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THE CONCEPT OF OBLIGATION IN THE CONTEXT OF DECISION THEORY

I. INTRODUCTION

Three observations have been the stimulus to my thinking about obligation. One is the penetrating but baffling paper by H. A. Prichard (1932) entitled 'Duty and Ignorance of Fact.' I agree with almost everything Prichard has to say, at least insofar as I understand it, but I always finish rereading the essay with a feeling of incompleteness. What can be said about duty in the face of partial ignorance? Prichard does not make the next move to partial degrees of belief and the outlines of decision theory.

The second observation is that there seems to be no natural way to introduce the concept of obligation into a complete decision theory, fully equipped with a numerical subjective probability function and a numerical utility function, and the single rule of behavior always to maximize expected utility. The concept of obligation must be put in some early stage, almost surely at the point of extending the primitive at concepts of decision theory.

The third observation is that obligatory acts stand to acts in general as certain events stand to events in general – and here by *certain events* I mean those events that must occur with certainty. If A is a certain event and $A \subseteq B$ then B also is a certain event. The event that must occur is X , the set of all possible outcomes. If $A \subseteq X$ but $A \neq X$ then A may be subjectively certain but is not logically necessary. Here 'logically necessary' means that the occurrence of such an event A is imposed by the structure of the Boolean algebra of events, and not by the subjective probability measure or qualitative relation defined on the algebra. My inference from what has just been said about events and the analogy that constitutes the third observation is that we need to make explicit the logical structure of obligation in just the same formal way that we make explicit the logical structure of certainty in subjective probability theory and decision theory.

The rest of what I have to say shall be addressed to this task. I am sure I shall say a number of things that are wrong, but I look forward to learning from your corrections of my intuitions. I do not know that the theory I work out here can be used to answer any questions of real significance, but developing it has at least clarified my own thinking about obligation.

II. PRIMITIVE CONCEPTS OF THE THEORY

Because I want to make as explicit as possible the independence of the theory of obligation from the theory of utility, I shall deliberately leave out some of the concepts of standard decision theory – especially the concept of the set C of consequences, on which the utility function is ordinarily defined.

I retain X , the set of states of nature, and a set D of decisions defined on X . From a formal standpoint the elements of D are functions whose domains of definition are X . We could of course now introduce the set of consequences C as the union of the ranges of the functions in D , but I deliberately refrain from so doing.

Ordinarily in decision theory we would next consider a preference ordering on D , and then by appropriate definition – using some such device as constant decisions or functions – extend it to a probability ordering on the events that are a subset of X .

For our purposes here it is good enough just to assume both these orderings, and this we may do with one primitive, an ordering \geq that is a subset of $(D \times D) \cup (X \times X)$. We shall when needed use $>$ for strict preference and \approx for indifference, with their standard definitions in terms of \geq being understood. On D we talk about a preference ordering, perhaps one generated by obligations; on X , we talk about a subjective probability ordering. The axioms given below relate the two.

Finally, we come to the last primitive, the one that is especially important here. This is the set \mathcal{O} of obligatory acts. However, \mathcal{O} is not simply a subset of D , the full given set of acts or decisions, but rather a subset of conditional or partial acts. The idea is this. Ordinarily in decision theory an act or decision is defined on all states of nature and represents a decision as to how to act under all possible states of affairs. Such decisions are total functions, in a familiar terminology. Often only parts of such

functions would be considered obligatory. Consider this example. Let A be the event of a two-year-old child's starting to run across a busy street in Jones' presence. Let f be the act or decision that for every x in A is the act of stopping the child, and let f , for $x \notin A$, be the (passive) act of watching the child play. Then intuitively, not f , but f restricted to A , in symbols: $f \upharpoonright A$, is the obligatory act. So \mathcal{O} is a set of such partial functions, i.e., \mathcal{O} is just the set of obligatory acts.

The theory of obligation developed here is then stated in terms of a structure $\chi = \langle X, D, \mathcal{O}, \geq \rangle$, where X, D, \mathcal{O} and \geq have the set-theoretical properties described above – X and D must be nonempty but not necessarily \mathcal{O} ; and as events we take all subsets of X .

III. AXIOMS OF THE THEORY

The two most important ideas expressed in the axioms are the closure properties making explicit how new obligatory acts may be formed out of given ones, and the preference ordering of obligatory acts, as well as the ordering of such acts in relation to other acts. In addition, problems of consistency among obligations must also be faced.

Further remarks about the axioms and the statement of alternatives will be easier to formulate with the axioms already in front of us. I do note that de Finetti's qualitative axioms for subjective belief or probability are included because of the importance I attach to making explicit the relation between obligation and ignorance of fact, endorsing in the process Prichard's subjective view of the matter.

We also need one formal definition for the preference or choice axiom. This is the notion of the *maximum obligatory domain* of a decision or act, abbreviated MOD, and defined as follows:

A is the MOD of f if and only if $f \upharpoonright A \in \mathcal{O}$ and if $A \subseteq B$, but $A \neq B$ then $f \upharpoonright B \notin \mathcal{O}$.

DEFINITION. *A structure $\chi = \langle X, D, \mathcal{O}, \geq \rangle$ is a structure of obligation if and only if the following axioms are satisfied for all events A, B and C and all decisions f and g .*

Belief Axioms

- B1. *The relation \geq is a weak ordering on X .*
- B2. *$A \geq \emptyset$.*

B3. *Not* $\emptyset \geq X$.

B4. *If* $A \cap C = B \cap C = \emptyset$ *then* $A \geq B$ *if and only if* $A \cup C \geq B \cup C$.

Closure Axioms

Cl1. *If* $A \subseteq B$ *and* $f \mid B \in \mathcal{O}$ *then* $f \mid A \in \mathcal{O}$.

Cl2. *If* $f \mid A, g \mid B \in \mathcal{O}$ *and* $A \cap B = \emptyset$ *then* $f \mid A \cup g \mid B \in \mathcal{O}$.

Consistency Axiom

Con. *If* $f \mid A, g \mid B \in \mathcal{O}$ *and* $A \cap B \neq \emptyset$ *then* $f \mid A \cap B = g \mid A \cap B$.

Preference or Choice Axiom

Ch. *If* A *is the MOD of* f *and* B *is the MOD of* g , *and either* $A > \emptyset$ *or* $B > \emptyset$ *then* $f \geq g$ *if and only if* $A \geq B$.

Because the belief axioms have been commented on extensively in the literature of decision theory I shall not say anything about them here. The two closure axioms do not guarantee that the set \mathcal{O} of obligatory acts is nonempty, for in many decision situations it is reasonable to suppose that there are no obligatory acts, and the concept of obligation does not have direct relevance to a choice among acts. The first closure axiom does say that if a partial function or partial act is obligatory then a further restriction to a smaller domain, that is, a restriction to a more restricted and more specific event will also be obligatory. To extend the example given earlier, if B is the event of a two-year-old child's starting to run into a busy street and A is the more specific event of the child's being two feet from the curb as well, then the closure axiom requires that given it is obligatory to stop the child in the case of event B it is also obligatory in the case of event A . The second closure axiom specifies a method of building up complex obligatory acts from simpler ones. If f is obligatory given event A and g is obligatory given event B , and if the intersection of A and B is empty so that not both A and B can occur together, then the union of the two obligatory acts is also obligatory.

The consistency axiom is more controversial than the preceding axioms in terms of standard discussions of obligation. It is sometimes maintained that obligations can be inconsistent, but the function of this axiom is that in a given structure of obligations no such inconsistency

can occur. If two acts are obligatory and their domains overlap then the axiom requires that the two acts be identical on the common domain, that is, on the common event $A \cap B$.

By far the strongest axiom is the last one, the preference or choice axiom. This axiom asserts that one act will be preferred to another or chosen in place of another just on the basis of obligation and without any consideration of utility. This means that whenever there are any acts that are obligatory and the events on which they are conditioned have nonnull probability, then obligation dominates all other considerations of utility. Utility or desirability would enter only in choosing between two obligatory acts whose conditional events had equal probability of occurring. The second aspect of this axiom, which represents a strong assumption, is that the only basis for choice among obligatory acts is the probability of the conditional events' occurring. This part of the axiom answers in a very strong form the question left unanswered by Prichard. Roughly speaking, the axiom asserts that apart from information all obligatory acts are equivalent in terms of preference or choice; one act is not per se more obligatory than another, given that both belong to the set of obligatory acts. The only basis for choice is information. An obligatory act conditioned on the more probable event should be the one chosen. To paraphrase the title of Prichard's article, the force of this axiom is to say that duty depends on factual belief. To put it more strongly, we might even say that the force of the axiom is that all duties are equally obligatory, and the choice among them depends *only* on factual beliefs.

In all likelihood the choice axiom is too strong and needs to be weakened in any one of several ways. The point of stating it here is to make explicit what might be called the simple theory of obligation. What is not clear to me is how to use something other than degree of factual belief or desirability as a basis for arbitrating between various obligations. Certainly we all recognize that one obligation can be overridden by another. For example, it is an obligation not to shove other people while walking on the sidewalk, but that obligation can be overridden by the obligation of saving a child from being hit by a car. In order to reach the child in time, it would be considered appropriate by almost everyone to rudely push another adult. The obligation to be polite and considerate while walking on a sidewalk is relatively minor compared

to the obligation to make an effort to prevent harm to a child. The present choice axiom clearly does not differentiate between these two obligations; it could even be that the act of shoving the adult is a more certain violation of obligation than the act of reaching for the child. What seems to be needed is an additional structure of preference or choice on obligations independent of considerations of information. This additional structure should depend upon the seriousness or importance of the obligations. Even then, I foresee difficulties, for if obligatory act f given A is more serious or important than obligatory act g given B , it may still be the case that we should not select f over g because the probability of event A 's occurring is very small in comparison to the probability of B 's occurring. In other words, it will not be sufficient simply to introduce an independent hierarchy of seriousness. However, it is clear that a natural apparatus can be drawn from decision theory to take account of this hierarchical problem, namely, we can think of assigning a weight of seriousness to each obligatory act, and then compute expected seriousness by taking expectation with respect to the subjective factual beliefs. I shall not work out the details of this additional development here, but it constitutes a natural extension of the simpler theory that is the central focus of the present paper.

IV. SOME ELEMENTARY THEOREMS

It is easy to prove a number of elementary theorems about obligation which follow from the axioms. Some examples are given here. The proofs will mostly be omitted.

THEOREM 1. *If $f_A, g_B \in \mathcal{O}$ then $f_A \cup g_B \in \mathcal{O}$.*

This theorem asserts an unrestricted closure property of \mathcal{O} that is stronger than Axiom C1 2, but follows from this axiom and the consistency axiom.

THEOREM 2. *If A is the MOD of f and B is the MOD of g , and $A \subseteq B$ then $f \leq g$, provided either $A > \emptyset$ or $B > \emptyset$.*

This theorem says that if whenever A occurs B must occur and if A is the maximum obligatory domain of f , and B of g , then g should be (weakly) preferred to f .

THEOREM 3. *If $A \cap B = \emptyset$, A is the MOD of f , B is the MOD of g , and $B > \emptyset$, then any function h in D such that $h \mid A \cup B = f \mid A \cup g \mid B$ is preferred to f , i.e., $h > f$.*

This theorem gives a method for building up preferred 'composite' obligatory acts.

THEOREM 4. *Let F be the set of all acts f such that the MOD of f is strictly more probable than \emptyset . Then F is weakly ordered by \geq , i.e., \geq is transitive and strongly connected on F .*

V. COMPARISON WITH DEONTIC LOGIC

It will be instructive to compare some of the systematic characteristics of obligatory acts in the present theory with the view of obligatory acts developed in deontic logic.

One of the first things noticeable is that the concept of negation does not naturally apply in the present theory to acts as functions. It is especially not natural to talk about the negation of an act. From an uninteresting set-theoretical standpoint the complement of the act considered as a function is defined with respect to a universe that can be specified but the concept of complementation put in this fashion does not have an interesting interpretation, for the complement of an act is not an act. What should be explicitly noted is that the ordinary sentential language and the ordinary use of the sentential connectives do not apply in a simple way to acts considered as functions.

A detailed comparison with deontic logic does deepen the feeling for the structure of the present theory. In his classical article, von Wright (1951) gives a number of laws of deontic logic. Von Wright's notation is this. Propositions are denoted by initial capital letters of the alphabet; OA means that A is obligatory and PA that A is permitted.

To begin with, there is the tautology

$$PA \leftrightarrow \neg(O \neg A),$$

where \neg means negation and \leftrightarrow means *if and only if*. Translation into our setup requires definition of a permitted (partial) act. Let us call the set of such acts \mathcal{P} , which we define as follows.

DEFINITION. $f \mid A \in \mathcal{P}$ if and only if there is no g and no event $B \subseteq A$ such that $g \mid B \in \mathcal{O}$ and $f \mid B \neq g \mid B$.

The conceptual similarity to von Wright's equivalence is apparent. A more complex point to raise in the context of decision theory is this. We might want to liberalize the notion of permitted acts by requiring

that the event B have positive probability, i.e., $B > \emptyset$, or in familiar terminology of probability theory we ignore sets of measure zero.

Von Wright's second law is that OA entails PA . Here and in what follows I shall write the corresponding property in the present theory as a theorem, numbering consecutively with the theorem of the last section.

THEOREM 5. *If $f \mid A \in \mathcal{O}$ then $f \mid A \in \mathcal{P}$.*

This theorem follows essentially immediately from the consistency axiom and the definition of \mathcal{P} .

Next follow four laws that von Wright calls laws for the dissolution of operators.

- a. $O(A \& B)$ is identical with $(OA) \& (OB)$,
- b. $P(A \vee B)$ is identical with $(PA) \vee (PB)$,
- c. $(OA) \vee (OB)$ entails $O(A \vee B)$
- d. $P(A \& B)$ entails $(PA) \& (PB)$.

Corresponding to (a) we have:

THEOREM 6. *If $f \mid A, f \mid B \in \mathcal{O}$ then $f \mid A \cap B \in \mathcal{O}$.*

On the other hand, it does not follow, as in the case of 'half' of (a) that if $f \mid A \cap B \in \mathcal{O}$ then $f \mid A \in \mathcal{O}$ and $f \mid B \in \mathcal{O}$. So here a clear conceptual difference exists.

Corresponding to (b), we have:

THEOREM 7. *If $f \mid A \cup g \mid B$ is a function, then $f \mid A \cup g \mid B \in \mathcal{P}$ if and only if $f \mid A, g \mid B \in \mathcal{P}$.*

Again, we miss a full analogue, which would be

$$f \mid A \cup g \mid B \in \mathcal{P} \text{ if and only if } f \mid A \in \mathcal{P} \text{ or } g \mid B \in \mathcal{P};$$

here the implication from right to left is false.

Corresponding to (c) we have an even poorer analogue, but a complete analogue of Theorem 7, with obligation replacing permission.

THEOREM 8.

$$f \mid A \cup g \mid B \in \mathcal{O} \text{ if and only if } f \mid A, g \mid B \in \mathcal{O}.$$

In the case of Theorem 8 we do not need the hypothesis of Theorem 7, for Theorem 1 guarantees that the union of any two obligatory acts is also obligatory, a part of our strong requirement of consistency.

As to (d), we have:

THEOREM 9. *If $f \mid A, g \mid B \in \mathcal{P}$ then $f \mid A \cap g \mid B \in \mathcal{P}$, but not conversely.*

Disparities between deontic logic and the present theory are already evident. They are made even more so when we consider von Wright's six laws of commitment. The first one asserts that $OA \ \& \ O(A \rightarrow B)$ entails OB . The absence of negation of an act as function has already been noted. There are similar difficulties with an adequate notion of implication, for the Boolean operation corresponding to implication is ordinarily defined in terms of complementation and union, or complementation and intersection.

In view of these problems, it is natural to seek for an approach within the present theory that is set-theoretic rather than function-theoretic in character. This we can do along the following lines. First, rather than use von Wright's notation, because of confusion with the event notation used here, let us use lower-case letters ' p ', ' q ', ' r ', etc., for acts, and let an act now be a *set* of partial functions in the sense of this paper. To avoid overlapping terminology let us call these new acts *k*-acts, where the ' k ' stands for kind, since acts as functions represent more closely individual acts rather than kinds of acts. Second, it will be simplest to relativize *k*-acts to a given event or state of affairs A . Generally the reference to A shall be omitted, and A shall be assumed constant. Granted the relativization the acts are now total. In other words, p is a *k*-act (relative to A) if and only if p is a subset of function acts $f \mid A$. For formal explicitness, we define

$$\mathcal{A}(A) = \{f \mid A : f \in D\}.$$

Then

DEFINITION. *p is a k -act (relative to A) if and only if p is a subset of \mathcal{A} . Complementation or negation is defined relative to \mathcal{A} , and implication is given its usual Boolean definition. We define Op to mean that p is an obligatory *k*-act as follows.*

DEFINITION. *Op (relative to A) if and only if there is a partial function $f \mid A$ in p and $f \mid A \in \mathcal{O}$.*

It follows, of course, from our axioms that there is at most one such $f \mid A \in \mathcal{O}$, i.e., essentially from the consistency axiom, there can be no conflict of obligation relative to a given state of affairs A .

From this point on we can follow von Wright rather closely. First we define permission.

Pp if and only if not $O\neg p$.

The following theorems then follow easily, using mainly the Consistency Axiom. The first four correspond to (a)–(d) above.

THEOREM 10. $O(p \cap q)$ if and only if Op and Oq .

THEOREM 11. $P(p \cup q)$ if and only if Pp or Pq .

Proof: By virtue of Theorem 10, we have

$O(\neg p \cap \neg q)$ if and only if $O\neg p$ and $O\neg q$,

whence by elementary logic

not $O(\neg p \cap \neg q)$ if and only if not ($O\neg p$ and $O\neg q$),

and thus by applying de Morgan's law to the Boolean algebra on the left and to the sentential logic on the right, we have

not $O\neg(p \cup q)$ if and only if not $O\neg p$ or not $O\neg q$.

Using then the definition of permission, we obtain the theorem.

THEOREM 12. Op or Oq if and only if $O(p \cup q)$.

Proof: Going from left to right, by hypothesis there is an $f \mid A$ in \mathcal{O} such that either $f \mid A$ is in p or $f \mid A$ is in q , whence $f \mid A$ is in $p \cup q$. The converse is similar.

In Theorem 12 we find a remaining fundamental difference from von Wright's logic. In his system, Op or Oq entails $O(p \cup q)$, but not conversely, for he has in mind that a disjunction of acts may be obligatory without either member being so. That is not the case here because of the generation of obligatory k -acts from a given state of affairs A and at most one function-theoretic obligatory act.

THEOREM 13. If $P(p \cap q)$ then Pp and Pq .

In the case of this theorem, we match exactly the strength of von Wright's logic. The converse implication holds in neither system. The absence of this converse is closely related to another question discussed by von Wright. He asks what should be the logical status of the propositions $P(p \cap \neg p)$ and $O(p \cup \neg p)$. It might be thought both should be theorems – the empty k -act is permitted and the universal k -act is obligatory, but von Wright suggests the best course is to regard them as expressing contingent propo-

sitions, and with this view the present theory is in agreement. In order for $O(p \cup \neg p)$ to hold, for instance, an obligatory partial act $f|A$ must be in \mathcal{O} , but this is not required. Indeed, it would be contrary to the spirit of the present theory to require that for each $A > \emptyset$ there be an $f|A$ in \mathcal{O} ; only an ultra-Calvinist view of the world could tolerate such a feature.

I now turn to von Wright's six laws of commitments, formulated as Theorems 14, 15, 17–20. I note explicitly that Boolean implication $p \rightarrow q$ is defined as $\neg p \cup q$.

THEOREM 14. *If Op and $O(p \rightarrow q)$ then Oq .*

Proof: By hypothesis $f|A$ is in p , in $\neg p \cup q$, and also in \mathcal{O} , and so by the Boolean version of tollendo ponens, $f|A$ is in q .

THEOREM 15. *If Pp and $O(p \rightarrow q)$ then Pq .*

Proof: By hypothesis there is an $f|A$ in $\neg p \cup q$ and also in \mathcal{O} , but by the definition of P , $f|A$ is not in $\neg p$, and so $f|A$ is in q , and thus Pq .

However, as the last statement of the proof shows, we can strengthen this theorem to the conclusion that q is obligatory. This conclusion runs counter to von Wright's intended interpretation, and is certainly a controversial feature of the present setup. Von Wright had in mind something like the following. Promising is permitted. It is obligatory if a promise is given to keep it. Consequently keeping promises is permitted. In this instance a temporal sequence of acts constitutes the intended interpretation, but in the underlying model of the present theory the situation is static. Given the state of affairs A , exactly one partial act $f|A$ can be performed, and it may or may not be obligatory. What this adds up to is this. If there is an obligatory k -act p , then for any k -act q if q is permitted it is also obligatory. I formulate this principle as a theorem to be scrutinized more intensely later.

THEOREM 16. *If Op and Pq then Oq .*

I now return to von Wright's third law of commitment, stated as Theorem 17.

THEOREM 17. *If not Pq and $O(p \rightarrow q)$ then not Pp .*

Proof: By hypothesis $f|A$ is in $\neg p \cup q$, in $\neg q$ and in \mathcal{O} , whence $f|A$ is in $\neg p$, and thus not Pp .

THEOREM 18. *If $O(p \rightarrow (q \cup r))$, not Pq and not Pr then not Pp .*

Proof: By hypothesis $f|A$ is in $\neg p \cup q \cup r$ and in \mathcal{O} , but $f|A$ is not in q and not in r . So $f|A$ is in $\neg p$, and thus not Pp .

THEOREM 19. *If Op and $O((p \cap q) \rightarrow r)$ then $O(q \rightarrow r)$.*

Proof: By hypothesis $f|A$ is in p and in \emptyset , and also in $p \cap q \rightarrow r$, but $p \cap q \rightarrow r = p \rightarrow (q \rightarrow r)$, so $f|A$ is in $q \rightarrow r$, as desired.

THEOREM 20. *If $O(\neg p \rightarrow p)$ then Op .*

Proof: Follows at once from the Boolean identity $\neg p \rightarrow p = p$.

From the theorems that have just been proved it is clear that the obligatory theory of k -acts is somewhat stronger than von Wright's deontic logic. In particular, Theorems 12 and 16 are not true in his theory.

However, Theorem 12 fails – it just becomes an entailment rather than equivalence – if we broaden the definition of k -act so that it is not restricted to a given event A . To avoid confusion with the definition of k -acts already given, I use ' α ', ' β ', ' γ ', etc., to stand for these broadened k -acts. I shall still refer to these new objects as k -acts but the notation will signal that the new definition is being used. First, we define \mathcal{F} as the set of all partial functions. Formally,

$$\mathcal{F} = \{f | A : A \subseteq X \text{ and } f \in D\}.$$

Then

DEFINITION. *α is a k -act if and only if α is a subset of \mathcal{F} .*

The only other change is to relativize obligation to a given state of affairs A . In other words, in the modified theory of k -acts, obligation rather than the k -acts themselves is relativized to A . Intuitively this fits well the general view of this paper that obligations do not hold absolutely but relative to factual beliefs about the true state of affairs. The formal definition of Op (relative to A) can stand as given earlier, but now it is $O\alpha$, and α itself is not restricted to A .

Using this wider concept of k -act we may look at Theorem 12 and see why now we may not infer from $O(\alpha \cup \beta)$ that $O\alpha$ or $O\beta$. As a counterexample let $f|A$ be in \emptyset , not in α and not in β , but let $A = B \cup C$ with $f|B$ in α and $f|C$ in β .

As to Theorem 16, it is not changed by the broadened concept of k -act. Suppose α is obligatory. Then $f|A$ is in α and also in \emptyset . Now suppose β is permitted. Then $f|A$ is not in $\neg\beta$, but since $f|A$ is in α , it is in $\beta \cup \neg\beta$, and thus in β , so β is obligatory.

Because Theorem 16 holds also under the modified concept of k -act, it is worth scrutinizing its meaning more carefully. As a truth about the general theory of moral obligation it seems too hard a saying even for

those of Calvinistic bent. It is considerably more reasonable when it is assessed in the context of the decision context used here. The theorem applies when we are given a state of affairs A and there is an obligatory act α in circumstances A . In this environment any permissible act β must be *identical with* α , and hence obligatory. Put another way, in circumstances that mandate an obligatory act, any other act is forbidden.

Because of the clarity and explicitness of von Wright's classic article on deontic logic it has been a natural touchstone for analyzing the theory of obligation from a decision-theoretic viewpoint. However, in his book, *Norm and Action* (1963) von Wright expresses dissatisfaction with several aspects of the 1951 article. The principal ones are these: (i) the definition of permission in terms of obligation and negation, as given above; (ii) the principles of distributivity and commitment discussed above; (iii) the treatment of acts as propositions and the consequent application of sentential connectives to form new, complex acts.

The last point I have already dwelled upon. In a decision-theoretic context it is natural – and by now almost a convention – to treat acts as functions, not as propositions or events. The problem of permission and its definability in terms of obligation is especially severe in the theory I have developed, in view of Theorem 16. But I do emphasize that Theorem 16 does *not* hold for individual acts taken as partial functions. In other words, there are acts $f \mid A$ and $g \mid B$ such that $f \mid A \in \mathcal{O}$, $g \mid B \in \mathcal{P}$ and $g \mid B \notin \mathcal{O}$. On the other hand, we do have an analogue of Theorem 16 when the state of affairs A is held constant.

THEOREM 21. *If $f \mid A \in \mathcal{O}$ and $g \mid A \in \mathcal{P}$ then $g \mid A \in \mathcal{O}$.*

The theorem follows from the fact that in the theory postulated here, for a given A there can be just one obligatory act, and therefore $g \mid A = f \mid A$.

Concerning the principles of distributivity and commitment stated in von Wright's 1951 article, I shall not expand further upon the comments made already when their formal status in the present theory was examined.

VI. FURTHER AXIOMS

Comparison with deontic logic is useful because of the effort that has been made to be clear about the logical structure of the deontic modalities, but moral philosophy will remain weak in substantive structure and content if it remains formally at the broad level of generality of deontic

logic. Richer structural assumptions are needed to make deeper contact with the concept of obligation that has been the focus of so much philosophical analysis.

Working out the concept of expected seriousness has already been alluded to. The hard part of this effort, developing a hierarchy of seriousness, or, as we might say, a hierarchy of obligations, is as yet mainly untouched. It is hardly likely that intuitive considerations alone will be sufficient to construct such a hierarchy, and it should be obvious from earlier remarks that I would scarcely expect to use a priori arguments to justify the necessarily detailed additional axioms that are needed.

The spirit of investigation should be that which dominates normative economics – the detailed analysis of alternative formal structures. In the theory of moral obligation, as in the theory of most other concepts in moral philosophy, there has as yet been too much Lockean clearing of the underbrush and too little Newtonian building. The present paper is meant to be a modest contribution to the Newtonian task.

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