The Logic of Ordinary Language

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Is there a logic of ordinary language? Not obviously. Formal or mathematical logic is like algebra or calculus, a useful tool requiring its own symbol system, improving on ordinary language rather than analyzing it (Quine, 1972). As with algebra and calculus, people need to study this sort of logic in order to acquire any significant facility with it. (Introductory logic teachers can testify to the troubles that ordinary people have with basic principles of formal logic.) Psychologists have demonstrated that almost everyone has difficulty applying abstract principles of formal logic, for example, in the Selection Task (Wason, 1983). And, despite claims that logic courses help people reason better, training in formal logic does not appreciably affect how people reason in situations to which abstract logical principles are relevant (Nisbett, 1993, 1995).

On the other hand, even if modern logic is an *improvement* on ordinary thought and practice, some sort of logic may be built into ordinary language or reflected in ordinary practice. Physics too is concerned to improve ordinary thinking, not to analyze it, and ordinary students often have trouble applying principles of physics in solving “word problems.” But we can also study naive or folk physics as reflected in ordinary language and in expectations about the behavior of objects in the world (Gentner and Stevens, 1983; Hayes, 1978, 1985; Ranney, 1987). Perhaps we can study naive or folk logic in the same way that we can study naive physics.

But what might distinguish principles of ordinary logic from other ordinary principles? Traditionally, at least three points have been thought to be relevant in distinguishing logic from other subjects. First, logical principles are principles of logical implication or inference; second, logical principles are concerned with *form* rather than content; third, logical principles of implication or inference cannot in general be replaced by corresponding premises.

Logical rules as normative rules of inference

It is sometimes said that some logical principles are normative rules of inference (Blackburn, 1994). This isn’t quite right, but let us pursue the idea for a while.

The idea is that the principle of disjunctive syllogism, for example, is the principle that it is normatively correct to infer from a disjunction, *P or Q*, together with its the denial of one disjunct, *not P*, to its other disjunct, *Q*. This inference would be direct or elementary, warranted by a single principle of inference. More complex inferences or arguments would involve several steps, each step following from premises or previous steps by some acceptable principle of inference.

What is meant here by "inference" and "argument"? If an inference is simply defined as doing whatever accords with the acceptable principles of inference, then we do not learn anything about logic from the remark that logical principles are normative principles of inference or argument. The remark reduces to the empty claim that logical principles are normative principles for doing what satisfies logical principles.

It is natural to suppose that inference and argument are connected with something that ordinary people regularly do—they reason, they infer, they argue. More precisely, people reach conclusions, arrive at new beliefs, as a result of reasoning, they reason to new conclusions or to the abandonment of prior beliefs. Reasoning in this sense is reasoned change in view.

So, one version of the idea we are considering takes the logical principle of disjunctive syllogism to be a rule for arriving at new beliefs on the basis of prior beliefs.

> Disjunctive syllogism *as a rule of inference*. If you believe a disjunction *P or Q* and you believe the denial of one of its disjuncts, *not P*, then it is normatively permitted for you to infer and so believe its other disjunct, *Q*.

Using this idea to try to help specify what logic is, we now have that principles of logic are or are among the normative principles of reasoned change in view.

Accepting this idea as a first approximation, we might next ask whether we can distinguish *logical* rules, like disjunctive syllogism, from what Ryle (1950) calls “inference tickets” and what contemporary cognitive scientists (e.g. Anderson, 1983; Card, Moran, & Newell, 1983) call “productions, as in

> Today is Thursday. So, tomorrow is Friday.

or

> This burns with a yellow flame. So, it is sodium.

Sellars (1982) argues that a sense of nomic or causal necessity arises from the acceptance of nonlogical inference tickets. Accepting an inference ticket that allows one to infer directly from the premise that something is copper to the conclusion that it conducts electricity is a way of treating the relation between copper and conducting electricity as a necessary or lawlike relation.

One issue, then, for this approach is whether logical principles can be distinguished from nonlogical productions or inference tickets.

Logical rules as formal and as irreplaceable by premises

Here we might turn to the second and third ideas about logic mentioned above. The second idea was that logic has to do with *form* rather than content. Perhaps the logical principles are the formal inference tickets. But to explore that thought we need to know how to distinguish "formal" principles from others.

It may help to consider also the third idea that the acceptance of logical principles is not in general replaceable by the acceptance of premises. Accepting nonlogical productions or inference tickets is in some sense equivalent to accepting certain general conditional statements as premises, statements like "If something is copper, it conducts electricity." But not all productions or inference tickets can be replaced with such premises.

In particular, there is no straightforward generalization corresponding to disjunctive syllogism *(*Quine 1970). We can't simply say, "If, something or something else, and not the first, then the second." To capture the relevant generalization, we might talk of the truth of certain propositions: "If a disjunction is true and its the denial of one disjunct is true, then the other disjunct is true." Or, we can appeal to a schema, "If *P or Q* and *not P*, then *Q*," where this is understood to mean that all instances of this schema are true.

Not only does this provide an interesting interpretation of the notion that logical principles do not derive from corresponding generalizations concerning the relevant subject matter, it also suggests a way to distinguish form from content for the purposes of saying that logical generalizations are formal. Logical generalizations are formal in that they refer most directly to statements or propositions as having a certain form rather than to nonlinguistic aspects of the world. The logical generalization corresponding to disjunctive syllogism refers to *disjunctions*, i.e., to propositions having disjunctive form, whereas the nonlogical generalization refers to copper and electricity.

The fact that logical generalizations are generalizations about propositions of a certain linguistic form makes it plausible to suppose that there might be such a thing as the logic *of* a given language—a logic whose generalizations refer to linguistic forms of that language. So, it might make sense to speak of the logic of ordinary language, or at least of a logic of a particular ordinary language.

Of course, it might turn out that a given ordinary language (or even all ordinary languages) lacked sufficient regularity of form or grammar to permit the statement of logical generalizations. In the early 1950s, many researchers agreed with Strawson (1950) when he said, “Ordinary language has no exact logic.” This is the only claim of Strawson’s that Russell (1957) was willing to endorse. But after Chomsky (1957) and other linguists began to develop generative grammar, many researchers came to think it might be possible after all to develop a logic of ordinary language.

Implication and inference

Before considering further the connection between grammar and logical form, I need to clear up a point left hanging earlier: the relation between implication and inference, or more generally, the relation between arguments as structures of implications and reasoning as reasoned change in view.

The generalization corresponding to disjunctive syllogism says that, whenever a certain two propositions are true, a certain other proposition is true; in other words, the first two propositions *imply* the third. The rule of disjunctive syllogism is a rule of implication, or perhaps a rule for recognizing certain implications. All so-called logical "rules of inference" are really rules of implication in this way.

Logical rules are universally valid; they have no exceptions. But they are not exceptionless universally valid *rules of inference*. So it is not always true that, when you believe a disjunction and also believe the denial of one disjunct, you may infer and so believe its the other disjunct. For one thing, you may already believe (or have reason to believe) the denial of that other disjunct, so that recognition of the implication indicates that you need to abandon one of the things you started out believing and not just add some new belief. Even if you have no reason to believe the denial of the other disjunct, you may also have no reason to care whether the consequent is true. You may have other things to worry about, such as where you have left your car keys. Faced with such a practical problem, it is not at all reasonable to make random inferences of conclusions implied by your present beliefs.

Even if logical rules have *something* to do with reasoning; they are in the first instance rules of implication. Rules of implication are distinct from rules of inference even if inference involves the recognition of implication and the construction of arguments (structures of implications). To understand how logic can be relevant to reasoning, we therefore need to understand how the recognition of implication can be relevant to reasoning.

Reasoning may involve the construction of an argument, with premises, intermediate steps, and a final conclusion. Notice, however, that an argument is sometimes constructed backwards, starting with the conclusion and working back to the premises, and sometimes in a more complex way, starting in the middle and working in both directions. It is of the utmost importance to distinguish the rules that have to be satisfied for such a structure to be an acceptable argument from procedures to be followed by the reasoner who constructs the argument. The rules of logic may be (among the) rules that have to be satisfied by an argument structure. They are not procedures to be followed for constructing that argument.

A further point is that, even when an inference involves the construction of an argument, the conclusion of the inference is not always the same as the conclusion of the argument. The argument may provide an inferred explanation of some data. In that case, the conclusion of the argument is something originally believed and one or more premises of the argument are inferred in an inference to the best explanation.

Of course, there are cases in which the conclusion of an accepted argument is also a new conclusion of one's reasoning; one sometimes does accept something because it is implied by things one previously believes. But it is important that there are other cases of reasoning to which implications and arguments are similarly relevant. In all cases of argument construction, one's most immediate conclusion is probably best taken to be the argument as a whole: one accepts the parts as parts of that whole. There are also cases in which one accepts an argument as valid without accepting all of its parts, although that is no doubt a relatively sophisticated achievement.

Sometimes one accepts an explanatory argument as a whole or chunk, as it were, instantiating a template for the whole argument. In coming to believe what another person says, one typically accepts a complex explanation of the following general form.

P
S is in a position to know whether P.
So, S comes to know that P.
S wants me to know whether P.
So, S says something to me that means that P.

Presumably, this sort of explanation does not have to be discovered from scratch each time someone tells one something.

Principles of reasoned change in view

A full account of the relation between rules of logic and principles of reasoning would have to specify the principles of reasoned change in view (Harman, 1986; Harman, 1995). Here I can only vaguely sketch the relevant principles with respect to three factors: conservatism, goals, and coherence.

Reasoned change in view is *conservative* in at least two related respects. First, the default position is *no change*. Change in view is what requires justification, not continuing to believe as one already believes. Second, when a change is called for, one seeks as it were to minimize the needed change so that one will make the least change that will eliminate inconsistency or answer one's questions.

Reasoned change in view is *goal-directed* in that new views typically arise only because one is interested in answering certain questions (Harman, 1997). One's interests control one's reasoning. (This is *not* to say that it is reasonable to accept a conclusion simply because one wants it to be true!)

We can use the term *coherence* to stand in for all the other factors relevant to change in view. Following Pollock (1979), let us distinguish *negative coherence*, i.e., lack of incoherence, from *positive coherence*, i.e., positive features of a view that justify its acceptance over other views that are at least equally good with respect to answering questions in which one is interested and minimizing changes in one's initial view. Explanation is a coherence giving factor, as is a certain sort of simplicity (Harman, 1994). This is why much inference is inference to the best explanation.

I cannot present here a detailed account of inference. For present purposes, my main point is that logical rules like disjunctive syllogism are not directly rules of inference but are rules of implication. To "possess" such a rule might be to have a recognitional capacity—an ability directly to recognize instances of, say, disjunctive syllogism as implications. So-called nonlogical inference tickets might also be conceived in this way. They would not really be inference tickets but would be capacities to recognize implications—implication tickets!

The psychology of deduction seeks to discover what procedures people use to decide what follows from what, especially where the implication is not immediate. (It's like studying what procedures people use to add columns of numbers or solve problems in physics.) One theory, defended e.g. by Rips (1994), is that people try to construct arguments in accordance with rules of natural deduction. Another theory, defended by Johnson-Laird (1993) says that people use something like truth tables. That is, they try to consider various possible cases in which the premises could be true in order to see whether the conclusion holds in all those cases. Both of these theories allow that certain implications are recognized directly and immediately while others are recognized indirectly and more slowly, if at all.

Knowledge, truth, and form

I now want to return to the distinction between form and content, where the logical rules are those that hold by virtue of form and where the nonlogical rules are those that hold by virtue of content. I noted a connection between this idea and the idea that the logical rules are those for which the corresponding generalizations require talk of relations of truth among propositions of certain related forms. However, there are cases in which, although the generalizations corresponding to certain rules appear to require such talk of truth, the rules in question seem less “formal” than other more strictly logical rules.

Consider the rule that *S knows that P* implies *P*. As with logical principles, there is no appropriate generalization at the same level as the instances of this rule. For example, it does not make sense to say, “If someone knows something, then it.” Instead, we have to refer to the truth of the relevant sentences or propositions, as in “All instances of the following implication schema are true: if S knows that P, then P.” Or perhaps we can say, “If S knows something, then it is true.”

We might try to avoid mention of truth via a principle like the following (suggested to me but not endorsed by David Lewis).

(K*) If someone knows that something is a certain way, then it is that way.

(K*) does not by itself cover all the instances we want, for example,

(I) Jack knows that either grass is green or snow is white.

In order to apply (K*) to (I), we might suppose that (I) is equivalent to “Jack knows that the world is such that either grass is green or snow is white.” But the principle that lies behind that equivalence is formally similar to the knowledge principle, but stronger:

(W*) The world is such that *P* implies (and is implied by) *P*.

Using this principle together with (K*) does not get rid of the need for talk of truth. (Indeed, "the world is such that *P*" looks like a terminological variant of "it is true that *P*."

I mentioned two possible generalizations about truth corresponding to the knowledge principle.

(K1) All instances are true of "If someone knows that P, then P."

(K2) If someone knows something, it is true.

Scott Soames observes (private communication) that there is an apparent problem with (K2). Although (K2) seems correct at least at first, puzzles arise concerning what it is that is known and what it is that is true. Ordinary language distinguishes propositions from facts. Propositions can be true or false, can be stated, believed, and disbelieved, and can have certain sorts of structure. Facts can obtain and be known. To know that either grass is green or snow is white is to know the fact that either grass is green or snow is white, not just to know the proposition that grass is green or snow is white. (To know that proposition is to be familiar with it, not necessarily to know that it is true.) But then it is unclear what we would be quantifying over in saying, “If someone knows something, it is true.” The thing known is a fact, which is not the sort of thing that is true in the relevant sense. The thing that is true is a proposition, which is not what is known in the relevant sense.

Despite this, (K2) seems a perfectly acceptable remark in ordinary English. And there seem to be many other cases in which ordinary language mixes ontological categories in this way. “The book on the table with the red cover, which weighs three pounds, took four years to write, has been translated into several languages, and read by millions of people.” (Chomsky, MS). The book on the table is a particular physical object. That physical object didn’t take four years to write and it hasn’t been read by millions of people. What to say about this very common type of apparent ontological confusion in ordinary language is unclear.

In any event, the immediate point is that we cannot state a generalization corresponding to the knowledge schema without invoking truth or something equivalent to truth. So, in that respect, the knowledge schema resembles the rule of disjunctive syllogism. So, should we say that this principle of knowledge is a logical principle? Is there a logic of knowledge in ordinary language?

The trouble is that the knowledge rule seems less formal and so less like a rule of logic than disjunctive syllogism. So, we may be pulled in two different directions. In one respect the rule is like standard logical rules; in another respect it is not.

Using (Real) Grammar and Logic To Specify Form

Why does the rule about knowledge seem less formal than disjunctive syllogism? Perhaps because of the difference between *or* and *know*, namely that *or* is a member of a very small closed lexical class of atomic sentential connectives, whereas *know* is a member of a large and open-ended lexical class of atomic relations (Harman, 1976, 1979). To describe a proposition as of the form *P or Q* is therefore to describe it in contrast with a very small closed class of similar structures, perhaps only *P and Q* and *P but Q*. To describe a proposition as of the form *S knows that P* is to describe it in contrast with a large and open ended class of similar structures in which *knows* is replaced with *believes, hopes, expects, fears, intends, says, denies*, etc. A pattern seems relatively formal to the extent that it contrasts with a small closed class of structures and a pattern seems less formal to the extent that it contrasts with a large open class of similar structures.

By an “open lexical class” I mean a class of vocabulary items of the language to which new members are easily added. A “closed lexical class” is a class of vocabulary items to which it is difficult to add new members.

It seems plausible that the logic of ordinary language should be relatively fixed, whereas the nonlogical principles and vocabulary should be relatively easy to change—the form relatively fixed and the content more variable. The vocabulary items standing for sentential connectives, in other words, the atomic sentential connectives, are relatively fixed; the atomic predicates are not; so particular atomic sentential connectives count as part of form and particular atomic predicates count as part of content. By this criterion, then, to identify a proposition as having the form, *S knows that P*, is to make a less purely formal identification than to identify a proposition as having the form, *P or Q*.

Almost any two vocabulary items differ syntactically in some respect or other, so grammar will not always be preserved when one term replaces the other in an expression in the same class. For example, *and* and *or* do not have exactly the same syntactic distribution, nor do *know* and *believe*. The relevant classes of lexical entries (atomic vocabulary items) are logical classes—the class of atomic predicates, the class of atomic sentential connectives, and so forth.

Looser and Stricter Conceptions of Logic

Much more needs to be said here, but suppose that some sort of distinction along these lines between form and content can be made out. Does that mean that the logic of ordinary language does not include the knowledge rule? By one criterion—formality—the answer seems to be that the knowledge rule is not part of the logic of ordinary language. By another criterion in terms of lack of a straightforward generalization and the resulting need for talk of truth, the answer seems to be that the knowledge rule is part of the logic of ordinary language.

It is not obvious that ordinary reasoning is sensitive to any distinction between logical rules and nonlogical implication tickets. We recognize immediate implications of both sorts. So, when we make such a distinction on the basis of ordinary practice and the grammar of ordinary language, we may not be making a distinction that matters to ordinary reasoners.

If it makes no psychological difference, we could simply allow for two senses, looser and stricter, in which a rule is a logical rule. So, let us say that a rule is at least *loosely logical* if there is no straightforward corresponding generalization so that we need instead to talk of the truth of certain propositions in order to state the relevant generalization. Let us say that a rule is also *strictly logical* if it is at least a loosely logical rule that appeals only to (relatively) formal aspects of structure. Then, disjunctive syllogism is not only loosely but also strictly logical, whereas the knowledge rule is only loosely logical. Disjunctive syllogism is part of the strict logic of ordinary language, whereas the knowledge rule is only part of the loose logic of ordinary language.

Further Issues

A fuller discussion must say something about quantification in ordinary language, as well as identity theory and set theory. In each of these cases there are at least some loosely logical principles because the corresponding generalization talk of the truth of certain propositions—quantificational principles of generalization and instantiation, a principle of the substitutivity of identity and a principle of set abstraction. Are there also strictly logical principles of quantification, identity, or set theory built into ordinary language?

What words represent quantifiers? It might seem that there are indefinitely many such words, *all, some, few, many, most, several, lots, one, two, three, four, …* This would mean that quantifier words formed a large open set and so were not logical constants. So the relevant principles of quantification would only be loosely logical principles, not strictly logical principles by the criterion given here.

But perhaps a better syntactic-semantic analysis distinguishes some of these words from others, treating most of them as predicates or relations of sets of groups of things. The quantifiers as atomic variable-binding operators would be the smaller group *a, the, some, all, each*, and *every.* Notice we can say *the many apples, every few years,* or *all nine ministers,* but not *the all apples, every some years, nine few years*, or *all many apples*. We say *the apples were most, all, or some of the fruit*, treating *most, all,* and *some* as indicating relations between sets.

This approach needs to be developed further in order to determine what if any strict quantificational logic it would find in ordinary language. Clearly, this logic would not be the logic of the syllogism, which treats *all* and *some* as logical constants.

As far as the logic of identity and the logic of sets are concerned, if these logics are expressed using atomic relational predicates (perhaps the copula “be” used in one or another sense), then they must be a loose logics only, because the class of atomic predicates is large and open-ended. On the other hand, we have just seen that some sort of reference to sets is tied into the ordinary system of quantification. Furthermore, a notion of nonidentity or distinctness is also involved in the system of quantification in ordinary language (Wittgenstein, 1922). Two different quantifiers with the same scope cannot be treated as referring to the same things, so, for example, the remark, *everyone is loved by someone*, is not made true simply because (if it happens) everyone loves him or herself. Similarly, assumptions about distinctness are built into certain grammatical constructions, so that the subject and object of a very cannot be interpreted to refer to the same thing unless a reflexive construction is used. Compare, *Mark saw the chairman in the mirror* and *Mark saw himself in the mirror.*

Therefore, it is quite likely that if there is a strict logic of quantification built into ordinary language, that logic will also incorporate some aspects of the logic of identity and the logic of sets. However, it is unclear to me just what the relevant principles would be.

Bibliography

Anderson, J. R. (1983). *The Architecture of Cognition*. Hillsdale, NJ: Erlbaum.

Blackburn, S. (1994). Rule of inference. *The Oxford Dictionary of Philosophy*, Oxford University Press, pp. 334-5.

Card, S. K., T. P. Moran, T. P., and A. Newell (1983). *The Psychology of Human-Computer Interaction*. Hillsdale, NJ: Erlbaum.

Carroll, L. (1895). What the tortoise said to Achilles, *Mind* 4.

Chomsky, N. (1957). *Syntactic Structures. The* Hague: Mouton.

Chomsky, N. (MS). “Internalist Explorations.” To appear in a volume of essays for Tyler Burge, edited by Bjorn Ramberg, Cambridge, Massachusetts: MIT Press.

Davidson, D. and G. Harman (1972). *Semantics of Natural Language*. Dordrecht, Reidel.

Gentner, D. and A. L. Stevens, editors (1983). *Mental Models*. Hillsdale, NJ: Erlbaum.

Harman, G. (1976). Logic and grammar. In Rameh, C. editor, *Semantics: Theory and Application. Georgetown University Round Table on Languages and Linguistics.* Washington, D. C.: Georgetown University Press, pp. 173-180.

Harman, G. (1979). “If and modus ponens: a study of the relations between grammar and logical form,” *Theory and Decision* 11, pp. 41-53

Harman, G. (1986). *Change in View: Principles of Reasoning*. Cambridge, Massachusetts: MIT Press/Bradford Books.

Harman, G. (1994). Simplicity as a pragmatic criterion for deciding what hypotheses to take seriously. In Stalker, D., editor, *Grue: The New Riddle of Induction*. Peru, Illinois: Open Court, pp. 153-171.

Harman, G. (1995). Rationality. In Smith, E. E., and Osherson, D. N., editors., *Thinking: Invitation to Cognitive Science, Volume 3,* Cambridge, Massachusetts: MIT Press, pp. 175-211.

Harman, G. (1997). “Pragmatism and Reasons for Belief.” In Kulp, C. B., editor, *Realism/Antirealism and Epistemology.* Lanham, Maryland: Rowman & Littlefield, pp. 123-147.

Hayes, P. J. (1978). The naive physics manifesto. In Mitchie, D., editor, *Expert Systems in the Microelectronic age.* Edinburgh, Scotland: Edinburgh University Press.

Hayes, P. J. (1985). The second naive physics manifesto. In J. R. Hobbs and R. C. Moore, editors, *Formal Theories of the Commonsense World.* Norwood, N. J.: Ablex.

Johnson-Laird, P. N. (1993). *Human and Machine Thinking*, Hillsdale, NJ: Erlbaum.

Nisbett, R. (1993). *Rules for Reasoning*. Hillsdale, N.J.: Erlbaum.

Nisbett, R. (1995). Which inferential rules are easy to change, and which hard? Lecture at the *Rutgers Conference on Epistemology and Evolutionary Psychology*, April 22, 1995.

Pollock, J. (1979). A plethora of epistemological theories. In Pappas, G., editor, *Justification and Knowledge*. Dordrecht, Holland: D. Reidel.

Quine, W. V. (1972). Methodological reflections on current linguistic theory. In Davidson and Harman (1972).

Quine, W. V. (1970). *Philosophy of Logic*. Englewood Cliffs, NJ: Prentice-Hall.

Ranney, M. (1987). *Changing Naive Conceptions of Motion*. Doctoral dissertation, University of Pittsburgh, Learning Research and Development Center.

Rips, L. (1994). *The Psychology of Proof: Deductive Reasoning in Human Thinking*. Cambridge, Massachusetts: MIT Press.

Russell, B. (1957). Mr. Strawson on referring, *Mind* 66.

Ryle, G. (1950). If, so, because. In M. Black, ed., *Philosophical Analysis*. Ithaca, New York: Cornell University Press.

Sellars, W. (1982). *Science and Metaphysics: Variations on Kantian Themes*. New York: Humanities Press.

Strawson, P. F. (1950). On referring, *Mind* 59.

Wason, P. C. (1983). Realism and rationality in the selection task. In Evans, J. St. B. T., editor, *Thinking and Reasoning: Psychological Approaches*. London: Routledge & Kegan Paul.

Wittgenstein, L. (1922). *Tractatus Logico-Philosophicus*. London: 1922.