The Ideal Language Tradition

The Revolution in Philosophy

Bertrand Russell (1872-1970)

- Among the first philosophers who noticed that a new form of philosophy was now possible, was Russell.
- Russell's philosophy was in continuous flux and development, we will be concerned here with two milestones: 'On Denoting' and *Our Knowledge of the External World* (and of course with *Principia Mathematica*).

On Denoting

- Russell was among the first and few people who took notice of Frege's work at all.
- If we look at 'On Denoting', first published in 1905, we see Russell taking up the problem Frege had been dealing with in 'Über Sinn und Bedeutung'.

Denoting phrases

- 'the present King of France', 'the present King of England', 'a man'

"This is the principle of the theory of denoting I wish to advocate: that denoting phrases never have any meaning in themselves, but that every proposition in whose verbal expression they occur has a meaning."

How it works

"Thus 'the father of Charles II. was executed' becomes 'It is not always false of x that x begat Charles II. and that x was executed and that 'if y begat Charles II., y is identical with x' is always true of y'." [...]

"The above gives a reduction of all propositions in which denoting phrases occur to forms in which no such phrases occur. [...] The evidence for the above theory is derived from the difficulties which seem unavoidable if we regard denoting phrases as standing for genuine constituents of the propositions in whose verbal expressions they occur."

Alexius Meinong

- Meinong, for example, had thought that for an analysis of a denoting phrase, the phrase had to denote something – the object the phrase is about.
- Now, in cases in which there is no such object found in the world, this object nevertheless had to exist to explain the contribution of the denoting phrase to the proposition.

Gottlob Frege

- Similarly, Frege had to stipulate a *Bedeutung* for every denoting phrase. Although he could use *Sinne* to explain how the denoting phrase contributes to the thought expressed by a sentence, he had to stipulate that denoting phrases refer to the empty set (the “null-class”) to explain how the *Bedeutung* of the phrase would contribute to the truth value of the sentence.

Adequacy Criteria

- Russell already uses the paradigmatic method of analytic philosophy.
- He starts with a number of puzzles that a theory of denoting phrases is required to be able to solve.
- These puzzles are *adequacy criteria* for the theory. He then produces a formal theory that does this.

Ideal Language Solution

- Of course, the reduction of denoting phrases leads to representations of the propositions that are very unlike the ordinary language sentences we started with – however, since we can show that the initial puzzles disappeared, we have shown that the solution *is a real one*.

Principia Mathematica

- But Russell also continued other ideas that were originally stemming from Frege, the most important of which maybe was the project of *Logicism*.
- As explained earlier, Logicism was the idea that mathematics could be shown to be just logic, logic, and nothing but logic.

Russell Class

- Frege’s logicism of *Grundgesetze der Arithmetik* seemed doomed because of the possibility to define the Russell Class.
- In Frege’s system it was possible to define a class by quantifying over a totality of classes including the class being defined:

The Class of all Teacups

- The Class of all Teacups, for example, does not have itself as a member, since it has teacups as members and itself is not a teacup, but a class.
- However, the class of all non-teacups has as members all objects which aren’t teacups. Since the class of all non-teacups is itself not a teacup, it has itself as a member.

The Class of all Classes

- Equally, the class of all classes can be defined. The class of all classes contains itself, since it is a class.
- The class of all classes that contain themselves can also be defined without problems, it would, for example, contain the class of all classes and the class of all non-teacups. *The class of all classes that do not contain themselves*, would – on the other hand contain the class of teacups. But now: would it contain itself?

Contradiction in Naïve Set Theory

- If the Russell Class does contain itself, it should not belong to the class of classes that do not contain themselves.
- If it does not belong to that class, however, it should contain itself.

Russell's Theory of Types

- The Theory of Types that Russell had developed in his 'Mathematical Logic as Based on the Theory of Types', and on which the system of the *Principia Mathematica* is built, was designed to solve this problem.
- All classes in this theory belong to certain type, and these types are ordered hierarchically. It is only possible for a class to have elements that are of a type lower than that of the class itself.

Russell's Theory of Types

- Given such a hierarchy of types, the definition of a class could not range over all classes including itself.
- Avoiding Russell's paradox gave logicism a certain structure.
- Given that when defining a class in Russell's system we can always only appeal to the elements of a lower level, the reconstruction of mathematics gives rise to a hierarchy.

Whitehead's Extensive Abstraction

- In addition, Whitehead had started to provide a method of logical construction, the so called "method of extensive abstraction", by which philosophically dubious entities (such as properties or geometrical points) could be abstracted from unproblematic concrete entities, thereby providing a method appropriate to reductive analyses.

Whitehead's Extensive Abstraction

- Russell, taking the case of points, explains the problem in *Our Knowledge of the External World*:
  - The space of geometry *and* physics consists of an infinite number of *points*, but no one has ever seen or touched a point. If there are points in sensible space, they must be an inference. It is not easy to see any way in which, as independent entities, they could be validly inferred from the data; thus here again, we shall have, if possible, to find some logical construction, some complex assemblage of immediately given objects, which will have the geometrical properties required of points. [...] Exactly how this is to be done I do not yet know, but it seems fairly certain that it can be done.

The reductionist's programme

- The reason for Russell's optimism "that it can be done" was Whitehead's apparent success in abstracting points from classes of physical volumes.
- Although this doesn't provide a complete reduction of points to sense data, it comes quite close. The next question is whether the objects of physics could be constructed from experiences.
- The physical 'objects' construed from sense data need not be given an independent ontological status, and thus such a construction of physical objects might properly be viewed as a reduction to sense data.

The reductionist's programme

- Russell enthusiastically advertised this idea in *Our Knowledge of the External World*:
  - [Whitehead's method of abstraction] clears away incredible accumulations of metaphysical lumber [...]. When a group of objects have that kind of similarity which we are inclined to attribute to possession of a common quality, the [method of extensive abstraction] shows that membership of the group will serve all purposes of the supposed common quality, and that therefore, unless some common quality is known, the group or class of similar objects may be used to replace the common quality, which need not be assumed to exist.

How far as it went

- Russell then sketched how concrete physical objects might be constructed from phenomenal experiences, how instants of time might be abstracted from overlapping events, etc.
- The two desiderata he mentioned were this: (a) to find a solipsistic basis of physics that does not presuppose the existence of other minds, and (b) to build physics on the basis of experienced sense data alone (Russell had to presuppose unexperienced sense data to account for objects that no one is paying attention to).

Carnap's adoption in the Aufbau

- Carnap's *Aufbau* is in part the adoption of this programme for the purposes of epistemology, and is traditionally, though not quite correctly, considered a work of reductive empiricism.

Carnap's adoption in the Aufbau

- According to the principles of empiricism, sensory experience is the only source of knowledge and consequently all our knowledge is *reducible* to the *given*, the sensory experiences.
- The traditional interpretation reads the *Aufbau* as providing exactly such a reduction, in accordance with Russell's doctrine that
  - [t]he supreme maxim in scientific philosophizing is this: Wherever possible, logical constructions are to be substituted for inferred entities. ('The Relation of Sense-data to Physics')

The classical reading of the Aufbau

- This reading was prominently promoted by Quine which might well be the reason for the similarity amongst later interpretations of the *Aufbau*.
- To interpret Carnap's work in this way is not completely unreasonable, as the above quote Russell's was chosen by Carnap as the epigraph for the book.
- In addition, Carnap refers to Russell frequently in the beginning of the *Aufbau*, he adopts Whitehead's method of extensive abstraction, and he draws connections between his work and Russell's and Whitehead's logicist reduction of mathematics.

The modern interpretation

- However, in recent years it has been emphasised by many scholars that the important new aspect of Carnap's *Aufbau* was really its use of modern logic and the theory of relations.
- For Carnap, a constitutional system which is straightforwardly built on elementary experiences (we define 'constitutional system' properly a bit further below) was not the principle aim of the work; his aim was rather to show in general how logic and mathematics can be used for such a construction.

The problem of objectivity

- Carnap's presupposition was that scientific statements are really statements about *structure*; otherwise science could not be objective. Carnap thought that all reference to the material or concrete was, after all, subjective.

The problem of objectivity

- To see this, note that our experience when making a scientific observation is private.
- We cannot compare the experience we have during the observation with the experience had by another scientist.
- Each person's experience is unique and subjective.
- What we can do, however, is agree (or disagree) on structural relations between such experiences.

The problem of objectivity

- Imagine carrying out a chemical experiment during which a liquid suddenly turns a certain colour.
- The qualitative phenomenal state you are in when experiencing this colour is, first of all, something private and ineffable.
- You cannot communicate to others exactly *what it is like* to experience the exact colour you experience.
- What you can communicate, however, is whether this colour is the same as that colour (pointing to a specific colour on a colour chart) or whether it is brighter or darker; you can talk about relations between such experiences and thus talk about structural aspects in an objective way.

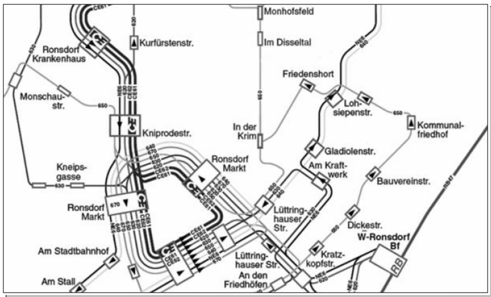
Structure to the rescue

- For science it is therefore possible and necessary to talk only about structure (*Aufbau*, §16).
- But if all scientific statements are really all about structure, contrary to our *prima facie* understanding, then they all must be translatable without loss into statements which obviously are only about structure.
- How is such a transformation achieved?

The railroad map analogy

- Carnap draws an analogy to a railroad map.
- The stations on a railroad map are normally labelled with names.
- This is unnecessary, however. It would be more than sufficient to identify the stations via their structural role on the map.

Ronsdorf



Structural Decsription

- Instead of 'In der Krim' the structural description might identify this junction as '2-line T-junction which is one junction away from a 4-line T-junction and two 1-line junctions'.
- If this definition does not suffice to identify the point in question we can add more information about that junction's structural relationships.
- It seems that we can identify any point by its structural relations, as long as there is enough information provided by the map.
- If this part of the map would not suffice to tell two points apart, we could turn to the larger map of all Ronsdorf, or all Wuppertal, or the whole region.

A demarcation criterion

- If we adopt this programme, all scientific statements are assumed to be translatable into structural descriptions.
- If a difference cannot be captured in this way, that is, if a difference cannot be translated into a structural difference (given all information science can offer), this difference is not *objective*.
- The translatability thesis by Carnap thus works like a *demarcation criterion*. Only those statements which are translatable into structural statements are considered *scientific* statements.

Constitutional Systems

- A *constitutional system* in Carnap's sense is a stage by stage ordering of objects such that the objects at a certain stage are constituted by the objects of a lower stage.
- Due to the transitivity of the constitution relation, all objects of the system are constituted from the objects of the first stage or level, the so called "basis" of the system.

Constitutional Systems

- As an example of such a constitutional system, Carnap considers the system of arithmetic concepts.
- In this system, all kinds of numbers, rational, real, etc., are constituted from the natural numbers, as pairs of natural numbers, equivalence classes of such pairs of natural numbers, and so on.
- This way all statements about the objects of arithmetic can be reformulated into statements about the basic objects, the natural numbers.

Constitutional Systems as Rational Reconstructions

- This example also shows that a constitutional system need not mimic the actual process of knowledge acquisition.
- Few people have real numbers psychologically represented as Dedekind cuts (the name of one such construction of the reals).
- A constitutional system is a *rational reconstruction* of our intuitive constitution of the world.
- It operates with fictitious assumptions and idealisations which need not have counterparts in actual processes.

The rational reconstruction of epistemology

- One such fiction is "the given". That Carnap did not naïvely consider it an unproblematic basis of knowledge becomes clear from the fact that he also offered other possible bases.
- Such idealisations are not true or false, but are more or less "right", i.e. more or less pragmatically justified.
- They have to be idealised to keep the constitutional definitions as clear as possible; if they serve this purpose they *are* "right".

Characteristics of Constitutional Systems

- Thus, there are two general points about constitutional systems that we should keep in mind:

(1) Constitutional systems are rational *re*constructions. That is, they are undertaken after science is already done, so to speak, but do not try to build up a system of scientific knowledge independent of science.

(2) Constitutional systems are *rational* reconstructions. They do not aim at matching the actual genesis of our knowledge. A constitutional system operates with idealisations and simplifications and is not affected by criticism which merely highlights that "really" the acquisition of knowledge proceeds differently.

The Aufbau

- The first problem in giving such a constitutional system is to select its basic constituents. Although this selection is a matter of convention, it is not arbitrary.
- The limits of choice were – according to Carnap – set by positivism and transcendental idealism. Positivism claimed that the sole material of knowledge is the experiential given, whereas idealism emphasised correctly that we need a system of order and basic relations to get the system of knowledge off the ground.

Two Sub-problems

- The first is finding the basic objects and the second is finding the relations which can hold between these objects in order to build up from those basic objects.
- In set-theoretic terms, the basis chosen must be a structured set, a relational system.
- Carnap favours for his constitutional system a system which is built in (loose) accordance with the actual process of knowledge acquisition.

Epistemic Primacy

- This is why his stages of constituted objects, the different levels of the system, are ordered with respect to their *epistemic primacy*.
- That means that concepts like 'red' and 'hard' appear on a lower level than concepts like 'energy potential' or 'conducts electricity'.

A Solipsistic Basis

- Carnap chooses as his main example a constitutional system that has a solipsistic base.
- Since this base is the only one he considers in detail, later interpreters have taken the *Aufbau* to concern only that system.

Carnap's phenomenalism

- It seems clear, however, that Carnap's system is *not* phenomenalistic in the *traditional* sense as so many authors have claimed. Phenomenalism, as for example in the writings of Ernst Mach, starts from sense data, treating "phenomena" as basic.
- In Carnap's sense such phenomena are *not* epistemically primary.

Elementary Experiences – the basis

- Sense data are abstractions from unstructured elementary experiences and occur in a later stage of the constitutional system.
- Carnap's basis (following the *Gestalt*-psychologists of his time) is comprised of elementary experiences which are time slices of the total stream of experiences of the constituting subject.
- These erlebs are primitives *within* the system.

Recollection of similarity – the basic relation

- In addition, Carnap needs a basic relation among these primitives.
- Carnap's choice of a basic relation, 'recollection of similarity', *Rs*, is also motivated by Gestalt-psychological considerations and the intention to keep the constitutional system as simple as possible.

Recollection of similarity – the basic relation

- *Rs* is characterised as follows:
  - elementary experiences *x* and *y* of some individual stand in the relation *Rs* if and only if *x* and *y* are elementary experiences which are judged as partially similar by the individual on the basis of a comparison of the recollection of *x* with *y*, i.e. they are almost identical with respect to some experiential part.
- The relation of part-identity, *Pi*, is defined on *Rs*. *Pi* is reflexive and symmetric, but not transitive (we will use *Pi* in our examples below (for convenience's sake); Carnap does not use *Pi* for his actual constructions).

One possible construction

- Although all the systems that Carnap considers in the *Aufbau* have such a simple similarity relation as their basic relation, other basic relations are conceivable (*Aufbau*, §104), and later Carnap thought that a system with more than just one basic relation would be more capable.

Getting started

- After the basis is chosen, the problem becomes constructing all other objects from this basis alone.
- Of course, the problem is that *in* the system the basic elements are primitive, i.e. they do not have any properties to which we could appeal for the constitution of the next stage.
- It was the most important achievement of the *Aufbau* to have demonstrated in detail how enough information can be distilled from a set of property-lacking, atomic elements to start the process of constitution for objects of higher order.

Quasi-Analysis

- Carnap probably derived his method of quasi-analysis from Whitehead's method of *extensive abstraction* which the latter had used for the constitution of geometric objects, having learned about it from Russell's presentation.
- For Carnap the method of quasi-analysis is the method for the constitution of scientific objects in general.
- Whereas Whitehead was concerned with abstract objects only, Carnap adopted the method of constitution for all non-basic entities.

Ontological Neutrality

- "Quasi"-objects are in no way less real than other objects.
- An object is a quasi-object iff it is constituted via quasi-analysis from the basic elements.
- 'Quasi' thus denotes a logical status. In Carnap's terms, all "real objects are quasi-objects" (*Aufbau*, §52).

An example of proper analysis

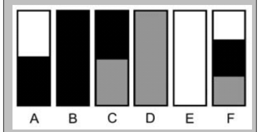
- To see how this programme is meant to function, we start with an example of proper analysis.
- As we have said, the primitive objects are erlebs, elementary experiences.
- Such erlebs are time slices of the whole stream of experience of the constituting individual.

Paula's erlebs

- Our constituting individual is Paula. Paula has only very limited visual experiences (and only visual experiences, to keep the example simple). In particular, her visual field consists of simple "coloured" areas – these are her *erlebs*.
- However, Paula has no colour concepts to begin with; all she has are erlebs and the recollection of similarity relation, *Rs*.
- We assume that Paula has only a crudely working visual system and that the erlebs she has collected after an exciting afternoon amongst black, white, and grey coloured objects are the following:

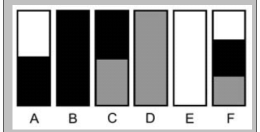
Paula's erlebs

- Let us use A to F to name the six different erlebs, represented by the boxes. We know that for Paula these erlebs are all primitive, i.e. erlebs are, at this point, merely different wholes. Paula has no concept of colour she could use to classify them, nor does she even notice that the erlebs have any properties.



Paula's erlebs

- What is given to her instead is a relational ordering of the erlebs. For simplicity, we will use the relation of *part identity*, *Pi*. Two *erlebs* are related by *Pi* if they have some quality in common.
- If we order Paula's erlebs in this way, we obtain the following set of ordered pairs:



Paula's erlebs

{<A, A>, <A, B>, <A, C>,
<A, E>, <A, F>,
<B, A>, <B, B>, <B, C>,
<B, F>,
<C, A>, <C, B>, <C, C>,
<C, D>, <C, F>,
<D, C>, <D, D>, <D, F>,
<E, A>, <E, E>, <E, F>,
<F, A>, <F, B>, <F, C>,
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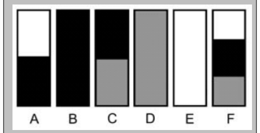
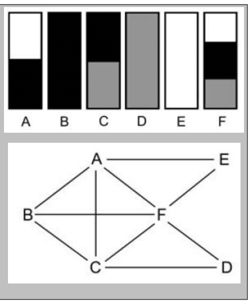


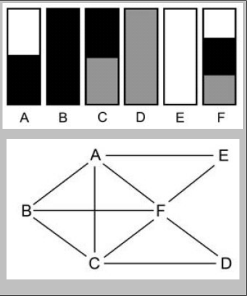
Paula's erlebs

- This is all the information Paula has.
- She knows which erlebs are distinct (indicated by the different letters) and how they are related according to *Pi*.
- This relation between her erlebs could also be represented as a graph, thereby keeping the analogy to Carnap's railroad-map. Such a graph for Paula's erlebs would look like this:



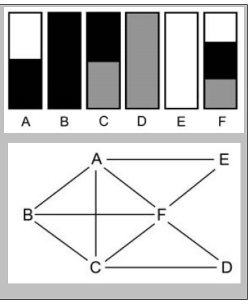
Paula's erlebs

- Here we have represented all two distinct *Pi* related erlebs of Paula as directly connected by a straight line (and those not *Pi* related as unconnected).



Quasi-Analysis

- Now we let here single out all these sets of erlebs whose members are pair wise Pi-related and for which there is no erleb outside the set which is not pair wise Pi-related with every member in the set.

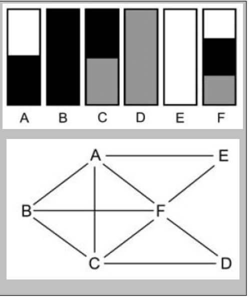


Paula's erlebs

- This will give Paula the following classes:

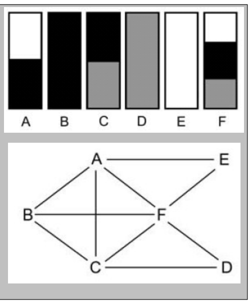
{A, B, C, F}, {A, E, F},
{C, D, F}

- But these are just the classes of (partially) black, white, and grey erlebs.



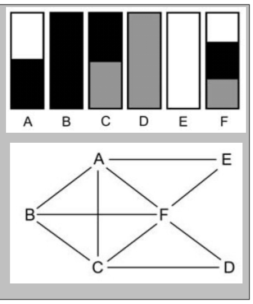
Paula's erlebs

- Hence, although Paula had no information about the colour of the erlebs and no notion of their parts, etc., but only an extensional ordering by Rs to begin with, she was able to retrieve the complete colour information.



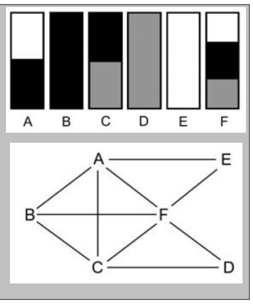
Paula's erlebs

- The "parts" the erlebs have in common, are "quasi-parts", because the erlebs were originally given as primitives.
- However, we have now ordered them *as if* they had parts and as if they had properties.



Paula's erlebs

The quasi-properties "white", "grey", and "black" are now our second-order objects. This is the first step in constituting the world from nothing but similarity ordered primitives.



How to proceed from here

- Given these second-order objects, it is now conceivable how Paula could proceed.
- She could again order them with a similarity relation of second order and thereby constitute third-order objects.
- Carnap provides such a constitution only for the very first steps of a constitutional system, constituting the quasi-properties and relations of quasi-properties.
- He then claims that all scientific objects and properties are retrievable that way.