Argument schemes—an epistemological approach

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ABSTRACT: The paper develops a classificatory system of basic argument types on the basis of the epistemological approach to argumentation. This approach has provided strict rules for several kinds of arguments. These kinds may be brought into a system of basic irreducible types, which rely on different parts of epistemology: deductive logic, probability theory, utility theory. The system reduces a huge mass of different argument schemes to basic types and gives them an epistemological foundation.

KEYWORDS: adequacy of arguments, argument schemes, branches of argument schemes, epistemological theory of argumentation, Kienpointner, practical arguments, probabilistic arguments, types of types of arguments, validity, Walton.

1. THEORIES OF ARGUMENT SCHEMES AND THE AIMS OF THIS PAPER

The ancestor of the theories of argument schemes is Aristotle's incredibly rich and elaborated "Topics", which dominated rhetoric until the 20th century. However, with the renaissance of argumentation theory at the end of the 1950s, the study of argument schemes has undergone a continuous inflow of new ideas and approaches. Some important contributions since then have been made by Perelman & Olbrechts-Tyteca (1958), Hastings (1963), Grennan (1984, 1997), Schellens (1985, 1987), Govier (<1985> 2000, 1987), Kienpointner (1992a, 1992b), Walton (1996), Garssen (1997, 2001, 2002), and Walton & Reed & Macagno (2008). Although progress has been made, most of these approaches are still strongly influenced by Aristotle's "Topics";[1] and this might be problematic. Topics, or "topoi" in Greek, are commonplaces; and the main idea of a topical approach to argumentation is to establish collections of powerful contents, i.e. ideas from which to argue convincingly, which then are classified according to again contentual categories. Three interrelated argumentation theoretical problems with this approach are, first, that the lists of resulting schemes are long, often very long, never complete and always arbitrary. Second, today's approaches should not be contentual but formal, thereby explaining the contents. Third, there is no (more general) theory behind these lists of schemes, which could explain and guarantee their validity or some other form of value as well as bring us nearer to a really complete list.

A quite different approach to argument schemes has been followed in the epistemological theory of argumentation, in particular by Feldman (<1993> 1999) and myself

[1] An important exception are e.g. Govier's system of argument schemes (Govier <1985> 2000) and her reflections on classes and the completeness of such classes of argument schemes (1987: 37-54), which are comparatively near to the epistemological approach in argumentation theory.

Zenker, F. (ed.). *Argumentation: Cognition and Community. Proceedings of the 9th International Conference of the Ontario Society for the Study of Argumentation* (OSSA), May 18-21, 2011. Windsor, ON (CD ROM), pp. 1-32.

(Lumer 1990). The main idea of the epistemological theory is that argumentation should lead to knowledge or rationally justified belief; and the theory that explains what rationally justified belief is and provides criteria for this is epistemology in cooperation with other fundamental philosophical disciplines such as logic, theory of probability and theory of practical rationality or prudential desirability. Accordingly, in the two books just mentioned, formal criteria for good arguments are developed on the basis of these theories. Though the resulting lists of argument types are quite comprehensive and cover many more argument schemes than the approaches based on topics, these lists are not complete, and they are not systematised in a way that leads to an understanding of the interrelations between various groups of argument schemes and to achieving some sort of completeness.

The present paper tries to provide this missing kind of (epistemological) theory of argument schemes. The function of argumentation and the structure of argument will briefly be explained starting from an exposition of the basic idea of the epistemological theory of argumentation. This exposition also serves to show how, and on which bases good arguments should be constructed, according to the epistemological theory. Among these bases are logic, probability theory and the theory of practical rationality and desirability. The theory then goes on to sketch a classification of argument schemes that indicates which kinds of (good) deductive, probabilistic and practical arguments are based—and in which way—on these underpinnings. The classification strives for a certain kind (cf. below) of completeness of the presented argument types.

However, before beginning with the constructive part of this endeavour, a short critique of some paradigmatical theories of argument schemes shall deepen the appreciation of the advantages of the epistemological theory of argument schemes.

2. SOME CURRENT THEORIES OF ARGUMENT SCHEMES—AND THEIR SHORTCOMINGS

To discuss two paradigmatic theories of argument schemes may be sufficient to illustrate the necessity for a different approach and its required features. The theories chosen for this aim are Kienpointner's "Alltagslogik" (1992a) and "Argumentation Schemes" by Walton, Reed and Macagno (2008).

2.1 Kienpointner's "Alltagslogik"

Kienpointner's rich collection contains a list of 58 main argument schemes plus 15 subschemes (1992a: 250-402; cf. Kienpointner 1992b: 179-182)—strongly influenced by Aristotle's "Topics" and Perelman's & Olbrechts-Tyteca's work (1958). These schemes are divided into three main classes: I. warrant-using, II. warrant-establishing, and III. other schemes, which contain 21 groups of schemes such as "definition", "genus-species", "whole-part", "identity / similarity", "inductive examples", "cause-effect", "action-result", "ends-means", "analogy" or "authority". As these names clearly reveal, this classification of groups is semantic, not formal. One of the genus-species schemes e.g. is scheme (5):

(5) What is predicated on the species [e.g. human] is also predicated on the genus [e.g. living being].
X [e.g. to be mortal] is predicated on the species [human].
Therefore: X [to be mortal] is predicated on the genus [living being].

(Kienpointner 1992a: 264; insertions in square brackets and translation are mine, C.L.)

One of the whole-part schemes e.g. is scheme (11):

(11) What is predicated on the whole is also predicated on its parts.
X is predicated on the whole.
Therefore: X is predicated on the parts.

(Kienpointner 1992a: 274; my translation, C.L.)

A strong characteristic of Kienpointner's theory is that he tries to give the schemes a deductively valid form. 47 of the 58 schemes are deductively valid—44 of them have the simple *modus ponens* form ('if *p* then *q*; *p*; therefore, *q*') or the general *modus ponens* form ('all *F* are *G*; *a* is *F*; therefore, *a* is *G*')—, another eight schemes are probably intended to be deductively valid, though they are not (a premise is always missing in schemes 20, 21, 24 and 25; in schemes 22, 32, 33 and 53 qualifiers like 'probably' prevent deductive validity [2]). Apart from one scheme whose structure is not clear to me (scheme 16, Kienpointner 1992a: 276), only two schemes (55 and 56, Kienpointner 1992a: 385) are neither deductively valid nor (probably) meant to be so.

The problem of argument validity is lurking behind this kind of (quasi-)deductivism. Kienpointner defends a relativistic conception of validity, according to which validity and truth depend on the subjects' language games (Kienpointner 1992a: 133-165). The deductivist approach is in strong contrast to this relativism and probably is intended to resolve the following major problem. It is a commonplace in argumentation theory that many good arguments, even if they are taken as enthymemes and completed with additional appropriate premises, are not deductively valid. Therefore, a theory of good but not deductive arguments is needed, which is one of the big challenges in argumentation theory. Now, Kienpointner seems to want to resolve this problem by transforming the respective schemes into deductively valid schemes in two ways, strengthening the premises (in particular in his schemes 5, 11-14, 17, 27, 46-50), or weakening the conclusions (e.g. in schemes 51-52). As a consequence, however, the strengthened premises are plainly or, depending on the respective concretisation, in many or most cases false—this already holds for the first premises of the above cited schemes 5 and 11; two other examples are: 'You shall do what everybody / the majority does' (major premise of scheme 17, Kienpointner 1992a: 276) and: 'If the effect justifies the evaluation *X*, also the cause has to be evaluated as *X*' (major premise of scheme 46, Kienpointner 1992a: 340). And the weakened conclusions in most contexts are useless—e.g. in scheme 51 the conclusion, instead of the generalisation 'all *X* are *Y*', is only: 'not a few / numerous / many / most *X* are *Y*' (Kienpointner 1992a: 368), which mostly is not a very helpful result

[2] In scheme 32 Kienpointner puts 'probable' into brackets (Kienpointner 1992a: 311); in scheme 53 he writes 'true / probable' (Kienpointner 1992a: 374). This loose handling of qualifiers with a too facile switch from true to probable, could indicate that Kienpointner might not be completely aware of the radical change for the inference's validity induced by such a switch.

if one needs this conclusion as a premise for further reasoning. So Kienpointner's schemes are only an illusory solution to the problem of ampliative, hence non-deductive argument schemes, which have the function to provide comparatively strong conclusions on the basis of weaker premises. Instead of resolving this riddle, Kienpointner's proposal eliminates ampliative schemes altogether.

Three further problems of Kienpointner's list of argument schemes are these. First, the arguments from analogy (schemes 55-56, Kienpointner 1992a: 385) are fallacious. The problem is that analogies hold only up to a certain point and that in standard argumentative situations we never know whether we are before or beyond that point; in addition, there is not even a statistical basis we could use to estimate how far the analogy goes; furthermore, often there are problems of interpretation so that we do not even know what the continuation of the analogy would be. Therefore, analogies have only heuristic but no probative value. Second, even apart from having disregarded (nearly) all ampliative argument schemes, Kienpointner's list is very far from being complete in the deductive realm. As already mentioned, most of his schemes have the simple or general *modus ponens* form; Kienpointner's list contains only very few other deductive or intended to be deductive forms (schemes 32, 33, 37, 51 and 52). In logic there are, of course, hundreds of deductively valid inference forms, many of them are also used in everyday or scientific reasoning. In addition, other weak forms of arguments are missing, in particular practical arguments. Finally, as already the title of Kienpointner's book indicates, the list is intended to cover only forms of everyday reasoning; hence all argument schemes used primarily in scientific contexts are missing. Third, with respect to assessing argument schemes, their strength or fallaciousness, the semantic classification of schemes is not theoretically revealing.

All this points to a deeper problem. Kienpointner's "Alltagslogik", or "everyday logic" uses a bottom-up empiristic method. He has analysed large linguistic corpora of everyday arguments, arguments in public debate or in advertising, reconstructed these arguments and classified them. Though this enormously elaborate work is helpful in some respects it does not provide a real theory of argument, which could explain what arguments are, what there function or aim is and how their structure serves to fulfil this function. There are three major instrumentalist conceptions of arguments and argumentation in present argumentation theory, the epistemological, which says that argumentation should lead us to justified belief, the rhetorical (in a strict sense), which sees changing an addressee's beliefs as the function of argumentation, and the consensualistic approach, which takes consensus or the resolution of differences of opinion to be the function of arguments (Lumer 2005b: 189-192). Although Kienpointner's approach is rhetorical in a broad sense, he does not commit himself to any of these or another instrumentalist conception of argumentation. However, only an instrumentalist conception of arguments can provide the basis for an elaborate construction and evaluation of argument schemes. Therefore, the bottom-up and in a broad sense rhetorical approach cannot provide a deeper understanding of arguments nor a deeper evaluation of the validity of argument schemes nor a systematic reconstruction of known schemes and the construction of new ones, with the final end to develop a complete system of argument schemes.

2.2 Walton's, Reed's and Macagno's "Argumentation Schemes"

Walton & Reed & Macagno (2008) have recently presented what is currently the most fruitful system of argument schemes in the rhetorical (in the broad sense) tradition. This is a list, called "*compendium*", of 60 main argument schemes and a further 44 sub-schemes, handily described with additional critical questions (Walton et al. 2008: 308-346).[3] The schemes again are differentiated according to their content, like "argument from position to know", "argument from expert opinion", "argument from sunk costs", "argument from sign", "argument from rules", or "argument for an exceptional case". However, as compared to Kienpointner's system, at least *prima facie* a considerable progress has been made. Like Walton's previous endeavour, i.e. "Argumentation Schemes for Presumptive Reasoning" (Walton 1996), the collective work (Walton et al. 2008) contains an explicit and new treatment together with an extensive list of presumptive or plausibilist argument schemes. Among the 104 listed schemes only 24 are deductively valid and another four are analytically valid, i.e. deductively valid if supplemented by analytically true premises (my classifications and counts).[4] Hence the remaining 76 schemes should be presumptive argument schemes. The new treatment of presumptive schemes consists in adding critical questions to the scheme itself, e.g.:

> 1. ARGUMENT FROM POSITION TO KNOW
> *Major premise:* Source *s* is in position to know about things in a certain subject domain *f* containing proposition *p*.
> *Minor premise: s* asserts that *p* is true (false).
> *Conclusion: p* is true (false).
> CRITICAL QUESTIONS
> CQ1: Is *s* in position to know whether *p* is true (false)?
> CQ2: Is *s* an honest (trustworthy, reliable) source?
> CQ3: Did *s* assert that *p* is true (false)?
>
> (Walton et al. 2008: 309, Variables changed to my system, C.L.)

The critical questions, according to Walton et al., express the defeasibility of plausibilist arguments. Since plausibilist arguments are not strictly binding like deductive arguments, the addressee can ask these critical questions before accepting the conclusion (Walton et al. 2008: 8). The argument is defeated if the addressee asks an appropriate critical question that is not answered by the proponent (ibid.: 3, 9). This treatment of defeasability implies that Walton's, Reed's and Macagno's conceptualisation of presumptive arguments is dialogical. According to them, advancing an argument shifts the burden of proof, and asking the critical question shifts it back again etc. (ibid.: 12, 35-37). In the end holds: "A presumptive argumentation scheme imposes a relation of conveyance on the respondent such that if he accepts the premises, and if the scheme is applicable, and if all the requirements of the scheme are met, the conclusion is conveyed to him by these factors." And this means "that he has now been given a cogent reason for accepting it" (ibid.: 36).

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3 The idea to add specific critical questions to every argument scheme goes back to Hastings (1963).

4 The deductively valid schemes are: 4, 11.1, 11.2, 12.1, 12.2, 13.2, 14, 15, 16, 17, 18.2, 21.1, 21.2, 26, 26.1, 32.2, 38, 41, 46, 48, 55.1, 55.2, 55.3, 56; the following schemes are analytically valid: 3, 44, 51, 54.2 (cf. Walton et al. 2008: 310-344).

To begin with the last point: The quality, validity or acceptability of an argument and hence the truth, probability or acceptability of its conclusion can hardly be a question of dialogue and burden of proof because we can use these arguments privately, for ourselves or scrutinise e.g. written arguments of arguers who are unreachable for us (dead, staying in distant places etc.) for epistemic purposes, i.e. for examining whether the thesis is true. In such cases there is no respondent and no burden of proof. In addition, if I present a bad argument to a clever or to a simple addressee where the latter accepts nearly everything and the former nearly nothing of my argument this does not change anything with regard to the quality of my argument. Therefore, the critical questions should be treated as being possibly asked by the arguer himself. Consider the example cited above. Questions CQ1 and CQ3 only ask for the truth of the premises, which could be done for every premise of every argument. Hence, these critical questions do not add anything new regarding presumptive arguments. The only new point is touched upon in question CQ2: Is the source honest (trustworthy, reliable)? A too obvious objection regarding this question, however, is: why has the answer to this question not been inserted into the argument as a further premise in the first place? The authors ask this question themselves (Walton et al. 2008: 32 f.), but, they do not give a real answer to it. (They maintain only that the insertion is impossible in some cases, which even if it were true, does not say anything about the cases where it is possible.) So let us assume that the judgement '*s* is an honest (trustworthy, reliable) source' is added to the above cited scheme as a further premise. This does not yet make the scheme deductively valid, it remains a presumptive scheme. Now, however, no critical question is left over, the critical question approach of presumptive arguments has vanished, leaving behind a presumptive argument scheme without any theoretical approach to explain its validity, acceptability or quality. As I said, the scheme obtained, i.e. 'Source *s* is in position to know about things in a certain subject domain *f* containing proposition *p*. *s* is an honest (trustworthy, reliable) source. *s* asserts that *p* is true. *Conclusion: p* is true', is neither deductively nor analytically valid. Even if someone is in a position to know about *p* he need not know whether *p*, even if he asserts that *p*: he may not have examined at all whether *p*; the verification may have been false nonetheless; he may have forgotten the correct result etc. And even if the source knows the truth about *p* and is generally honest and trustworthy he may have a particular reason in this situation to tell lies. The facts stressed in the premises only make it probable that the source knows whether *p* and that he is truthful, thereby making *p* probable as well. This result, however, suggests an adequate reconstruction of the example as a probabilistic argument, e.g. as:

Basic probability (establishing argument):
P1: Source *s* is in position to know about things in the subject domain *f* of *p*.
P2: *s* is an honest (trustworthy, reliable) source.
P3: *s* asserts that *p* is true.
P4: If an honest person asserts a proposition *x* which is in his sphere of competence then *x* is true in the vast majority (about 95%) of cases.
(P5: The addressee has no better relevant information about *s* and *p* than that expressed in P1-P4.)
T *p* is highly probable (has a probability of 0.95).

Such a probabilistic reconstruction provides a clear structure for the argument in question and a strong epistemological underpinning, namely probability theory. Probability theory would constitute the basis of an enormous wealth of probabilistic argument schemes. However, Walton's, Reed's and Macagno's compendium does not contain any probabilistic argument.

With this we are back to the compendium. Notwithstanding the enormous summarising work put into this list, it has several fundamental weaknesses from a theoretical point of view. 1. Though the authors affirm the opposite (Walton et al. 2008: 364), the compendium is far from complete. Apart from probabilistic arguments most deductive arguments are missing as are many others, e.g. a really comprehensive practical justification of actions or of instruments, interpretative arguments, complex arguments of any form. Furthermore, all argument schemes primarily used in scientific contexts are missing as well. 2. On the other hand, the compendium contains many superfluous entries. Most of the listed deductive schemes admittedly (ibid. 365) have the *modus ponens* or the general *modus ponens* form, whereas the defeasible schemes mostly have the form of what the authors call a "defeasible modus ponens" (ibid.). If the compendium in general contains so many schemes, why do so many schemes of the same form have to be included into the list? Why does it not suffice to include only the *form* of the arguments so that countless specialisations of this form can be constructed by the users of the compendium? 3. The compendium is not ordered in a very helpful way. Where at a first glance the schemes simply seem to be put into a row, a second glance reveals that they are somewhat ordered into thematic groups like arguments about knowledge transfer or practical arguments for evaluations—without indicating this explicitly. However, given the implicitness of this grouping and the thematic incompleteness as well as the overlap of such possible groups the compendium remains rather confusing. (In a somewhat theoretical attempt the authors, further below (Walton et al. 2008: 348-351), propose a more formal classification of argument schemes. But this classification contains schemes not included in the former list and, conversely, does not include all schemes of the compendium; the first big group is defined in a way as to include the other groups etc. So this classification does not help that much.) 4. I think the majority of the listed schemes does not represent good arguments. According to my rough count, 18 out of the 104 schemes are not valid but can be repaired [5], mostly in the way taken above, in the reconstruction of the scheme 'argument from position to know'. However, another 57 (!) schemes are not valid and not repairable in such an easy way because too many premises are missing, or because it is not obvious which premises are missing, or because the structure fails completely.[6] In addition, four deductively valid schemes contain premises that are plainly false—schemes 21.1, 21.2, 38, 41 (cf. Walton et al. 2008: 322, 334, 336). The authors may contest these verdicts and others may find some of my evaluations debatable; after all what "too many" missing premises are is not clear-cut. But the real problem is that the authors have no general criterion of argumentative validity or of good arguments by which they could

[5] These are schemes: 1, 2, 4.2, 4.3, 4.4, 13.1, 22.3, 27, 28, 30, 31.2, 40, 54.1, 54.3, 58, 59.1, 59.2, 60 (cf. Walton et al. 2008: 309-346).

[6] This holds for the schemes: 4.1, 4.5, 4.6, 4.7, 4.8, 4.9, 4.10, 4.11, 5, 6.1, 6.2, 6.3, 6.4, 7, 8.1, 8.2, 9.1, 9.2, 10.1, 10.2, 18.1, 19.1, 19.2, 20, 22.1, 22.2, 22.4, 22.5, 22.6, 23, 24, 25, 26.2, 29, 31.1, 31.3, 31.4, 31.5, 32.1, 33.1, 33.2, 33.3, 33.4, 34, 35, 35.1, 36, 37, 39, 42, 43, 45, 47, 49, 52, 53, 57 (cf. Walton et al. 2008: 311-344).

defend the adoption of a specific scheme for their compendium. Still less do they present a justification of such criteria which would tell the reader why he should use the schemes or accept conclusions obtained on their basis. 6. Finally, Walton's, Reed's and Macagno's approach, like Kienpointner's, does not contain a real theory of argument schemes on the basis of a functional conception of arguments, starting from which good arguments can be constructed.[7] It is a bottom-up collection of (in most cases) empirically found schemes. However, without such a theory neither the completeness nor the simplicity of a compendium of schemes can be achieved; furthermore, the quality of the arguments cannot be justified and new good arguments cannot be invented.

These negative criticisms conversely imply positive guidelines for the theory of argument schemes. Hence the theory to be developed in the following, among others, shall be based on a functional idea of arguments; it shall lead to a complete system of argument schemes; and it shall provide a justification as to why to adopt the theory and the single schemes.

3. ARGUMENT CHEMISTRY—TYPES OF TYPES AND CLASSES OF ARGUMENTS

In a classification of argument schemes or, more generally, in a theory of argument types we very often have to speak of "argument types". However, a differentiation of argument types can be undertaken on quite different levels, where e.g. higher order types subsume types of a lower level; or complex types consist of elementary types. In order not to confuse these different levels of differentiation it is useful to distinguish, define and christen several types of argument types, including, of course, 'argument scheme'.

Probably the best known field with a comparable mereology in which simple and complex units and groups of such units are differentiated is chemistry. Therefore, I will often use this analogy for an easier explanation of the classificatory concepts in argumentation theory and sometimes, for mnemonic reasons, also borrow chemical expressions for types of argument types.

On the most basic level we have to distinguish simple and complex, or as I will call them, elementary and molecular arguments. *Molecular arguments* are composed of elementary arguments in a (upside down) tree structure such that there is one final or highest elementary argument for the final thesis, and the other, lower arguments justify intermediate theses, lemmata, that are premises of a higher elementary argument. *Elementary arguments* are not composed in this way. If elementary arguments are put together so that they constitute a molecular argument I say that they are *combined* to form a *compound*. The general form of an ideal, elementary or molecular argument here will be called "*argument scheme*". In the analogy chosen here, (valid) argument schemes corre-

[7] Walton, Reed and Macagno mention some functions of argumentation—remove doubt, remove disagreement, settling an issue (Walton et al. 2008: 268 f.); and their approach is mainly consensualistic with rhetorical components. However, the functions just mentioned are far from being clear; and what is more, the schemes are not developed on this basis and the authors do not explain how the schemes could fulfil these functions. In addition, the authors dismiss a strong relation of good arguments to truth and validity (ibid.: 269) and thus reject an epistemological approach to argumentation. There are strong reasons in favour of this approach; however, the authors do not provide anything, even only approximately, as strong as this approach in their own theory.

spond to chemical *substances*. In the following, I will speak mostly of *ideal*, i.e. completely explicit and good or valid, argument schemes though usually leaving out the qualification “ideal”; however this shall not imply that all argument schemes are ideal; we can also speak of “not ideal argument schemes” or even “fallacious argument schemes”. In addition, the schemes described below are always completely explicit; enthymematic versions of them could easily be added; however in the present context of classifying the main types of arguments this would not be revealing but only swell the exposition. In the examples given below pieces of the argument which tend to be left implicit are put in angle brackets. To include also molecular schemes in the system of argument schemes may seem debatable. However, there are several types of arguments, like interpretative arguments, arguments to the best explanation or justifications of actions, adequacy proofs, which are common but not well-understood and which argumentation theorists consider as argument schemes that a system of argument schemes should capture (cf. e.g. Govier 1987: 50, 53). Given the diffusion of these argument types and their complexity they should be included in a system of argument schemes that tries to capture and explain all relevant types of arguments. Since we cannot, from the start exclude that such argument types are molecular, the system of schemes should be open to include these types as well and hence call their forms “argument schemes”. In fact, as will be shown below, the examples just mentioned (interpretative arguments etc.) are all molecular arguments.

According to these definitions, ‘All men are mortal. Socrates is a man. Therefore, Socrates is mortal.’ is an (ideal) elementary argument; the form of this argument, i.e. the general *modus ponens* ‘All *F* are *G*. *a* ist *F*. Therefore, *a* is *G*.’ is an (ideal) elementary argument scheme. Also all the other deductive inference schemes (if they are not circular and can be penetrated by someone in reasonable time) provide ideal elementary argument schemes, e.g. double negation: ‘It is not the case that not *p*. Therefore *p*.’, contra-position: ‘If not *q* then not *p*. Therefore, if *p* then *q*.’, or introduction of disjunction: ‘*p*. Therefore also, *p* or *q*.’ I have found a list with names for 75 schemes from propositional logic; there may be about another 100 standard inferences from predicate logic, for which however the nomenclature is more limited—though, of course, we have the names of the syllogisms. These are only the ideal *deductive* elementary argument schemes; in addition there are ideal probabilistic argument schemes—e.g. *basic probability establishing*: ‘*x*% of the *F* are also *G*. *a* is *F*. ⟨The data base *d* does not contain better information about *a, F*s and *G*s.⟩ Therefore, the probability that *a* is *G* ⟨on the data base *d*⟩ is *x*%.’ [8]—and practical elementary argument schemes (see below), which however, unfortunately, mostly have no names. All compounds of elementary argument schemes are molecular argument schemes. This holds in particular for deductive argument schemes. Sometimes we can present substantially the same inference as a somewhat complex elementary argument or split it up, for less well trained addressees, into several steps thus obtaining a molecular argument—a trivial case is: elementary scheme: ‘If *p* then *q*. If *q* then *r*. *p*. Therefore, *r*.’; molecular scheme: ‘If *p* then *q*. *p*. Therefore, *q*. However also, if *q* then *r*. Therefore, *r*.’ According to the numbers of (ideal) elementary argument schemes already

[8] In the respective example of subsection 2.2, the premises P1, P2, P3 correspond to, or better: are concretisations of, the second premise here (in the scheme ‘basic probability establishing’); i.e. the second premise here is distributed over three propositions there; hence, for fitting the scheme here, those premises may be reformulated and contracted to one premise: ‘P1-P3: The proposition *p* has been asserted by some honest (trustworthy, reliable) source (*s*) who is in a position to know about things in the subject domain (*f*) of *p*.’

mentioned, the number of (ideal) molecular schemes must be huge; we can easily exceed 10,000, and we only have names for a very few of them.

For theoretical reasons we may want to divide the elementary argument schemes into groups or classes, as in the periodic system. Unfortunately, no well-known chemical term for such groups fits the argumentation theoretical requirements.[9] A (non-chemical) term well-fitting to these requirements is '*branch*', where such branches may fork into *branchlets*; and the whole system of (ideal) elementary argument schemes would be the *argument tree*. These terms capture the following features of a classificatory system of elementary argument schemes. The single elements of the system, i.e. the elementary argument schemes (or leaves in the analogy), always are attached to one branch only; and every scheme is attached somewhere; the branches may split into branchlets, i.e. subgroups; the various branches may have quite varying numbers of leaves, i.e. elementary argument schemes. Apart from these features, the terms 'tree' and 'branch' are neutral as regards contents and, therefore, may be used in competing approaches in argumentation theory. In the epistemological theory of argumentation presented here, the branches, of course, will not be defined e.g. in semantical categories but according to the argument schemes' epistemological underpinnings; in particular there will be a deductive, a probabilistic and a practical branch, which have logic, probability theory and (prudential) desirability theory respectively as their basis.

Finally, we may want to group all (ideal) argument schemes, elementary and molecular, according to theoretical considerations. One reasonable system of doing this divides the set of all schemes on the basis of the branches (or branchlets) in the element tree because these branches already represent theoretically important differentiations. The groups would then be composed of three subsets: i. all elementary schemes belonging to this branch; ii. all molecular schemes which are combined only of elementary schemes belonging to this branch (*pure molecules*); iii. all molecular schemes with elements from different branches (*impure molecules*) but in which one or several elements from this branch are dominant because they are the final or highest elements, or because they take up the major part of the time or space or because they require the main intellectual effort. According to this grouping principle, there may remain a residual class of *hybrid argument schemes* (not matching to a branch) with impure molecular schemes that do not fulfil condition iii. Objects of common knowledge with such a structure, i.e. which are tripartite sets where the subsets are less and less bound to the main set, are comets. Comets have: i. a nucleus, ii. a coma, and iii. a tail. Therefore, groups of argument schemes composed in the way just explained here will be called "*comets* (of argument schemes)".

Having introduced this terminology, we can now specify the aims of the theory of argument schemes to be developed in the rest of this paper, in particular the aims regarding completeness of the classifications to be provided. 1. Given the numbers cited above, in this paper it will not be possible to generate a complete list of all elementary argument schemes. In addition, a certain kind of openness of the set—we may perhaps always be able to invent some rather complex elementary scheme nobody has thought of

[9] The term 'period', i.e. a row of the periodic system, originates from the fact that the chemical properties in one row are periodically repeated in the next row—which has no parallel in the system of elementary argument schemes. The term 'main-group', i.e. a column in the periodic system, is quite generic. Finally, there is not even a generally known overarching term in chemistry for the division into metals, non-metals, semi-metals, halogens, noble gases etc.

so far—could make it actually impossible to present a complete list. Finally, from a theoretical point of view, such a complete list would not even be very informative and revealing because, apart from knowing the most important elementary schemes, it is more important to understand (and memorise) the formation rules of the elementary argument schemes than to have them all present, including the most "absurd" and never used schemes. 2. However, it is intended to present a list of all branches of the tree of ideal elementary argument schemes, where the branches are tailored in such a way as to take up the basic possibilities for realising the function of argumentation. To reach this kind of completeness is particularly revealing theoretically because it guarantees that we have found the really basic principles of arguments and hence have understood the whole system of argumentation. In addition, this kind of completeness is practically informative because through it together with the theoretical explanation we will have collected the formation principles of all possible argument schemes. So, to present a complete list of branches with the explained features implies a theoretically very strong claim. 3. Analogous reasons such as those against a complete list of elementary argument schemes also speak against a list of all molecular argument schemes, however in a much stronger way. What can and should be presented, though, is a list of comets corresponding to the branches of the argument tree and an explanation of the most important not trivial molecular argument schemes. This will also help to reach some empirical confirmation of the completeness claim about the branches (cf. 2): every empirically found (ideal) argument scheme should be either elementary or it should be explainable as a compound of elementary schemes from the tree. This empirical confirmation will be flanked by theoretical considerations about possible ways to fulfil the function of arguments.

4. THE EPISTEMOLOGICAL APPROACH TO ARGUMENTATION THEORY

As stressed above in the critique of alternative approaches to the classification of argument schemes, such an approach, for providing a real theory, should be based on a general argumentation theory, which includes a determination of the function of arguments and argumentation. The approach underlying the theory of argument schemes to be presented in the following is the epistemological theory of argumentation (as it is e.g. sustained by Biro, Feldman, Goldman, Sanford, Siegel, Sinnott-Armstrong and myself; cf. Lumer 2005b). According to this theory, the standard output of argumentation is knowledge of the argument's thesis or justified belief in it in the epistemological sense. The appertaining standard input is, of course, that an arguer presents the argument to the addressee who is not yet convinced of the thesis. However, epistemologists stress that arguments can also be used for other functions specific to arguments, in particular for individually inquiring about the truth of hypotheses. Putting together standard input and standard output we get the standard function of arguments, which, according to the epistemological conception, may be called "*rational convincing*". Competing full-fledged argumentation theories are, first, rhetorical argumentation theories, which aim at persuasion, i.e. causing or increasing the addressee's belief in the argument's thesis (defenders of this view are e.g. Perelman, Olbrechts-Tyteca, Hamblin), and, second, consensus theories of argumentation, which see argumentation as a means for reaching (under certain restrictions) consensus, i.e. shared beliefs, in an argumentative discourse (different versions of this approach are e.g. Eemeren's and Grootendorst's Pragma-Dialectics and Habermas' discourse theory). This is not the place to defend the epistemological approach or to criticise its competitors (see however e.g.: Lumer 1990: 149-158, 287-296, 313 f., 401-404, 453 f.; Lumer 2005a, 2010). However, one big advantage of the epistemological approach is that it aims at true beliefs of the addressee or to come as close as possible to truth, which permits the addressee to orientate himself in the world and thus allows him to make optimum choices; the other approaches do not have this advantage.

The way by which epistemologically conceived argumentation attains the standard output is the following. The presentation of the argument guides the addressee in recognising the truth or acceptability of the thesis—so that he is convincing himself of the thesis. In order to be able to do this the argument has to be designed on the basis of a primary or secondary criterion of truth or, if unattainable, acceptability of the thesis; such criteria have been called "*epistemological principles*". *Primary criteria of truth* are the respective truth definitions of the thesis, i.e. the definitions or usage rules of the predicates, singular terms and logical operators together with the syntactical rules as they are studied in philosophical semantics—in the most trivial case e.g.: 'a complex proposition '*p* and *q*' is true iff both sub-propositions, '*p*' and '*q*', are true'. *Secondary truth or acceptability conditions* are based on the primary criteria and make use e.g. of the truth functional relations between logically complex propositions or of probabilistic relations between propositions. The most trivial general secondary truth condition is the *deductive epistemological principle*: 'a proposition *p* is true if (i) *p* is logically implied by (ii) true propositions.' An epistemologically good argument then consists of the thesis and a sequence of judgements listing the specified conditions—or at least the most important of them—for the truth or acceptability of the thesis (since the epistemological principles are general rules they have to be specified for the thesis in question). The Socrates syllogism 'P1: All men are mortal. P2: Socrates is a man. Therefore: T: Socrates is mortal.', e.g., is based on the deductive epistemological principle; it lists two true propositions (cf. ii) that logically imply the thesis (cf. i) and by "therefore" it intimates that these propositions imply the thesis (cf. i). An argument that specifies the conditions of an epistemological principle for the thesis correctly and for which these conditions are fulfilled is *argumentatively valid*; hence argumentative validity of deductive arguments implies deductive validity and soundness, i.e. truth of the premises.[10] The addressee then can use the argument for checking whether the conditions of the epistemological principle are fulfilled. If he has done so with a positive result he has recognised the truth (or acceptability) of the thesis; and because he has done so on the basis of an epistemologically distinguished principle he has acquired a rationally justified belief.

Argumentatively valid arguments are good instruments. However only a few good instruments can be adequately used for realising their standard output in a given situation. This applies to arguments as well. For every thesis there are numerous secondary ways of recognising their truth or acceptability; each of them can be captured by a different argumentatively valid argument. However, most of them are not epistemically accessible to the addressee, i.e. the addressee cannot check immediately whether all the truth or acceptability conditions listed in this argument are fulfilled; hence, the addressee cannot use this argument for recognising the thesis's truth or acceptability. Therefore,

[10] Because this is only a very rough exposition this explanation of argumentative validity is not complete. A precise general definition of this term can be found in Lumer (2005a: 234-236); a specified definition of 'argumentative validity' for deductive arguments is given in Lumer (1990: 187-189).

argumentatively valid arguments that are also epistemically accessible (in a certain situation, in particular for a given addressee) are *adequate* for fulfilling the (epistemologically conceived) standard function of arguments (in this situation).

The most important point of this brief exposition in the present context is that epistemologically conceived arguments rely on distinguished epistemological principles or, more generally, on truth and acceptability criteria developed in various philosophical sub-disciplines. Such sub-disciplines are in particular: logic, probability theory and prudential decision or desirability theory.

5. ELEMENTARY ARGUMENT SCHEMES—THE BRANCHES OF THE ARGUMENT TREE

According to the ideas explained above, the (main) branches of the tree of elementary argument schemes will be tailored in such a way that they take up the basic possibilities for realising the function of argumentation. There are two major advantages of dividing argument schemes in this way. If the definition of a branch takes up a basic possibility for realising the function of argumentation, identifying the related branch then is a guide for constructing a functioning or valid argument. And conversely, assigning a branch to a given argument will help to evaluate its validity because this classification refers to the respective criteria of functioning arguments.

According to the just given exposition of the epistemological approach, the function of argumentation is to rationally convince by allowing the addressee to recognise that some truth or acceptability criteria for the thesis are fulfilled. The most general forms of such criteria are epistemological principles, which list quite different truth or acceptability conditions. Therefore, in the epistemological theory of argumentation, elementary argument schemes should be branched according to their underlying epistemological principles. This kind of branching has further advantages beyond those already mentioned. Because arguments list the specified truth or acceptability conditions of the respective epistemological principle, the argument schemes of different branches are also quite different both externally and structurally. Furthermore, the various principles provide arguments of different strength; hence, classifying arguments and argument schemes according to their underlying epistemological principle also implies information about the strengths and weaknesses of this type. These are rather strong reasons for classifying epistemologically conceived argument schemes according to their underlying epistemological principle. These reasons do not exclude that also a different kind of branching may be useful. But the advantages of such a different system would have to be shown in the first place.

Now the most basic epistemological principles and epistemological bases used in different argument types are the deductive, the probabilistic and the practical epistemological principle with deductive logic, probability theory and prudential decision and desirability theory as their epistemological underpinnings. Therefore, the main branches of the epistemological tree of argument schemes are the deductive, the probabilistic and the practical branch. Of course, in any of these branches we have many argument schemes, which cannot be listed here. But we can (roughly) describe the different structural conditions generally holding in the various branches.

5.1 Deductive argument scheme

The conditions for ideal deductive arguments are these:

Deductive argument schemes:

DA1: Form of the deductive schemes: n judgements $r_1, \ldots, r_n$. From these a thesis t is inferred: '$r_1, \ldots, r_n$. Therefore, t.'

DA2: Argumentative validity: 1. guarantee of truth:
1. The judgements $r_1, \ldots, r_n$ are true.
2. The judgements $r_1, \ldots, r_n$ logically imply the thesis t.

DA3: Argumentative validity: 2. Adequacy in principle: There is at least one person who at a certain time justifiedly believes that the reasons $r_1, \ldots, r_n$ are acceptable but who does not justifiedly believe this about the thesis.

DA4: Situational adequacy: A valid deductive argument is adequate for rationally convincing an addressee iff the following conditions are fulfilled:
1. Rationality of the addressee: The addressee is linguistically proficient, open-minded, attentive, and discriminating.
2. Convincability: The addressee does not yet know that the thesis is true.
3. Rational acceptance of the reasons: He justifiedly believes that the reasons $r_1, \ldots, r_n$ are acceptable but does not justifiedly believe this about the thesis.
4. Intelligibility of the argument: The relation of implication between the propositions of the arguments and the proposition of the thesis is sufficiently direct so that it can easily be grasped by the addressee.

Comments: These conditions for deductive arguments—as will be also the following conditions—are abridged; complete conditions: Lumer 1990: 187-189. DA1, the description of the form of deductive arguments is empty in the sense that all arguments fall under this description. This holds because of the polymorphism of deductive arguments, which does not permit any more specific description. However, condition DA2 discriminates between deductive and other arguments and argument schemes; also conditions DA3 and DA4 have different counterparts in other branches. Adequacy in principle (DA3) shall guarantee that deductive arguments are functioning instruments suited for realising their standard function, i.e. to rationally convince; in particular, this condition excludes that an argument which fulfils conditions DA1 and DA2 begs the question nonetheless. Adequacy in concrete situations (DA4) instead is a sort of instruction for use, which tells us in which situations we can use the functioning instrument for its purpose.

5.2 Probabilistic argument schemes

There is a great variety of elementary probabilistic argument schemes. In the following only a general description of probabilistic argument schemes for singular probabilistic judgements following the probability calculus will be provided. Schemes of this type are e.g.: 'The relative frequency of *F*s among *G*s ⟨according to data base *d*⟩ is *x*. *a* is *G*. ⟨We have no better information about *a*, *F*s and *G*s.⟩ Therefore, the probability that *a* is *F* ⟨on the data base *d*⟩ is *x*.' or: 'The probability of *a* ⟨on the data base *d*⟩ is *x*. The probability of *b* ⟨on the data base *d*⟩ is *y*. *a* and *b* are mutually exclusive. Therefore, the probability that *a* or *b* happens is $x+y$.' or: 'The probability of $a\&b$ ⟨on the data base d⟩ is x. The probability of b ⟨on the data base d⟩ is y. Therefore, the probability of a given b is x/y.' Arguments for *general* probabilistic propositions, i.e. arguments for the theorems of the probability calculus, are deductive, not probabilistic; they do not depend on a given data base. Therefore, they will not be discussed here. Many argument schemes from statistics of various forms (e.g. establishing confidence intervals or variances, significance calculations) instead belong to the branch of probabilistic argument schemes but will not be discussed here for reasons of space and simplicity. In some of them the thesis even has the simple form 'the probability of p on the data base d is x' but the general theoretical premises used in them go beyond the axioms and theorems of the simple probability calculus. – Since "PA" will be used for abbreviating "practical argument", the acronym "LA" ("*L*ikelihood *A*rgument) will be used for probabilistic argument.

The conditions for ideal probabilistic arguments are these:

Probalistic argument schemes:

LA1: Form of probabilistic argument schemes: 'r_1, …, r_n. Therefore, t.'
1. Form of the thesis: t, the thesis has the form: 'The probability of a (given b) on the data base d is x.'
2. Forms of the reasons: 1. At least one of the reasons r_1, …, r_n is an axiom or theorem of the probability calculus, hence a general probabilistic judgement. 2. At least one of the reasons is (i) a relative frequency judgement 'The relative frequency of *F*s among *G*s in the data base d is y.' or (ii) a singular probability judgement 'The probability of proposition p on the data base d is y.' or (iii) a conditional probability judgement 'The probability of proposition p given q on the data base d is y.' or (iv) a probability judgement that gives the probability of a mathematically complex term composed of probability expressions of the form 'the probability of p on the data base d' or 'the probability of p given q on the data base d' (e.g. '$(P_d(p\&q)/P_d(p) = y$').
3. Data basis: The relative frequency and singular probability judgements among the reasons all refer to the data base d (cf. LA1.1) or in part to d and the other part to a predecessor d_{prior}, i.e. d without some evidence e ($d_{prior} = d\backslash e$).

LA2: Argumentative validity: 1. guarantee of truth:
1. True premises: The judgements r_i of r_1, …, r_n are true.
2. Inferential validity: The axioms and theorems of the probability calculus contained in r_1, …, r_n and the other reasons perhaps contained in r_1, …, r_n mathematically imply t—i.e. according to deductive and arithmetic rules.
3. Best evidence: d does not contain information that permits stronger conclusions about *a—i.e.* the target proposition of the thesis t (cf. LA1.1)—(or, respectively, about the conditional probability $P_d(a/b)$).

LA3: Argumentative validity: 2. adequacy in principle: the argument fulfils the standard function of arguments; i.e. because it is well-ordered and does not contain superfluous irritating material it can guide a process of recognising the truth of t without having prior knowledge of t.

LA4: Situational adequacy: A valid probabilistic argument is adequate for rationally convincing an addressee of the thesis t and for making him adopt the thesis's probability for himself iff the following conditions LA4.1 to LA4.5 are fulfilled.

1. Rationality of the addressee: The addressee is linguistically competent, open-minded, attentive, discriminating and does not have a sufficiently strong justification for the thesis *t*.
2. Convincability: The addressee does not yet know that the thesis *t* is true.
3. Rational acceptance of the reasons: The addressee has recognised the truth of the reasons $r_1, \ldots, r_n$ or is able to recognise them immediately.
4. Argumentative knowledge (of the addressee): The addressee knows at least implicitly the idea of the probability calculus and the mathematics used in the argument. And
5. Data base: The data base d_h of the addressee (or *h*earer) is identical to the data base *d* used in the argument or so near to *d* that the resulting probabilities regarding the reasons r_i and the thesis *t* remain unaltered.

An *example* for such an (ideal) probabilistic argument is: 'Nearly all / 98% of the people ⟨of at least two years age⟩ who live in Germany speak German. Xaver lives in Germany ⟨and is more than two years old⟩. ⟨This is all we know what could be relevant for determining Xaver's linguistic capacities of German. Foundation principle: If the relative frequency of *F*s among *G*s on a data base *d* is *x*; some *a* is *G*; and *d* does not provide better information, then the probability that *a* is *F* is *x*.⟩ Therefore, Xaver nearly certainly / with a probability of 0.98 speaks German.'

Comments: The complete version of these conditions is given in: Lumer 2011a. Probabilistic arguments typically, if the resulting probability remains below 1, cannot prove the thesis; so they are only substitutes for stronger arguments (or other means of cognising) which could prove the thesis but which are unavailable or too costly. Therefore, the imperfect knowledge obtained by probabilistic arguments is defeasible and open to be substituted by the results of stronger methods of cognising. This makes up the non-monotonicity of probabilistic arguments: further information can require a revision of the probabilistically justified thesis. This leads to at least two forms of data dependencies of probabilistic arguing. (i) A thesis's probability has to be determined on the basis of the strongest information already acquired (cf. LA2.3). (ii) In addition, of course, one might convince an addressee that the probability of a thesis *t* on a certain data base *d* is *x*. However, this would only be a kind of hypothetical belief if *d* were not the addressee's data base; he would believe: if my data base were *d* I now would believe that the probability of *a* is *x*. So, if the addressee shall adopt the probability *x* argued for as his own, the data base of the argument must (in its relevant parts) coincide with his own data base (cf. LA4.5). This data base dependency goes beyond the requirement of rational acceptance of the reasons (LA4.3)—which has a counterpart in the conditions for deductive arguments: DA4.3—as can be seen considering the following case: if the addressee had rationally accepted the reasons but had e.g. additional information about *a* (in the extreme case he could even know that *a*) then he should not adopt the probability calculated in the argument on the data basis *d* as his own. There is no parallel to this in deductive argumentation.

5.3 Practical argument schemes

Practical argument schemes have their name because in the last instance they shall guide our practice, i.e. our actions. Elementary practical arguments schemes systemise arguments for personal prudential value judgements, i.e. theses of the form: '*p* is good / bad for the subject s to the degree x.', where p is a state of affairs. An argument of this type is not yet immediately practical because the thesis does not yet imply whether the subject s should do something about the value object p and if yes what. But such elementary argument schemes can be used as premises for directly practical, i.e. action justifying arguments, which however are already molecular: 'That the subject s does action A_1 (at time t) is the best option for s (among the options considered)'. The molecular argument for justifying this optimality judgement consists of various elementary arguments for valuations of the single options considered and a final deductive argument for the thesis that doing A_1 has the highest value (cf. below).

The conditions for ideal practical arguments are these:

Practical argument schemes:

PA1: Form of the (differentiating) practical argument scheme:
1. Form of the thesis: The thesis t has (in the most ideal case) the form: 'On the data base d the (prospect) desirability of event e for subject s (and a relevance threshold r) is u.' The *prospect desirability* is a consequentialist form of desirability where the consequences of the value object are not known with certainty but only probabilistically, such that the value of these possible consequences has to be adjusted according to their probability. (A special form of prospect desirability is *expected desirability* which weights probabilistic consequences linearly, i.e. by their probability.) *Total desirability* is a limiting case of prospect desirability where all consequences have the probability 1.
2. Forms of the reasons: 1. There are n judgements of the form: 'On the data base d the probability that e implies (in particular: causes) the consequence c_i is p_i.', with $0<p_i\leq 1$. 2. For all judgements of the first form there is an associated judgement of the form: 'On the data base d the prospect or total desirability of the consequence c_i for the subject s is u_i.' Prospect desirabilities have to be provided if the consequences have relevant but not certain consequences themselves. The total desirability instead can be given if the consequence has no relevant consequences or if these consequences are known with certainty. 3. There is one judgement of the form: 'On the data base d, the consequences $c_1, \ldots, c_n$ are all the r-relevant consequences of e.' This means for all these consequences c_i (the absolute value of) the product of their probability p_i and their prospect or total desirability u_i (for s) is equal to or greater than the relevance threshold r ($|p_i \cdot u_i| \geq r$); and there are no further consequences of e exceeding the relevance threshold r. 4. Finally, there is one judgement stating: 'The sum of all the products of the relevant consequences' c_i desirability u_i and their respective probability p_i is equal to u ($\sum_i u_i \cdot p_i = u$).' This is only the standard version of reason type 4, which uses expected utility as the measure of e's prospect desirability, i.e. the desirability of a consequence is weighted according to its probability (linear probability weighting). Sometimes more complex forms are proposed, which use non-linear weights of probabilities or utilities. Such complications may be ignored here.
3. Data base: All reasons mentioning a data base refer to the same data base d.

PA2: Argumentative validity: 1. guarantee of acceptability: 1. All reasons r_i of the argument are true. 2. The consequences of e listed in the first series of reasons (PA1.2.1) are disjunct, i.e. one and the same consequence is listed only once, and no one of the listed consequences is (partially) entailed in another consequence.

PA3: Argumentative validity: 2. Adequacy in principle: There is a person s_x for whom *d* is the set of relevant data which can influence the evaluation of *e*.

PA4: Situational adequacy: A valid (differentiating) practical argument with the characteristics just explained is adequate for rationally convincing an addressee *h* (hearer) that *e* is desirable for *s* to the degree *u* iff the conditions PA4.1 to PA4.5 hold:
1. Rationality of the addressee: The addressee is linguistically competent, open-minded, attentive, discriminating.
2. Convincability: The addressee does not have a (valid) justification for the thesis *t* or for a contradicting thesis, which attributes *e* a different desirability than *u*, or only a justification that is weaker than the one presented in the argument.
3. Data base: d_h, i.e. the addressee's data base, in its parts relevant for the argument is identical to data base *d* underlying the argument or it is a subset of *d*. In the latter case and if the addressee's data base d_h contains data incompatible with the argument's data base *d,* before an adequate use of the argument, the arguer and the addressee first have to exchange information and perhaps also other arguments to equalise the data bases *d* and d_h.
4. Knowledge about the consequences: The addressee already justifiedly believes in the consequence listing reasons (reasons of type PA1.2.1) or he is able to recognise their acceptability immediately. (There are no respective conditions regarding the evaluating reasons (PA1.2.2) and the calculation (PA1.2.4) because the truth of these reasons can be recognised immediately, *in actu*. And there is no prior knowledge requirement with respect to the completeness statement because its truth, given the huge data bases we usually dispose of, cannot be positively recognised at all.)
5. Relevance level: The relevance level *r* chosen in the argument is not more coarsely-grained than the level rationally desired by the addressee.
6. Practical function: For having a practical function, i.e. for making the addressee not only rationally believe in the thesis *t* but making him also adopt the valuation expressed in it as his own, the value subject *s* (referred to in the thesis *t*) has to be identical to the addressee *h* or has to have—in the relevant respects—the same value function as the addressee *h*.

An *example* for such an (ideal) practical argument is: 'To cycle to the office is a good physical exercise for me, it is eco-friendly, nearly as fast as to go by car, and the probability of being caught in a rain today is marginal / 1%. ⟨According to my present information, these are all the relevant consequences of cycling to the office.⟩ These consequences, according to my preferences, are very good, good, satisfactory and marginally bad respectively ⟨which can be rated as $4 + 2 + 1 + (-2 \cdot 0.01)$⟩, ⟨which sums up to a very, very high utility ⟨to a utility of 6.98⟩⟩. Therefore, cycling to the office ⟨according to my present information⟩ is very, very good for me ⟨has a rating of 6.98⟩.' Because the first three consequences, unlike the fourth, are certain there is no need to weight them by their probability.

Comments: The complete conditions are given in: Lumer (1990: 362-366). That in the evaluative reasons (cf. PA1.2.2) the consequences are again appraised in terms of prospect or total desirability seems to lead to a vicious circle because the argument's thesis is already of this type of evaluation. However, in the end consequences should be appraised in terms of their own *intrinsic desirability* and the *intrinsic desirability* of their consequences, hence in terms of a desirability that is attributed to the value object independently of its consequences. So, tracking the consequences of consequences up to intrinsically relevant consequences leads to leaving the seeming circle with the help of a different kind of evaluation. Practical arguments that track the way of consequences up to this end may be called "*grounding practical arguments*". Since the ways to possible intrinsic consequences are usually so ramified and pass so many intermediate consequences, real grounding practical arguments are very rare; instead, in our practical arguments we follow these ramifications only up to a certain point and estimate the prospect desirability of the remaining branchelets. Which objects have intrinsic value and how much is the topic of a long lasting philosophical discussion, which cannot be dealt with here. However, the hypothesis that has the most supporters is rational hedonism, according to which only one's own pleasures and pains have intrinsic desirability for oneself. Such a hypothesis provides the basis for quantifying the desirabilities in the evaluating reasons (PA1.2.2).

5.4 The irreducibility of the three branches

Are these three argument schemes really basic, or is it possible to reduce one or even two of them to another scheme?

(1) Deductive arguments, in principle, could be conceived as special probabilistic arguments: the premises would have to be transformed into the form: 'The probability of r_i on the data base d is 1'; and the deductive inference relation would have to be expressed as a conditional probability of 1: 'The probability of t given r_1 and … and r_n on the data base d is 1.' However, it would be misleading and unwise to conceptualise deductive arguments in this way. First, the "conditional probability" is not established on a frequentist basis but logically. Second, by such a reduction one would introduce data base dependency and non-monotonicity where there is no need to do so.

(2) Also, practical arguments cannot be reduced to probabilistic arguments for similar reasons. The valuations and the calculation are not probabilistic at all. The basis for the final step in practical arguments from all the premises to the conclusion is the definition of 'desirability' and not the probability calculus.

(3,4) Deductive and probabilistic arguments cannot be reduced to practical arguments because the latter have such a special thesis and form that the reduction would not work in most cases yet for this reason. – The really interesting cases of a possible reduction are the remaining two.

(5) Because of the particular form given here to probabilistic arguments, namely to include the respective axiom or theorem of the probability calculus among the premises and to make the reference to the data base explicit, their premises analytically imply the thesis. However, other features make the reduction of probabilistic to deductive arguments impossible. The pragmatic requirement LA4.5, that the argument's data base has to be identical to the addressee's data base, and the best evidence requirement LA2.3 (that the data base does not contain information which permits stronger conclusions about the thesis) have no counterparts in deductive argument schemes. This is necessarily so because probabilistic arguments are only substitutes for stronger arguments so that a rational subject will abandon the weaker justification and rely on a stronger one as soon as it is

available—this is the non-monotonicity of probabilistic arguments—; for deductive arguments there is no need to switch to a stronger justification.

(6) Finally, practical arguments cannot be reduced to deductive arguments either. Prima facie, practical arguments may be conceived as definitoric arguments: they try to show that the conditions of the definition of 'prospect desirability' are fulfilled for the evaluation in question; hence, adding this definition the argument should be deductively valid. However, three features of practical argument schemes prevent such a reduction. First, the definition of 'prospect desirability' requires the inclusion of all the possible consequences with a desirability unequal to zero in the evaluation. But usually there are so many consequences which fulfil this condition that it is impossible and pragmatically useless to list them all. This implies that the deductive premise set is incomplete. The introduction of a relevance threshold is only a workaround for this problem. Second, that all non-neutral or relevant consequences are included among the consequences listed is necessary for the practical arguments' validity (cf. PA1.2.3 and PA2.1), but because of our huge data bases this completeness cannot be proved positively. Therefore, the respective adequacy condition of practical arguments, unlike that for deductive arguments, does not require the respective justified belief about the premise (cf. PA4.3 and DA4.3). Third, because of their probabilistic components, practical arguments too, unlike deductive arguments, depend on a data base. In addition, for practical arguments fulfilling their specific practical function, the value subject spoken of in their theses has to be the addressee (or someone with the same value function).

These results show that deductive, probabilistic and practical argument schemes make up three different branches in the tree of elementary argument schemes. Their epistemological underpinnings are: deductive logic, probability theory and (prudential) desirability theory. These epistemological underpinnings are so different from each other that these three branches also have to be distinguished from the epistemological point of view.

6. ADDING MOLECULAR ARGUMENT SCHEMES—THE COMET SYSTEM OF ARGUMENT SCHEMES

According to the principles of the classification system explained above (sect. 3), the branches of the tree of elementary argument schemes make up the nuclei of the comets of elementary and molecular argument schemes. Therefore, we will have a deductive, a probabilistic and a practical comet. The following comet system contains only the most important schemes and groups of schemes and is far from being complete. As explained above (sect. 3), argument scheme comets consist of three main subgroups: the nucleus, i.e. elementary schemes of the respective branch, the coma, i.e. pure molecular schemes of the respective branch, and the tail, i.e. impure molecules with dominant elements from the respective branch. However, the following classification system does not divide elementary and molecular pure argument schemes (nucleus and coma) into two different groups because, as a consequence of the fact that we can omit lemmata thus condensing a molecular argument to a complex elementary argument (cf. above, sect. 3), there is a smooth transition between them so that many names would have to be listed twice. Sometimes it is also difficult to decide whether a given molecular scheme is still pure or already impure (hence whether it is part of the coma or of the tail). This is due to the fact that nearly all reasons of an argument may be justified by further elementary arguments, which then may belong to another branch. With respect to this problem, the following classification tries to consider only what is most essential and typical for a certain argument scheme, i.e. to cut the non-essential parts, for making the classification more significant.

The comet system of argument schemes:

1. Deductive argument schemes:

1.1. Pure deductive argument schemes:

1. Elementary deductive argument schemes which correspond to the inference schemes of deductive (propositional and predicate) logic. – The following subgroups of pure deductive argument schemes are mainly distinguished content-wise, according to particular premises used. Apart from that they may have quite different forms. The three subgroups listed, analytical, definitoric and subsuming legal arguments, can be elementary or molecular; therefore, they are neither a subgroup of elementary deductive schemes nor parallel to them. This kind of complication is the price of inserting groups defined by contents—which is done here for illustrative reasons. The same complication holds for the other schemes defined content-wise of the following main groups (in particular indicatory arguments and genesis of knowledge arguments).

2. Analytical arguments, which may be elementary or not, are arguments with (exclusively or predominantly) analytically true premises.

2.1. Mathematical proofs (including proofs in probability theory and pure mathematical statistics) use mathematical axioms as their most important premises.

3. Definitoric arguments are arguments which have a definition as their major premise and which in their further premises claim that the definitoric conditions are fulfilled for a certain object. If the object fulfils all the definitoric conditions the defined concept applies to it. There are some exceptions of definitoric arguments where the definition is so strong that its condition cannot be proved to be fulfilled; the definition of 'prospect desirability' is a case in kind. In such a case the definitoric argument is also necessarily incomplete and hence not deductively valid.

3.1. Descriptive statistical arguments: Descriptive statistics is that branch of applied statistics that deals with the analysis of data about a sample, e.g. what the mean value and the variance of a certain kind of value in the sample is or what the correlation between several types of values in the sample is. The respective arguments use the definitions of these statistical terms as premises. And because they apply them to a rather limited set (the sample) for whose elements complete data are used, these arguments are deductively valid.

4. Subsuming legal arguments have a legal norm as their major premise, whereas the minor premises describe a certain case and claim that the conditions of this norm (do not) apply to this case.

1.2. Impure deductive argument schemes:

1. Adequacy proofs have a list of adequacy conditions as their major premise ('an adequate *F* has to fulfil conditions *a*, *b*, *c*.'); the minor premises of the final elementary argument state that these conditions are (not) fulfilled for a certain object, which in the final thesis is judged to be (not) adequate. So far adequacy proofs are purely deductive. However, to prove that the single conditions are fulfilled is a further essential part of adequacy proofs. These elements often will not be deductive.

2. Probabilistic argument schemes:

2.1. Pure probabilistic argument schemes:

1. Elementary probabilistic argument schemes use the axioms and theorems of the probability calculus as their major reasons and apply them to particular cases, thereby sustaining a singular probabilistic thesis which depends on a certain data base (cf. above, sect. 5). —The following subgroups of pure probabilistic argument schemes are mainly distinguished content-wise, according to particular premises used.

2. Generalising arguments / enumeratively inductive arguments are arguments which infer from the fact that a certain attribute is present in every element of a sample that this attribute will be present in every element of the population. Though this enumerative induction in everyday life is undertaken in a primitive form without further qualification or with an unclear reservation, e.g. that the general thesis "probably" holds, for being epistemologically valid these arguments have to be regimented by statistics. Statistics, however, in an improved version of these arguments, attributes a probability value to the thesis, and this value depends mainly on the (random) sample selection and the sample size.[11]

3. Projective statistical arguments are regimented by projective statistics, which is that part of statistics that deals with the question if and with which probability the features found in a sample can be projected on the population. A classical question is the determination of confidence intervals for a predefined significance level. The significance level is a desired degree of probability that the projection is correct, e.g. 0.95 or 0.99; the confidence interval then is an interval for a sought value for which, on the basis of our findings about the sample we can say that the real value with a probability of 0.95 or 0.99 is within this interval.

4. Indicatory arguments / arguments from sign infer from evidence about an indicator or sign to the state of affairs indicated, e.g. 'Peter's bicycle stands before Tom's house. Therefore, Peter is in Tom's house.' Sometimes they are reconstructed as abductive arguments, i.e. as an inversion of a *modus ponens* argument: 'if *a* then *b*. *b*. Therefore,

[11] A strong argument against a probabilistic conceptualisation of enumerative induction was that the probability of universal laws then must have a probability of zero or close to zero because in the case of universal laws the sample is vanishingly small compared to the population. In particular usual requirements of a random selection of the sample cannot be fulfilled because we have access only to a very limited section of the universe. At first sight surprisingly, however, statistical significance calculations do not take into account the size of the universe but only the sample size. This approach may be justified if we can assume a background hypothesis that the universe is homogenous. This background assumption, however, cannot be justified statistically; it has to be justified quite differently. Pascal arguments offer one possibility for doing so (cf. below and Lumer 1997).

a.' However, this argument scheme, of course, is not deductively valid and empirically so often false that it is considered to be a fallacy, which has even its own name: "affirming the consequence". On the other hand, indicatory arguments often seem to function quite well, like the bicycle example. Therefore, a different reconstruction is required, which can also capture the difference between valid and invalid indicatory arguments. One such reconstruction is a simple probabilistic argument, a basic probability establishing argument (cf. above, sect. 2): '*b* has the quality *B*. In most cases ⟨relative frequency *z*⟩ where an *x* is *B* this *x* is also *A*. ⟨The addressee has no better information about *b* and *B*s and *A*s.⟩ Therefore, most probably ⟨with a probability of *z*⟩ *b* is also *A*.' or: '*a* stands in relation *B* to *b*. In most cases ⟨relative frequency *z*⟩ where an *x* stands in relation *B* to a *y*, *x* stands also in relation *A* to *y*. ⟨The addressee has no better information about *a*, *b*, *A*s and *B*s.⟩ Therefore, most probably ⟨with a probability of *z*⟩ *a* stands in relation *B* to *b*.' In our example the relation *B* may be: 'person *x*'s bicycle stands before building *y* ⟨and *x* is not in sight outside of *y*⟩' and *A* may be: 'person *x* is in building *y*'. Such a probabilistic reconstruction gives the scheme a clear and justifying epistemological basis.

5. Genesis of knowledge arguments are arguments which infer from an arguer's claim about a state of affairs and a story about (i) how the claim has been verified by someone and (ii) how this knowledge has been transmitted to the arguer to the (high) probability of the claim. The two stories can be more or less extended; genesis of knowledge arguments which provide more details tend to be stronger. In minimalist versions of genesis of knowledge arguments one of the two stories is omitted entirely and the other is reduced to one sentence; such arguments are very weak. Genesis of knowledge arguments can be basic probability establishing arguments (cf. the reconstruction above, in subsect. 2.2). Very often, however, they are molecular, combining several elementary probability establishing arguments which lead step by step from the claimed state of affairs to the arguer's claim. There are several traditional subforms of genesis of knowledge arguments, which differ with respect to the kind of source they are relying on. (More details: Lumer 1990: 246-260.)

5.1. Arguments from personal verification describe how the arguer himself has verified the thesis by observation.

5.2. Arguments from witness testimony rely on an observation (in principle open to any rational subject) by a witness.

5.3. Arguments from historical sources rely on historical documents.

5.4. Arguments from authority / from expert opinion rely on an expert's opinion about a matter for experts.

2.2. Impure probabilistic argument schemes:

1. Interpretative arguments / arguments to the best explanation are more complex than the pure probabilistic arguments considered so far. With the help of several alternative sets of hypotheses they try to explain some known facts about whose origins we have not sufficient information; then they determine the probabilities of these sets of hypotheses; finally, they may establish the probability of a particular hypothesis from these sets one is specially interested in. In a whodunit this special thesis e.g. may be that person *s* has committed the murder. So these arguments consist of several subtypes: (i) arguments which establish that a certain set of hypotheses really explains the known facts; these arguments can be deductive or statistical; (ii) arguments which try to determine the prior probability of such a set of hypotheses; (iii) arguments in which the posterior probability of the sets of hypotheses is calculated with the help of Bayes' law, based on the fact that the known facts can be explained only with these sets of hypotheses; (iv) one argument that sums up the posterior probabilities of those sets of hypotheses which contain the particular hypothesis in question. (More details about interpretative arguments: Lumer 1990: 224-246.)

3. Practical argument schemes for value judgements:

3.1. Pure practical arguments for pure evaluations:

The scheme for differentiating practical arguments described above (sect. 5) captures mainly valuations under risk, i.e. situations in which we can only assign probabilities to the possible consequences of the value object. To this argument scheme we have to add further argument schemes for other informational situations.

1. Practical arguments for (pure) evaluations under certainty.

2. Practical arguments for (pure) evaluations under risk.

3. Practical arguments for (pure) evaluations under simple uncertainty are designed for situations in which we cannot assign numerical probabilities to (some or all) possible consequences of the value object.

4. Practical arguments for (pure) evaluations under radical uncertainty are designed for situations in which we even have difficulties in establishing the kind of possible consequences of the value object.

3.2. Impure practical argument schemes:

1. Practical arguments for / justifications of actions are arguments for an optimality judgement that a certain course of action is the best among the available options. In these molecular arguments first the various options have to be assessed in pure practical arguments; subsequently the best option has to be determined in an analytical argument.

2. Arguments in favour of / justifications of instruments are arguments for an optimality judgement that a certain instrument is the best among the available tools or at least a very good instrument. What has to be valued here is the typical use (depending on the kind of instrument, this may be a use over a long time) of such an instrument; in addition, particular weight is given to the functional requirements of such an instrument; if a given instrument does not fulfil the standard function of this type of instrument to a certain degree the instrument is discarded altogether—independently of how well it fares in other respects.

2.1. Practical arguments for definitions justify a definition by showing that, apart from fulfilling the formal requirements of definitions, it is a good or the best instrument in the respective context; i.e., with the help of this definition, e.g. certain axioms or theorems of a theory can be formulated quite easily. (More details: Lumer 1990: 209-221.)

2.2. Practical arguments for empirical theories (in particular also physical theories) try to show that a given empirical theory is the best among the proposed theories. The main task of these arguments is not to show that the theory under scrutiny is essentially true in the sense of not making false predictions; this is only one aspect and more or less presupposed. The main task is instead to show that the theory fulfils the functional requirements of good empirical theories well: (1) the theory is simple, contains only few relatively simple axioms; (2) it is (relatively) fundamental in the sense of capturing the most basic empirical laws, the smallest causal steps; (3) it is complete, i.e. it can explain all phenomena of its empirical field; (4) there are no anomalies which the theory cannot explain; etc.

2.3. Practical arguments for technically-constructive theories in philosophy are used in some philosophical theories which take the construction of useful instruments to be one central task of several philosophical sub-disciplines, e.g. in ethics the construction of moral criteria, in logics the construction of logical operators and inference systems, in epistemology primary and secondary criteria for knowledge and justification, in argumentation theory systems of argument schemes. On a very abstract level the respective philosophical arguments in favour of certain normative criteria then are again justifications of instruments as just explained. (More details: Lumer 2011b.)

3. Arguments for evaluations based on adequacy conditions are less elaborate than the practical arguments described above (sect. 5) in the sense that they do not really quantify. Their bases are adequacy conditions which represent certain advantages or necessary conditions a certain type of instrument should have. However, the argument goes beyond stating that the adequacy conditions are fulfilled; it proceeds to an evaluation, taking e.g. particularly into account to what degree the adequacy conditions are fulfilled. Because of their somewhat primitive form, which does not make use of a precise formal structure, they are also especially suitable for justifying more formal schemes of practical argument and of reasoning in a non-circular way.

4. Arguments for welfare-ethical value judgements presuppose a welfare-ethical criterion for ‘moral desirability’ which aggregates the individual desirabilities of a given object for the interested persons to a comprehensive moral desirability—e.g. the utilitarian definition of ‘moral desirability’ as the sum (or the mean) of all individual desirabilities, or a more complex, e.g. prioritarian or moderate egalitarian, definition of ‘moral desirability’. The molecular argument then consists of a series of elementary practical arguments that establish the various individual desirabilities of the object in question, and an elementary definitoric argument that aggregates the obtained individual desirabilities with the help of the definition of ‘moral desirability’ to the final moral value judgement.

5. Pascal arguments / practical arguments for theoretical theses are practical arguments which justify that in a given epistemic and practical situation it is best to act as if a certain thesis were true. Although these arguments cannot substantiate the thesis itself on theoretical grounds—the adequacy conditions of Pascal arguments require that no such theoretical grounds are available—they aim at an epistemic acceptance of the thesis on practical grounds, e.g. that otherwise no action would be possible or that a realist interpretation of phenomena would facilitate our reasoning. Because of their minimalist epistemic presuppositions Pascal arguments are particularly suitable for deciding on some very fundamental philosophical questions—like the existence of the outside world or the homogeneity of the universe. (More details: Lumer 1997.)

4. Hybrid argument schemes:

So far I have not found valid standard schemes of molecular arguments which are so heterogeneous that they cannot be assigned to the three comets (which have the branches as their nucleus). Hence the class of hybrid schemes remains empty for the time being.

7. COMPLETENESS OF THE BRANCHES OF THE ARGUMENT TREE

In sections 4 and 5 some hints about the instrumental adequacy of the arguments set out in the branches have been given. In section 5 the irreducibility of the branches has been proved. What has still to be shown is the completeness of the comet system.[12] As explained above, the *list* of argument schemes in the comet system of section 6 is not complete. The comet system is complete at most in the sense that all valid argument schemes can be integrated into it insofar as these schemes are elementary and pertain to the branches set out in section 5 or are molecular and can be decomposed into elementary argument schemes which again pertain to the branches. So what has to be shown here is the completeness of the branches explained in section 5 (and taken over in section 6). There are at least three main ways to show—positively or negatively—the completeness of the system of argument schemes.

7.1 Empirical search

One can check whether i. empirically found arguments and ii. argument types proposed by theoreticians represent schemes covered by the comet system. If an argument scheme has been found that is not (and shall not be) covered by the system it has to be shown that this scheme is not valid or is defective in another way. I have checked many arguments found in the literature and all the schemes proposed in the argumentation theoretical literature consulted (in particular, of course, the lists of Kienpointner and Walton et al.) and have not detected any good scheme that would not be covered by the proposed system. (Because the vast majority of e.g. Kienpointner's schemes is elementary and deductively valid it is already covered by group 1.1.1 of the above classification. The same holds for the deductively valid schemes of Walton, Reed and Macagno (cf. above, note 4), whereas their many "defeasible modus ponens" schemes that are reconstructable as basic probability establishing or similar schemes as well as some others [13] are covered by groups 2.1.1, 2.1.4 or 2.1.5 of the above classification; with several major modifications their scheme 22.3 (Walton & Reed & Macagno 2008: 323) can be reconstructed as the action justification scheme (scheme 3.2.1 of the above classification).)

However, I would like to mention some proposals made in the argumentation theoretical literature which I have discarded. *Arguments from analogy* (proposed e.g. by Govier 1987: 50; <1985> 2000; Walton et al. 2008: 315-316; Kienpointner 1992a: 384-

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[12] See also Garssen's list of formal adequacy conditions for theories of argument schemes (Garssen 2002: 233).

[13] More precisely, the following schemes of Walton, Reed and Macagno can be reconstructed as probabilistic schemes: 1, 2, 4.2, 4.3, 4.4, 13.1, 27, 28, 30, 31.2, 40, 54.3, 59.1, 59.2, 60 (Walton, Reed & Macagno 2008: 309-346).

393) have already been criticised (above, subsect. 2.1) as fallacious; the same holds for Walton's, Reed's and Macagno's schemes for *presumptive reasoning*. Govier, following Wellman, has proposed "*conductive*" *argument* schemes, which list several arguments independent of each other but all relevant and necessary for the conclusion (Govier 1987: 50; 1999: 155-180). These explanations are very vague and may cover quite different argument schemes. Simple practical arguments (cf. above, sect. 5, schemes 3.1) have these features; but they are explained here in a much more precise and theoretically revealing way. Other arguments subsumed by Govier as being conductive may be reconstructed as interpretative arguments (my scheme 2.2.1), still others are convergent deductive arguments (e.g. arguments for a negated general proposition where several instances that falsify the general proposition are invoked). So, conductive arguments do not really make up a kind. One of the theoretically most ambitious challenges to the above system of branches presumably is Rescher's *plausible reasoning* (Rescher 1976), which could constitute a fourth branch of the tree. However, I have found Rescher's proposal lacking in several respect and, therefore, not included. (The plausibility values are arbitrary or at best intuitive. The whole system of plausible reasoning is much weaker than probabilistic reasoning, without offering any advantage in exchange. It is not integrated into a complete system of reasoning that also includes probabilistic reasoning. The possibility of admitting contradictory propositions each with high plausibility values shows that the system covers at most initial plausibilities but not a (temporary) final state of one's consideration.) A further candidate that might establish a fourth branch of elementary argument schemes are argument schemes on the basis of non-monotonic logic (overview: Antonelli <2001> 2010). Apart from their (often) enormous complexity, some major problem of these logics are that they do not provide an epistemological underpinning and justification of their systems: why is it epistemically rational to believe in the conclusions of the respective inference rules? Another problem is that these systems do not differentiate degrees of justification. As a consequence they have difficulties to handle justified but contradicting beliefs.

For illuminating criteria for epistemologically good and rational ways of reasoning and arguing, another candidate that might constitute a further branch of the tree of elementary argument schemes shall be dicussed in more detail: Rescher's concept of presumptive reasoning (Rescher 2006). Rescher's presumptive reasoning is inspired by default-logic, as it has been suggested in Artifical Intelligence (e.g. by Reiter 1980 or Bach 1984). It is a form of defeasible, hence non-monotonic reasoning, which in the absence of better information and of refuting instances infers from some, however, insufficient evidence on a tentatively but, until further evidence, unrestrictedly accepted conclusion, i.e. the presumption (Rescher 2006: 27-38). A typical scheme of presumptive reasoning is:

Presumptive specialisation:
P1: *F*s are normally *G*.
P2: *a* is *F*.
⟨P3: *a* is a normal *F*.⟩ Therefore:
C: *a* is *G*.'
—where P3 is only an implicit premise. (ibid. 77; 33 f.)

Some characteristic differences with respect to probabilistic inferences are:

(i) The major premise P1 is not a relative frequency judgement but a predicate logical general proposition with a restricting condition—in the example: normalcy —, which may be precise but which usually is rather open and vague, as e.g. is 'normality' ($\forall x(Fx \,\&\, Nx \rightarrow Gx)$).
(ii) The conclusion is an unrestricted proposition; it does not contain any modal or probabilistic qualification.
(iii) The implicit premise (P3) makes the inference deductively valid.
(iv) However, this implicit premise is completely unjustified—in strong contrast to what is usually required by epistemic rationality for inferential cognisance.

Though theoreticians of presumptive reasoning and default logic think to have modelled a specific kind of everyday reasoning, this is probably false: At least somewhat epistemically rational people do not take the result of an insecure reasoning procedure to be an unrestricted conclusion—in contrast to (ii); instead they add a (vague) quantitative or qualitative qualifier to it, like 'with 90% probability', 'most likely', or 'presumably'—in the latter cases quantifications may be added later, if and when necessary. However, even if only a minority undertook such qualifications this would be the epistemically rational way to handle defeasible reasoning; and epistemic rationality is what matters here, not typical behaviour. Of course, a justified quantitative, probabilistic qualification of the conclusion requires a respective qualification in the major premise P1 too—in contrast to (i). However, once having changed the inference so far, i.e. introduced quantitative information, one can now rely on probabilistic calculations and probabilistic inferences—in contrast to (iii)—; there is no need to falsely pretend to know what is unknown: P3—in contrast to (iv). Such a transformation of presumptive reasoning into probabilistic inferences presupposes a frequentist analogue P1f to the major premise P1: P1f: '*x*% of the *F*s are *G*'. This quantification may be difficult to provide. However, even if we do not know precise percentages we can estimate them.

Why is this probabilistic reasoning epistemically rational and presumptive reasoning not? There are several major advantages of probabilistic inferences with respect to presumptive reasoning. 1. Even a qualitative modifier is an important reminder of the conclusion's uncertainty, which as a consequence cannot be used like a certain proposition as premise for further inferences (in probablistic reasoning the premise remains a probability judgement). Further inferences have to transmit also this uncertainty. This is a question, at least, of clarity. 2. Not adding a modifier easily leads to contradictions like the lottery paradoxon. (If you roll a fair dice the probabilities that '1' results is 1/6; and so it is for all the other possible results. With presumptive reasoning, however, you have to say that '1' normally does not come up as a result; hence the presumption is: ''1' will not come up'. But so you have to say for '2' and all the other possible results. But this contradicts your true belief that one of the six numbers will be the result of the next roll.) 3. A quantitative modifier (even a very vague and unprecise like 'most likely' as compared e.g. to 'quite likely' or 'rather likely') permits to compare degrees of justification and thus to dismiss the weaker justified beliefs in case of contradicting beliefs. 4. In addition, it allows to decide whether the degree of justification is sufficient or whether more information should be provided for making the belief more certain. 5. And only a quantitative modifier allows to increase the degree of justification even below certainty, e.g. from a probability of 0.8 to 0.98. 6. Not disposing of a (frequentistically justified) probabilistic quantification leads to ignoring somewhat unlikely risks and chances; in presumptive reasoning these are simply discounted as not existing because they are beyond normalcy; hence one cannot take these risks and chances into account in one's decision—e.g. keep one's hands off options with unlikely but great risks or decide for (repeating) options with somewhat unlikely but huge advantages or prepare for the dangers of the unlikely but serious consequences—; and this can lead to enormous losses or to losing reachable gains. 7. Rescher's assertions to the contrary notwithstanding (Rescher 2006: 45-53), there is no good practical or epistemical justification for presumptive reasoning. The main rationale for this conception seems to be only that it captures some ways of everyday reasoning—which is neither true nor a good justification. To assume the completely unjustified tacit premise (P3 in "presumptive specialisation") in the proposed unqualified form to be true is simply irrational; it is pulling the white rabbit of missing informations out of the hat. And to accept the unqualified conclusion, hence, is not justified either. Frequentist probabilistic reasoning, on the other hand, is practically justified via its in the long run good consequences: using the probability judgements in Bayesian decisions, in the long run and on the basis of the law of large numbers, will lead to better results than any other decision strategy which also disposes only of the same limited information. Presumptions (in Rescher's sense) cannot have this decisive advantage because, being unqualified, they simply do not contain the frequentist information presupposed in Bayesian decisions. 8. Rescher's system of presumptive reasoning so far is rather incomplete. It does not say anything about how to combine it with other kinds of reasoning or how to justify general presumptions.—I think these are sufficient reasons to dismiss presumptive reasoning and, hence, also this possibility of a fourth branch of the tree of elementary argument schemes. To sum up: not to have empirically found further argument schemes is a weak confirmation of the system's completeness. But more confirmation would be better.

7.2 Closure of the comet system

The comet system should be closed in three respects. (i) It should have argumentative counterparts to all kinds of cognitions for which such counterparts are possible. (ii) The premises of all argument schemes should be possible conclusions of an argument scheme belonging again to the system—if the premise is not of such a type that it can be recognised only in a way which has no argumentative counterpart (cases in kind are observation and introspection, which, however, do not exclude *indirect* ways of arguing for observational and first-person mental propositions). Put differently: For all the types of premises mentioned in the description of the argument schemes holds: this type of premise can be argued for with the help of an argument that is captured by the system—unless the premise is of a type that can be recognised only in such a way that has no argumentative counterpart. (iii) It should be possible to justify all the proposed argument schemes with the help of an argument covered by the system.

With respect to the first two kinds of closures (i and ii) the following holds. There are several forms of direct verification: empirical observation, introspection, practical evaluation and inferences (on the basis of logical operators). Empirical observation and introspection have no argumentative counterpart because they are not merely verbal but require a certain personal situation. The other kinds of direct verification instead have their argumentative counterparts in the system of argument schemes: practical and deductive arguments. In addition, there are indirect forms of cognitions: in particular probabilistic reasoning and practical justifications of theoretical propositions; these, of course, have argumentative counterparts included in the list: probabilistic and Pascal arguments. With respect to the third kind of closure (justification of the argument schemes), instead the following holds. The comet system includes several argument schemes by which types of arguments and cognition can be justified: practical justifications of technical-constructive theories, arguments for evaluations based on adequacy conditions and Pascal arguments. These argument types are sufficient to justify all valid kinds of arguments and cognitions.—Closure, however, offers only a very weak confirmation of the completeness.

7.3 Theoretical considerations

The only positive "proof" of the system's completeness probably are theoretical considerations about possible argument types. I cannot offer a real proof of this kind but only something much weaker, speculations in favour of the completeness. For assessing the possibilities of further branches of argument schemes, first of all the role of the three included branches has to be envisioned. *Deductive arguments* rely on deductive relations, which are based on the logical operators. They are the only certain types of arguments, even though they unfold their full epistemic potential only in combination with uncertain types of arguments, which provide premises that for reasons of epistemic accessibility could not be proved deductively, in particular universal empirical laws. *Practical arguments*, in principle, could be definitoric arguments with the definition of 'prospect desirability' as their major premise. However the informational requirements of this definition are so far-reaching that the resulting arguments must remain approximate and probabilistic. Finally, *probabilistic arguments* from the very beginning have been introduced for providing uncertain but helpful information as a substitute in cases where certain cognition is impossible or too expensive. This role, of being an uncertain substitute, leads to non-monotonicity and data dependency.

Now, can there be further fundamental types of cognition and arguments, i.e. further branches with these or similar roles? 1. The facts that deductive arguments are based on logical operators, i.e. something deeply embedded in our language, and that in the course of 2500 years of epistemological research no other certain type of argument has been discovered make it very unlikely that there is such a further certain type of argument schemes. 2. I cannot exclude that there is or will be another standard argument scheme originating in the unattainability or impossibility of properly handling the huge mass of information needed or desired in certain standard situations (as is the case with practical arguments) and whose independency from the other schemes is based on the special way of handling the unavoidable incompleteness by flexible forms of approximation. However, if such approximations are needed only now and then one might help oneself by combining several forms of arguments that include e.g. mathematical approximation or probabilistic estimates without introducing a new branch of argument schemes. What makes practical arguments different in this respect and hence has led to establishing an independent branch of argument schemes are, first, the ubiquity and urgency of the epistemic problem they are answering, namely decisions about actions, and, second, the existence of everyday forms of reasoning by pondering the advantages and disadvantages of several options which cry out for an epistemological backing and refinement. It is unlikely that conditions as strong as these will be fulfilled in other contexts. 3. I cannot exclude, too, that there are or will be developed further branches of uncertain argument schemes beyond probabilistic arguments which infer from insufficient evidence to informationally stronger theses. However, all the schemes proposed so far in the literature have been found defective: abduction, conduction, Walton's presumptive reasoning, Rescher's plausible and presumptive reasoning, nonmonotonic logics like default logic or paraconsistent logic (which have not been discussed here). A general problem of such proposals is a lack of an epistemological backing and, in most cases, the inability to differentiate various degrees of uncertain justification. Probability theory instead has several advantages for which new schemes to be proposed should provide equivalent advantages: probabilistic arguments have solid epistemological underpinnings, namely probability theory; probability attributions have a frequentist foundation; decision theory has found second-best solutions for cases where we do not even have an empirical basis for attributing empirically frequentist probabilities, namely to use Laplace probabilities instead; probabilistic arguments make you pay the ampliative increase in (however not surely justified) information by a quantified reduction of certainty, i.e. probability degrees; the immense usefulness of this kind of specifiedly uncertain information has been proved in decision theory: in the long run, (normal) decisions according to expected desirability lead to the best results when taken together. Therefore, the hurdles for additional branches of insecure argument schemes are high.

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