
Unification through frame-theoretic glasses

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We often hear that simplicity, explanatory power and unification, though aesthetically pleasing features of theories, are at best pragmatic considerations in matters of theory choice. In this talk, we argue that unification is demonstrably more than just a pragmatic consideration. After briefly surveying some failed attempts to carve out an adequate conception of unification, we proceed to offer our own conception, which, roughly speaking, amounts to a measure of the confirmational connectedness between content parts of a hypothesis. This enables us to make the claim that unification is at least partly an empirical, i.e. not merely a pragmatic, consideration in matters of theory choice. We end the talk by attempting to articulate this account of unification in frame-theoretic terms, namely as the connectedness between frames, their attributes and value-ranges.

Perhaps the best known conception of unification is that of Friedman (1974). He argues that there is an intimate connection between explanation, understanding and unification. An adequate theory of explanation must show how explanation generates understanding. And understanding is generated when we reduce the number of independently acceptable law-like assumptions that are required to explain phenomena. The lower that number the more unified a hypothesis, argues Friedman. The problem with this conception is that it is not clear how to count the number of independently acceptable assumptions. As Salmon (1998) points out, Friedman's own '*K*-atomic' way of counting such assumptions – a statement *S* is *K*-atomic if it is not equivalent to the conjunction of $n \geq 2$ law-like statements that are acceptable independently of *S* – is flawed as it turns out that no fundamental law statements qualify as *K*-atomic.

Although it ultimately fails, Friedman's account does at least get one thing right by placing the emphasis of the analysis on acceptability and hence on confirmation. Our proposal shares this emphasis. It departs from the notion of confirmational disconnectedness, roughly, the degree to which the content of a hypothesis is contrived or forcibly unified. The more confirmationally disconnected the content parts of a given hypothesis, the less unified it is. What is disconnectedness? To understand this notion appeal is needed to the notions of *relevant deductive consequence* and *relevant element* which we will briefly explain here – for more details see Schurz and Weingartner (2010). A relevant deductive consequence is, roughly, a proposition that has been validly derived in classical logic but that is also relevant in the sense that none of its constituent formulas can be replaced *salva validitate* of the derivation. A content element is, again roughly, a proposition whose content is so small that it cannot be decomposed into smaller content parts. On the basis of these two notions we may now construct the notion of confirmational disconnectedness. Two content parts of hypothesis expressed as consistent propositions *A*, *B* are *disconnected* if and only if (i) $P(\alpha/\beta) = P(\alpha)$ for all propositions α , β where α is a relevant (and non-redundancy containing) deductive consequence of *A* and β is a relevant (and non-redundancy containing) deductive consequence of *B* and (ii) for any such pair of α , β , there is no proposition γ that is a rele-

vant deductive element of $\alpha \wedge \beta$. Disconnectedness forms a barrier against the spread of confirmation between content parts. This means that more disunified hypotheses earn a smaller amount of spreading-support than less disunified ones. The latter are thus to be preferred to the former.

How can this idea be reconstructed in frame-theoretic terms? If hypotheses can be represented as sets of frames (see Anderson, Barker and Chen 2006), then content parts of hypotheses can be represented as subsets of those sets. We conjecture that the confirmational disconnectedness between content parts of a hypothesis is reflected in the way subsets of a hypothesis' frame-theoretic representation are related. One way to flesh out this idea is that subsets of frames that can be excised from the frame-theoretic representation of a confirmationally successful hypothesis without requiring a co-relative adjustment to the attributes and value ranges of the remaining frames are entirely disconnected from them. It may thus be said that such subsets are disunified from the rest of a hypothesis' frames.

Anderson H., Barker P. & Chen X. (2006). *The Cognitive Structure of Scientific Revolutions*. Cambridge: Cambridge University Press.

Friedman M. (1974). Explanation and Scientific Understanding, *Journal of Philosophy* vol. 71(1), pp. 5-19.

Salmon W. (1998). *Causality and Explanation*. Oxford: Oxford University Press.

Schurz G. & Weingartner P. (2010). Zwart and Franssen's Impossibility Theorem Holds for Possible World-Accounts but not for Consequence-Accounts to Verisimilitude, *Synthese* vol. 172, pp. 415-436.