in reverse sequence ('conditional *analysis*'):
Δ sequence ⇓ Δ object ⇓ Δ in all directions ⇓ Δ direction ⇓ Δ point ⇓ difference.

'Conditional synthesis', however, raises the question relevant to design 'how to proceed now?' or: 'which representations are even more possible on this basis?'. For example: difference ⇑ Δpoint ⇑ Δdirection ⇑ Δin all directions ⇑ Δobject ⇑ ...?
Suppose an 'object' is constituted this way, what makes 'difference of object' even more possible than a representation of sequence? According to note a on p266: Δobject ⇑ context. Besides the object, there is still a 'rest' in the picture.

You can continue with Δobject ⇑ Δcontext ⇑ Δborder ⇑ Δdenial ⇑ Δconfirmation ⇑ Δobservation.
The 'difference *between* object and context' is what we usually call 'border'.
Deviating from that boundary inwards into the object means temporary denial of the context (confirming the object) and outwards denial of the object (confirming the context).[a]

Balancing at the boundary itself is questioning. A 'ground-breaking' designer knows what I am talking about.[b]

After the concept of 'object' became available, I could name 'the rest' as 'context', but to make the step to the 'border' in between I had to use the preposition 'between' and the conjunction 'and'. In logic, 'and' is an overlap and that is not the case here. 'A difference between' is not 'different from': AΔB is not ΔB (note a p268).
So object ⇑ Δobject ⇑ context ⇑ Δcontext ⇑ Δ+object&context.

For two objects that touch each other without overlap, I use the & symbol. 'Case' is shown as +object&context and 'difference of case' as Δ+object&context. 'Border' is then displayed as -object&context and 'difference of boundary' as Δ-object & context.

Now I can still imagine an important split after 'object' and 'context': the summary of both as 'case'.
Difference of case (per place or moment) makes it possible for you to imagine 'more' cases.

a Confirmation supposes denial, not vice versa. After all, denying your denial is a confirmation, but not the reverse.
At the 'inside' of the border you can 'question' the object ('What is that?'), at the outside you can question the context.
By doing so, you change the level of scale through detailing or expanding your view.
For an observer it concerns impressions, for a designer expressions (constructions). In both cases confirmation ⇓ repeating.

b Designing requires some denial of actual truth. It starts with an empty object in a given context. Filling that interior then changes (denies) the exterior.

What differs from more cases is not 'as much', but less, because 'as much' already means 'more' (cases).
In brief: Δobject ⇑ Δcontext ⇑ Δ+object&context ⇑ Δmore ⇑ less. This may fill the gaps in ***Fig. 57*** p107.

Fig. 259 is a summary of conceptual conditions explained above: *difference* makes attention possible (focus), *difference of attention* makes concentration on a viewpoint possible, *difference in viewpoint* makes it possible to distinguish between directions and so on. Forming a concept ('object') is not sufficient to construct a next step.
To do this you first have to make a **difference** (Δobject) within that concept.

Δobject can make several new objects imaginable that can already have their own name and continue their own way to new imaginable possibilities. In that case (Δobject ⇑ object&object&object ...) there is a branch upwards.
A branch downwards or root (object ⇓ Δobject&Δobject&Δobject…) would mean that there are different suppositions (⇓) that make the same object conceivable. These are not included in ***Fig. 259***. I chose one only to prove the possibility.

<table>
<tr><td></td><td>?</td><td></td></tr>
<tr><td>?</td><td>observation ⇑</td><td>?</td></tr>
<tr><td>quality ⇑</td><td>Δ confirmation ⇑</td><td>less ⇑</td></tr>
<tr><td>Δplace ⇑</td><td>Δ denial ⇑</td><td>Δmore ⇑</td></tr>
<tr><td>Δdistance ⇑</td><td>Δ border ⇑</td><td>Δ case ⇑</td></tr>
<tr><td>Δ size ⇑</td><td>Border = -object&context ⇑</td><td>Case = +object&context ⇑</td></tr>
<tr><td>Δ sequence ⇑</td><td colspan="2">Δcontext ⇑</td></tr>
<tr><td colspan="3">Δobject ⇑</td></tr>
<tr><td colspan="3">Δ in all directions ⇑</td></tr>
<tr><td colspan="3">Δ direction ⇑</td></tr>
<tr><td colspan="3">Δpoint ⇑</td></tr>
<tr><td colspan="3">Δ attention ⇑</td></tr>
<tr><td colspan="3">difference ⇑</td></tr>
</table>

Fig. 259 A staircase or tree of conceptual conditions with splits of a conceivable subject

Imagination in design
Designing as 'making difference' is creating a new step up (?) in ***Fig. 259***. If the building plan for that new step has been formed by others and transferred to us in the prevailing culture and language, then we call this design process 'learning'. Within the subject, however, learning requires its own creative co-action (make a distinction, not a copy).
'Attention' must be divided ('looking around') about attention points to make an understanding of 'direction' possible (⇑).

This designing and learning process is cyclical. The staircase is repeatedly incurred per 'case'. A conditionally passed concept is then available on every next or previous step. As a result, the concepts or images undergo continually small changes ('nuances') that do not come back in well-defined generalizing words that are once linked to them as labels.

What is constituted this way is not a 'semantic network' that associates or defines concepts, but a network that makes new concepts *possible*, using concepts that have ever passed before in each branch.
This is most similar to a (learning and designing), growing neural network (§ 27 p144).
In ***Fig. 259*** horizontal and downward connections are laid as axons that grow between the neurons.

In a 'case' the entire context (the 'universe') cannot be included. The concept of 'border' can be retrieved from another (at least once run through) branch and applied to form a 'frame' in a side branch as a border of a 'case' with **more** (other, different) cases. At that moment the frame becomes '**the most**'.
When you involve 'size', then the object is '**less**' (small). In this sequence, the 'grain' is a vanishing point ('**the least**').

In ***Fig. 259*** 'attention' ('focus', a physical effort) and 'direction' are the basis on which an observing subject develops its perceptions and design abilities. However, the basic and following conditional routes proposed here are arbitrary.
Other bases are possible and the routes for building these abilities will vary with each subject. Every subject is different and difficult to generalize. These are not facts, but possibilities.

Fig. 259 thus only illustrates the role of practical conditionality in our imagination. Reality is definitely more varied and complex. This could be improved and supplemented by further research.
For example, in ***Fig. 259*** lack in between concepts such as 'difference between', 'difference of', 'difference of a', and 'in all' that must be constituted. Here, for the time being, these constitutions have been bypassed with symbols.

In the practice of designing and executing the conditionality is recognizable as a step-by-step plan with an irreversible sequence of steps.[a] The 'ingenious inspiration' must also consist of such steps: making connections fast and setting up steps towards an innovative design concept. If these steps could be followed and described in slow motion, some understanding of them could make the design practice more innovative.

The subject-bound, 'subjective' conceptual conditions for conceivability and design will still require a lot of discussion and study, given the variety of possibilities to come to a design. The object-bound (Abiotic, Biotic and Cultural) conditions for

a Eekhout(2015)Componentontwerpen en productontwikkeling(Amsterdam)IOS Press

conceivability can probably result in a more 'objective' and linear set of conditions, although the multitude of multiform subjects is included as a physical condition.

OBJECTIVATING IN THE LANGUAGE OF A SUBJECT

In the following sections I limit myself to the possibility conditions of a world full of differences that can exist without knowing and designing subjects. Those conditions are, however, necessarily described from the view of such a subject and in its linear language. The sentences of that language then contain (unlike images) an active operating subject x as actor, a verb (operator, symbol ○) and a passively processed object y. You can display that as x○y or y(x).

The actor may be 'objectified' to a operating object (another person, an inanimate matter or abstraction), but the conditions under which his action is possible are subordinate clauses, references. These usually remain unspoken (ceteris paribus) assumptions. The verb 'to be' can further generalize words ('a human *is* an animal'), specify ('she is biologist') or define (x=y). The result remains a generalization with a *truth value*.

For the constitution the operator between x and y becomes a potentialis[a] with *possibility* value:
'x makes (a representation of) y possible' (x⇑y) or 'y becomes possible through (a prior representation of) x' (y⇓x).
By omitting 'a prior representation of' (in brackets), a representation becomes equivalent to an external object, without having to presume an observer every time.

What exactly happens in the head is thus reduced to representations with objects that can obey the same conditionality as objects in the outside world (house ⇓ foundation ⇑ floor ⇑ walls ⇑ roof).
Internal objects may correspond to external objects, but lying is possible.
In the case of design, they do not yet must have an equivalent in the outside world. They *can* ever be 'realized'.

The execution of a design is literally the ex-port and materialisation of an internal object.
The required actions can have the same order as the conditions for the representation (foundation ⇑ floor ⇑ walls ⇑ roof ⇑ house). However, conditions often remain unspoken because they are automatically forgotten or because there are no words for them. It is first and foremost images, objects that can also represent actions.

The constitution of the following paragraphs is a translation of images. This leads to embarrassment solutions in the choice of generalizing words. They rarely cover the image that belongs in the constitution and I hope that the intended image will still

a Potentialis is actually a subjuctive mood, https://en.wikipedia.org/wiki/Subjunctive_mood : 'a verb-mode that is common in, among others, the Indo-European languages. A grammatical form of comparable meaning is also known in the Semitic and Finnish-Ugric languages.' If the potentialis only exists in a few languages, then that could be an explanation for an innovative advantage of the speakers with these languages as their mother tongue. After all, they are used to thinking in terms of just that language.

evoke the right image in the context of their sequence. Images are also multi-dimensional. They do not always comply with the linear truth logic with its prohibition of linear contradictions (***Fig. 5*** p13 and § 10 p34).

Because conceptual conditions are subjectively construed in different ways, they can not be derived unambiguously. These are 'subjective conditions', the result of which, however, can be broadly shared in words.
Because I have to transmit thoughts in the language of a subject, I will use such trivial[a] words and not check their suppositions. After all, that would amount to the constitution of our entire vocabulary.

Because they are widely shared, I only constitute the most substantial. If I have not constituted substantial subjective suppositions, constituted or not constituted immediately, then they are referred to as words with an asterix (*) when they are used for the first time. Where they are constituted, they are once **bold**.

An asterix (*) means 'not or not immediately constituted'. **Fat** means 'here constituted' and **fat*** 'not further constituted'.

Abiotic, Biotic and Cultural conditions therefore claim to be to be 'objective' without assuming a subject.
However, in order to *describe* them I still need the language that subjects share with each other.
I assume that you understand the *concepts* of **Fig. 259** p271 and the terms 'frame', 'grain', 'most', 'least' of p272 and 'perpendicular' of **Fig. 57** p107, having constituted the 'trivial' words in one way or another and share them with me.

So I assume that with the objects {**attention, distance, confirmation, context, case, boundary, size, in all directions, frame, grain, quality, more, most, less, least, perpendicular, object, denial, place , point, direction, sequence, observation**} we mean the same as 'conceptual conditions'.
The **plural form** and **repetition** supposes Δobject, a branch that you could add to ***Fig. 259***.

THE Δ BEFORE EACH CONCEPT MAKES NEW REPRESENTATIONS, CONCEPTS AND IMAGES POSSIBLE.
A remarkable effect of constitution is that you can skip steps and still see the conditionality of the beginning and end result, for example difference ⇑ observation[b].
No one will deny this, although in ***Fig. 259*** different kinds of intermediate steps were necessary to arrive at 'observation'. They may act as 'unspoken suppositions'.
Fig. 46 p51 and ***Fig. 52*** p63 are also such a '*contraction*' of series of consecutive suppositions.

a With 'trivial' words such as 'one', 'the' and the concepts I have circumvented with symbols, I therefore rely on a common interpretation, regardless of the way in which they are constituted per subject.
b Observation supposes (⇓) difference. If everything would be white, then nothing could be observed.

Constitution aims to clarify these unspoken suppositions, to insert steps that can lead to new representations and lateral branches if you add a Δ. So I will see the contraction of ***Fig. 52*** p63 as a hypothesis to test and complete or expand it, with forgotten steps and explore some side branches ('*expansion*'). This then concerns the representations that have made possible the language of science (chapter 6-9) and design (***Fig. 46*** p51).

This exercise can never be complete, because it aims to make new representations possible and to avoid the blocking. The elaboration is limited. It is no more than an illustration and a test of the method.
The emphasis is on the Abiotic conditions, because those are the bottom steps, which work through in the Biotic and Cultural sequel. The B and C variety is also so large that different routes are possible.

§ 47 ABIOTIC CONDITIONS

In § 33 'Physic' (p190) an advance has been made on this exercise in response to some examples from physics. Newtons mass m, distance s and time t and their relativation must in any case be constituted, as well as the concepts volume V, pressure P and temperature T, which relate to the scale level of large numbers of particles and the uncertainty of place and time on the smallest imaginable scale.

Physics supposes a linear truth logic without contradictions (chapter 3 p34) and a mathematics of exact equality and repetition (chapter 6 p105). Mathematical reasoning started with the long experience of hunting and collecting.
Collecting supposes to *select* and *unite* a set.
Hunting not only involves the manual dissecting (*sorting*) of the prey, but also the *distribution* of the booty.

Agriculture taught to *divide* the country, divide the time into equal seasons, months, days, to *count* and discretely *distribute* them. Trade learned to count goods (to name equal *parts*), to detach this number from the quality, the value, to multiply (*unite*), *divide* and exchange (*equate*) numbers. The sharing and unification began analogously, but became discrete as soon as exact equality and repetition had to be supposed.

Design does not seek linguistic truth, but images of realizable possibilities (***Fig. 46*** p51).
Not equality, but 'difference' then comes first and 'perpendicular contradictions' are allowed.
I assume that most can be fitted in ***Fig. 52*** p63 column A: difference ⇑ change ⇑ relation ⇑ selection ⇑ combination.

DIFFERENCE ⇑ CHANGE[a]

The first Abiotic condition is **difference**, the only condition that does not have any preceding conditions itself.
Difference is supposed in any other condition (each Δ in ***Fig. 259*** p271). Even equality* supposes difference.

A 'difference' can always differ more* (eg if only by distance, more 'difference of place'), but not always less.
If you can not observe or imagine less, then you approach a limit (an imaginary 'zero value') of difference: **equality**. Equality, however, is not perceptible without any difference of place, because equality supposes different objects.[b] Everything differs.
Equality ⇓ difference. Difference ⇑ equality

Equality is then a special **value of difference** ('almost zero', the least difference, the grain of perception or representation) and not its opposite or denial. You therefore can not define 'difference' as 'inequality'.[c]
A 'value' of difference supposes 'different differences' (Δdifference). From the grain of difference 'more' difference makes a subsequent 'value' of difference imaginable.[d]
Δdifference ⇑ Δdifference&equality ⇑ value of difference.

'Equal equalities' do not make a new difference or idea imaginable, but 'different differences' do.
From equality onwards, different 'values' of 'more difference' are conceivable (**variation**). Δvalue ⇑ variation.
Δvariation then ⇑ different variations in different directions (different differences): variation in space* and in time*.

Change supposes a special *difference* in the direction of time*.[e] Any change can change more, but not always less.
If you can no longer observe or imagine less, then you *approach* the limit of change: staying equal (**duration**). Everything changes, supposing a *difference* of 'moment'*.
That makes duration imaginable: change ⇑ duration.

Duration thus is a **value of change** (the least imaginable change, 'zero change') and also not its opposite or denial.
A 'value of change' supposes 'different changes' (Δchange). From the grain of change

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a The first steps of this constitution I owe to Leeuwen(1966)A Relation Theoretical Approach to Pattern and Process in Vegetation(Wentia)15 25-46 and Leeuwen(1971)Ekologie(Delft)THD3404, http://www.taekemdejong.nl/Publications/Leeuwen/Leeuwen(1971)Ekologie(Delft)THD%203404.pdf p15.
b 'Equality' is therefore not the exact equality assumed at the limit, but 'almost' exactly the same. 'Exact' equality does not exist in the observable, 'operating', 'actual', reality, although it is supposed (*ex* act) in mathematics. This way you can easily replace Carnaps' similarity with 'equality'.
c Russell(1903)The Principles of Mathematics(London1996)Norton does so in §167 p179: 'difference' in the sense of dissimilarity, and in §23 p26: "Diversity is defined as the negation of identity".
However, if a variable takes the value 0, then it is not yet the denial, the opposite or the negative value of that variable.
d ***Fig. 5*** p7 (perpendicular paradox) gives an alternative, pictorial constitution of the 'value' of difference. In the direction of the difference the 'most difference' is conceivable and perpendicular to it the 'least' (equality). There are 'values' between the two. Here, however, the distance over which the difference extends at vague limits also plays a role. The greater the distance, the less difference becomes visible, until 'no difference' (equality) can be found between the grains.
e Ashby(1957)An Introduction to Cybernetics(London)Chapman p9

'more change' makes sequential values of change imaginable. Δchange ⇑ change&duration ⇑ value of change.

'**Dimension**' usually supposes two opposite* directions, but in reality the time dimension has one direction ('**future**').
A difference in that 'seventh direction' is therefore irreversible, but its opposite direction remains imaginable ('**past**').
That makes a **moment** imaginable as a limit between past and future ('**now**') or an imagined past or future 'now".
Spatial and temporal variation make room for other 'qualitative' dimensions imagined as variables*.

Imagining opposite directions ('dimensions') is physically taught as front-back, left-right, bottom-up, past and future as 'natural directions' of a body. They are subjectively constitutable, for example as it is done in ***Fig. 259*** p271.
The boundary between each pair of opposite directions ('here' or 'now') is represented as ' **I** ': the point where all subjective directions cross as coordinate axes, and from which all directions can be distinguished.

The ability to make different representations in different directions develops through movement* of a subject or sensor. This movement makes possible to change attention (focus) and to go through the different branches in ***Fig. 259*** p271. Then movement can be constituted: Δplace ⇑ **movement**. 'Moment' is then a 'place' in the fourth dimension.

The change of place creates the ability to 'decentralize' (p77) to 'you', 'he' or 'it' with their own point of view and natural directions. In children, 'playing tag' results in a significant "You are it". By tagging you prove the equality of place and therefore an identity change: 'I was it, now you are it'. 'I' exchanges the role of approaching (⇓ less distance) in removing (⇓ more distance) and 'you' in reverse.

The distinction between place and moment (here and now, there and later, there and then) supposes the ability to separate Δplace and Δmoment from any object summarized in one representation.
This separation is conceivable due to the acquired ability to make different representations in different directions.
The connection or summary can be imagined by 'measuring*' the value of both (irrespective of the direction).

'**Measuring**' supposes three objects[a]: the object you want to measure (for example Δplace ⇑ **distance**), an object with which you measure (for example a ruler) and an action (comparing*).
A ruler ⇓ at least[b] a sequence of similar objects (units), in one and the same direction

a So this is a branching down (⇓⇓⇓).
b There are more conditions (branch down) such as: 'only different from place', and 'contiguous' (**Fig. 57** p55).

('right', 'straight' ***Fig. 57*** p107).
A clock ⇓ at least a sequence of equal actions (eg the stroke of a pendulum).

A sequence of similar objects (units) also makes a **variable** such as distance or duration imaginable.[a]
If the unit is equal to the grain, then a variable covers all values of each corresponding variation of Δobject (for example, all locations and moments per grain that a moving physical object passes).
Each value has its own name with a readable sequence of magnitude: a **number** ⇓ sequence&Δsize&Δname*.

'**Comparing**' supposes Δaction&Δvariable&Δobject such as measuring distance and duration of a displaced object.
After the reduction into two 'measures', a third object in the representation can establish a coherence* between distance and duration. For example, 'speed' v=s/t is a coherence of distance traveled s with duration t.
If you would take actual movement as a starting point, then the usual constitution v ⇓ s&t might change into t ⇓ s&v.

Due to the ability to make different representations in different directions, more variables are conceivable than only those of distance s and duration t, for example size*, mass*, pressure* or temperature*.
You can speak of 'equality in difference' if different objects are the same from a certain 'viewpoint' or in a certain 'respect'*. Bullets of lead or wood can be equal in size, but not in mass.[b]

DIFFERENCE IN CHANGE ⇑ COHERENCE
It seems obvious to associate '**coherence**' primarily with 'connection*', but connection in one direction supposes separation* in the other directions ('tube'). Moreover, it is a special value of *separation* (approaching its zero-value), because you can always further separate objects from each other, but not always less. So connection ⇓ Δseparation.

'Coherence' sets limits to the possibilities of change through **structure** ⇓ separations&connections ⇓ Δseparation.[c]
Fixed* objects in a structure limit the movement of movable*[d] objects (***Fig. 260***). So, coherence ⇓ difference in change.

a So this is a branching upwards (⇑⇑).
b The objectifying word 'property' for mass or size, for example, suggests that a value of a variable is 'own' to the object.
I prefer to choose the subjectifying word 'mark' as 'operating on a subject'.
c Examples. In a cylinder motor, the cylinder limits the expansion of the expanding gas into one direction (***Fig. 175*** p90). The 'degrees of freedom' of individual molecules (the freedom of movement in every direction and rotation) are limited by the fixed cup shape (***Fig. 49*** p13). In a laser (p96) the random movements of photons are limited into one direction.
d 'Movable' is supposed in the aggregation states of liquid and gas, waves and individual particles with all 'degrees of freedom'.

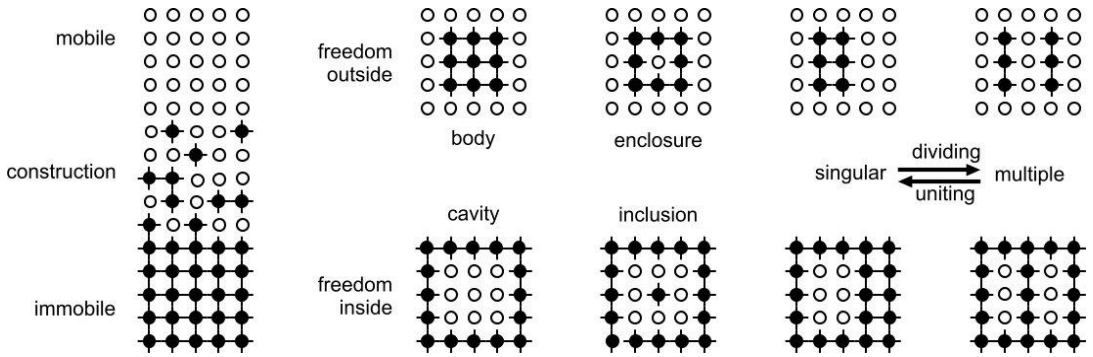

Fig. 260 Examples of structure, sets of separations and connections

The upper row in ***Fig. 260*** ('external* freedom*') has an improbable* (biotic) counter-variant ('internal* freedom')[a] in the lower row. Living cells suppose fixed enclosure or containment of more variable and movable objects.

At the limit (the 'zero value' of separation) the objects are one and the same object. There is no separation, therefore no connection* either. Both suppose distance.
Distance ⇑ separation* ⇑ connection*.
A greater distance makes connection less probable*. A solid body (***Fig. 260***) ⇓ dispersion (***Fig. 261***) of connections*.
Accumulation ⇓ least distance. **Dispersion** ⇓ more distance between objects ⇑ **isolation**.

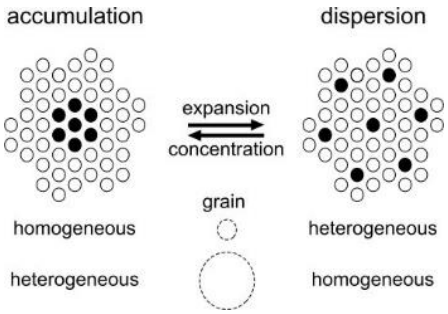

Fig. 261 Scale sensitive accumulation and dispersion

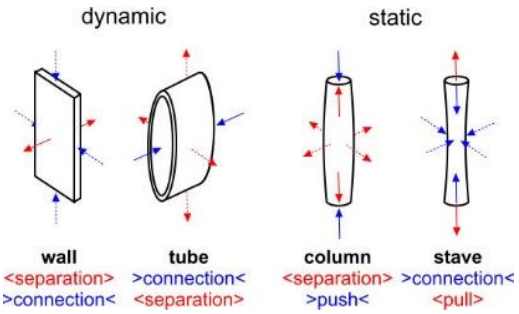

Fig. 262 Dynamic or static separation and connection

Separation ⇓ two-sided difference in opposite direction and equality in the other ⊥ dimensions ('wall' in ***Fig. 262***). **Connection** at greater distance ⇓ bilateral equality in the opposite direction and difference in the other ⊥ dimensions ('tube' in ***Fig. 262***).
Connection ⇓ ⊥enclosure in ***Fig. 260***, extending into the third dimension of ***Fig. 262***.
Accumulation and dispersion are scale sensitive (***Fig. 261***, ***Fig. 6*** p14). They can change when the grain changes.

Both separation and connection suppose a direction. ***Fig. 49*** p54 already showed variants of separation in 1 or more directions and of connection perpendicular (⊥) thereto. If you only consider the fixed components ('static mechanics'), then separation and connection have a different meaning than in dynamic mechanics (***Fig. 262***).
Static separation ⇓ resistance* to push*; static connection ⇓ resistance to pull*.

a Jules Deelder once said this beautifully: "Within the limits, the possibilities are as great as outside".

I hope that ***Fig. 260*** - ***Fig. 262*** speak for themselves as 'visual constitution' of {**mobile, construction, immobile, freedom, outside, inside, body, cavity, enclosure, inclusion, singular, multiple, dividing, uniting, accumulation, dispersion, expansion, concentration, homogeneous, heterogeneous, grain, wall, tube, column, stave**}*.
So, I will not verbally constitute then further, but take them for granted as I did for the conceptual conditions on p274.

Pressure, however, is a substantial object in thermodynamics that deserves further constitution. In the static mechanics of solid objects (***Fig. 262***) the column reacts to an externally convergent pressure from two sides, with an ⊥divergent pressure inside. The opposite applies to 'pull'. That '*balance**' between static connection and separation prevents possible movement in one dimension. The ⊥'transitional contraction'[a] does not play a role within that balance.

The thermodynamics of mobile objects supposes equal pressure in three dimensions. However, just as in static mechanics it is measured per* unit of *area** (the cross-section of the column or the surface of an enclosing wall).
You may represent the pressure distributed across a surface as a 'point load' ('**force**') in the center of the surface.
In ***Fig. 262*** (column) pressure is shown that way with arrows as forces at one point.

Subjectively, pressure is literally the in-pression* of a force on a body surface. The quantifying representation 'pressure∗surface=force=mass∗acceleration'[b] supposes values, and mathematical operations* summarized as '○'.
Their constitution from practical operations such as uniting a multiple, dividing a singular in ***Fig. 260*** may precede their invention. **Mass** ⇓ resistance to movement. **Surface** ⇓ ⊥Δdistance&○. A**cceleration** ⇓ change of movement.

The other substantial objects in thermodynamics are volume, energy, temperature, heat and entropy:
Volume ⇓ surface&⊥Δ distance&○. **Energy** ⇓ force&Δdistance&○. **Temperature** ⇓ average*&energy&Δmovement. **Heat** ⇓ temperature&pressure&○. **Entropy** ⇓ Δheat&temperature&○.
Average ⇓ different sizes of different objects and a mathematical operation: **average** ⇓ Δ measure & Δ object & ○.

A representation such as 'pressure∗volume/temperature remains the same'[c] supposes a stabilizing 'coherence'.
The result remains the same, while the variables vary. However, the objects are not physical objects, but values and uniting and dividing operations that make the

a In the case of the compressed column, it would be better to speak of 'cross expansion', but the calculation that also applies to this is mainly based on the stretching of elastic material. In fact, the ancient Greeks beautifully portrayed the 'transversal expansion' by giving the columns of their temples a slight outward curvature ('entasis'). That subtle exaggeration recalls the mechanical task of a column.
b Newton F=m∗a p83
c Boyle-Gay-Lussac p∗V/T=n∗R p88

coherence.[a] Unifying or dividing make ∗ or / imaginable if a condition of 'equal parts' is added. That is something else than physical 'connection' or 'separation' between different parts.

At both sides of a fixed separation (wall) the pressure, volume and temperature of mobiles can be different.
At both sides of a mobile separation (cavity) fixed objects get a relative freedom of movement.
A cavity 'divides' the wall into two parts. If that are equal parts, then '/' applies.
The difference between an action object 'to divide' (verb) compared to 'separation' (noun) plays an interesting role.
With 'dividing' the other ⊥ dimensions are missing, because a verb supposes one dimension (a time sequence).
A quantitative value or measure does not have ⊥ dimensions and that prevents logical ('square') contradictions.

Three-dimensional representations in the linear language of mathematics are reduced to straight sizes in different directions, from which a spatial image can be constructed.
These directions are also expressed in a linear measure (angle). The cartesian ⊥ standard directions (x, y, z) only provide names.
The perpendicularity itself must be constructed or read in a multidimensional image in order to become imaginable.

Thermodynamics supposes also a difference of *grain* between volume and molecule, bridged with a statistical object 'average' (⇓ Δmeasure&Δobject&○), with which a 'chance' for deviations is again conceivable.[b]
Temperature is conceivable as such an average (kinetic energy) of a large number (n moles) of particles (molecules).
In the representation 'pressure∗volume/temperature=nR', n and R are constants.[c] The coherence remains the same.[d]

The expressions on both sides of the / sign are in turn the energy content of the whole (Q) and the kinetic energy of the average particle. The energy of all particles together is therefore for gas nR∗temperature.
As soon as particles concentrate locally to a more solid body ('condensing' or 'freezing'), the link no longer occurs.
The particles lose freedom of movement and thus kinetic energy. ΔQ/temperature (entropy) is no longer constant.

a The values themselves also suppose operations (eg *adding* units).
b So probability calculation makes a scale jump. That makes paradoxical change of meaning possible. (***Fig. 6*** p8).
c R only calculates the unit (from 1 mol gas with a given temperature in K into the usual energy unit J).
d Any mathematical coherence, for example F=m∗a, can be represented as 'remaining equal' (to a constant), for example F/m∗a=1.

DIFFERENCE IN COHERENCE ⇑ SELECTION ; **DIFFERENCE IN SELECTION** ⇑ COMBINATION
Selection and combination of different particles bring us to the field of nuclear physics and chemistry[a].
Separation usually costs energy. Connecting generally provides the kinetic energy that is released when concentrating particles give up their freedom of movement.
Molecules suppose a relation of atoms that are connected by attractive* forces, but remain separated by repulsive* forces at a smaller distance.

However, larger molecules also disintegrate more easily, because the surrounding mass increases the pressure on the repulsive forces. Separation can release the potential energy from those 'compressed springs' (energy = power*distance) if it becomes larger than the connecting forces at greater distance. Something similar applies in the atomic nuclei, so separation of large nuclei or connection of small, can detach nuclear energy (nuclear fission or fusion).

The variety of objects (Δobject in ***Fig. 259*** p271) was limited in mechanics and thermodynamics, so that I could give a simple (but incomplete) sketch of their constitution. In nuclear physics more forces and particles have to be distinguished, but their sustainable combinations result in a limited number of chemical elements. However, with the larger grain of chemistry a much larger number of durable combinations of those elements is possible.

Moreover, the coherence in chemical compounds is different per environment, changeable, and can have completely different operation* even with the same composition of elements ('isomers' ***Fig. 213-Fig. 216*** p214).
Form (⇓ dispersion&direction) plays a substantial role in that effect.
Linear nomenclature and formulation make form and operation constructable, but without 3D images still unimaginable.

Operation (⇓ selection & direction) supposes separating[b] small parts from a larger coherence.
A subject receives a small part of it, for example light particles (photons) that give a characteristic impression of that coherence, so that the subject can make a representation of it. The attribute in this representation is therefore not a property or characteristic 'own' to an object, but a part of its operation.

In addition to this informative effect on an observing subject, an object can separate energy or material.
A cannon can shoot a bullet, an atom can separate radiation or have a '**repulsive effect**'.
Objects such as masses and charged particles can also have an '**attractive effect**'. This is difficult to imagine as a separation. It can be represented as a separation of 'gravitons', but these have not yet been observed.

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a In Dutch 'chemistry' is called 'scheikunde', the art of *separation*.
b Separating supposes an outward* direction. A mathematical 'abstraction' ⇓ an informative separation of equal or repetitive objects.

How to imagine attraction
Repelling action can possibly be imagined between objects that shoot bullets at each other, hit each other by each shot and get a divergent recoil themselves so that they are driven apart. *Attractive effect* is more difficult to imagine without some elastic medium that absorbs tension. A medium is a false assumption, because attraction and repulsion between masses operate in vacuum and both are stronger as the distance between two masses becomes smaller.

Mass ⇓ resistance to acceleration. That resistance must be overcome by an attraction[a] to allow masses to move towards each other in an accelerated manner. 'Movement' (⇓ Δplace) includes more (supposes less) than the quantitative abstractions[b] of Newton: **speed** v=Δdistance/Δtime (s/t), **impulse** i=m∗v (m∗s/t), **acceleration** a=v/t (s/t∗t)[c], **force** F=m∗a (m∗s/t∗t) and **energy** e=F∗s (m∗s∗s/t∗t or $m*v^2$)[d] or Einsteins $e=m*c^2$ (0 p164) for masses 'at rest'.[e]

Now suppose you cut a mass m 'at rest' in two: m_1 and m_2. This supposes that you apply a distance s between both in a short time and give both a speed of v=½∗s/t in the opposite direction, seen from m_1 together s/t.
This separation supposes a short acceleration a=s/t∗t of m_2 so a force $F=m_2*s/t*t$, sustained over a distance s, with an energy $e=m_2*s*s/t*t$. That must be added to its energy 'at rest' $e_0=m_2c^2$ before the separation.

The mass m_2, however, has grown by a factor γ compared to m_1 (***Fig. 167*** p165), , but t and s have become a factor 1/γ smaller (***Fig. 170*** p167): m'=m∗γ, t'=t/γ and s'=s/γ. Of that energy $e=m_2*s*s/t*t$ that you have put in at the separation is very little: $e'=m_2*\gamma*(s/\gamma)*(s/\gamma)/t*\gamma*t*\gamma=m_2*s*s/t*t*\gamma*\gamma*\gamma$. Where has the rest e'-e remained?
That negative residue (graviton?) lies on the slope of a space-time dimple *ready to undo the separation*.

The contraction of the meter and expansion of the second (the hard to imagine 'curvature of space time') provides the tension that can be measured as attraction. You should imagine that curvature from another dimension ⊥ dimensions s and t. With this, attraction (joining) ⊥ rejecting (separating) is again conceivable (***Fig. 262*** p279).

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a According to Newton with $F=Gm_1m_2/r^2$, where m_1 is the mass of the first object (in kg), m_2 the mass of the second object (in kg), r the distance between the centers of gravity of both (in m), G the gravitational constant = $(6{,}67428 \pm 0{,}00067) \times 10^{-11}$ $Nm^2\,kg^{-2}$.
https://en.wikipedia.org/wiki/Gravity

b Quantitative abstraction supposes an object from which repetitive or similar objects can be extracted (detached, separated), which can be placed linearly in a named order (variable). The number, the quantity, has no direction itself

c Change of direction under the influence of a force is also concerned as 'acceleration'. For example, a 'negative' acceleration ('delay') supposes 180° change of direction. 'Mass ⇓ resistance to acceleration' can then also stand up to resistance to directional change: 'Mass persists in movement along a straight line'. In the case of a hard collision without loss of heat, momentum and energy remain operational in the opposite direction.

d I always wonder what the other combinations m∗s, m∗t, s∗t, m/s, m/t, m∗t/s or m/s∗t could mean.

e Mass 'is' then energy, because c^2 is a constant. However, this 'is' only concerns a linear-quantitative reduction that is supposed at '=' (between variables where appropriate units are used). The dimensions of mass and energy are equated. 'Energy = mass∗constant' is therefore not yet a definition. 'Slowness' or 'resistance to acceleration' could be a definition, although I take them here as a supposition next to possibly others, such as 'space-requiring'.

Function ⇓ operation
In mathematics, 'operation' (⇓ selection & direction) is limited to quantities as '**function**': 'y as a function of x', y=f(x).
The selection (⇓ separation in coherence) then involves distinguishing between variables that are detached from a *qualitative* coherence in order to combine their operation in their own *quantitative* coherence. The supposed direction distinguishes y=f(x) from x=f(y). A formula such as $y=x^2 \Leftrightarrow x=\sqrt{y}$ does not have such an explicit direction.

A full sentence 'Movement operates on mass.' can also be represented as qualitative 'full sentence function' without quantitative reduction: mass(movement), 'mass as an effect of movement'. The '=' sign is omitted so that you do not immediately suppose a quantity, and the task of 'f' is taken over by the brackets. 'Δoperation' makes many new representations possible. Restriction to 'function' only runs the risk that you forget 'side effects'.

'What is the function of this medicine?' is easier to answer than 'What is the operation of this medicine?'
The function of a cough drink is to help you get rid of the cough, but its operation includes all side effects in all people in all circumstances. This brings us back to chemistry and opens the perspective to biology. Chemistry is not only the art of separating, but also the art of combining.

Combination (⇓ difference in selection) makes new connections possible. The combinatorial explosion of possible connections is much greater than the small number that survived its selection in the course of evolution.
The 12 elements of § 34 p196 can be combined in 12^2 pairs.[a] If DNA were the largest molecule with 250 million base pairs[b] each consisting of 22 atoms of 4 types (C, O, P, N), then there are $4^{5\,500\,000\,000}$ combinations.

However, DNA is limited to fixed combinations of C, O, P and N (base pairs), leaving $4^{250\,000\,000}$ possible combinations. If there are 10 000 000 (10^7 or 4^{12}) species, each with their own unique DNA, then only a very small number of combinations (4^{12}) survived the evolutionary selection of the unimaginably large number of possibilities.[c]
That number is even smaller when you consider that the DNA of most species counts less than 250 million base pairs.

However, evolution selected only 22 combinations of 3 base pairs out of $4^3=64$, coding 22 types of amino acids.
Fig. 195 p203 shows an unreal example of a small protein molecule containing 20

a 'Combination' is not used here in the mathematical sense. An object then may only occur once in the selection from all (also selected) possibilities. An object may occur here more frequently and each different sequence is counted as a different possibility.
b https://en.wikipedia.org/wiki/DNA
c The pharmaceutical industry thinks to outwit 4.5 billion years of evolution by coming up with drugs that do not occur in nature. It is unlikely that evolution has not tried these chemical compounds already long ago. She then rejected them because they did not benefit the species in the long run due to their side effects.

different, most usual amino acids.
Life uses actually only 100 000 much larger proteins. These 'selected combinations' count 50 to 3 000 amino acids out of ample 22^{3000} possibilities.

In addition to that group of proteins, there are many other groups that are combined into organs.
On a subsequent scale level these are combined again into organisms and again into organizations.

From 26 letters of the alphabet 26^2 words of 2 letters can be put together, 26^3 of 3 letters and so on. That is already 11 881 376 possible words from 5 letters. These are then only the possibilities in that one dimension of the linear language, but proteins branch into two dimensions and organs into three. Language is then a combination of a limited selection of words that are moreover limited in a prescribed grammatical order.

From the point of view of design, 'combinations of selected combinations' in four dimensions are the order of the day. Difference in selection makes combinations possible: Δselection ⇑ combination. A selection of steel beams and concrete surfaces allows for combinations other than wooden beams and bricks. Life phenomena start with a small selection of materials, but that has produced an unimaginable number of combinations at every level of scale.

§ 48 BIOTIC CONDITIONS

In § 38 (p237) an advance has been taken on this exercise in response to some examples from biochemistry and biology. The Abiotic conditions difference ⇑ change ⇑ coherence ⇑ selection ⇑ combination that have been elaborated above, are basic abiotic conditions for life.

Without **differences** in the environment and accordingly adapted different life forms, life would have no 'choice' during the great changes in the earth's environment and would quickly have died out. Dinosaurs did not survive the long night of the Cretaceous, nocturnal animals (our ancestors) took over. **Changes** (eg mutations) made other **coherences** possible at every level of scale. Other coherences in turn made different **selections** possible and new **combinations**.

Fig. 52 p63 column B states as Biotic conditions: metabolism ⇑ regulation ⇑ organization ⇑ specialization ⇑ reproduction. You can recognize a system in which the abiotic conditions of column A return on each preceding condition: difference in combination ⇑ metabolism; change in metabolism ⇑ regulation; coherence in organization ⇑ specialization; combination in specialization ⇑ reproduction.

Does this system represent a practical constitution of our representation of life? Reproduction characterizes life as far as we know it. We know, however, life forms that no longer reproduce (sterile specimens, eg mules). It is probable that evolution has produced masses of sterile forms that we obviously no longer know. Yet a mule is

a living creature. Reproduction is therefore not the first condition. Other conditions have to be fulfilled first.

METABOLISM ⇓ **DIFFERENCE IN COMBINATION**
A chemical reaction ⇑ metabolism. A combination of substances is then changed to a different combination.
An organism combines such reactions in cycles (for example ***Fig. 209*** p212 or ***Fig. 230*** p219).
Every chemical reaction, every reaction cycle, every organ, every organism and every organization, in short every system* has an **input** and an **output** (⇓ inward and an outward movement of substances[a]).

System ⇓ inputΔ output (difference between input and output), otherwise it is a tube (throughput).
InputΔoutput ⇓ Δcombination. A system recombines, changes (makes different) combinations.
Storage ⇓ delayed output. This allows new inputs to be combined with old inputs.
Death ⇓ output without input.

REGULATION ⇓ **CHANGE IN METABOLISM**
Catalysts, enzymes (bio-catalysts), RNA-recipes, hormones or (un)blocking stimuli outside the organism, accelerate or delay reactions and the operation of systems. For example, the search for food supposes an accelerated selective input, triggered by the hormone ghrelin.[b] This hormone is a small protein (peptide) that is made faster with an RNA recipe (***Fig. 197*** p204) than by entropy-driven chance.

ORGANIZATION ⇓ **COHERENCE IN REGULATION**
The release of C from CO_2 is abiotically an improbable reaction that is accelerated by photosynthesis (p210).
The oxidation of hydrocarbon (incineration) is a probable and (explosive) rapid process that is delayed by stepwise energy transfer (p199, p205). Photosynthesis and slow burning ⇓ a long cycle of improbable reactions, connected in a strictly conditional sequence, but separated from more likely entropy driven processes.

Such a cycle of acceleration and deceleration supposes a stable relationship in regulated processes (organization).
Many such cycles of consecutive reactions work within a living organism. Compared to their abiotic probability (entropy) they are unlikely to be accelerated or delayed. Each reaction provides input for the next, but such a cycle as a whole (at another level of scale) also has entries and exits for selective input and output.

a 'Substance' ⇓ mass, energy or information.
b https://en.wikipedia.org/wiki/Hunger_(motivational_state)

This selection of import and export supposes regulation and also separation of more likely processes (***Fig. 200*** p205). Membranes select as sieves or they are equipped with selective valves or devices (***Fig. 208*** p210).
The output of a cycle works again as input from another cycle elsewhere. This supposes a connecting infrastructure and logistical arrangement (organization) to deliver the right package at the right cycle.[a]

SPECIALIZATION ⇓ **SELECTION IN ORGANIZATION**
In the carbon cycle outlined above, the tasks of photosynthesis and combustion are roughly divided between plants and animals. They specialize in different environments with different survival strategies.
Different organisms can also divide tasks among themselves in a separate context (symbiosis). Within a living organism, specializations are separated in a fixed context and divided over organs and within a cell over organelles.

REPRODUCTION ⇓ **COMBINATION IN SPECIALIZATION**
Biodiversity ⇑ risk coverage. Major changes in the environment lead to the extinction of unadapted species.
A wide variety of species with different survival strategies makes the survival of some species more likely.
If evolution had only provided for one species, then this species would not have survived dramatic changes in Earth's history. Mutations never come in time.

Mutations sometimes produce variants with new specializations that can survive in new environments.
The average number of mutations is estimated at 64 for a human individual.[b] That number doubles with every next generation. In the case of asexual reproduction it remains the same, but the combination of two individuals squares the number of possible child variants that can be exposed to natural selection, even if only a few of them are realized.

Eternal life could realize more variants per couple, but also duplications. Biodiversity is more served by combinations of new individuals who have had a common ancestor for several generations and are equipped with more different mutations. They would not fight with the ancients for limited resources.
Biodiversity is served by temporary lives of old individuals, by death.

§ 49 CULTURAL CONDITIONS

In § 45 'Cultural ' p263 an advance has been taken on this exercise in response to a number of cultural examples.
The Biotic conditions of metabolism ⇑ regulation ⇑ organization ⇑ specialization ⇑

a This logistics was clarified by Rothman, Schekman and Südhof. They received the Nobel Prize in Physiology or Medicine for this in 2013
b Drake,Charlesworth,Charlesworth,Crow(1998)Rates of Spontaneous Mutation(Genetics)0401 148 4 1667-1686
http://www.genetics.org/content/148/4/1667.full

reproduction that have been elaborated above, are also conditions for cultural phenomena.

Without processing information (news) you can not arrange your experiences, not organize daily life without certainty. You then cannot distinguish tasks and choose one of them. You cannot add anything or share it with others (culture).

Fig. 52 p63 column C states as Cultural conditions: information ⇑ security ⇑ affection ⇑ identity ⇑ influence.
There is a system recognizable in which the biotic conditions of column B return as an effect on each preceding condition: metabolism of reproduction ⇑ information; regulated information ⇑ security; organized security ⇑ affection and so on.Does this system represent a practical constitution of our representation of culture?

INFORMATION ⇓**METABOLISM OF REPRODUCTION**
In this astonishing variety of life, writers are not lacking in the choice of environments, characters, their shape, behavior and their specific suppositions in different combinations that they want to reproduce with their own metabolism. Designers have a metabolism with which they combine their input with their own representations.
They become mother and father of the design by linking their name to it.

New representations as an individual's input supplement old ones or replace them before they are expressed.
With some good will this can be called 'metabolism' if you want to maintain the constitution system that I followed here. You can then call the output 'reproduction', although 'expression' (ex-pression) is a word that is closer to 'birth', the expression of what you carry with you. An expression can contain mutations that evoke new representations.

The output of one individual is input for other individuals with a different metabolism (exchange).
Your representations may end up in different cycles that have their own input and output. Some elements continue to circulate in different subcultures, the common denominator of which is called 'culture'. That makes you cautious in your expressions. Too much recognition yields boredom, too much surprise stress and opposition (***Fig. 51*** p55).

This set of shared representations (culture) changes with every new generation. Boredom can cause premature death (note a p77). In case of boredom, a new generation is news and strengthens the hormonal desire for children.
Food for thought (news) is a physiological necessity of life (stimulus hunger) and the source of motivation such as Maslow (p96) supposed in his hierarchy of needs: physiology ⇑ safety ⇑ love ⇑ esteem ⇑ self-realization.

SECURITY ⇓ **REGULATED INFORMATION**

Too little news gives uncertainty, an experience of insecurity. Too much news brings overload and stress.
In the latter case, the import must be delayed, the attention distributed over time and space, as any living organism distributes explosive energy in small steps over time and space. If there is too little news, the input must be accelerated.
You have to come into action and look around to find news in your home, on the road, in work or on vacation.

AFFECTION ⇓ **ORGANIZED SECURITY**

An urban culture organizes its securities (living, working, recreation and traffic) in a fixed structure with variable, free use (due to coherence). An object of affection, attachment (whether it is a city, a culture or a person) must be recognizable and surprising to the individual (on some points equal, on others different or changeable). The attachment to a culture depends on the personal balance in the traditional security and freedom it offers.

If it imposes too much security or freedom, then artistic-religious countercultures offer a counterbalance.
Too much certainty is compensated in an artistically free-spirited subculture, too much freedom in a religious one.
Social cohesion supposes affection with a subculture of people with the same specific balance and amplitude between freedom and security. Freedom is the limit ('zero value'), because what is certain can always made more certain.

IDENTITY ⇓ **SPECIFIC AFFECTION**

On p243 I defined identity as 'difference with the rest and continuity in itself'. In its bare form this is name and address, origin and provenance. A culture that gives you a place of your own in space and time, a home and a task, the esteem, the appreciation, the prestige that goes with it, makes a specific affection for your self possible. Self-conscious self-esteem is a condition for one's identity (continuity and difference with the rest), appreciation for and of that 'rest'.

INFLUENCE ⇓ **REPRODUCED IDENTITY**

Maslow's 'self-realization' is then the *expression* of that own identity in its own territory and beyond.
The language is a limited means of expression, but what you write you can connect to your name (copyright).
What you do is an expression of your identity. Work creates property, a (mobile) territory, an sphere of influence.
This ensures a sustainable feedback of identity, a memory of yourself, a recognition by someone else.

§ 50 CONCLUSION

This chapter is no more than an illustration of a method used to derive underlying suppositions from common representations (*conditional analysis* ⇓). The more distant goal is opening and exploring new roads on top of these suppositions and their more primitive forerunners (⇑) by design. This *conditional synthesis* does not consist solely of combining, but above all by making more distinctive differences (Δ), prepared for natural selection.

Making *equal* is not art, the entropy of sun, wind, water and earth[a] already do so. To make a lasting improbable *difference*, millions of centuries of evolution were needed, but each individual organism is also back to ground in a matter of seconds. Designing is also making a difference, otherwise it is copying. People only need a few seconds or years for that.[b] In a short time, this has made many different (sub)cultures (art, technology and knowledge) *possible*.

Logic has made a difference between different types of 'or' and 'as', mathematics between different types of equality and repetition, physics between mass and weight, biology between species and the human sciences between freedom and certainty. These are just a few examples of difference making design in science. Once that difference was made between variables, generalization, the discovery of equality and repetitions could begin.

This has previously made unimaginable realities conceivable in an increasing number of specialized disciplines. Specialization makes deepening possible, but it does not escape unspoken 'ceteris paribus' assumptions about 'the rest'. My leak attempt to relate these disciplines to each other in a conditional order is probably open to a lot of criticism. However, it is sufficient to establish the inadequacy of generalization.

The real diversity demands much more distinction. The possible variety has hardly been mined. **Fig. 52** p63 sets out 3∗5 picket posts with a conditional sequence in that unexplored area. This chapter places some scientific objects in that field of conditional coordinates. Their place in that field could be reasonably well determined, but there is room for infinitely more objects that have no name yet.

The question, of course, is whether these are the correct coordinates, whether the picket posts are at a comparable distance, or whether all the imaginable can find a place here. I have paid the most attention to the Abiotic conditions, the endangered very basis of life and culture. A complete elaboration would encompass our entire vocabulary and all productions of human culture including biology and humanities.

That goes beyond my power, but this exercise gives me confidence in the method of conditional analysis and synthesis. They create space in our imagination for more

a Jong(2008)Sun Wind Water Earth Life Living Legends for Design(Delft)TU lecture paper http://www.taekemdejong.nl/Publications/2009/Territory59.pdf
b Jong(2009)The evolution of a design(Delft)Darwin-year lecture in the Botanical Garden for technical plants TUDelft http://www.taekemdejong.nl/Publications/2009/The%20evolution%20of%20a%20design.pdf

possible designs beyond the oppressive horizon of our probable futures. 'There must be some way out of here. '[a]

a Dylan(1967)All along the watchtower