Nagel: The Reduction of Theories

Mention that both Nagel and O&P are eager to contrast their notions of reduction with logical positivism (e.g. Nagel page 348), notice also the difference to Kuhn (and Feyerabend).

Nagel on reduction

Reduction, in the sense in which the word is here employed, is the explanation of a theory or a set of experimental laws established in one area of inquiry, by a theory usually though not invariably formulated for some other domain. (page 338)

Homogeneous reductions: relations between two sets of statements that employ a homogeneous vocabulary (page 339).

Inhomogeneous reductions, sitat side 340 (merket med blått).

(...) the subject matter of the primary science appears to be qualitatively discontinuous with the materials studied by the secondary science. (page 342)

Nagel has a rather long discussion of scientific language and of different types of statements that occur.

Four classes of statements that may occur in a science S:

1. Theoretical postulates of S
2. Experimental laws of S
3. Observation statements of S
4. Borrowed laws of S

Formal conditions for reduction

(i) Axioms, special hypotheses, and experimental laws of the sciences involved in a reduction must be available as explicitly formulated statements, whose various constituent terms have meanings unambiguously fixed by codified rules of usage or by established procedures appropriate to each discipline. (page 345, the latter rules out e.g. trivial modifications of the primary science)

(ii) Every statement of a science S can be analyzed as a linguistic structure, compounded out of more elementary expressions in accordance with tacit or explicit rules of construction. (page 439)

(iii) Condition of connectability: “Assumptions of some kind must be introduced which postulate suitable relations between whatever is signified by ‘A’ and traits represented by theoretical terms already present in the primary science.”

Condition of derivability: Assuming connectability, all the laws of the secondary science must be logically derivable from the theoretical premises and their associated coordinating definitions in the primary discipline.
The nature of bridge-laws (the assumptions that assure connectability)

Three options, they might be:

- Logical connections (ruled out be Nagel)
- Conventions
- Factual or material connections (empirical connections)

The latter two are compatible, since the status of the bridge laws might depend on the context of exposition (brief discussion on page 356-357). “It is therefore not possible to decide in general whether the postulate is a coordinating definition or a factual assumption, except in some given context in which the reduction of thermodynamics to mechanics is being developed. (Page 357, my italics)

Beware that Nagel holds that derivability (which he takes to imply connectability) is a necessary and sufficient condition for reduction (footnote on page 355), thus, in no way does he require that the assumptions (bridge laws) be biconditionals (that however, is a common claim about the Nagelian account of reduction, see e.g. Kim).

Nonformal conditions for reduction

- The premises of the primary science should not be *ad hoc* assumptions (rules out reductions by trivial extensions of the primary science, page 358).
- The combined assumptions of the primary science should unify/relate seemingly unrelated laws of the secondary science (page 359).
- The primary science should be helpful for developing the secondary science (page 360).

Hinting at Schaffner:

Nagel’s account is sometimes criticized for being to strict, i.e. the conditions on reduction makes them very rare. Schaffner for example stresses how reductions can be reformative; in the sense that what is actually reduced (and thereby preserved) is a slightly revised version of the secondary science/theory.

Nagel is aware of the issue, but handles it rather differently, he suggests that:

(…) whether a given science is reducible to another cannot in the abstract be usefully raised without reference to some particular stage of development of the two disciplines.

(page 361)

So where Schaffner introduces a similarity relation between a reduced theory and its derived counterpart, Nagel seems to think of the reduced theory as a development of the earlier version, if reducible at all.

Section 3 (pages 364-366)

Nice discussion of the relata of the reduction relation; statements/theories or properties? He argues strongly for the first and against the latter, relevant for much contemporary discussion, especially in philosophy of mind.
IV The doctrine of emergence

Two versions of emergence; the nonpredictability version and emergent evolution (i.e. that new properties emerge as the universe unfolds...?).

Finally, his discussion of parts, wholes and organic unities

Well worth reading, but should, in retrospect, be supplemented with some info on mereological theories/calculus of individuals.