

HUMAN ABILITIES AND DYNAMIC
MODALITIES*

In his pioneering *Essay in Modal Logic*, G. H. von Wright, after systematising the uses of various modal words, said in a concluding note

An important use of [the modal words] is connected with the notions of an ability and of a disposition and with the verb 'can'. For example: Jones can speak German (=it is possible for Jones to make himself understood in German); Jones cannot speak German (=it is impossible for Jones to make himself understood in German). We shall call the modal concepts which refer to abilities and dispositions dynamic modalities (I am indebted for the term to Mr. Geach)... The question whether the dynamic modalities, i.e. the logic of abilities and dispositions, is subject to exactly the same formal rules as the alethic modalities will have to be investigated separately. (*An Essay in Modal Logic*, Amsterdam, 1951, p. 54.)

So far as I know von Wright himself has never since directly investigated that question. In *An Essay in Deontic Logic and the General Theory of Action* (1968) he took a different approach to the notion of ability (pp. 47–57), which he employed also in *Explanation and Understanding*. In this paper I propose to investigate his original question, namely whether the dynamic modality of ability is subject to the same formal rules as the alethic modalities formalized by systems such as Lewis's S4 and S5 and von Wright's own M. I shall answer this question with a definite negative. I shall then ask whether the logic of ability, while not equivalent to any alethic modal logic, can be formalized in a system which resembles alethic systems in the way that current logics of obligation, knowledge and belief do. I shall conclude that unlike deontic, epistemic and doxastic logics, the logic of ability cannot be captured in a modal system with a possible world semantics of the kind familiar since the work of Kripke and Hintikka. To put the point paradoxically in the terms of von Wright: the thesis of my paper is that dynamic modality is not a modality.

I

A number of points in the passage from *An Essay in Modal Logic* call for comment. Von Wright mentions two types of dynamic modality: ability

and disposition. I take it that the power of speaking German is given as an example of an ability. No example is suggested of a disposition: perhaps such properties as the brittleness of glass and the power of *acqua regia* to dissolve gold are meant. If we understand 'ability' and 'disposition' in this way, it must be at least initially an open question whether the same formal rules hold for abilities as hold for dispositions. Aristotle drew a sharp distinction between rational powers, such as the ability to speak Greek, and natural powers like the power of fire to burn. If all the necessary conditions for the exercise of a natural power were present, then, he maintained, the power was necessarily exercised: put the wood, appropriately dry, on the fire, and the fire will burn it; there are no two ways about it. Rational powers, however, are essentially, he argued, two-way powers, powers which can be exercised at will: a rational agent, presented with all the necessary external conditions for exercising a power, may choose not to do so. Jones may be a skilled Germanist and be at the podium of a hall filled with sharp-eared German speakers; for reasons of his own he may refuse to speak or launch into ancient Gaelic. (*Metaphysics, Theta*, 1046a–1048a.)

If Aristotle was right to draw such a distinction – and many recent philosophers have argued for a similar distinction, notably M. R. Ayers in *The Refutation of Determinism* – then the formal rules for ability will not be quite the same as those for disposition. A logic of Aristotelian ability would need to include a law corresponding to the medieval tag *eadem est potentia oppositorum* to express the two-way openness of rational powers. Henceforth I shall have little to say explicitly about natural powers or the dispositions of inanimate agents. I shall concentrate on the human skills and abilities of which the ability to speak a language furnishes a paradigm example.

It is noteworthy that von Wright found a certain difficulty in translating English sentences containing 'can' into a canonical form suitable for representation within his symbolic systems. He translated 'Jones can speak German' as 'It is possible for Jones to make himself understood in German'. It is not clear to me why he altered 'speak German' into 'make himself understood in German'; if such changes always need making then any modal logic to formalise 'can' will need a formidable appendix of translation rules. I think, however, that this is an accidental difficulty, and that the point would have been as well made by saying that 'Jones

can speak German' means the same as 'It is possible for Jones to speak German'. What is more serious is that, whichever of the two forms we use, what follows 'it is possible that' is not a proposition, and therefore cannot be formalised by ' Mp ' if ' M ' is a proposition forming operator on propositions and ' p ' is a propositional variable.

There is, of course, nothing in the letter ' M ' which prevents it from being used as a proposition-forming operator on something other than a proposition. It might be an operator which forms propositions out of verbs, like the English expression 'I can...'. In an earlier part of his *Essay* von Wright presented a system M1 in which it was a condition of well-formedness that each (propositional) variable fell within the scope of exactly one modal operator. Clearly, there is no reason why we should not treat the variables in the system M1 as verb-variables and the operator ' M ' as interpretable as 'I can' (or, less egotistically, attach subscripts to it in such a way that ' M_a ' means 'A can', ' M_b ' means 'B can' and so on). The operator ' L ', which is equivalent to ' NMN ' might then plausibly be read as 'I can't help,' since it seems to mean 'It is not the case that I can not...'. If we allow ourselves to do this, then we can interpret formulae of the system M1 as laws of a logic of ability. Some of the results appear quite plausible: for instance

$CLpMp$: If I can't help ϕ ing, then I can ϕ .

$CAMpMqMApq$: If either I can do p or I can do q , then I can either do p or do q .

Both of these look *prima facie* like laws we would want in any formal logic of ability.

There would be two ways, however, in which such a system would have to remain radically incomplete as a system to formalize the logic of ability. In the system M1 formulae like ' $CpMp$ ' and ' $CLpp$ ' would be ill-formed, since one of the variables is not within the scope of a modal operator. This would be reflected in the suggested interpretation by the corresponding English expressions not being genuine sentences (e.g., 'If swim I can swim', 'If I can't help smoking smoking'). In such a system we would not be able to render symbolically sentences such as 'If I am swimming, then I can swim' or 'If I can't help smoking then I smoke' which, whether or not they are logical *truths*, should surely be capable of formulation in any system of dynamic modality. A system like M1 would

be incapable of formalising any inference from what a man actually does to what he can do, or from what he can't help doing to what he will actually do. Indeed, despite what we suggested a moment ago, the system isn't strictly capable of handling the notion of not being able to help doing something. For if ' p ' is not a propositional variable, then a formula like ' $NLNp$ ' contains an equivocal use of ' N ', once as an operator on propositions and once as an operator on verbs.

Secondly, the system M1 does not admit of the iteration of modal operators, since every variable must be within the scope of only one such operator: formulae such as ' MMp ' or ' LLp ' are illformed. Thus we could not express in this system – even if we waive the difficulty just mentioned – propositions such as 'If I can't help being able to \emptyset , then I can \emptyset ' and 'If I can \emptyset , then I can't help being able to \emptyset ' which seem to express a truth and a falsehood respectively. Many of our abilities seem to be abilities for being able: the ability to learn German, for instance, seems to be the ability to become able to speak German. It seems therefore that we want a logic of ability which will permit the iteration of the ability-operator in some way, just as we want a logic of ability which will permit the ability-operator to operate on propositions. Clearly an ability-operator which fulfils the latter of these requirements will also be able to fulfil the former, since a statement of ability is itself a proposition.

An ability-operator which fulfils these requirements is 'I can bring it about that...' or 'I can make it the case that...'. If we interpret the operator ' M ' in this way, and the propositional variables in the normal way, then we can interpret as English sentences not only the well-formed formulae of the system M1, but also the much larger class of well-formed formulae of the system M, which permits the iteration of the modal operators at will and counts as well-formed a formula containing variables not within the scope of any modal operator.¹

II

If we interpret the system M in this way, it soon becomes clear that neither it nor the related systems M' and M'' are adequate to capture the logic of the 'can' of ability. This is most conveniently shown if we consider the systems in the axiomatic form in which they are presented in von Wright's appendix, in which it is shown that M' is equivalent to the

Lewis system S4 and M'' to the Lewis system S5. (M is equivalent to the Feys system T.)

To illustrate the breakdown of these systems as applied to the logic of ability, I shall consider the system M' or S4. I choose it in preference to the others as being initially the most plausible, and because as I shall indicate later I believe that it does come close to capturing two ordinary language senses of 'can', whether or not it captures the notions of logical possibility and necessity for the sake of which it was originally devised.

The system M' contains three axioms: $CpMp$, $EAMpMqMApq$ (which are also axioms of M) and $CMMpMp$ (the characteristic S4 axiom). Let us begin by considering the last. An interpretation of this on the lines suggested would be 'If I can bring it about that I can bring it about that I am speaking German, then I can bring it about that I am speaking German' or, equivalently, 'If I can acquire the ability to speak German, I can speak German'. This is clearly false. If, when applying for a post in a German department, I am asked whether I can speak German, it would hardly be proper for me to reply 'yes', starting from the premise that I can acquire the ability to speak German (say by attending courses for three years) and reasoning with the aid of $CMMpMp$ and *modus ponens*. Hence $CMMpMp$ ought not to be a law of the logic of ability.

What of the two axioms which are common to M' and M ? $CpMp$ at first looks unimpeachable. If I am speaking German, surely I can speak German. P. T. Geach, talking of concepts, has this to say in his book *Mental Acts*:

To say that a man has a certain concept is to say that he *can* perform, because he sometimes *does* perform, mental exercises of a specifiable sort. This way of using the modal word 'can' is a minimal use, confined to a region where the logic of the word is as clear as possible. *Ab esse ad posse valet consequentia* – what is can be, what a man does he can do; that is clear if anything in modal logic is clear. (*Mental Acts*, London 1959, p. 15)

But is it so clear? Perhaps, we may imagine, it is inconceivable that someone should speak a language without being able to speak it. In fact, it is quite often done. The late Pope Pius XII used to give audiences to American servicemen at the Vatican. The gracious speech which he delivered on these occasions had been composed, I was told, by an Irish monsignore and learned by heart under the coaching of an elocutionist. At those audiences the Pope spoke English; but he was not, in the normal sense, able to speak English.

The example may be contested (is such parroting really 'speaking English'?). But others are beyond dispute. A hopeless darts player may, once in a lifetime, hit the bull, but be unable to repeat the performance because he does not have the ability to hit the bull. I cannot spell 'seize': I am never sure whether it is an exception to the rule about 'i' before 'e'; I just guess, and fifty times out of a hundred I get it right. On each such occasion we have a counter-example to $CpMp$: it is the case that I am spelling 'seize' correctly but it is not the case that I can spell 'seize' correctly.

Counterexamples similar to these will always be imaginable whenever it is possible to do something by luck rather than by skill. But the distinction between luck and skill is not a marginal matter in this context: it is precisely what we are interested in when our concern is ability, as opposed to logical possibility or opportunity. Of course it is on the basis of people's performances that we attribute skills and abilities to them; but a single performance, however successful, is not normally enough to establish the existence of ability. (I say 'not normally' because a single performance may suffice if the task is sufficiently difficult or complicated to rule out lucky success. Pushing one's wife in a wheelbarrow along a tightrope stretched across Niagara Falls would be a case in point.) But it would only be if a single performance always established an ability that we could offer $CpMp$ as a law of the logic of ability.

Let us turn to the remaining axiom: $EAMpMqMApq$. One half of this is $CAMpMqMApq$. This, as mentioned earlier, looks at first like a genuine law of the logic of ability to the effect that if I either can bring it about that p or can bring it about that q , then I can bring it about that either p or q . For, one might argue, bringing it about that ' p ' is true is *eo ipso* bringing it about that ' p or q ' is true, and so is bringing it about that ' q ' is true; so any exercise of the ability to bring it about that p , and any exercise of the ability to bring it about that q , will *eo ipso* be an exercise of the ability to bring it about that q . But this is not correct, as is most easily seen by considering an example where ' q ' is 'not p '. The President of the United States has the power to destroy Moscow, i.e., to bring it about that Moscow is destroyed; but he does not have the power to bring it about that either Moscow is destroyed or Moscow is not destroyed. The power to bring it about that either p or not p is one which philosophers, with the exception of Descartes, have denied even to God.²

The other half of the biconditional equally is not a law. This may seem surprising. Surely, if I can either do X or do Y , then either I can do X or I can do Y . For instance, if I can either walk to the door or crawl to the door, then either I can walk to the door or I can crawl to the door. The claim 'I can take it or leave it' is surely a stronger claim than either 'I can take it' or 'I can leave it'. Surely each of the weaker claims severally – let alone their disjunction – can be inferred from the stronger claim.

This is correct, but it does not show that $CMApqAMpMq$ is a logical law if 'M' is interpreted as suggested. In ordinary English 'I can do X or Y ' is commonly equivalent to 'I can do X and I can do Y '.³ 'I can take it and I can leave it'. But if we take ' p ' as 'I take it' and ' q ' as 'I leave it', then $CMApqAMpMq$ must be read: 'If I can bring it about that either I take it or I leave it, then either I can bring it about that I take it, or I can bring it about that I leave it'. This may perhaps be true, but 'I can bring it about that either I take it or I leave it' is not what is normally meant by 'I can take it or leave it'. If my wife is worried about my smoking, and thinks I have become addicted, I may try to reassure her by saying 'Don't worry about the cigarettes: I can take them or leave them alone'. No doubt the reassurance will be unsuccessful; but it would be downright dishonest if my only grounds for making the statement were my knowledge that, complete addict as I am, I nevertheless make true 'Either I am taking a cigarette or I am leaving cigarettes alone' every time I compulsively reach for the pack.

If we are careful in interpreting $CMApqAMpMq$ we see that it does not express a logical law. Given a pack of cards, I have the ability to pick out on request a card which is either black or red; but I don't have the ability to pick out a red card on request nor the ability to pick out a black card on request. That is to say, the following ($MApq$) is true:

I can bring it about that either I am picking a red or I am picking a black

but the following ($AMpMq$) is false:

Either I can bring it about that I am picking a red or I can bring it about that I am picking a black.

Similar counterexamples can be constructed in connection with any other discriminatory skill (e.g., one may have sufficient skill at darts to be quite

sure of hitting the board, and yet not be at all sure of obeying either the command 'Hit the top half of the dartboard' or the command 'Hit the bottom half of the dartboard').

The failure of ability to distribute over disjunction is a particularly serious matter. There are alethic modal systems which, like the logic of ability, lack the law $CMMpMp$. And like the logic of ability deontic logics lack the law $CpMp$ – in an imperfect world it is unsafe to assume that whatever is the case is permitted to be the case. But there are no modal systems in which the weak operator fails to distribute over disjunction so that $EAMpMqMApq$ fails to be a law.

III

It is time to make more precise the nature of the 'can' that we have been trying to fit to formal systems. In recent years philosophers and linguists have offered a number of distinctions between senses and uses of 'can' and between corresponding different types of possibility. Drawing on their work one can offer an incomplete list of ten distinguishable 'can's, which can be set out in Table I.⁴

Most if not all of these classifications reveal different senses of 'can': uses of 'can' in which different syntactical and semantical rules apply. Even within the ten different classes there are significantly different subclasses of instances, as the examples illustrate. Fortunately it is not a matter of present concern to investigate these differences in detail: the point of the table is to illustrate by contrast the particular type of 'can' under discussion, the 'can' which is used to report those human abilities, exercisable at will, of which the voluntary movements of the body and the speaking and thinking of units of language are the standard examples.

Some of the types of possibility which I have listed are capable of being confused with ability, and some of them are deliberately identified with ability by some philosophers. The possibilities most frequently thus confused or identified are circumstantial and epistemic possibility, corresponding to the 'can' of opportunity and the 'can' of consistency with known data. There are, I think, good philosophical reasons for refusing the identification; but one does not need to be grinding a philosophical axe in order to draw the distinctions, and indeed in English they are clearly marked linguistically. The epistemic can – where 'it can be that p '

TABLE I

Example	Type of possibility, etc.	Type of modality
(1) (a) <i>Modus ponens</i> cannot lead from true premisses to a false conclusion (b) Nine can be divided by three (c) Equals can be substituted for equals	Logical or formal possibility	Alethic
(2) (a) Men cannot survive without oxygen (b) Smoking can cause cancer	Physical possibility; dispositions, natural powers	Dynamic
(3) (a) She can speak Russian (b) I can't touch my toes (c) Anyone can learn to drive a car	Ability, mental and physical powers; personal powers; human possibility	Dynamic
(4) (a) I couldn't cross the road (b) We can't expand the economy indefinitely	Circumstantial possibility; opportunity	
(5) (a) I could have sunk the putt (b) I was able to overtake the car	Particular possibility; 'all-in' can; natural possibility	
(6) (a) He can be very stubborn (b) You can't take a joke	Volitional possibility; character	
(7) (a) Can you pass the salt? (b) I could have slapped her face	Willingness, particular inclination	
(8) (a) I can hear a strange noise (b) I can't feel any pain	Perception and sensation	
(9) (a) Stonehenge could be a primitive computer	Epistemic possibility, consistency with known data	Epistemic
(10) (a) You can import one fifth duty free (b) You can get down now (c) I cannot condone perjury	Legal, moral possibility	Deontic

is equivalent to 'For all we know to the contrary, *p*' – unlike the 'can' of opportunity or ability, is replaceable by 'may', and in British English usually is so replaced. The 'can' of ability and the 'can' of opportunity differ from each other in the way they form the future tense. 'I can speak Russian', in the present, according to context, may express either an ability or an opportunity. Not so in the future.

I can speak Russian tomorrow, we have guests coming from
Moscow

is correct; but not

*I can speak Russian next spring; I'm taking a beginner's
course this fall.

The future of the 'can' of opportunity may be either 'I can' or 'I will be able'; the future of the 'can' of ability must be 'I will be able'. Similarly with conditionals. If an ability is attributed conditionally, it must be expressed by 'will be able' or the like; an opportunity can be attributed conditionally by the plain 'can'. Compare:

If you give me a hammer, I can mend this chair
with;

*If you teach me carpentry, I can mend this chair.

It is not difficult to see philosophical reasons for this and connected linguistic differences. A skill or ability is a positive explanatory factor in accounting for the performance of an agent; an opportunity is rather a negative factor, the absence of circumstances that would prevent or interfere with the performance. Many abilities are states that are acquired with effort; opportunities are there for the taking until they pass. Whereas I have to possess an ability before I can exercise it, I may have an opportunity to do something which passes away before the time for taking it arrives: that is to say, it may be that now nothing prevents me from \o ing at *t*, but before *t* arrives something will have transpired to prevent me.

An ability is something internal to an agent, and an opportunity is something external. It is difficult to make this intuitive truth precise. The boundary between external and internal here is not to be drawn simply by reference to the agent's body: illness, no less than imprisonment, may take away the possibility of my exercising some of my abilities without necessarily taking away the abilities themselves. One thing that seems

clear is that the presence of absence or an opportunity must be something external to an agent considered as a locus of current volition of wanting: of current decision, intention, choice and desire.⁵ The mere lack of a desire to do something, the mere presence of a desire to do the opposite, does not by itself remove the opportunity to do it. I am away from home for three weeks and I fail to write to my wife: when I return home I can hardly avoid her reproaches by saying "I had no opportunity to write: every time I had a spare moment I was prevented by a strong desire for a Martini".

Abilities and opportunities are, of course, interconnected. Abilities can be exercised only when opportunities for their exercise present themselves, and opportunities can be taken only by those who have the appropriate abilities. The greater one's ability the less one needs in the way of opportunity: a cliff which would be impossible of ascent for the normal person presents the skilled mountaineer with an opportunity for a good climb. Conversely, some opportunities may be so good that one needs no great ability to make use of them: if the ball is only 1 mm from the edge of the hole it will not take a very skillful golfer to sink the putt. In the limiting case, omnipotence needs no opportunities; or, to put it another way, omnipotence can make an opportunity out of anything. On the other hand, it does not seem that we can say that if an opportunity is good enough no ability at all will be needed to exploit it. The opposite pole from omnipotent ability seems rather to be the necessary exercise of natural powers, where what we have is not so much an opportunity for action as a sufficient condition for a reaction. Perhaps we should say that the realm of application of the two concepts of opportunity and ability coincides, with omnipotence and necessitation marking the extremes on either side.

The fifth of the types of 'can' listed above was isolated in a famous controversy between J. L. Austin and P. Nowell-Smith: the 'all-in can' defined as ability plus opportunity. Von Wright, in his more recent work, has made a suggestion which is tantamount to the proposal that the logic of ability should be approached via the logic of an 'all-in "can"'. In *An Essay on Deontic Logic and the General Theory of Action* he introduces a modal operator '*M*', to be read as 'it is possible that', such that an expression consisting of '*M*' followed by an action-description or a biography⁶ says that a certain action or life is possible. He continues:

The possibility of a certain action or life may be said to depend on two factors. It depends first of all upon the agent's *ability*, upon what he *can do* in the various acting-situations. But it also depends upon which acting-situations are possible in nature, upon the opportunities for action which nature (inclusive of other agents) will 'allow' (p. 49).

The aspect of possibility relative to ability von Wright calls 'human possibility'; that relative to opportunity he calls 'physical possibility'; the 'all-in' possibility he calls 'natural possibility'. As a formalisation of natural possibility he proposes the system M. But he adds:

The question may be raised, whether the system M is the modal logic which best serves the purposes of [the] logic of action. On this question I shall only say that the modal logic we need must, in my opinion, be *at least as strong* as the system M. Perhaps it could be some stronger modal logic such as Lewis's S4 or S5.⁷

However, if what we have said so far is correct, the system M is *far too strong* for the logic of natural possibility and the 'all-in "can"'. For something is only naturally possible for an agent if the agent has both the ability and the opportunity to bring it about. Therefore the logic of natural possibility must be no stronger than the logic of ability. But, as we have seen, the logic of ability must be weaker than M in that it must not contain as theses either C_pMp or $EMApqAMpMq$.

The system M, however, is far more promising as a candidate to formalise the logic of the 'can' of opportunity. I have an opportunity to \emptyset iff nothing prevents me from \emptyset ing, i.e., if nothing compels me not to \emptyset . If something compels me to \emptyset , then I cannot help \emptyset ing. These (approximations to) conceptual truths resemble the interdefinability of '*L*' and '*M*' in the von Wright-Lewis systems. Remembering that compulsion is determination by external factors, we can interpret '*L*' as 'External factors make it unavoidable that...' and '*M*' as '*NLN*', i.e., as 'It is not the case that external factors make it unavoidable that not...'. Mention of external factors shows that, as we should expect, the notion of opportunity is a relativised one for whose formalisation we shall need some such device as subscripts. Using subscripts we can read ' $M_a p$ ' as 'A can (opportunity-wise) bring it about that *p*' or 'There is an opportunity for A to bring it about that *p*' where this is to be taken as meaning ' $NL_a Np$ ', i.e., 'No factors external to *A* have made it unavoidable that not *p*'. 'External to *A*' here means, as indicated earlier, 'external to *A* considered as a locus of current volition'.

It will be obvious that the upshot of these suggestions is that '*M*' rep-

resents a notion considerably broader than the ordinary notion of opportunity. For instance, wherever ' p ' is a necessary truth, it will follow from these definitions that $M_a p$ is true, whereas no agent A can bring it about that a necessary truth is true. Given the definition of ' M ' in terms of ' L ' and the translation of ' L ' into ordinary language, there is nothing paradoxical about the result; but it shows that the English reading suggested for ' M ' is only a very rough approximation. Again, if an agent is about to be necessitated to \emptyset by a determining antecedent condition, he will *a fortiori* not be compelled by external factors not to \emptyset , and therefore in this sense of 'can' he can \emptyset . This conflicts with the point made above that necessitation by a sufficient condition does not seem to count as the exploitation of an opportunity. What this shows, however, is not that M is the wrong logic to apply to the formalisation of opportunity, but that it captures a form of possibility which lets in as well as opportunity in the normal sense the kind of possibility which von Wright calls physical possibility. But this broadening, if I am not mistaken, is harmless and no more objectionable than the broadening of the use of 'if ... then' which takes place when these words are used as a reading of the sign for material implication.

If the modal operators are interpreted in this manner, then the axioms of M recover the plausibility which they lost when interpreted in terms of the logic of ability. Let us, as before, for simplicity's sake drop the subscripts and read ' L ' and ' M ' as first person operators. Then $CpMp$ seems an obvious truth; if p is the case, the nothing made it unavoidable that it was not the case, and a fortiori nothing external to me made it unavoidable that it was not the case. We can no longer provide counterexamples to the distribution of ' M ' over disjunction, and so we can accept the second axiom $EAMpMqMApq$.

Perhaps, following von Wright's suggestion in an analogous context, we should raise the question whether a logic stronger than M would be the appropriate one to formalize opportunity. What of the S4 axiom $CMMpMp$? Interpreted on the present lines, it would state that if no factors external to me have made it unavoidable that factors external to me have made it unavoidable that not p , then no factors external to me have made it unavoidable that not p . Is this correct? Suppose that factors external to me have made it unavoidable that p , and yet it is not the case that factors external to me have it unavoidable that factors external to me

have made it unavoidable that p . Then either the factors which have brought about the constraining factors are internal to me; or there are no such factors, and the constraining factors were not unavoidably brought about by anything. The first possibility can be ruled out: while a present state of compulsion may have been brought about by factors which *were* internal to me, these factors must now have ceased to be internal or the present state would not be one of compulsion. The second possibility is less easily dealt with: to rule it out would need, *inter alia*, an account of the notion of 'bringing about' and of the appropriate notion of 'unavoidability'.⁸ On these topics von Wright's work has thrown much light; but they are beyond the scope of the present paper. I shall not try to decide whether the S4 axiom $CMMpMp$ should be accepted as a law of the logic of opportunity. If it is, there would not here be any clash with the ordinary use of 'opportunity': an opportunity for an opportunity is itself a kind of opportunity; this at least is a feature of the concept of opportunity we use when we talk of equality of opportunity.

Though the S4 axiom may be acceptable in the logic of opportunity, the characteristic S5 axiom is not. $CMLpLp$ if accepted as a law of the logic of opportunity would mean that every opportunity for a constraint was itself a constraint; it would mean that wherever it is possible for me to be forced to do something I am forced to do it. A world in which the S5 axiom held in this logic would be a nightmare world of unremitting compulsion.

The suggestion that S4 may be the appropriate system for the logic of opportunity is given some support by the parallel between the logic of opportunity and the logic of knowledge; between the 'can' of opportunity and the epistemic 'can'. The weak operator ' M ' in epistemic logic is sometimes read as 'It is credible that...' or 'It may, for all we know, be that...' or simply 'For all we know to the contrary...' It can be defined in terms of a strong operator ' L ' understood as 'It is known that': ' Mp ' thus comes out as 'It is not known that not p '. If we make the artificial assumptions that we know the logical consequences of what we know, and that whatever we know we also know that we know, then the appropriate system for epistemic logic appears to be S4. Both the opportunity 'can' and the epistemic 'can' seem to be essentially negative notions: the absence of knowledge, or constraint, in the opposite direction. Like the logic of op-

portunity an adequate epistemic logic has to be relativised, as it is by Hintikka in his *Knowledge and Belief*.

IV

Let us return to the problem of formalising the 'can' of ability. This 'can', like the two operators we have just been considering, is essentially a relativised operator, unlike the corresponding operator for logical possibility. R. Hilpinen has devised a system of relativised modality, but the rightly does not offer it as a formalisation of dynamic modality: considered as such it would be open to a number of the objections made earlier to von Wright's system *M*.⁹

In one respect the formalization of the 'can' of ability should be a simpler matter than that of the other [two] 'can's we have considered. Opportunities are things which come and pass away; they are not like logical truths which remain for ever the same. Clearly, a full formalisation of the logic of opportunity would need to be combined with a tense-logic, or a time-logic, to allow for an indication of the time at which an opportunity occurred. Similarly, abilities come and go; what we are now able to do we may not always have been able to do and we may not always continue to be able to do. Once Falstaff could slip through a ring; some day we may be able to cure cancer. But the temporal modifications necessary in a logic of ability are simpler than those in a logic of opportunity.

In a logic of opportunity it is not only the opportunity-operator which needs to allow for temporal qualification. Consider the following examples:

- (1) Now I can see you; a few moments ago I was busy, and couldn't.
- (2) I can dine with you tomorrow, but not on Tuesday.
- (3) Yesterday I could lecture on 5 May, today I can't (my engagement book has got filled up in the meantime).

In the first example the modality is temporally qualified but not the action; in the second the action is dated but not the modality; in the third, the action and the modality are both qualified but the temporal qualification of each is different. Clearly, an adequate formalisation of opportunity-sentences will have to allow for independent dating of the sentence modalised and of the modalisation. So too with epistemic logic, where

we want to be able to formalise such sentences as 'It is known today that there will be a meeting tomorrow, but it was not known yesterday that there will be a meeting tomorrow'. With the 'can' of ability no such double dating is necessary. The ability-operator needs temporal specification, but the description of the exercise of the ability should not be temporally specified. For abilities are inherently general; there are no genuine abilities which are abilities to do things only on one particular occasion. This is true even of abilities, such as the ability to kill oneself, which of their nature can be exercised only once.¹⁰

In fact, despite the superficial expectation of similarity, the logic of ability is fundamentally different from that of the other 'can's. The inapplicability of the axioms of the Lewis-type systems which we saw in earlier sections is a symptom of a deeper feature of ability. To see this we must turn briefly from the syntax to the semantics of modal systems.

Kripke and Hintikka and their followers have shown how the semantics of a modal system may be formalized with the aid of the notion of a set of possible worlds and of an alternativeness relation between members of the set. In this type of account the proposition ' Lp ' is true in a given possible world if the proposition ' p ' is true in every possible world alternative to that possible world; the proposition ' Mp ' is true in a given possible world if the proposition ' p ' is true in some possible world alternative to that possible world.

The philosophical interest of possible-world semantics is that it enables us to systematize our intuitions about the truth-conditions of propositions containing various modal operators. Formal semantics does not enable us to dispense with intuition: we still have to use our intuitions as rational users of language to decide whether or not a given formal semantics captures the informal meaning of an ordinary language modal word. But we can apply our intuitions not just piecemeal to particular formulae – which may well result in contradictory upshots – but to systems as a whole. In the light of this one is then able to make a rational decision between conflicting intuitions in particular cases.

In effect it is the alternativeness relation on which we have to focus the beam of philosophical intuition. The Kripke-Hintikka approach permits the alternativeness relation to have a wide variety of properties: the two-placed relation of alternativeness may or may not be, for instance, transitive, symmetrical or reflexive. There are necessary relationships between

the properties of the alternativeness relation in the semantics and the different syntactic systems: thus a semantics system in which the alternativeness relation is also transitive and symmetrical will make true under every interpretation all and only the theses of the Lewis system S5.

In relating the formal modal operators with the modal words of ordinary language, consequently, it is important to direct one's attention to the interpretation of the alternativeness relation. For epistemic logic, for instance, a world $W2$ will be alternative to a world $W1$ if it is a world in which whatever is known in $W1$ is true. A world $W2$ will be deontically alternative to a world $W1$ if in world $W2$ all obligations holding in $W1$ are fulfilled. A world $W2$ will be alternative to $W1$ in the logic of opportunity if in $W2$ all constraining forces operative in $W1$ have achieved their effect.

Now what would be the corresponding intuitive account of the alternativeness relation for a logic of ability? One suggestion which comes to mind is that in the logic of ability $W2$ is alternative to $W1$ if in $W2$ all the abilities present in $W1$ have been exercised. Analogy with the other cases would suggest that if this were the appropriate relation then the 'can' of ability should be represented as a strong modal operator (' L ') not, as we have so far supposed, a weak one like the other 'can's. At first sight this seems reasonable enough. But reflection shows that there is something wrong with the idea of a world in which all A 's abilities are exercised. For suppose that for some \emptyset A is able to \emptyset and is able not to \emptyset : John, say, can be a smoker and can also be a non-smoker, i.e., not be a smoker. Then in a world in which all John's abilities are exercised, it will be true both that John is a smoker and that he is not a smoker. And that is not a possible but an impossible world.

It is true that people may have inconsistent beliefs and may be under incompatible obligations: so that a world in which all a person's beliefs were true, and a world in which all his obligations were fulfilled, may be as impossible as a world in which all his abilities are exercised. That is why it has been found convenient in doxastic and deontic logic to adopt the assumption that one is dealing with rational belief and reasonable obligation. This is a justifiable simplification, because it is a defect in beliefs and obligations to be inconsistent: a defect which calls in question *pro tanto* their genuineness as beliefs and obligations. But with ability it is not so. That I have the ability to \emptyset in no way weakens the claim that

I have the ability not to \emptyset : it is a merit, not a defect, in an ability that it is accompanied with an ability of a contrary kind and is therefore an ability which can be exercised at will: indeed it is a mark of full-blooded ability, as I have been using the term, as opposed to natural power, that it should be a two-way ability of this kind.

The difficulty in applying possible world semantics to the logic of ability goes further than the problem of finding the appropriate alternativeness relation, however. In the different modal logics some principles follow from special assumptions about the nature of the alternativeness relation while others follow from the basic framework of possible world semantics. But one of the principles which we earlier gave reason for rejection – the distribution law, $EAMpMqMApq$ – is a principle of this kind. Given the customary semantic analysis, this says that if a disjunction is true in some possible world, then one of the disjuncts must be true in some possible world. This principle will hold no matter how we choose our possible worlds or specify our alternativeness relation.¹¹ Hence, if we regard possible world semantics as making explicit what is involved in being a possibility, we must say that ability is not any kind of possibility; or, as I put it at the beginning, that dynamic modality is not a modality.

v

In this final section I shall consider briefly two possible lines of escape from the impasse we have reached in exploring the formal properties of the ‘can’ of ability. One way leads through the logic of action, the other through the logic of volition. I shall consider the two in turn.

It is not surprising, it may be suggested, that the ‘can’ of ability should prove recalcitrant when considered as a modality: for it represents a complex concept where the theories of modality and of activity intersect. The way out of the difficulties, therefore, may be to separate out, in formalisation, the motions of possibility and action. Suppose, for instance, that instead of representing ‘I can bring it about that...’ by the operator ‘ M ’ alone, one introduced an operator ‘ D ’ corresponding to ‘bring it about that...’ so that ‘I can bring it about that p ’ was symbolised by ‘ MDp ’. This would give us the requisite symbolic multiplicity to cope with the apparent failure of ability to distribute over disjunction. The counter-examples given earlier would show that $CMDA pqAMDpMDq$ wasn’t

logically true; but this is not a counterexample to $CMApqAMpMq$. The important question would be whether $CMADpDqAMDpMDq$ was a logical truth, and this of course would depend on the theory of action incorporated in the rules for 'D'. Similarly the counterexamples to the rule that *ab esse ad posse valet consequentia* could be explained as counterinstances not to $CpMp$, but to $CpMDp$; and the interesting question would be whether $CDpMDp$ held.¹² The problems thus become more tractable; but rather than disappearing they return as problems in the logic of action.

This can be seen if we consider a recent interesting paper of von Wright's, 'Deontic Logic Revisited' (*Rechtstheorie* 1973, 37ff). In that paper von Wright modifies his earlier position on deontic logic and introduces a system in which the connectives which bind descriptions of actions are not the same as those which connect propositions – verb phrases, or descriptions of action being, as in von Wright's earliest deontic work and as in the interpretation of M1 proposed above, the intended substitutions for the basic variables of the system. Von Wright's new system can be presented in the style of the present paper in the following manner. Let p , q , etc. represent verb-phrases for actions, and let 'L' 'A' 'N' symbolize conjunction, disjunction, and negation as applied to such phrases to make molecular verb-phrases out of them. Let 'D' followed by an atomic or molecular verb-phrase represent the proposition that I perform the action described by the verb-phrase. 'K' 'A' 'C' 'N' outside the scope of the operator 'D' are to be truth-functional connectives in the normal way. The system has the following special axioms:

- (A1) $CDNpNDp$;
- (A2) $EDNNpDp$;
- (A3) $EDKpqKDpDq$;
- (A4) $EDNKpqAADKNpNqDKpNqDKNpq$.¹³

In his paper von Wright does not explicitly link his system for the description of action with a system of modality: but in the course of distinguishing between the non-performance and the omission of an action (between NDp and DNp) he has this to say:

Omission is here understood as something stronger than the mere fact of not-doing. It is not-doing in a situation when that which is not done *could* have been done by the agent in question.

This suggests that a system combining modality with action theory should contain, on von Wright's view, the equivalence

$$EDN_pKND_pMD_p.$$

Interestingly enough, this equivalence plus the characteristic S4 theses (in particular CLC_pqCM_pMq and CMM_pMp) will yield

$$EMD_pMDN_p$$

which has a reasonable claim to be a formalisation of the Aristotelian principle about two-way powers, *eadem est potentia oppositorum*.¹⁴

Another interesting feature of von Wright's system in the present context is that it lacks the law CD_pDA_pq . This is exploited by von Wright in his treatment of Ross's paradox, to avoid the conclusion yielded by some deontic logics that an obligation to mail a letter is an obligation to mail a letter or burn a letter. In the present context the failure of this law enables us to solve the difficulty mentioned earlier that such things as the impossibility of bringing about a logical truth seemed to provide counterexamples to CAM_pMqMA_pq . The counterexamples, we can now say, are really counterexamples to $CAMD_pMDqMDA_pq$; and this is a principle which, in the absence of CD_pDA_pq , we have no reason to accept.

But the other half of the troublesome biconditional EAM_pMqMA_pq is not so easily dealt with. For when we attempt to apply von Wright's system to the solution of this problem we discover that it has a defect as a logic of action which is precisely analogous to the defect of M as a logic of ability. The difficulty arises over disjunctive actions. Von Wright's fourth axiom yields (given that iterations of 'N' within the scope of 'D' can be cancelled in the light of axiom (2)) the following equivalence:

$$EDA_pqAADK_pqDKN_pqDK_pNq.$$

Von Wright uses this to explicate the notion of disjunctive action.

Consider, when we can truly attribute to a man the *action* of, say, reading or writing. If we do not know for sure what *a* is doing this afternoon, but think he is engaged in studies, we may say we think he is reading or writing. But this, usually, means no more than affirming the disjunction of the two propositions that he is reading or that he is writing. But suppose *a* is my student and that I order him to spend the afternoon reading or writing. Then he will have to consider what to do, paying attention to both alternatives. Assume he decides not to comply with the order. Then he omits both actions. Assume however that he complies. Then he omits the conjunctive omission of

both the actions. This he can do in one of three ways. Either he reads but omits to write, or he writes and omits reading, or he does a little of both. Whichever course he chooses, decides to do, his action is intentional under the description '*a reads or writes*'. He performs the disjunctive action of *reading or writing*.

If, as this passage suggests, von Wright's system is meant to be a logic of action as intentional under a certain description, then the equivalence stated above does not hold. Our earlier counterexamples will show this. If I am given the order 'Either pick a red card or pick a black card', then I can obey it by picking out a card at random from the downward facing pack. My action is then intentional under description 'Either picking a red card or picking a black card'; but it is not intentional under the description 'Both picking a red card and picking a black card' (because that is not a true description of the action at all) nor is it intentional under the description 'Picking a red card and omitting to pick a black card' nor the description 'Picking a black card and omitting to pick a red card'. My action is not intentional under either of those descriptions, for each description, severally, can fail to hold without my intention being thwarted; indeed at the time of performing the action it is not even conscious under either of those descriptions. I conclude then that as it stands von Wright's *Rechtstheorie* system will not enable us to solve the difficulties which led to our earlier impasse.

I turn to the other way out. Many philosophers have maintained that, in the words of J. L. Austin, all 'can's are constitutionally 'iffy': that is to say, that any statement of an ability to \emptyset on the part of an agent is to be analysed as a conditional to the effect that if certain conditions are fulfilled the agent will \emptyset . If such a suggestion is to be worth considering, clearly the conditions of \emptyset ing will have to be interpreted broadly enough to include the agent's wants. We cannot say that 'I can \emptyset ' is equivalent to 'If I have the opportunity to \emptyset , and I do my best to \emptyset I will \emptyset ': I agree with Austin against Nowell-Smith that even all-in power plus will does not necessarily suffice for successful action, because abilities are inherently liable to fail on occasion for no reason. However, 'I can \emptyset ' surely does entail 'If I have the opportunity to \emptyset and I do my best to \emptyset , I most likely will \emptyset '. Abilities which were never, or rarely, exercised at will in the appropriate circumstances would be suspect.

Some of the arguments of this paper could be looked on as givings up-port to a conditional analysis of 'can'. On such an analysis, it might be

claimed, one might expect there to be the breakdown of the distribution of ability over disjunction on which we have so often remarked.¹⁵ Certainly there can be no doubt that the logic of human abilities is connected with that of trying, wanting, intending and choosing. But on one point the argument whether 'can's are constitutionally 'iffy' has been based on a confusion. Both parties to the debate have often assumed that in the expression 'I can if I choose' the 'if' clause expresses a condition on the ability. They have then gone on to argue whether it was an ordinary 'if' or a special 'if' analogous to the 'if' in 'there are biscuits on the table if you want them'. Davidson has recently argued that in such cases no special 'if' is called for.¹⁶ Be that as it may, it is a mistake to read 'I can if I choose' as equivalent to 'If I choose, I can'. 'I can if I choose' is elliptical for 'I can \emptyset if I choose', where the appropriate substitution for ' \emptyset ' will be given by the context; and in 'I can \emptyset if I choose' the 'if' clause is to be taken with the \emptyset , as qualifying the exercise, not the ability. (Consider the capacity to weep: a child does not have this capacity at all when newborn; I do; but I don't have the ability which an actress would have, to weep-when-I-choose or weep-if-I-choose.)¹⁷

This confusion, of course, is no essential part of the conditional analysis of ability. Still, linking the logic of ability with that of choice will not enable one to circumvent the problems raised in the present paper. The logic of volition – of practical inference – is a region where almost total darkness reigns. I will mention just two of the problems which the notion of volition involves over and above the obvious problems about ability. First of all, the notion of wanting like that of belief is an intentional notion and therefore raises problems of referential opacity. Thus, if the notion of ability is to be analysed in terms of wanting or trying it too will be affected with referential opacity. Secondly, the direction of fit between language and what language is about is different in the case of the expression of wants and in the case of the expression of beliefs. The onus is on a belief to conform to the facts; an expression of a want casts an onus on something non-linguistic to conform to something linguistic. When we match beliefs against the world we appraise the beliefs as true or false; when we match the world against our wants we appraise the world, or bits of it, as satisfactory or unsatisfactory. It is a matter of dispute whether this different direction of fit should make a difference between the logic of theory and the logic of practice. To the extent that it should

the analysis of abilities in terms of volition will lead to complications in the ability which are not – like the complications of referential opacity – paralleled in epistemic and doxastic logic.

I conclude that despite the spectacular progress of modal logic in the last two decades we are still as far from a satisfactory formalisation of the ‘can’ of ability as we were when von Wright wrote his pioneering *Essay*.

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NOTES

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¹ The line of thought explored in this first section was suggested by corresponding explorations of von Wright in the area of deontic logic. Over the years von Wright has wavered between reading a formula of deontic logic such as ‘Op’ as ‘one ought to do p’ and reading it as ‘it ought to be the case that p’. (See, for instance, ‘Deontic Logic Revisited’, *Rechtstheorie* 1973, p. 37). A way of reading ‘Op’ which he sometimes adopts is ‘it is obligatory to see to it that p’ (*An Essay in Deontic Logic and the General Theory of Action*, Amsterdam 1968, p. 37). My suggestion here is in the same spirit; but I prefer the expression ‘bring it about that p’ because ‘bring it about that’ does not carry the suggestion of intentionality, of purposively bringing it about that p, which to my ear ‘see to it that p’ does.

² Here I am indebted to Dr. P. J. FitzPatrick.

³ “He can speak Spanish or Portuguese” as Prof. A. Brod has pointed out to me, may mean “Either he can speak Spanish, or he can speak Portuguese; I don’t know which”.

⁴ For the distinctions used in the table, see F. R. Palmer, *A Linguistic Study of the English Verb* (London 1965); B. Aune, article ‘Can’ in *The Encyclopedia of Philosophy*; J. L. Austin, ‘Ifs and Cans’ in *Philosophical Papers* (Oxford 1961); P. Nowell-Smith, ‘Ifs and Cans’, *Theoria* 26 (1960) 85–101; M. R. Ayers, *The Refutation of Determinism* (London 1968); R. Gibbs, ‘Real Possibility’, *American Philosophical Quarterly* 7 (1970) 340–348; A. M. Honoré, ‘Can and Can’t’, *Mind* 73 (1964) 463–479; J. P. Snyder, *Modal Logic and Its Applications* (New York 1971) and G. H. von Wright, *An Essay on Modal Logic* (Amsterdam 1951).

⁵ The qualification ‘current’ is important: clearly one can be constrained by past desires whose effects may now be unalterable.

⁶ These are both technical terms of von Wright’s theory, defined in such a way as to approximate to an idealisation of the intuitive meaning of the terms.

⁷ Von Wright maintains basically the same position in *Explanation and Understanding* (London 1971).

⁸ For instance, it might be that a satisfactory analysis of the notion of bringing about would show that if A brings it about that p then A brings it about that A brings it about

that p . If so, then the second possibility would be ruled out (for an agent who brings about a state of affairs *a fortiori* renders it unavoidable).

⁹ 'An Analysis of Relativised Modalities' in *Philosophical Logic*, ed. by J. W. Davis, D. J. Hockney, and W. K. Wilson, (Dordrecht 1969), p. 181.

¹⁰ For some ingenious but inconclusive arguments to the contrary, see Honoré *art. cit.*

¹¹ For this important point I am indebted to Prof. Stalnaker.

¹² To deal with these matters adequately would need a whole logic of action; but I think it can be seen that no combination of the system M with an action-operator will serve the purpose. For if the notion of agency represented by 'D' is taken to be mere brute agency, with no suggestion of intentionality or voluntariness, then $CMADpDq-AMDpMDq$ will be a logical truth, but it will be possible to find counterexamples to $CDpMDp$ and thus to $CpMp$; whereas if the notion of agency represented by 'D' includes a type of intentionality strong enough to safeguards $CDpMDp$ from falsification, then it will be possible to find counterexamples to $CMADpDqAMDpMDq$ and thus to $CMpqAMpMq$.

¹³ The fourth axiom appears to be misprinted in the *Rechtstheorie* article. As stated above it conforms to von Wright's explanation in the accompanying English text, rather than to his formulation (in Russellian style) of the axioms.

¹⁴ At least to some versions of this principle; Aristotle does not appear consistent in its enunciation.

¹⁵ If we put 'T' for 'try to bring about that' then a first attempt at the conditional analysis of 'can' replaces ' Mp ' by ' $CTpp$ '. Then the law to which we have found counterexamples is $CCTApqAppqCAppCTqq$ which is not a distribution law. 'T' does not in fact distribute over disjunction ($ETApqATpTq$ is not a law); but in a logic of rational attempts, $ETKpqKTpTq$ would no doubt be a law so that 'T' would distribute over conjunction. The trouble with ' $CTpp$ ' for ' Mp ' is that one becomes omnipotent by never trying.

¹⁶ In *Essays on Freedom of Action*, ed. by T. Honderich (London 1973).

¹⁷ It is a merit of von Wright's *Rechtstheorie* system that it enables one to distinguish between $CpMDq$ and $MDCpq$.