Deduction, Induction, Conduction. An Attempt at Unifying Natural Language Argument Structures

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Chapter 6

Deduction, Induction, Conduction:
An Attempt at Unifying Natural Language Argument Structures

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1. Introduction

At the top level of what might be called the most entrenched ontology of natural language argument, normally at least two structures are distinguished: the *deductive* and the *inductive* one (Rehg 2009, Sinnot-Armstrong & Fogelin 2010, Snoeck Henkemans 2001). The first may be characterized as an information-*preserving* transition from premise(s) to a conclusion, the latter as an information-*enlarging* transition. Oftentimes, 'truth' or 'content' may be substituted for 'information.'

It might too early to say if *abduction* has lost the race for recognition as a third top-level category. Should it lose, then presumably that will be because its structure appears to be too similar to (reverse) deduction. Another candidate is *conduction*, proposed by Wellman (1971, 1975) and revived by Govier (1987a, b, 1999, 2001; also see Hitchcock 1981, 1994). Among its premises, conductive arguments feature counter-considerations against pro-reasons, against the conclusion, or against both. Generally, the conductive structure is filled out by an accumulation of individually non-decisive reasons. It is empirically instantiated in deliberative (Scriven 1981) and interpretative contexts (Allen 1993, Ball 1995), and has also received attention in legal studies (Aqvist 2007, Feteris 2008).

With Wellman, we hold that the conductive structure should be treated as a variant of neither the deductive one nor the inductive one.[1] If the conductive structure were treated as a token of the deductive structure, well-accepted properties of the deductive structure would be lost—which is undesirable.[2] Further, if the conductive structure were treated as a token of the inductive structure, then the distinction between "a premise being accepted *simpliciter*" and "a premise being accepted *and weighed* (or valued in importance)" would be leveled—which is at least equally undesirable.

Moreover, we claim that reducing the conductive to the inductive structure is more promising than a reduction of the conductive to the deductive structure, but nevertheless mistaken. Instead, we investigate the (presumably unorthodox) attempt of reversing this process, and understand the inductive as a limiting case of the conductive structure. We think there is a case to be made; and also the deductive structure might be understood as a limiting case of the conductive structure.

In Section 2, the conductive structure is introduced, and the deductive, inductive and conductive ones are distinguished on the criteria *information content* and *support dynamics*. The introduction of weights serves to explicate evaluative criteria (Section 3) and allows

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[1] "[I] must admit that the reasons for a moral judgment do not logically entail it; that is, the logical connection between factual premises and moral conclusions cannot be deductive. Those who hold that all reasoning is deductive, or even either deductive or inductive, must reject my view of moral knowledge because the sort to thinking involved in weighing the pros and cons is neither deductive nor inductive" (Wellman 1988, p. 292).

[2] This is opposed to Bickenbach and Davies's (1998, pp. 321f.) claim: "If conduction were straight-forwardly a matter of weighing (…) the argument would be either deductive or inductive."

for a reductive treatment (Section 4). Further evaluative constraints are discussed (Section 5) before closing with a summary and outlook (Section 6).

2. The conductive structure introduced and distinguished

2.1 The conductive or pro/con structure

By "conductive structure" we refer to the abstract properties of those natural language arguments (as opposed to their contents) that are reconstructable such that:

(1) Pro-reasons and counter-considerations form (normally two) groups, the elements of which are partially ordered on some scale capturing the notion comparative importance.[3]

(2) Pro-reasons confer positive and con-reasons negative support to the conclusion or some group element.

(3) An on balance principle (OBP) indicates that support for the conclusion is based on or comes about by considering more than one group.[4]

The above three conditions appear sufficient to identify a conductive structure, but they are perhaps not necessary.

The conductive structure is also known as the "pro/contra" argument form (Naess 2005). Wellman (1971) considered it in the context of case-by-case (ethical) reasoning; Govier later revived the idea in informal logic. The conductive structure is characterized most markedly by its conclusion being arrived at through a *weighing of pro reasons against counter-considerations*. On Wellman's view, "[t]o claim that a statement is true is to claim that the reasons for it outweigh the reasons against it (…)" (1971, p. 192).[5] Presently, a weaker claim is accepted in the context of pro/con argument: To claim that a proposal (not a statement) is acceptable (not true) is to claim that the reasons for it outweigh the reasons against it.

Several disciplines (e.g., economics, jurisprudence, political science, psychology, philosophy) acknowledge a weighing of considerations as an indispensable feature of deliberation.[6] However, little is known about the processes or mechanisms (if any) that sustain it. Since the 1960s, mathematical modeling is regarded to have established the principled impossibility of *always* arriving at a unique aggregated preference order (*Arrow's theorem*).[7] Should results transfer, this goes at least some way towards explaining why little

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[3] The notion *comparative importance* is adopted from Gärdenfors (1984).

[4] The on balance principle (OBP) can be added in the reconstruction process or might appear as an overt discourse item. Typically, it will be a variation on: "While I/we *acknowledge* your reasons for X, I/we hold that …"

[5] The sentence continues: "(…); to claim that an argument is valid is to claim that it would be persuasive after indefinite criticism" (Wellman 1971, p. 192f.).

[6] Kock (2007, p. 185) presents the classical virtues *prudence*, *social instinct*, *courage*, *temperance*, then cites Cicero: "[I]t is often necessary in deciding a question of duty that these virtues be weighed against one another" (*De Officiis* 1.63.152).

[7] Arrow (1950) derived his theorem from comparatively weak assumptions. Reference to *values* was purposefully avoided. Instead, the (presumably less charged) term 'preference' is used. The theorem suggests that Arrow's assumptions may be strengthened. Rather than working with comparative

attention has been paid to the conductive structure. Moreover, along with Wellman, many are of the opinion that there is no formal or general logic that could be used to evaluate conductive arguments in the same sense that deductive or inductive arguments may be evaluated. This view is often based on the ground of a principled distinction between *practical* and *theoretical* reasoning (e.g., Kock 2009a, b).

Addressing evaluative standards at the end, we are mainly concerned with relations between deduction, induction and conduction. Our starting point is to question the usefulness of the practical/theoretical distinction for argument structures.

2.2 Information content and support dynamics

For the purpose of distinguishing the conductive from the deductive and the inductive structure, two criteria will be employed.

(1) The comparative difference in information content of the premise-set *vis à vis* the conclusion (*information content*).[8]

(2) The dynamic behavior of the support relation between premise and conclusion under premise-revision (*support dynamics*).

By *support relation* we designate what is also called *argumentative strength* or *justificatory force* (see, e.g., van Eemeren and Grootendorst 2004). By *dynamic behavior* we designate the effect suffered by this support relation upon premise retraction or premise addition.[9] By *premises* and *conclusion*, we designate natural language sentences and their (descriptive or normative propositional) contents. '$P_n \therefore C$' shall mean that C *is* a consequence of a set with n premises, and *is not* such a consequence when "$\therefore$" is starred ("$*\therefore$"). Deductive, inductive, and conductive consequences are indicated by the subscripts DED, IND and CON.

If one employs these criteria, differences are obtained when comparing paradigmatic instantiations ("toy examples") of the three argument structures. These differences provide support for the claim that the *weighing of pros and cons* is not merely an accidental feature of the conductive structure—a feature one would dispense with carelessly when treating pro/con arguments under the reconstructive standards of the deductive or inductive argument form.

2.3 The deductive structure

If a conclusion is a *deductive* consequence of a group of premises, then the information content of the premise group, $I(P_n)$, is equal to the information content of the conjunction of the premise-group and the conclusion, $I(P_n \wedge C)$. We can allow the conclusion to be a

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preferences (*ordinal scale*), at cardinal value (*interval scale*) unique social welfare functions become more expectable. Also see Scriven (1981).

[8] 'Information content (difference)' should be understood informally; we do not offer a formal measure (likewise for 'relevance', below). Information may be understood as semantic content, the Bar-Hillel/Carnap distinction into *factual* and *instructional* content being basic (see Floridi 2005, section 3).

[9] These operations are adopted from the AGM approach which models the dynamics of deductively closed and consistent sets of sentences. See Alchourón, Gärdenfors and Makinson (1985) and Gärdenfors (1984, 1988, 2003, 2005).

premise-repetition (copy), yet require that premises are individually and jointly consistent[10] as well as relevant to the conclusion. Expressed concisely:

(1) If $P_n \therefore_{DED} C$, then I $(P_n \wedge C)$ = I (P_n)

It is a different question whether the premise group P_n is (externally) consistent to some other premise group, e.g., background knowledge. However, P_n must be internally consistent, otherwise any conclusion would follow deductively (*ex falso quodlibet*).

As for dynamics, in the *deductive* case, premise addition is without effect upon the support that premises lend to a conclusion, since *monotony* holds. Monotony means: If a set of premises deductively entails a conclusion, *C*, then the logical conjunction of this set and any premise deductively entails *C*. In contrast, premise deletion literally "destroys" the argument, once it is required that the premise group feature no irrelevant premises. With '&' for addition and '–' for retraction, we can write:

(2) If $P_n \therefore_{DED} C$, then P_n & $P_m \therefore_{DED} C$ and $P_n - P_m * \therefore_{DED} C$

As a paradigmatic (meta-level) example of a deductive structure, consider the following instantiation of disjunctive exploitation (*p* or *q*; *p* is not the case; therefore *q*).

Example of a Deductive Argument

    (P1)   An argument is either deductive or defective.
    (P2)   This argument is not deductive.
    (C)   This argument is defective.

This is a meta-level instantiation, since both premises are *un*acceptable. After all, (P1) states a non-exhaustive dilemma and (P2) states a factual falsehood. Nevertheless, the premises deductively imply (C), which is an acceptable conclusion: "This argument is defective." (This example can easily be replaced with a less loaded one.)

Under the above constraints (internal consistency, relevance), and for reasons of deductive logic, there can be no premise (P3), the addition of which would render (C) anything less than the deductive consequence of (P1) and (P2). In other words, *via* premise addition, one cannot change the conclusion of a deductive argument. Moreover, upon deletion of (P1) or (P2) from the premise group, (C) could remain a deductive consequence only if (P1) or (P2) are replaced. So, in order to *maintain* deductive support for (C), premise deletion incurs premise revision.

In summary, in the deductive structure, *premise weakening* does not come in degrees. A conclusion either is a deductive consequence of some premise set or it is not. Moreover, premise *addition* does not strengthen the premises in the sense that "including new information" suggests. This means, a conclusion which is to remain a deductive consequence of a group of old and new premises will be *supported* by the entire premise group only if new and old information has (somehow) been "integrated."

The above considerations set the stage for the claim that, if the conductive structure is a limiting case of some other structure, then it seems implausible to assume that the reducing structure will be deductive.

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[10] Consistency means that instantiations of '*p* $\wedge$ *non p*' do not occur.

2.4 The inductive structure

If a conclusion is the *inductive* consequence of a group of premises, then the information content of the conjunction of the premise-group and the conclusion is at least as great as the information content of the premise group alone. In other words, the transition to the conclusion may be *ampliative*.

$$(3)\ \text{If } P_n \therefore_{\text{IND}} C, \text{ then I } (P_n \wedge C) \geq \text{I } (P_n)^{11}$$

As for dynamics, in the inductive case, both premise addition and premise deletion will necessarily *influence* the support that the premises lend to conclusion. Below, this influence is indicated by a subscripted '+/-,' and holds under the same constraints as in the deductive case (consistency, relevance).

$$(4)\ \text{If } P_n \therefore_{\text{IND}} C, \text{ then } P_n \ \& \ P_m \therefore_{+/-} C \text{ and } P_n - P_m \therefore_{+/-} C$$

As a paradigmatic (object-level) example of an inductive argument, consider the following. It is a simplified version of an example from Toulmin (1958). Copi and Cohen (2001) call it *statistical* syllogism, since (P2) is not general. (Ignore for the moment that (P2) is untrue; presently, most Swedes do not commit to any religion.)

   Example of an Inductive Argument

   (P1)   Peter was born in Sweden.
   (P2)   90% of Swedes are Protestants.
   (C)   Peter is a Protestant.

Under the above constraints (consistency, relevance), there may—for empirical reasons— be a premise (P3), addition of which ceases to render (C) the inductive consequence of (P1) and (P2), e.g.:

   (P3)   Peter's parents emigrated from China 15 years ago.

So, *adding* information to the premises of an inductive argument can weaken the premise-conclusion support. In the two-premise example above, premise-deletion will likewise destroy the argument; this mirrors the deductive case. However, for inductive arguments with more than two premises, premise addition or deletion normally affects support in a less drastic way: premise change will strengthen *or* weaken the inductive support lend upon the conclusion. Only in cases of unexpected new information would support be drastically reduced. If so, then the negation of *C* is supported.[12]

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[11] By choosing '≥', we also account for *enumerative induction* (e.g., "This marble is black, so is this, and this, etc.; therefore: All *these* marbles are black"), where the information content of the conclusion is equivalent to that of premises (compare the deductive structure). In contrast, 'If $P_n \therefore_{\text{IND}} C$, then I $(P_n \wedge C) > $ I (P_n)' captures cases of inducing content which goes *beyond* the premises. The induced content may be considered *new information* relative to this premise group.

[12] In probabilistic terms, this is expressed by taking a conclusion, *C*, (rather than *non C*) to be inductively supported as long as its (objective or subjective) probability value is within the]0.5, 1[interval. Wellman (1971, p. 269) mentions cases in which supporting and support-undermining reasons can

2.5 Reasons against the conclusion vs. reasons against the premises

In the above example, (P1) and (P2) are reasons *for* the conclusion, (C), while (P3) is a reason *against* (C), possibly in conjunction with a premise that China's population is not predominantly Protestant. Furthermore, for any con-reason to undermine the conclusion of a deductive argument the consistency requirement levied onto the premise group must be undermined. Therefore, a reason against a deductive consequence is also a reason against at least one premise. As (P3) shows, in the inductive case, this is not so: (P1-P3) are jointly consistent.

   In the three-premise inductive example (P1–P3), the geographic origin of one's family is not logically inconsistent with one's own nationality and that nation's religious proportions. (P1–P3) are logically independent. Rather, the Chinese heritage of Peter's parents, as expressed in (P3), provides a reason against the conclusion (Peter is a Protestant) receiving inductively strong support from the premises. (P3) is not a reason undermining a group element (P1, P2). Likewise,

>   (P4)   Peter has dark eyes and black hair.

may be construed as a reason against the conclusion (though not a decisive one), possibly in conjunction with a premise expressing that China's population is predominantly black-haired and dark-eyed.[13]

   Finally, the order in which information is received matters at least to some extent. For example, the support (C) receives from (P1) and (P2) does not seem to be affected when (P4) is added. However, support for (C) is affected negatively when (P4) is accepted along with (P1–P3). The Chinese family heritage is relevant insofar as hair and eye color follow particular distributions in a population.

2.6 The conductive structure

If a conclusion is the *conductive* consequence of a group of premises, then the information content of the conjunction of the premise-group and the conclusion is larger than the information content of the premise group. This mirrors the inductive case in which the transition to the conclusion is ampliative.

>   (5) If $P_n \therefore_{COND} C$, then I $(P_n \wedge C) >$ I (P_n)[14]

Unlike the inductive case, the pro and the con premises groups *can*, but they need not be jointly consistent. Moreover, adding or retracting a relevant premise from either the pro or the con group *can*, but need not result in a difference with respect to the support conferred by the premises upon the conclusion. So, a conductively supported conclusion will not necessarily be less supported when a reason is retracted, nor necessarily more supported when one is added. This feature holds under the relevance constraint on premises.

>   (6) If $P_n \therefore_{CON} C$, then P_n & $P_m \therefore_{CON} C$ and P_n - $P_m \therefore_{CON} C$

"balance out," i.e., the 0.5 point. He holds that occasionally more than one conclusion may be equally supported.
[13] Here is a natural contact point with defeasible reasoning (Pollock 2010, Woods 2010) which, presently, I cannot develop. For details, see Pinto (this volume, Ch. 8).
[14] Weakening this to 'If $P_n \therefore_{COND} C$, then I $(P_n \wedge C) \geq$ I (P_n),' as suggested for enumerative induction, might also be reasonable. See note 11.

The distinct support behavior under premise-change can be explained by the independent relevance of the premises for the conclusion,[15] and by an arguer not only retracting or expanding premises, but also updating[16] the *importance* of premises. Both explanations do not exclude, but rather complement, each other. The odd connection between premise revision and support-strength appears to be the most marked difference between the conductive and the inductive structure.

As a paradigmatic example of a conductive argument, consider the following. Here, (CC) stands for *counter-consideration*, (PR) for *pro-reason* and (OBP) for *on balance premise*; order and numbering are presumed to be arbitrary.[17]

Example of a Conductive Argument

(CC1) Aircraft travel leaves a large environmental footprint.
(CC2) Aircraft travel is physically exhausting.
(CC3) Aircraft travel is comparatively expensive.
(CC4) Airports do not always route baggage correctly.

(PR1) Aircraft travel is comparatively fast.
(PR2) I am overworked and likely able to sleep on the plane.
(PR3) My department reimburses travel expenses.
(PR4) Environmental footprint-differences can be compensated by purchase.

(OBP) PR1–PR4 outweigh/are on balance more important than (CC1–CC4)

(C) It is OK[18] to travel to the conference by aircraft (rather than by train).

The near-triviality of this example is on purpose.[19] (PR3) could be retracted, e.g., upon coming to learn that the department cannot reimburse 100% of travel cost. This would constitute (CC5). Also (CC2) could be retracted and modified, e.g., upon coming to learn of a first class ticket. Finally, a family member's illness could be a counter-consideration against a presumption of the conclusion (namely, to attend the conference), *without* pertaining to any pro reason.

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[15] This is suggested in Govier (2001). She ranks pro-reasons and counter-considerations as part of argument evaluation. Importantly, not the premises are ranked (e.g. according to importance), but each premise's associated conditional generalization according to the size of its exception class (a.k.a., the scope of its *ceteris paribus* clause). I find it more natural to rank the "individuated reasons," i.e., "$Fa \rightarrow Ga$" rather than "CP [$\forall x (Fx \rightarrow Gx)$]." On Govier's method, see Wohlrapp (2008, pp. 316-334), translated in Zenker (2009a), and Zenker (2009b).

[16] See Wohlrapp (2008) for an account of such updating. He assumes that premise importance is a function of how an issue is subjectively constituted ("framed"), and holds that continued discussion can lead to a correct (or ultimate) framing.

[17] I owe the core of this example to Hans Hansen. Considerations of persuasive effect may pertain to the order in which pro and con reasons are presented, e.g., "pro followed by con, etc., conclusion" or *vice versa* or "pro/con, pro/con, etc., conclusion." Here, I can neither address these, nor any dialectical considerations.

[18] Instead of 'it is OK' (Pinto 2009), 'apt' or 'adequate' could be used.

[19] Deciding on aircraft travel is trivial compared to socio-political issues such as global warming, population growth, genetic engineering, aging societies.

In this example, (PR2–PR4) counter (CC1–CC3), while (PR1) is not addressed by a counter-consideration ("is open"). It is difficult to discern how (PR1) could be addressed, other than by cancelling the above presupposition, in which case (PR1) would be rendered irrelevant. Moreover, (CC4) remains unaddressed by any pro-reason. It might be countered by stating that the objective probability of *my* baggage (as opposed to a piece of baggage similar to mine) being routed incorrectly on *my* flight (as opposed to a flight similar to mine) is epistemically inaccessible to me. Hence, the accessible probability of a baggage loss event is a subjective credence value. This *should* be less important than considerations which do not depend on subjective credence, such as the environmental footprint.

In summary, featuring both pro *and* con reasons, the conductive argument structure, as described here, bears a stronger resemblance to the inductive than to the deductive structure. For reasons of consistency and monotony (above), to respect the pertinence of counter-considerations appears not possible in the deductive structure.

2.7 Closure principle vs. On balance principle

As a necessary evaluative condition, the 'principle of total evidence' associated with induction demands that a conclusion count as inductively supported *only if* all relevant reasons appear in the premise group.[20] Some of these may be counter-considerations.

This inductive closure principle resembles the 'on balance principle' of a conductive argument. However, the total evidence principle serves a different purpose. Like the conductive principle, it signals that the transition to the conclusion is based on a finite premise group. Additionally, it spells out the normative demand that this group be *exhaustive* or complete with respect to relevant considerations.

In contrast, the on balance principle indicates at most a descriptive truth, namely that the transition from the premises to the conclusion occurs on the basis of (at least) two particular groups of premises, the pro and the con group. But there is usually no indication that these groups satisfy additional normative standards. Rather, if such a requirement is imposed on the argument, this occurs when evaluating the argument.

It seems natural to assume that various specifications of the on balance principle can give rise to distinct evaluative constraints. I return to this in Section 3.

2.8 The dynamics of the premise groups

Premise groups of a conductive structure may (in principle) be thought of as dynamic. More precisely, the groups of premises claimed to be positively or negatively relevant to a conclusion may be understood as *dynamic* in two senses.

In a *simple sense*, groups are dynamic because new reasons pro/con a given conclusion can be added to the premise set (Wohlrapp 2008). This at least holds in principle. However, it is not clear (to me) to what extent the presumed openness of the pro/con premise groups translates into *qualitatively new* reasons.[21] Clearly, new reasons may again relate favorably or unfavorably either to the conclusion or to the premises. This, however, is also the case in the inductive structure.

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[20] It is another matter if one can *know* that the principle is sufficed. But it is a correct criterion nevertheless. *Ex ante* knowledge of the reference class of a future event is an independent problem, unless total evidence would include information we currently do not know how to access or assess.

[21] For example, the debate on the permissibility of abortion and human embryonic stem cell research (Zenker 2010) normally features *exactly four* entrenched con-reasons (aka. "SCIP arguments" for species, continuity, identity, potentiality).

In a *less simple sense*, the group of premises in a conductive structure remains dynamic with respect to the positive support conferred by the pro-reasons upon the conclusion and the negative support by the con-reasons undermining it, as each reason in the pro and the con group can be assigned (what may most generally be called) an *evaluative mark*. This mark can, but it need not be represented by a numeral. If it is, one speaks of a *weight, w*. It may be captured as a function assigning a positive real number[22] to a premise.

$$(7)\ w\ (P_n) \to R+$$

Thus, over and above (positive or negative) support for a conclusion, the differential support-*contribution* of a premise for a conclusion is indicated.

3. Towards evaluative criteria

Given the above, the support which the conclusion of a conductive structure receives from the premises may be captured as the sum of aggregated weights of pro and con reasons. In other words, for one conclusion (rather than another) to be the conductive consequence of a group of *pro and con* premises, a comparison must yield a weight-*difference*.[23] If such aggregation is a mere matter of summation, this yields:

$$(8)\ \text{If } Pro_n, Con_n \therefore_{\text{CON}} C, \text{ then } \sum w\ (Pro_n)\ /\ \sum w\ (Con_n) \neq 1$$

The comparative importance of a reason *vis à vis* a counter-consideration cannot be represented in the inductive case—at least not without leveling the distinction between "a premise being accepted *simpliciter*" *vs.* "a premise being accepted *and weighted in a particular manner*." Indications of a premise's importance for a conclusion appear to be different from and are, perhaps, independent from, indications of its probability. After all, (im)probable premises can, but need not amount to (un)important considerations.

Through the assignment of comparative importance (*via* weights), and through the distinction of weights from probabilities, then, the inductive and the conductive argument structure come apart. The weight-update suffices to explain that conductively supported conclusions may cease to be supported upon retraction or addition of relevant premises; and it also suffices to explain that conductively supported conclusions may be maintained upon premise change.[24]

The above shall support the claim that the notion *comparative importance* can give expression to a reasonable evaluative constraint for pro/con arguments featuring an on balance principle. We return to the evaluative aspect below. First, we demonstrate that *comparative importance* in conjunction with *information content* and *support dynamics* can feature in a unified treatment of the deductive, inductive, and conductive structures.

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[22] One might further restrict this range, depending on the particular case.

[23] This difference could go above some threshold, to indicate its significance.

[24] So, by allowing weight updates, one may account for the observation that, despite a premise having been retracted, a proponent may still maintain her conclusion.

4. Two-step reduction

The following objection is immediate: On the present understanding, a conductive argument is but an inductive one in which the premises are consistent, relevant, etc., and each premise bears a weight reflecting its comparative importance for (supporting) the conclusion. Therefore, one might say, the conductive structure reduces to the inductive one in the limiting case where the assigned weights all take some constant value.

While *prima facie* plausible, it is a reduction in the opposite direction that harbors the potential for unifying argument structures. That is, rather than view the conductive as a limiting case of the inductive structure, one might view the inductive as a limiting case of the conductive structure.

If this move is accepted, the possibility for extending the reduction to the deductive structure arises. That is, one may try to understand both the inductive and the deductive structure as *successively reached* limiting cases of the conductive structure. The conductive structure would then be the richest of the three structures.

In the first step, to generate the inductive from the conductive structure, the range of assignable weights is constrained (here: from R+) to a constant value. In the second step, to generate the deductive from the inductive structure, the information content difference is constrained from $I\,(P_n \wedge C) \geq I\,(P_n)$ to $I\,(P_n \wedge C) = I\,(P_n)$.

The two sufficient (though perhaps non-necessary) criteria, *information content* and *support dynamics*, continue to distinguish the three structures. The principled difference between the conductive and the inductive structure is that weights can be updated upon premise change in the conductive, but not in the inductive (or the deductive) structure. Further, we can have information increase between premises and conclusion in the conductive and the inductive, but not in the deductive structure.

Dropping some of the subscripts, the following summarizes the desiderata. (Ps) indicates constraints on the acceptability of premises (Freeman 2005).

Conductive
    (C1)   If $P_n \therefore C$, then $I\,(P_n \wedge C) > I\,(P_n)$
    (C2) $P_n \,\&\, P_m \therefore C$ and $P_n \text{-} P_m \therefore C$
    (C3) $w(P_n) = \text{R+}$
    (Ps)   relevance

Inductive
    (I1)   If $P_n \therefore C$, then $I\,(P_n \wedge C) \geq I\,(P_n)$
    (I2) $P_n \,\&\, P_m \therefore_{+/\text{-}} C$ and $P_n - P_m \therefore_{+/\text{-}} C$
    (I3) $w(P_n) = \text{constant}$
    (Ps)   relevance, consistency

Deductive
    (D1)   If $P_n \therefore C$, then $I\,(P_n \wedge C) = I\,(P_n)$
    (D2) $P_n \,\&\, P_m \therefore C$ and $P_n - P_m * \therefore C$
    (D3) $w(P_n) = \text{constant}$
    (Ps)   relevance, consistency

5. Discussion

If a unification of argument structures were to be achieved, then this unification would have come about because the weights (which arise in reconstructing conductive arguments) were "carried through" to the deductive and inductive structure (where they do not arise). Since these weights are set to a constant value in the inductive and the deductive case, they do not matter there. They are "hidden."

We lay no claim to the psychological reality of weights. The above is only a model, and needs to be developed. In particular, allowing weights from R+ appears to be too large a region. A smaller interval could suffice, though this should be left to the individual case under study. For the analyst, the choice might depend on her evaluative purposes; the same holds for a minimal weight requirement (see below).

On our proposal, the conductive structure can, but it need not be treated as a third top level category. Rather, the three structures can be understood as variations along the dimensions 'information content-difference between premise and conclusion' and '(premise conclusion) support behavior under premise change'.

Taking the differential importance of premises seriously—by treating weights not as a *mere* metaphor—has useful implications for evaluating conductive arguments. As indicated above, if there is *no* weight difference between the summed weights of pro and con reasons, then—whatever the conclusion (C) may state—it cannot be more supported than its negation (*non* C). Hence, for any claim that a particular conclusion is, on balance, (significantly) *more* supported than another, there will be a weight assignment that makes it so.[25]

Any weight-update in response to new information can be traced. With respect to this update, then, additional normative constraints might be spelled out. Such constraints might include a *threshold* (the significance of a weight difference), *exhaustiveness* (all relevant considerations weighted), *homogeneity* (uniform weight-scales), *and ignorance* (absence of relevant considerations).[26]

Finally, provided the claim is raised—as it normally is when compromises between conflicting positions are supported—that counter-considerations are *respected* or *acknowledged* in a conclusion, then an evaluative condition consist in not allowing the assignment of the weight zero to any counter-consideration (*insincerity*). Content-wise, then, each counter-consideration must (somehow) be discernible in the conclusion (*differentiability*), unless the claim to having acknowledged it is simply false.

These constraints should be further developed and applied.

6. Conclusion

On two criteria, (i) the difference in information content between premises and conclusion and (ii) the dynamic behavior of the support for the conclusion upon premise change, the *deductive*, the *inductive* and the *conductive* structure may be distinguished. Allowing weights to be assigned to premises (which are variable in the conductive, yet constant in the deductive and the inductive structure), the three structures can be understood as variations on these criteria.

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[25] Analysts may motivate aborting a case, when it becomes clear that participants apply such weights incorrectly or, perhaps, treat them as metaphors after all.
[26] The constraints discussed here partially overlap with those of Mann (1977). The ignorance and the exhaustiveness constraint might perhaps be drawn into one.

Should unification be achieved here, then this would have been made possible by taking the weight metaphor ("weighing pros against cons") seriously. Building on the assignments of weights, several evaluative conditions for conductive arguments were proposed. Perhaps most basic are the non-zero difference between summed weights and the non-zero weight for pro or con-reasons. The first addresses an *imbalance* between pro and con reasons, the second *falsely* claiming to acknowledge counter-considerations.

Further conditions may become available as the model is developed. Perhaps, the region R+ will be too large to be useful in evaluation. Future work should investigate overlap with probabilistic modeling and importance measures, for example in risk assessment. Another task is to provide specifications of the on balance principle; one might investigate how a *proportionality principle* (or similar) differs from it (Zenker 2010). Finally, it might be possible to extend the "reduction" to abduction.[27]