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*New Foundations for Imperative Logic I: Logical Connectives, Consistency, and Quantifiers**

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Abstract

Imperatives cannot be true or false, so they are shunned by logicians. And yet imperatives can be combined by logical connectives: "kiss me and hug me" is the *conjunction* of "kiss me" with "hug me". This example may suggest that declarative and imperative logic are isomorphic: just as the conjunction of two declaratives is *true* exactly if both conjuncts are true, the conjunction of two imperatives is *satisfied* exactly if both conjuncts are satisfied—what more is there to say? Much more, I argue. "If you love me, kiss me", a *conditional* imperative, mixes a declarative antecedent ("you love me") with an imperative consequent ("kiss me"); it is *satisfied* if you love and kiss me, *violated* if you love but don't kiss me, and *avoided* if you don't love me. So we need a logic of *three*-valued imperatives which *mixes* declaratives with imperatives. I develop such a logic.

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1. Introduction

Jean-Dominique Bauby "dictated" his book, *The diving bell and the butterfly* (1997), one letter at a time: he selected each letter by blinking his left eye as the alphabet was being recited to him. He was almost totally paralyzed, afflicted with the aptly named *locked-in syndrome*. Imagine that you are in a similar predicament, but you cannot even blink: you are *totally* paralyzed. You will be cared for by one of two robot nurses. Both robots can scan your brain and translate some of your brain waves into English; but one of the robots can translate only those waves that correspond to *declarative* English sentences, and the other robot can translate only those waves that correspond to *imperative* English sentences. Which robot do you prefer as a nurse?

For the purpose of having your desires satisfied, the robot which can translate only into declarative sentences is apparently less suitable: it will be unable to translate if you mentally articulate, for example, "wipe my nose". You might think that to the same effect you can mentally articulate "I want you to wipe my nose", so that the robot will be able to translate. Taken literally, however, the corresponding declarative sentence can be interpreted as expressing a report on your mental state rather than a command. If the robot responds "I understand that you have the desire that I wipe your nose" and then does nothing, it will not do for you to mentally shout "do it!": the robot will be unable to translate. But what if you mentally articulate "I command you to wipe my nose"? Arguably the corresponding declarative sentence cannot be reasonably interpreted as not expressing a command.[1] But then you need not prefer either robot after all.

I draw three conclusions from this discussion of the above thought experiment. First, in addition to the distinction between declarative sentences and what such sentences typically express, namely *propositions*, there is a distinction between imperative sentences and what such sentences typically express, namely what I call *prescriptions* (i.e., commands, requests, instructions, suggestions, etc.).[2] Second, prescriptions are important: if we had to choose between being able to communicate only propositions and being able to communicate only prescriptions, at least in some cases we should choose the latter (cf. Hamblin 1987: 2). Third, prescriptions can be expressed not only by imperative but also by declarative sentences (like "I command you to . . .").[3] This fact, together with a tendency to focus on sentences rather than on what sentences express, may help explain why prescriptions, in comparison with propositions, have been so far neglected by philosophers and logicians alike.

Another fact which may help explain the comparative neglect of prescriptions by logicians is that prescriptions, unlike propositions, cannot be true or false: it makes no sense to say, for example, that (the imperative sentence) "kiss me" expresses a "true prescription".[4] Nevertheless, there are at least three reasons for including prescriptions in the scope of logic. First,

prescriptions can be combined by *logical connectives*: "kiss me and hug me" expresses (on a given occasion of use) the conjunction of the prescriptions that "kiss me" and "hug me" express (or would express, on the given occasion of use; I omit such qualifications in the sequel). Second, some prescriptions are *consistent* or *inconsistent* with others: "kiss me" and "don't kiss me" express prescriptions inconsistent with each other. Third, some prescriptions *follow* from (are *entailed* by) others: the prescription expressed by "hug me" follows from the prescription expressed by "kiss me and hug me". Or so, at any rate, it seems reasonable to say.

We are thus faced with a dilemma (cf. Jørgensen 1938).[5] On the one hand, if being apt for truth and falsity is necessary for falling within the scope of logic, then prescriptions fall outside the scope of logic. On the other hand, there are apparently powerful reasons for including prescriptions in the scope of logic. One reaction to this dilemma consists in proposing *analogues* of truth and falsity which do apply to prescriptions, and in expanding the traditional scope of logic so as to include entities to which these analogues apply. Two main kinds of such analogues have been proposed. First, *satisfaction* and *violation*: the prescription expressed by "kiss me" (directed to you) is satisfied if you kiss me and violated if you don't.[6] Second, *bindingness* and *non-bindingness*: the above prescription is binding if you have a reason to kiss me and non-binding if you have no such reason.[7] One can then define *non-truth-functional* connectives based on these analogues of truth and falsity. For example, one might suggest defining the *satisfaction-functional* conjunction of two prescriptions as the prescription which is satisfied if both conjuncts are satisfied and is violated otherwise. Whether to call such connectives "logical" is primarily a verbal issue; more interesting is the issue of whether such connectives are important or useful (cf. Castañeda 1960a: 26, 1971: 19, 1975: 101). Similarly for consistency and entailment.

The above remarks may suggest that *imperative logic* (the proper logic of prescriptions and, derivatively, of imperative sentences) is isomorphic to standard ("declarative" or "assertoric") logic:[8] every theorem of standard logic yields a corresponding theorem of imperative logic (and vice versa) by replacing talk of propositions, truth, truth-functional connectives, etc. with talk of prescriptions, satisfaction, satisfaction-functional connectives, etc. But then imperative logic is uninteresting; not because standard logic is uninteresting (cf. Hare 1954: 263), but rather because there is essentially *nothing new* to be said about imperative logic—or so it is sometimes argued.[9] There are at least two reasons, however, why imperative logic is *not* isomorphic to standard logic. First, contrary to what the above remarks may suggest, there are *three* possible satisfaction values: the conditional prescription expressed by "if you love me, kiss me" is (1) *satisfied* if you love and kiss me, (2) *violated* if you love but don't kiss me, and (3) *avoided* if you don't love me, regardless of whether you kiss me then.[10] Second, imperative logic *mixes* propositions with prescriptions. The above conditional prescription,

for example, is a conditional whose antecedent is a proposition (expressed by "you love me") and whose consequent is a prescription (expressed by "kiss me").[11] Or so, at any rate, it seems reasonable to say.

These two reasons why imperative logic is not isomorphic to standard logic suggest that some thought is needed on how to define logical connectives, consistency, and entailment in imperative logic. In this paper I propose and defend novel definitions of satisfaction-functional logical connectives, consistency, and quantifiers; with entailment I deal in another paper (see Vranas 2008, where I defend the equivalence of a satisfaction-based and a bindingness-based approach to "pure imperative inference"). Besides excluding entailment, the scope of the present paper excludes *syntactic* aspects of imperative logic (I introduce no formal language), and also excludes prescriptions that incorporate *second-best* instructions, like the prescription expressed by "don't smoke; but if you do, at least smoke in moderation". Nevertheless, I hope it will become clear that there are enough interesting things to say even within this restricted scope.

In §2 I propose a model of prescriptions. In §3 I deal with logical connectives, in §4 with consistency and inconsistency, and in §5 with quantifiers. I conclude in §6.

2. A model of prescriptions

What exactly is a prescription? Recall that I introduced prescriptions by analogy with propositions: propositions are what declarative sentences (and declarative utterances) typically express, and similarly prescriptions are what imperative sentences (and imperative utterances) typically express. If propositions are (as I take them to be) abstract entities, existing regardless of whether they are ever expressed, then so are prescriptions.[12] These remarks provide only an incomplete answer to the question of what prescriptions are. And even this incomplete answer is not uncontroversial: some people believe that propositions don't exist (or that they exist but are not abstract entities, for example because no abstract entities exist). There is no need for these people to stop reading: my main results, although formulated in terms of prescriptions, can be easily reformulated in terms of imperative sentences. Moreover, for my purposes I don't need to provide a complete answer to the question of what prescriptions *are*, what their *nature* is. My main concern is rather with the question of what prescriptions *are like*, what their *structure* is. So I may proceed like those mathematicians who "identify" the number zero with the empty set without thereby committing themselves to the claim that the number zero is *identical* with the empty set. In fact, I will "identify" prescriptions with certain sets.

The prescription expressed by "kiss me" is satisfied if you kiss me and violated if you don't; call the proposition that you kiss me the *satisfaction proposition* of the prescription, and the proposition that you don't kiss me

(more carefully: that it is not the case that you kiss me) the *violation proposition* of the prescription. More generally, to each prescription correspond two incompatible propositions: its satisfaction proposition, equivalent to the claim that the prescription is satisfied, and its violation proposition, equivalent to the claim that the prescription is violated. (The two propositions are incompatible because it is impossible for a prescription to be *both* satisfied and violated—although it is in general possible for a prescription to be *neither* satisfied nor violated, in other words to be avoided.) Conversely, I claim, to each ordered pair of incompatible propositions corresponds a prescription whose satisfaction proposition is the first proposition in the pair and whose violation proposition is the second proposition in the pair. (If S and V are declarative sentences that express respectively the first and the second proposition in the pair, then the concatenated sentence ⌜if it is the case that S or V, let it be the case that S⌝ expresses a prescription that corresponds to the pair.[13]) I assume that only one prescription corresponds to any given pair of propositions: no distinct prescriptions have the same satisfaction and violation propositions. If so, then there is a one-to-one correspondence between all prescriptions and all ordered pairs of incompatible propositions, and I can "identify" prescriptions with such pairs: *a prescription is any ordered pair of logically incompatible propositions*.[14]

It is worth pausing to notice how general this concept of a prescription is. First, it includes both *impersonal* prescriptions, commonly called *fiats* ("let there be light"), and *personal* ones, commonly called *directives* ("Lou, turn on the light").[15] Second, it includes both *multi-agent* (personal) prescriptions ("Lois and Louis, carry the piano upstairs") and *single-agent* ones. Third, it includes both *unconditional* prescriptions ("kiss me"), whose satisfaction and violation propositions are contradictories (i.e., the one is the negation of the other), and *conditional*—i.e., not unconditional—ones ("if you love me, kiss me"), on which I say more below. Fourth, it includes both *synchronic* prescriptions ("be there at 3pm today") and *diachronic* ones ("be there at 3pm every Wednesday"). Fifth, it includes *unsatisfiable* prescriptions, whose satisfaction proposition is impossible ("let 2 + 2 be 5"), as well as *unviolable* ones, whose violation proposition is impossible ("let 2 + 2 be 4").[16] Sixth, it includes *inexpressible* prescriptions if inexpressible propositions exist. Seventh, it includes prescriptions about the past: the ordered pair of the propositions that my son survived yesterday's battle and that he didn't survive is the prescription expressed by "let it be the case that my son survived yesterday's battle".[17]

Some people may think that the above concept of a prescription is too general; for example, they may balk at my talk of prescriptions about the past. These people are welcome (without detriment to my main results) to restrict the above concept so that *not* every ordered pair of incompatible propositions is a prescription; for example, so that only pairs of propositions *not* about the past are prescriptions. On the other hand, I grant that the

above concept of a prescription is not fully general: it includes only what may be called *thin* prescriptions, which are fully characterized in terms of a satisfaction and a violation proposition, but it excludes *thick* prescriptions, which have a richer structure (e.g., they incorporate second-best instructions). For example, according to the prescription expressed by "don't smoke; but if you do, at least smoke in moderation", it is "better" if you smoke moderately than if you smoke immoderately, although the prescription is violated in both kinds of cases. As I said in the last section, the scope of the present paper excludes such prescriptions.

When exactly is a prescription satisfied (or violated)? Distinguish two questions here: the definitional question of how to *define* the satisfaction of a prescription, and the pragmatic question of how to *find out* whether a given prescription is satisfied or not. (1) The above concept of a prescription provides a ready answer to the *definitional* question: given a prescription as an ordered pair of incompatible propositions, define its *satisfaction proposition* as the *first* proposition in the pair, and say that the prescription is *satisfied* exactly if its satisfaction proposition is true.[18] (Note that informally the concepts were introduced in reverse order: the concept of satisfaction of a prescription motivated the concept of a satisfaction proposition, which in turn motivated the concept of a prescription as an ordered pair of incompatible propositions.) (2) The *pragmatic* question is complicated by the fact that normally one is given a prescription not *directly*, as a pair of propositions, but *indirectly*, by means of an imperative sentence or utterance which can express more than one prescription. Suppose, for example, that I bark "get out!", and you get out not in the least influenced by my utterance, but rather because you were in the process of getting out anyway (cf. Harrison 1991: 106); is then my command satisfied? It depends. A prescription whose satisfaction proposition is the proposition that you get out is satisfied; but a prescription whose satisfaction proposition is the proposition that you get out *because* of my utterance is not satisfied. The situation is clarified by realizing that my utterance can express a prescription with either satisfaction proposition; I see thus no need to distinguish—as Moritz (1954: 114) and Moser (1956: 192) in effect do—in response to such examples two kinds of satisfaction.

Conditional prescriptions deserve special notice because they are at least partly responsible for the lack of isomorphism between imperative and standard logic.[19] I claimed that it is possible for a conditional prescription to be *avoided*: neither satisfied nor violated. But is this third value—avoidance—really needed? The material conditional expressed by "if he proposes, you will marry him" is *true* (rather than neither true nor false) if he doesn't propose; why not similarly say that the prescription expressed by "if he proposes, marry him" is *satisfied* (rather than neither satisfied nor violated) if he doesn't propose? (Cf. Chaturvedi 1980: 480.) Because, I answer, the above prescription would then be the same as the unconditional prescription, expressed by "let

it be the case that if he proposes you marry him", whose satisfaction proposition is the above material conditional.[20] But why, one might reply, aren't the "two" prescriptions the same after all? In response consider an analogy. Betting that the material conditional expressed by "if he proposes, you will marry him" is true differs from betting, conditionally on his proposing, that you will marry him: if he doesn't propose, then the bettor wins in the former case but neither wins nor loses in the latter case.[21] Consider also another analogy: if you promise me to marry him if he proposes, then you neither keep nor break your promise if he doesn't propose.[22] Conditional prescriptions are analogous to both conditional bets and conditional promises: they prescribe or proscribe nothing given that their condition does not obtain.[23]

I just spoke of the "condition" of a conditional prescription, but I have not yet defined this term. Let the *context* of a prescription be the disjunction of its satisfaction and violation propositions, and let the *avoidance proposition* of a prescription be the negation of its context. If a prescription is conditional, call its context its *condition*. If a prescription is unconditional, it has no condition but it does have a context; its context is necessary (since its satisfaction and violation propositions are contradictories), so its avoidance proposition is impossible. For example, the context of the prescription expressed by "kiss me" is the necessary proposition that either you kiss me or you don't, and the context (also the condition) of the prescription expressed by "if you love me, kiss me" is the proposition that you love me.

If propositions are "identified" with sets (e.g., sets of possible worlds or sets of histories in a branching time model), then instead of talking about the satisfaction, violation, and avoidance *propositions* of a prescription one can talk about its satisfaction, violation, and avoidance *sets*; moreover, negations, conjunctions, and disjunctions of propositions amount then respectively to complements (e.g., with respect to the set of all relevant possible worlds), intersections, and unions of sets. I adopt this identification from now on. This will enable me to use, without ambiguity, familiar symbols for the logical connectives that I will define in imperative logic; for example, I will use for the conjunction of prescriptions the ampersand ('&') without ambiguity, since I will not use it for the conjunction of propositions (for which I will use instead '∩', for set-theoretic intersection). Those who object to identifying propositions with sets can just translate what I will say from the language of sets to the language of propositions.

It is important to note that to specify a prescription it is enough to specify *any two* of its satisfaction, violation, and avoidance sets. (This is because the three sets form a *partition* of e.g. the set of all relevant possible worlds: they are mutually exclusive and collectively exhaustive. Therefore, given any two of them, the third is the complement of the union of the two.) One can interchangeably specify the avoidance set or the context: the one is the complement of the other. My canonical way of specifying a prescription is by specifying its satisfaction and violation sets, but sometimes it will be

more convenient to specify instead its context and either its satisfaction or its violation set. Moreover, since by noting that a prescription is unconditional one specifies its avoidance set (which is empty), to specify a prescription noted to be unconditional it is enough to specify either its satisfaction or its violation set (the one is the complement of the other for unconditional prescriptions).[24]

3. Logical connectives

In this section I deal first with negations (§3.1), then with conjunctions and disjunctions (§3.2), and finally with conditionals and biconditionals (§3.3).[25]

3.1. Negations

Take first the unconditional prescription expressed by "marry him". Its negation is the unconditional prescription expressed by "don't marry him". The negation is satisfied if the negated prescription ("marry him") is violated (i.e., if you don't marry him) and is violated if the negated prescription is satisfied (i.e., if you marry him). Take next the conditional prescription expressed by "if he proposes, marry him"; equivalently, by "marry him if he proposes". Its negation is the conditional prescription expressed by "don't marry him if he proposes"; equivalently, by "if he proposes, don't marry him". The negation is satisfied if the negated prescription is violated (i.e., if he proposes but you don't marry him), is violated if the negated prescription is satisfied (i.e., if he proposes and you marry him), and is avoided if the negated prescription is avoided (i.e., if he doesn't propose). These examples motivate the following definition:

> DEFINITION 1. The *negation* of the prescription with satisfaction set S and violation set V is the prescription with satisfaction set V and violation set S. In symbols: $\sim<S, V> = <V, S>$ (where $<S, V>$ is the ordered pair with first member S and second member V).[26]

Note that a prescription and its negation have the same context (the union of S and V) and thus also the same avoidance set (the complement of the context). Note also that the law of double negation holds: the negation of the negation of a given prescription is the given prescription. (Indeed: $\sim(\sim<S, V>) = \sim(<V, S>) = <S, V>$.)

Two other kinds of negation can also be defined. To motivate them one might argue that "don't do B if you do A" can be understood not only as "if you do A, don't do B", but also as "don't do the following: do B if you do A", where "don't do the following" can be understood either as "*don't satisfy* the following prescription" or as "*violate* the following prescription". Given, then, the prescription ("imperative") I with satisfaction set S and violation set V (i.e., $I = <S, V>$), define its *satisfaction negation* as the

Table 1. Satisfaction tables for the negation, the satisfaction negation, and the violation negation of a prescription.

Negated prescription ($I = <S, V>$)	Sat.	Av.	Viol.
Negation ($\sim I = <V, S>$)	Viol.	Av.	Sat.
Satisfaction negation ($\sim_S I = <S^c, S>$)	Viol.	Sat.	Sat.
Violation negation ($\sim_V I = <V, V^c>$)	Viol.	Viol.	Sat.

unconditional prescription (which can be expressed by "let I not be satisfied") with violation set S, and define its *violation negation* as the unconditional prescription (which can be expressed by "let I be violated") with satisfaction set V. (In symbols: $\sim_S <S, V> = <S^c, S>$ and $\sim_V <S, V> = <V, V^c>$, the superscript c denoting complementation. Note that the *negation* of I can be expressed by "let I be violated [equivalently: not satisfied] *if it is not avoided*".) If I is unconditional, then its negation, satisfaction negation, and violation negation coincide (because then $S^c = V$ and $V^c = S$). If I is expressed by "if you do A, do B", then its negation, satisfaction negation, and violation negation are expressed respectively by "if you do A, don't do B", "don't do both A and B", and "do A but not B". The "satisfaction tables" (analogous to truth tables; see Clarke 1985: 100) for negation, satisfaction negation, and violation negation are as in Table 1.[27]

From the above definitions it follows that satisfaction and violation negation are less fundamental than negation, in the sense that (1) the satisfaction and violation negations of any given prescription amount to the negations of some related prescriptions, but (2) not vice versa. Indeed: (1) the satisfaction and violation negations of $<S, V>$ are respectively the negations of $<S, S^c>$ and of $<V^c, V>$, but (2) the negation of a conditional prescription is always conditional and thus differs from the satisfaction and violation negations of any prescription (which are always unconditional). For this reason (among others) I do not dwell on satisfaction or violation negation in what follows.[28]

The literature on imperative negation abounds with distinctions which, even if *pragmatically* intriguing, are to my mind *logically* inconsequential. As a first example, inspired by Adler (1980: 62–3), one might argue that the prescription expressed by "open that window" can be negated in two ways, namely by the prescriptions expressed by "don't open that window *now*" and "don't open that window *ever*". But I don't think we have here two negations of a single prescription; we rather have the negations of two different prescriptions that can be expressed by "open that window", namely of the prescriptions expressed by "open that window *now*" and "open that window *sooner or later*". As a second example, inspired by Hamblin (1987: 64–5), one might argue that the prescription expressed by "be here at lunch" can be negated in two ways, namely by the prescriptions expressed by "let it be the case that you are not here at lunch" and "don't take steps to be

here at lunch". (These two sentences express different prescriptions because, for example, even if you don't take steps to be here at lunch, someone may bring you here at lunch against your will.) But I don't think we have here two negations of a single prescription; we rather have the negations of two different prescriptions that can be expressed by "be here at lunch", namely of the unconditional prescriptions which are satisfied respectively exactly if (1) you *are* here at lunch and (2) you *take steps* to be here at lunch. (These two prescriptions can be expressed respectively by "*let* it be the case that you are here at lunch" and "*make* it the case that you are here at lunch".[29]) The examples from the literature could be multiplied at length.[30]

To a different genre from that of the above examples belong three other kinds of imperative negation that have been proposed in the literature. It has been argued, in effect, that the prescription expressed by "kiss me" can be negated by the *propositions* that (1) you may refrain from kissing me (*permissive negation*), (2) I am not asking you to kiss me (*illocutionary negation*), and (3) you have no reason to kiss me—equivalently, the prescription expressed by "kiss me" is not binding (*bindingness negation*).[31] But I think it is gratuitous to say that the above three propositions are imperative negations of a *prescription*, given that they are straightforward, truth-functional negations of certain *propositions*. Specifically, (1)–(3) are respectively truth-functional negations of the propositions that (1′) you are obligated to kiss me, (2′) I am asking you to kiss me, and (3′) you have a reason to kiss me—equivalently, the prescription expressed by "kiss me" is binding.[32] Admittedly, on some "reductionist" theories of prescriptions (1′) or (2′) is *identical* with the prescription expressed by "kiss me". But such theories are subject to powerful objections (Hamblin 1987: 113–35),[33] and more generally, given what I said in §2, it is implausible to identify prescriptions with propositions (as opposed to *pairs* of propositions). So I will not say more on the above three kinds of negation.

3.2. Conjunctions and disjunctions

Take first the unconditional prescriptions expressed by "kiss me" and "hug me". Their conjunction is the unconditional prescription expressed by "kiss me and hug me". The conjunction is satisfied if both conjuncts are satisfied (i.e., if you both kiss and hug me) and is violated if at least one conjunct is violated (i.e., if you don't kiss me or you don't hug me—"or" being understood as including "or both"). Take next the conditional prescriptions expressed by "if you love me, kiss me" and "if you love me, hug me". Their conjunction is the conditional prescription expressed by "if you love me, kiss me, and if you love me, hug me"; equivalently, by "if you love me, kiss me and hug me". The conjunction is satisfied if both conjuncts are satisfied (i.e., if you love, kiss, and hug me), is violated if at least one conjunct is violated (i.e., if you love me but you don't kiss me or you don't hug me), and is avoided

Table 2. Partial satisfaction table for the conjunction of two prescriptions.

I&I′	Sat.	Av.	Viol.
Sat.	Sat.		Viol.
Av.		Av.	
Viol.	Viol.		Viol.

if both conjuncts are avoided (i.e., if you don't love me). These examples suggest Table 2 as a partial satisfaction table for conjunction.

Table 2 says that—just as in the above examples—the conjunction of two prescriptions is satisfied if both conjuncts are satisfied, is violated if both conjuncts are violated or one of them is violated and the other one is satisfied, and is avoided if both conjuncts are avoided. The shaded cells of the table correspond to the cases that are unavailable in the above examples: if two prescriptions have the same context (as any two unconditional prescriptions do, and as the prescriptions expressed by "if you love me, kiss me" and "if you love me, hug me" do) and thus also the same avoidance set, then if one of them is avoided the other one is also avoided, so there are no cases in which one of them is avoided but the other one is satisfied or violated. To fill in the table, take the conditional prescriptions expressed by "if you love me, kiss me" and "if you don't love me, kiss me". These two prescriptions have complementary contexts, so if one of the prescriptions is avoided then the other one is satisfied or violated. Their conjunction is the prescription expressed by "if you love me, kiss me, and if you don't love me, kiss me"; equivalently, by "kiss me whether or not you love me"; still equivalently, by "kiss me". (So the conjunction of two conditional prescriptions can be unconditional; contrast Adler 1980: 57.) It can be seen that, if one of the above two conjuncts is avoided, then the conjunction is satisfied if the other conjunct is satisfied, and the conjunction is violated if the other conjunct is violated; for example, if the first conjunct is avoided (you don't love me), then the conjunction is satisfied (you kiss me) if the second conjunct is satisfied (you don't love me but you kiss me) and the conjunction is violated (you don't kiss me) if the second conjunct is violated (you don't love me and you don't kiss me). This suggests filling in Table 2 as in Table 3.

According to Table 3, the conjunction of two prescriptions is violated exactly if at least one conjunct is violated, so the violation set of the conjunction

Table 3. Satisfaction table for the conjunction of two prescriptions.

I&I′	Sat.	Av.	Viol.
Sat.	Sat.	Sat.	Viol.
Av.	Sat.	Av.	Viol.
Viol.	Viol.	Viol.	Viol.

is the union of the violation sets of the conjuncts ($V_{I\&I'} = V_I \cup V_{I'}$). Moreover, the conjunction is avoided exactly if both conjuncts are avoided, so the avoidance set of the conjunction is the intersection of the avoidance sets of the conjuncts ($AV_{I\&I'} = AV_I \cap AV_{I'}$); equivalently, since the complement of the intersection of two sets is the union of the complements of the two sets (this is one of de Morgan's laws), the context of the conjunction is the union of the contexts of the conjuncts ($C_{I\&I'} = C_I \cup C_{I'}$). Finally, the conjunction is satisfied exactly if at least one conjunct is satisfied and no conjunct is violated ($S_{I\&I'} = (S_I \cup S_{I'}) - (V_I \cup V_{I'})$); equivalently, exactly if at least one conjunct is not avoided and no conjunct is violated ($S_{I\&I'} = (C_I \cup C_{I'}) - (V_I \cup V_{I'}) = C_{I\&I'} - V_{I\&I'}$; note that for *every* prescription the satisfaction set is the context minus the violation set). I see no simple way to express the satisfaction set, so I think the simplest way to specify the conjunction of two prescriptions is by specifying its context and its violation set:

> DEFINITION 2. The *conjunction* of two prescriptions (the *conjuncts*) is the prescription whose context is the union of the contexts of the conjuncts and whose violation set is the union of the violation sets of the conjuncts. In symbols: $<S, V>\&<S', V'> = <(C \cup C') - (V \cup V'), V \cup V'> = <(S \cup S') - (V \cup V'), V \cup V'>$ (where $C = S \cup V$ and $C' = S' \cup V'$).

This definition is useful because a general claim holds: for any imperative sentences S and S' expressing respectively prescriptions I and I', the concatenated sentence $\ulcorner S$ and $S' \urcorner$ expresses $I\&I'$. I have already partially supported this general claim by examining (in the process of motivating the definition) conjuncts with (1) identical and (2) complementary contexts. The general claim can be further supported by examining conjuncts with (3) nested and (4) overlapping contexts. For a case of nested contexts (i.e., contexts such that one of them includes the other but not vice versa), take the prescriptions expressed by "kiss me" and "if you love me, kiss me". The first prescription is unconditional and the second one is conditional; so the context of the second is included in the context of the first, the union of the two contexts is just the context of the first, and the conjunction is unconditional. The conjunction is violated exactly if the first conjunct is violated (you don't kiss me) or the second one is (you love me but don't kiss me); i.e., exactly if you don't kiss me. So the conjunction is the unconditional prescription which is violated exactly if you don't kiss me; this is just the first conjunct ("kiss me"), and this is indeed what the concatenated sentence "kiss me, and if you love me, kiss me" with some redundancy expresses. For a case of overlapping contexts (i.e., contexts such that neither of them includes the other and their intersection is nonempty), take the prescriptions expressed by "if he proposes, marry him" and "if he loves you, marry him". I leave it to the reader to verify that their conjunction is expressed by "if he proposes or he loves you, marry him"; this is indeed what

the concatenated sentence "if he proposes, marry him, and if he loves you, marry him" wordily expresses. Of course the accumulation of examples constitutes no proof of the above general claim, but it does constitute inductive support.[34]

The conjunction of two prescriptions can be expressed by "let neither prescription be violated if it is not the case that both prescriptions are avoided". One might propose adopting three further kinds of conjunction, corresponding to (1) "let neither prescription be violated" (*violation conjunction*), (2) "let both prescriptions be satisfied" (*satisfaction conjunction*), and (3) "let both prescriptions be satisfied if it is not the case that both are avoided" (following Rescher (1966: 111), call this *fusion*). This proposal founders on the general claim that I defended in the last paragraph: if the concatenated sentence ⌜S and S'⌝ in all cases expresses the conjunction, then in some cases it does *not* express the violation conjunction (or the satisfaction conjunction, or the fusion). For example, the (concatenated) sentence "if you love me, kiss me, and if you love me, hug me" expresses, as we saw, a conditional prescription, and thus does not express the satisfaction or the violation conjunction (which are unconditional) of the prescriptions expressed by "if you love me, kiss me", and "if you love me, hug me". Moreover, the (concatenated) sentence "if you love me, kiss me, and if you don't love me, kiss me" expresses a prescription ("kiss me") that is satisfied if you love and kiss me, but the fusion of the prescriptions expressed by "if you love me, kiss me" and "if you don't love me, kiss me" is never satisfied (because these two prescriptions cannot *both* be satisfied). I conclude that Definition 2 captures the only useful kind of imperative conjunction. I take this—to my knowledge novel—definition of imperative conjunction to be one of the main contributions of the present paper.[35]

I turn now to disjunctions. Take first the unconditional prescriptions expressed by "kiss me" and "hug me". Their disjunction is the unconditional prescription expressed by "kiss me or hug me". The disjunction is satisfied if at least one disjunct is satisfied (i.e., if you kiss me or you hug me) and is violated if both disjuncts are violated (i.e., if you neither kiss nor hug me). Take next the conditional prescriptions (with complementary contexts) expressed by "if you love me, kiss me" and "if you don't love me, kiss me". Their disjunction is the prescription expressed by "if you love me, kiss me, or if you don't love me, kiss me". In my judgment this is *the same as the conjunction* of these two prescriptions (cf. Belnap 1969: 131; Hamblin 1987: 86): it is the prescription expressed by "kiss me whether or not you love me" (equivalently, by "kiss me"). I am not too confident about this judgment, and psychological research suggests that I am not atypical: people have trouble making sense of disjunctions of (declarative) conditionals (Johnson-Laird & Byrne 2002: 656–7). But suppose my judgment is accepted (I give below a reason for accepting it); then, if one of the above two disjuncts is avoided, the disjunction is satisfied if the other disjunct is satisfied

Table 4. Satisfaction table for the disjunction of two prescriptions.

$I \vee I'$	Sat.	Av.	Viol.
Sat.	Sat.	Sat.	Sat.
Av.	Sat.	Av.	Viol.
Viol.	Sat.	Viol.	Viol.

and is violated if the other disjunct is violated. This suggests Table 4 and Definition 3:

> DEFINITION 3. The *disjunction* of two prescriptions (the *disjuncts*) is the prescription whose context is the union of the contexts of the disjuncts and whose satisfaction set is the union of the satisfaction sets of the disjuncts. In symbols: $<S, V> \vee <S', V'> = <S \cup S', (C \cup C') - (S \cup S')> = <S \cup S', (V \cup V') - (S \cup S')>$.

A reason for adopting this definition (and thus for accepting the above judgment) is that the relevant de Morgan's laws hold as a result: (1) the negation of the conjunction of two prescriptions is the disjunction of their negations, and (2) the negation of the disjunction of two prescriptions is the conjunction of their negations. (Proof of (1): $\sim(<S, V> \& <S', V'>) = \sim<(S \cup S') - (V \cup V'), V \cup V'> = <V \cup V', (S \cup S') - (V \cup V')> = <V, S> \vee <V', S'> = \sim<S, V> \vee \sim<S', V'>$.) This result has the consequence (as we will see in §5) that universal and existential quantification, defined as generalizations of conjunction and disjunction respectively, are interdefinable.[36]

Disjunctive imperative sentences and utterances are sometimes ambiguous. Suppose you ask me how to get to the library and, after some hesitation, I reply: "either go right or go left". Using terms introduced by Rescher and Robison (1964: 179), one can distinguish a *choice-offering* from an *alternative-presenting* interpretation of my utterance: do I mean that both ways lead to the library (so you have a choice), or that only one of the two ways does (I am not sure which one)?[37] It does not follow, however, that one can distinguish two corresponding disjunctions of the prescriptions expressed by "go right" and "go left". On the choice-offering interpretation, my utterance expresses the disjunction as defined above. On the alternative-presenting interpretation, does my utterance express a prescription at all? If it does, then it expresses the prescription which is violated if you neither go right nor go left and is *avoided* if you go right or left (if it were *satisfied* in the latter cases, then it would be identical with the prescription expressed on the choice-offering interpretation). But this prescription, which turns out to be expressible by "if you neither go right nor go left, go both right and left",[38] does not look like a disjunction of the prescriptions expressed by "go right" and "go left". Maybe it is more plausible to say that on the alternative-presenting interpretation my utterance expresses not a prescription but rather a *proposition*, for

example the (truth-functional) exclusive disjunction of the propositions that you have a reason to go right and that you have a reason to go left. But I don't need to insist on this: my present point is only that in any case there is no new kind of imperative disjunction that on the alternative-presenting interpretation my utterance expresses.[39]

3.3. Conditionals and biconditionals

The conditional whose antecedent is the *proposition* that he loves you and whose consequent is the *prescription* expressed by "marry him" is the conditional prescription expressed by "if he loves you, marry him". The conditional is satisfied if its antecedent is true and its consequent is satisfied (i.e., if he loves you and you marry him), is violated if its antecedent is true and its consequent is violated (i.e., if he loves you and you don't marry him), and is avoided if its antecedent is false (i.e., if he doesn't love you). Take next a conditional whose consequent can be avoided; for example, the conditional whose antecedent is the proposition that he loves you and whose consequent is the prescription expressed by "if he proposes, marry him". This conditional is the prescription expressed by "if he loves you, then if he proposes, marry him" (equivalently, by "if he loves you and he proposes, marry him"); it is avoided if its consequent is avoided (i.e., if he doesn't propose). These examples suggest Table 5 (Storer 1946: 31) and Definition 4:

> DEFINITION 4. The *conditional* whose *antecedent* is the proposition P and whose *consequent* is the prescription with satisfaction set S and violation set V is the prescription whose satisfaction set is the intersection of P with S and whose violation set is the intersection of P with V. In symbols: $P{\rightarrow}{<}S, V{>} = {<}P{\cap}S, P{\cap}V{>}$.

I leave it to the reader to verify three claims. First, the context of $P{\rightarrow}I$ is the intersection of P with the context of I. (So $P{\rightarrow}I$ is an *un*conditional prescription if P is necessary and I is unconditional.) Second, negating an imperative conditional amounts to negating its consequent: $\sim(P{\rightarrow}I) = P{\rightarrow}{\sim}I$. For example, as we saw, the negation of the conditional expressed by "if he proposes, marry him" is expressed by "if he proposes, don't marry him". Third, a law of exportation holds: $P{\rightarrow}(P'{\rightarrow}I) = (P{\cap}P'){\rightarrow}I$. (In my notation, P, P', P'', ... are always propositions, and I, I', I'', ... are always prescriptions ("imperatives").) Note also that, in contrast to standard logic, $P{\rightarrow}I$ is *not* "$P^c{\vee}I$" or "$\sim(P\&{\sim}I)$": I have not defined disjunctions or conjunctions of

Table 5. Truth-satisfaction table for the imperative conditional.

$P{\rightarrow}I$	Sat.	Av.	Viol.
True	Sat.	Av.	Viol.
False	Av.	Av.	Av.

propositions with prescriptions,[40] nor does it seem useful to do so. ("I know you are tired, but try again" expresses neither only a proposition nor only a prescription: it expresses rather *both* a proposition and a prescription. So if I were to define the conjunction of P with I, I would define it, uninterestingly, as the unordered pair $\{P, I\}$.)[41]

It has been noted in the literature that sentences like "if marry him, then he loves you" are ungrammatical; more generally, at least in English, no grammatical imperative clause begins with a conditional subordinator (like 'if', 'supposing', 'provided', etc.). It does not follow, however, that no conditional exists whose antecedent is a prescription:[42] motivated by the observation that "marry him *only if* he loves you" and "if he doesn't love you, don't marry him" express the *same* prescription (Castañeda 1970: 441–2), one might *define* $I \Rightarrow P$ as $P^c \rightarrow \sim I$ (Gensler 1990: 191). MacKay (1971: 95) objects in effect that, precisely because the former sentence expresses the prescription that the latter sentence expresses, the former sentence expresses a conditional whose antecedent is a proposition (namely, that he doesn't love you), not a prescription. I don't see, however, why a conditional whose antecedent is a proposition cannot be *identical* with a conditional (of a different kind) whose antecedent is a prescription (as the definition $I \Rightarrow P = P^c \rightarrow \sim I$ entails). Nevertheless, for the sake of simplicity, in what follows I don't talk about conditionals whose antecedents are prescriptions.

I turn finally to biconditionals. Take the prescription I which is expressed by "marry him" and the proposition P that he loves you. Their biconditional is the prescription expressed by "marry him if and only if he loves you". This prescription is the conjunction of the conditionals expressed by "marry him if he loves you" and "marry him only if he loves you"; equivalently, by "if he loves you, marry him" and "if he doesn't love you, don't marry him" (MacKay 1971: 95). It turns out that this conjunction—i.e., the biconditional—is satisfied if P is true and I is satisfied or P is false and I is violated (i.e., if he loves you and you marry him or he doesn't love you and you don't marry him) and is violated if P is true and I is violated or P is false and I is satisfied (i.e., if he loves you and you don't marry him or he doesn't love you and you marry him). We have thus Definition 5 and Table 6:

DEFINITION 5. The *biconditional* $P \leftrightarrow I$ (also $I \leftrightarrow P$) of the proposition P and the prescription I (the *conditions*) is the conjunction of the conditionals $P \rightarrow I$ and $P^c \rightarrow \sim I$. (So $P \leftrightarrow <S, V> = (P \rightarrow <S, V>) \& (P^c \rightarrow <V, S>) = <P \cap S, P \cap V> \& <P^c \cap V, P^c \cap S> = <(P \cap S) \cup (P^c \cap V), (P \cap V) \cup (P^c \cap S)>$.[43])

Table 6. Truth-satisfaction table for the imperative biconditional.

$P \leftrightarrow I$	Sat.	Av.	Viol.
True	Sat.	Av.	Viol.
False	Viol.	Av.	Sat.

Table 7. Definitions of logical connectives.

Connective	Definition
Negation	$\sim\!<S, V> = <V, S>$
Conjunction	$<S, V>\&<S', V'> = <(C\cup C')-(V\cup V'), V\cup V'>$ $= <(S\cup S')-(V\cup V'), V\cup V'>$
Disjunction	$<S, V>\vee<S', V'> = <S\cup S', (C\cup C')-(S\cup S')>$ $= <S\cup S', (V\cup V')-(S\cup S')>$
Conditional	$P\rightarrow<S, V> = <P\cap S, P\cap V>$
Biconditional	$P\leftrightarrow<S, V> = (P\rightarrow<S, V>)\&(P^c\rightarrow\sim\!<S, V>)$ $= <(P\cap S)\cup(P^c\cap V), (P\cap V)\cup(P^c\cap S)>$

I leave it to the reader to verify two claims. First, the context of $P\leftrightarrow I$ is the context of I. Second, just as in standard logic, negating an imperative biconditional amounts to negating one of its two conditions: $\sim(P\leftrightarrow I) = P^c\leftrightarrow I = P\leftrightarrow\sim I$. For example, the negation of the biconditional expressed by "marry him if and only if he loves you" is the biconditional expressed by "marry him if and only if he doesn't love you".

Table 7 recapitulates my definitions of logical connectives. The definitions of conjunction and disjunction can be readily generalized to arbitrarily (even infinitely) many conjuncts or disjuncts, and I understand them as thus generalized from now on.[44]

4. Consistency and inconsistency

The propositions that you will marry him and that you will not marry him are inconsistent in the sense that they cannot be both *true*; similarly, the prescriptions expressed by "marry him" and "don't marry him" are inconsistent in the sense that they cannot be both *satisfied*. This remark might suggest saying that a set of prescriptions is—in other words, the prescriptions in the set are—(logically) inconsistent exactly if it is (logically) impossible for the prescriptions in the set to be jointly satisfied. It turns out that this suggestion works for unconditional prescriptions but in general fails for conditional ones. For example, the conditional prescriptions expressed by "if he loves you, marry him" and "if he doesn't love you, don't marry him" are jointly unsatisfiable (the intersection of their satisfaction sets is empty) but there is not even a hint of conflict between them (cf. Castañeda 1970: 443); their conjunction, as we saw, is the biconditional expressed by "marry him if and only if he loves you". So *not every set of jointly unsatisfiable prescriptions is inconsistent*; joint unsatisfiability will not do as a definition of inconsistency.

I propose a different definition: a set of prescriptions (just like a set of propositions) is inconsistent exactly if the conjunction of its members is

self-contradictory. A proposition is self-contradictory exactly if it is *impossible* (i.e., necessarily false); similarly, I suggest, a prescription is self-contradictory exactly if it is *omniviolable* (i.e., necessarily violated), like the prescription expressed by "kiss me and don't kiss me". Note that *conditional* prescriptions need not be violated (since they can be avoided) and are thus not self-contradictory. This is so even for *unsatisfiable* conditional prescriptions. For example, the unsatisfiable conditional prescription expressed by "if you hug me, kiss me and don't kiss me" (equivalently, by "if you hug me, don't hug me") is not self-contradictory: it is not violated if you don't hug me. To be omniviolable is to be both unsatisfiable and unconditional. I propose thus the following definition:

> DEFINITION 6. A (nonempty) set of prescriptions is—in other words, the prescriptions in the set are—*inconsistent* exactly if the conjunction of the prescriptions is omniviolable (i.e., both unsatisfiable and unconditional), and is *consistent* otherwise (i.e., exactly if the conjunction of the prescriptions is satisfiable or conditional). (Given my definition of conjunction, one can equivalently say that a set of prescriptions is *inconsistent* exactly if it is necessary that at least one of the prescriptions be violated, and is *consistent* exactly if it is possible that none of the prescriptions be violated.)

Against this definition one might raise an objection inspired by Hamblin (1987: 183–4). If you are a private and you are separately issued, by two sergeants A and B, the orders to leave the room and not to leave the room respectively, then you are in a quandary about what to do; but if you are issued, by a single sergeant, the order to leave the room *and* not to leave it, then you are "entitled to shrug [the order] off as impossible to satisfy". Hamblin concludes: "There is a difference in kind between an order which can be regarded as void through impossibility and a set of two or more orders, separately but not jointly obeyable, that create a problem of choice for the addressee" (1987: 183–4). I don't think, however, that Hamblin's remarks pose a problem for my definition of the inconsistency of two or more prescriptions in terms of the self-contradictoriness (i.e., omniviolability) of a *single*, conjunctive prescription. To see why, take an analogy with propositions. If you are separately told, by two reliable people A and B, that the war is over and that the war is not over respectively, then you may be in a quandary about what to believe; but if you are told, by a single person, that the war is over *and* is not over, then you are entitled to shrug off this person's utterance as self-contradictory. But although this may show that one does not always have a *reason to believe* the conjunction of two propositions when one has a (separate) reason to believe each conjunct, one can still hold that the inconsistency of two propositions amounts to the self-contradictoriness of their conjunction. Similarly, although Hamblin's remarks may show that one

does not always have a *reason to satisfy* the conjunction of two prescriptions when one has a (separate) reason to satisfy each conjunct (in other words: that *the conjunction of two binding prescriptions need not be binding*), one can still hold that the inconsistency of two prescriptions amounts to the self-contradictoriness of their conjunction.[45]

According to Definition 6, a conditional prescription and its negation are always consistent; for example, the prescriptions expressed by "if you hug me, kiss me" and "if you hug me, don't kiss me" are consistent because their conjunction ("if you hug me, kiss me and don't kiss me") is conditional (and thus, as we saw, not self-contradictory). (More generally, *any* conditional prescriptions with identical contexts are consistent: their conjunction has the same context as each of them and is thus conditional.) One might object that a student could justifiably complain if she were given an exam whose instructions read: "Answer three of the five questions. If you answer both questions 1 and 2, answer also question 3. If you answer both questions 1 and 2, don't answer question 3". I agree that these instructions are not as *straightforward* as possible (in one sense they are like "answer as many questions as there are prime numbers between 10 and 20"), but are they logically *inconsistent*? No. The instructor could reply to the student: "Of course you can comply with the instructions: don't answer both questions 1 and 2". If the student were to respond that, although she can *avoid violating* the instructions, she cannot *satisfy* all of them, the instructor could explain that—as we saw—joint unsatisfiability does not entail inconsistency.

I also have a formal argument in support of the claim that any set consisting of a conditional prescription and its negation is consistent. The argument has two premises. (1) If some such set is *in*consistent, then any of its proper supersets (i.e., any "larger" set) which consists of prescriptions is also inconsistent; informally, "adding" prescriptions cannot "remove" the original inconsistency (cf. von Wright 1963: 141). (2) However, given any conditional prescription and its negation, there is always a third prescription such that the *three* prescriptions are *consistent*. For example, the prescriptions expressed by "if you hug me, don't kiss me", "if you hug me, kiss me", and "if you don't hug me, kiss me" are consistent because there is no conflict between the first of them ("if you hug me, don't kiss me") and the conjunction of the last two ("kiss me"). (More formally, the conjunction of the three prescriptions is expressed by "kiss me but don't hug me" and is thus not self-contradictory.) This argument can be readily generalized to any prescriptions whose conjunction is unsatisfiable but conditional,[46] so I conclude that—just as Definition 6 entails—such prescriptions are consistent. I grant, however, that it may be useful to distinguish sets consisting of such prescriptions from sets consisting of prescriptions whose conjunction is satisfiable, so the following definition may be useful:

Table 8. Consistency and inconsistency of a set of prescriptions.

	Conjunction conditional	Conjunction unconditional
Conjunction satisfiable	Fully consistent (hence consistent)	
Conjunction unsatisfiable	Semi-consistent (hence consistent)	Inconsistent

DEFINITION 7. A (consistent) set of prescriptions is *fully consistent* exactly if the conjunction of the prescriptions is satisfiable, and is *semi-consistent* exactly if the conjunction of the prescriptions is unsatisfiable but conditional.

Table 8 recapitulates my distinctions concerning consistency and inconsistency.

It can be shown that the conjunction of jointly satisfiable prescriptions is always satisfiable. (Proof: It follows from my definition of conjunction that the satisfaction set of a conjunction includes the intersection of the satisfaction sets of the conjuncts, so the former is nonempty if the latter is.) It follows that *jointly satisfiable prescriptions are always (fully) consistent*. So the idea that consistency amounts to joint satisfiability is "half-true": joint satisfiability is *sufficient* for consistency, but—as we saw—it is not *necessary* (some sets of jointly unsatisfiable prescriptions are—fully—consistent). Note that the conjunction of *unconditional* prescriptions is unconditional and its satisfaction set is the intersection of the satisfaction sets of the conjuncts; so for unconditional prescriptions joint satisfiability is equivalent to consistency and to full consistency.[47]

There is a further interesting distinction to make, between consistent sets of *personal* (see §2) prescriptions. Compare the prescriptions expressed by "if you hug me, kiss me" and "if you hug me, don't kiss me" with the prescriptions expressed by "if it rains, kiss me" and "if it rains, don't kiss me". In the case of the former two prescriptions, it *is* normally in your power to bring it about that neither prescription is violated (you can avoid hugging me), but in the case of the latter two prescriptions this is normally *not* in your power (you cannot prevent rain). Each of the above two pairs consists of semi-consistent prescriptions, but the distinction also applies to sets of fully consistent prescriptions: compare the prescriptions expressed by "if you hug me, kiss me" and "don't kiss me" with the prescriptions expressed by "if it rains, kiss me" and "don't kiss me". (If it rains, then one of the latter two prescriptions is violated no matter what you do.) Say, then, that a consistent set of personal prescriptions directed to a given agent is (1) *uncontrollably inconsistent* exactly if some proposition which it is not in the agent's power to make false entails that at least one of the prescriptions is violated, and is (2) *controllably consistent* exactly if some proposition which it is in the agent's power to make true entails that none of the prescriptions is violated.[48,49]

5. Quantifiers

In this section I define imperative quantifiers and I make two main points about them: they are (1) strictly speaking dispensable but (2) nevertheless useful. Before I begin, a terminological and a notational remark are in order. For convenience, in this section I revert to talking about the satisfaction and violation *propositions* (rather than *sets*) of a prescription, and I use my symbols for logical connectives and quantifiers with systematic ambiguity. For example, in this section I use the tilde ('$\sim$') sometimes for declarative negation (a function from propositions to propositions) and other times for imperative negation (a function from prescriptions to prescriptions); similarly for the arrow ('$\rightarrow$') etc. I trust the reader is by now sufficiently familiar with the distinction between propositions and prescriptions to avoid confusion.

To see why imperative quantifiers are strictly speaking dispensable, take a prescription that intuitively involves quantification; for example, the unconditional prescription expressed by "kiss everyone in the room". If Rx stands for "x is (a person) in the room" and Kx stands for "you kiss x", the above prescription is: $<\forall x(Rx\rightarrow Kx), \sim\forall x(Rx\rightarrow Kx)>$. So the prescription can be expressed by using only *standard* quantifiers, which attach to *propositional* functions like $Rx\rightarrow Kx$ (this is a function which assigns the proposition $Ra\rightarrow Ka$ to the value a of the variable x); there is no need to define *imperative* quantifiers, which attach to *prescriptional* functions like $<Rx\rightarrow Kx, \sim(Rx\rightarrow Kx)>$ (this is a function which assigns to a the prescription $<Ra\rightarrow Ka, \sim(Ra\rightarrow Ka)>$). This remark generalizes to every prescription that intuitively involves quantification: no matter how complex a quantificational structure the satisfaction and violation propositions of a prescription have, since they are *propositions* this structure can be captured by declarative quantifiers (if it can be captured by quantifiers at all).[50]

To explain why imperative quantifiers are nevertheless useful, I need first to define them. In standard logic, universal and existential quantification can be naturally introduced as generalizations of conjunction and disjunction respectively. To proceed analogously in imperative logic, consider a conjunction and a disjunction of indefinitely many prescriptional functions:

$$<Sx, Vx>\&<S'x, V'x>\&<S''x, V''x>\&\ldots =$$
$$<(Sx\vee S'x\vee S''x\vee\ldots)\&\sim(Vx\vee V'x\vee V''x\vee\ldots), Vx\vee V'x\vee V''x\vee\ldots>.$$
$$<Sx, Vx>\vee<S'x, V'x>\vee<S''x, V''x>\vee\ldots =$$
$$<Sx\vee S'x\vee S''x\vee\ldots, (Vx\vee V'x\vee V''x\vee\ldots)\&\sim(Sx\vee S'x\vee S''x\vee\ldots)>.$$

These identities, which follow from my definitions of conjunction and disjunction (transposed to prescriptional functions), suggest the following definitions:

DEFINITION 8a. $\forall x{<}Sx, Vx{>} = {<}\exists xSx\&{\sim}\exists xVx, \exists xVx{>}$.

DEFINITION 8b. $\exists x{<}Sx, Vx{>} = {<}\exists xSx, \exists xVx\&{\sim}\exists xSx{>}$.

These definitions, which can be readily generalized to prescriptional functions of more than one variable and to imperative quantifiers with nested scopes,[51] entail the quantificational analogues of the relevant de Morgan's laws: (1) $\sim\forall x{<}Sx, Vx{>} = \exists x{\sim}{<}Sx, Vx{>}$ and (2) $\sim\exists x{<}Sx, Vx{>} = \forall x{\sim}{<}Sx, Vx{>}$. (Proof of (1): $\sim\forall x{<}Sx, Vx{>} = \sim{<}\exists xSx\&{\sim}\exists xVx, \exists xVx{>} = {<}\exists xVx, \exists xSx\&{\sim}\exists xVx{>} = \exists x{<}Vx, Sx{>} = \exists x{\sim}{<}Sx, Vx{>}$.) The definitions may look complicated, but to appreciate their usefulness consider the following theorem:

THEOREM. The following identities hold ((1) and (2) on the standard assumption that the domain or universe is nonempty):

(1) $\forall x{<}Ax{\rightarrow}Bx, {\sim}(Ax{\rightarrow}Bx){>} = {<}\forall x(Ax{\rightarrow}Bx), {\sim}\forall x(Ax{\rightarrow}Bx){>}$ ("let every A be B").
(2) $\exists x{<}Ax\&Bx, {\sim}(Ax\&Bx){>} = {<}\exists x(Ax\&Bx), {\sim}\exists x(Ax\&Bx){>}$ ("let at least one A be B").
(3) $\forall x(Ax{\rightarrow}{<}Bx, {\sim}Bx{>}) = \exists xAx{\rightarrow}{<}\forall x(Ax{\rightarrow}Bx), {\sim}\forall x(Ax{\rightarrow}Bx){>}$ ("let every A—if there are any—be B").
(4) $\exists x(Ax{\rightarrow}{<}Bx, {\sim}Bx{>}) = \exists xAx{\rightarrow}{<}\exists x(Ax\&Bx), {\sim}\exists x(Ax\&Bx){>}$ ("let at least one A—if there are any—be B").[52]

The quantifiers in the left-hand sides of the above four identities are all imperative, whereas the quantifiers in the right-hand sides are all declarative. Not only are the left-hand sides *simpler*—in the cases of (3) and (4), *much* simpler—than the right-hand ones, they are also *more perspicuous.* For example, it is much easier to see that the prescription expressed by "if Jupiter is a god, worship him" ($Gj{\rightarrow}{<}Wj, {\sim}Wj{>}$) is an *instance* of the prescription expressed by "if there are any gods, worship all of them" if one expresses the latter prescription as in the left-hand side of (3) ($\forall x(Gx{\rightarrow}{<}Wx, {\sim}Wx{>})$) than as in the right-hand side ($\exists xGx{\rightarrow}{<}\forall x(Gx{\rightarrow}Wx), {\sim}\forall x(Gx{\rightarrow}Wx){>}$). (Obviously, Gx stands for "x is a god", Wx for "you worship x", and j for Jupiter.) This remark suggests that rules of inference proper to *predicate* imperative logic, like universal instantiation, are more naturally expressed by using imperative quantifiers than by using only declarative ones.

6. Conclusion

The main conceptual innovation of this paper is my identification of prescriptions with ordered pairs of logically incompatible propositions. This

simple yet powerful model of prescriptions enabled me to formulate straightforward definitions of logical connectives, consistency, and quantifiers which are adequate, I argued, to the facts of imperative discourse.

As the list of references at the end of this paper attests, a lot of work on imperative logic was published from the late 1930s to the late 1970s. Nowadays, however, hardly anyone works on the subject. In the massive, eighteen-volume second edition of the *Handbook of philosophical logic* (Gabbay & Guenthner 2001–2007), there is no chapter on imperative logic.[53] In *The Blackwell guide to philosophical logic* (Goble 2001), 'imperative logic' does not even appear in the index. These facts are a testament to the sadly underdeveloped state of the subject. It is my hope that with this paper imperative logic will begin to come of age. Of course the main work, namely the elaboration of an adequate concept of validity for imperative arguments, was not carried out above. But this is the task of a sequel to this paper.

Notes

[1] This is not to deny that the sentence can *at the same time* express a *report* of a command (on whether it can, see: Åqvist 1964: 249; Austin 1975: 5–6; Bach 1975; Castañeda 1975: 93, 128–9 n. l; Cohen 1964: 122; Gale 1970; Hamblin 1987: 127–8, 131–5; Harrison 1962: 445; Hornsby 1986: 93–6; Houston 1970; Langford 1968: 334 n. 11; Lewis 1970/1983: 224–5; McGinn 1977: 305; Schiffer 1972: 104–10; Sosa 1964: 37).

[2] (There is similarly a distinction between interrogative sentences and what such sentences typically express, namely *questions*.) On the distinction between imperative sentences and what such sentences typically express see: Adler 1980: 7; Bar-Hillel 1966: 79; Beardsley 1944: 179–80; Bergström 1962: 3–5; Castañeda 1968: 25–6, 1974: 37–9, 1975: 37–8; Chaturvedi 1980: 471; Davidson 1979/2001: 110; Espersen 1967: 80; Hamblin 1987: 3; Hare 1952: 4; Harrah 2002: 1; Peters 1949: 535–6; Prior 1949: 70, 1971: 65; Sosa 1966c: 224, 1967: 57; Weinberger 1958b: 157; Wilder 1980: 245, 247; Zellner 1971: 3–4. I use the term 'prescription' more or less like Clarke (1973: 150, 1979: 599) and Sosa (1966c: 224, 1967: 57), but unlike Hare (1952: 155–7, 1965: 173) or von Wright (1963: 7). (Contrast also Kelsen 1979/1991: 27, 154.) Castañeda (1972: 145, 1974: 36–40, 1975: 36–41, 43) distinguishes between what he calls "mandates" and "prescriptions": in his terminology, the sentences "open the window" and "please open the window" express different mandates (an order and a request) whose "common core" is a single prescription.

[3] The fact that declarative sentences can express prescriptions has been widely noted (see: Bergström 1962: 5, 7; Borchardt 1979: 193; Castañeda 1960a: 23, 1960b: 153, 1974: 38, 1975: 37–8; Davidson 1979/2001: 110; Davies 1986: 61–2; Espersen 1967: 80; Field 1950: 230; Geach 1958: 51; Gibbons 1960: 114; Grant 1968: 182; Green 1998: 719; Hilpinen 1973: 141; Katz & Postal 1964: 75; Kelsen 1979: 30, 87, 120, 1979/1991: 39, 108, 149–50; Ledent 1942: 263; MacIntyre 1965: 514; Manor 1971: 147; Mitchell 1957: 180–2; Moritz 1941: 224–5, 227; Opałek 1970: 170–1; Peters 1949: 535–6; Ross 1968: 36–7, 70; Sigwart 1889/1980: 18; Stenius 1967: 257; Stevenson 1944: 24; Weinberger 1958b: 153, 1972: 149; Wittgenstein 1953/1958: §21; Zellner 1971: 1; cf. Dworkin 1996: 109; Sperber & Wilson 1986: 247; contrast: Aldrich 1943: 656–7; Kalinowski 1972: 19–20). It has also been noted that interrogative sentences (like "will you please open the window?") can express prescriptions (see: Adler 1980: 7; Åqvist 1965/1975: 42; Davies 1986: 9, 32, 62; Duncan-Jones 1952: 192; Gibbons 1960: 114; Grant 1968: 185; Hall 1952: 155; Opałek 1970: 171; Ramírez 2003: 11; Wittgenstein 1953/1958: §21), and that imperative sentences (like "marry in haste and repent at leisure") can express propositions (see: Bergström

1962: 5; Bolinger 1967: 336, 340–6, 1977: 153, 158–64; Davies 1979, 1986: 43, 161–203; Espersen 1967: 80; Hamblin 1987: 15, 72; Lewis 1979/2000: 24; Rescher 1966: 2; Schachter 1973: 637, 650; Sosa 1964: 2–3; Zellner 1971: 80–3).

[4] The view that prescriptions cannot be true or false is widely accepted (see: Brkić 1969: 34; Carnap 1935: 24; Castañeda 1960b: 154, 1968: 35–6, 1974: 82–3, 1975: 99; Chellas 1969: 3, 1971: 116; Edwards 1955: 125–6; Engisch 1963: 4; Engliš 1964: 305, 310; Frege 1918–9/1956: 293; Frey 1957: 438; Grue-Sörensen 1939: 197; Hansen 2001: 205; Hornsby 1986: 92; Huntley 1984: 103; Jørgensen 1938: 289, 296, 1938/1969: 10, 17; Kalinowski 1972: 21, 24; Kelsen 1979: 131–2, 166, 1979/1991: 163–4, 211; Lalande 1963: 136 n. 1; Makinson 1999: 29–30; Manor 1971: 146; McGinn 1977: 305–6; Milo 1976: 15; Niiniluoto 1986: 113; Opałek 1986: 13; Oppenheim 1944: 149–50; Prior 1949: 71; Ramírez 2003: 2; Rescher 1966: 76; Ross 1941: 55, 1941/1944: 32, 1968: 102; Sosa 1964: ii, 3, 1967: 57; Stalley 1972: 21; Storer 1946: 26; Tammelo 1975: 35; Toulmin 1958: 52–3; Turnbull 1960: 377; van der Torre & Tan 1999: 74; von Wright 1968: 154, 1991: 266; Warnock 1976: 294–5; Weinberger 1958a: 4, 1958b, 1981: 94, 1991: 286; Wellman 1961: 240; Whately 1872: 42; cf. Aloni 2003: 59–60; Bergström 1962: 11–2, 16; Harrison 1991: 81–3). For rejections of the view see: Borchardt 1979; Gibbons 1960: 118; Ho 1969: 232; Kanger 1957/1971: 55; Langford 1968: 332; Leonard 1959: 172, 184–5 (contrast Sosa 1964: 54–61); Lewis 1969: 150, 1970/1983: 224, 1979/2000: 24–5; Lewis & Lewis 1975: 52–4; Sorainen 1939: 203–4; Sosa 1970: 215–6; cf. Aloni 2003: 60; Åqvist 1967: 21, 1972: 28–9, 1965/1975: 8, 130; Bohnert 1945; Fulda 1995; Menger 1939: 59. See also Wedeking 1969: 7–12.

[5] On "Jørgensen's dilemma" see: Alchourrón & Martino 1990: 47; Anderson 1999; Bergström 1962: 1–2, 36; Coyle 2002: 295–6; Espersen 1967: 59–61; Green 1998: 718; Ho 1969: 257; Kalinowski 1972: 58–9; Moutafakis 1975: 55; Ramírez 2003: 3, 17–9, 242–4; Rescher 1966: 75; Ross 1941: 55–6, 1941/1944: 32, 1968: 139–40; Stewart 1997; Volpe 1999; Walter 1996, 1997a, 1997b; Wedeking 1969: 2–3; Weinberger 1957: 103, 1958a: 8–9, 43–4, 1981: 89–90, 1991: 286, 1999; Woleński 1977; Zellner 1971: 13–4. Jørgensen's dilemma is usually formulated only with respect to the third reason (i.e., the one about entailment) that I gave for including prescriptions in the scope of logic. On the second reason (about consistency) see: Hare 1969/1972: 70, 1989: 24; MacIver 1948: 316–7; Miller 1984: 56; Routley & Plumwood 1989: 673; Weinberger 1981: 98; Zellner 1971: 16–7, 65–6. On the first reason (about logical connectives) see: Castañeda 1963: 277, 1968: 36, 1971: 17, 1974: 83, 1975: 99–100; Hamblin 1987: 71; Ross 1968: 140; cf. Hare 1952: 25.

[6] For present purposes I don't need to distinguish between saying that a prescription is (1) *satisfied* (see: Beardsley 1944: 178; Bergström 1962: 29–30; Clarke 1985: 100; Espersen 1967: 72; Frey 1957: 450–1; Grant 1968: 189–90; Hamblin 1987: 139–40; Hansen 2001: 207; Hare 1969/1972: 62–3; Harrison 1991: 105–6; Hofstadter & McKinsey 1939: 447; Milo 1976: 15; Ross 1941: 60, 1941/1944: 36–7; Sosa 1964: 65–6, 76, 1966c: 225–6, 1967: 59–60, 1970: 216; Weinberger 1958a: 29–30; Zellner 1971: 52–3; cf. Fisher 1962b: 232; Opałek 1971; Rescher 1966: 52–3), (2) *obeyed* (see: Adler 1980: 26, 74; Fisher 1962a: 198, 1962b: 232; Grant 1968: 195; Hamblin 1987: 26; Jørgensen 1938: 289, 1938/1969: 10; Lemmon 1965: 52–3; Prior 1949: 71–2, 1971: 71–2; Sosa 1964: 41–54; Strawson 1950: 141–2; von Wright 1968: 154; Williams 1963: 30; Zellner 1971: 83–97; cf. Chellas 1971: 117), and (3) *assented to* (see: Bhat 1983: 451, 460; Espersen 1967: 67–8; Gardiner 1955: 23–9; Gauthier 1963: 63–4; Hare 1952: 19–20; von Wright 1968: 154), although some authors make such distinctions (see, e.g.: Kelsen 1979: 44, 1979/1991: 57; Moser 1956: 191–3; Rescher 1966: 53–6; Wedeking 1969: 96–100; Zellner 1971: 52; also note 12 below).

[7] In the literature one encounters not only the term *binding* (see: Dubislav 1937: 341–2; Prior 1971: 65–9; Wedeking 1969: 20, 93), but also—with similar though not always the same meaning—the terms *accountable* (Hamblin 1987: 20, 91–2), *appropriate* (Castañeda 1960a: 35–43, 1963: 278; von Wright 1968: 154), *authoritative* (Hall 1952: 120–1; cf. Oppenheim 1944: 152–3), *correct* (Bohnert 1945: 314; Castañeda 1960a: 36; Gensler 1990: 194; Grue-Sörensen 1939: 197; Ramírez 2003: 151, 189, 284), *in force* (Espersen 1967: 68–9; Hamblin 1987: 169;

Lemmon 1965: 52–3; Sosa 1964: 70–1, 1967: 60–2; van Fraassen 1973: 15; von Wright 1968: 154; Wedeking 1969: 93; Zellner 1971: 49), *justified* (Castañeda 1960a: 35–43, 1960b: 170–3, 1963: 278, 1974: chap. 4; Dubislav 1937: 341–2; Espersen 1967: 78; Frey 1957: 457–8; Gauthier 1963: 63; Grue-Sörensen 1939: 197; Hofstadter & McKinsey 1939: 455; Jørgensen 1938: 289, 1938/1969: 10; Nielsen 1966: 239; Sosa 1967: 60; Wilder 1980: 246–7; Zellner 1971: 49–51; cf. Castañeda 1968: 37–8, 1974: 84; Edwards 1955: 126–32), *legitimate* (Broad 1950: 63; Castañeda 1975: 121–2, chap. 5; Hall 1947: 341, 1952: 115 n. l; Raz 1977: 83; Wedeking 1969: 93, 136–41), *orthopractic* (Castañeda 1960a: 37; Wedeking 1969: 107; Zellner 1971: 49), *orthotic* (Castañeda 1974: 116, 1975: 121–2, chap. 5), *proper* (Keene 1966: 60), *required* (Johanson 1988: 8, 13, 1996: 128, 2000: 247), and *valid* (Alchourrón & Martino 1990: 47, 55; Bergström 1962: 30; Espersen 1967: 67; Grue-Sörensen 1939: 196–7; Kelsen 1960: 9–10, 1979: 22, 39–40, 1979/1991: 28, 50–1; Nino 1978; Prior 1949: 71–6; Ross 1941: 58–60, 1941/1944: 35–6, 1968: 49, 177–80; Weinberger 1957: 109 n. 14, 124–5, 1958a: 4). See Vranas 2008 for more on bindingness.

[8] The term 'logic' can be used to refer to (1) a *subject* (cf. "deontic logic"), (2) a *system* (cf. "Łukasiewicz three-valued logic"), or (3) the *proper* system for a subject (cf. Schurz 1997: 13); I shift back and forth between these three uses, trusting that the context disambiguates. Given that 'imperative' is a *grammatical* term (contrasting with 'declarative', 'interrogative', and 'exclamative' when it refers to sentence type and with 'indicative' and 'subjunctive' when it refers to mood), it might have been better to talk about *prescriptional* logic, but I chose to stick with established terminology (cf. Belnap & Steel 1976: 6 n.). I understand *standard logic* as two-valued first-order predicate logic with identity and functions.

[9] In the literature one encounters not only the view that (1) imperative logic is uninteresting if (or because) it is isomorphic to standard logic (cf. Hall 1952: 132; Hanson 1966: 329; Hofstadter & McKinsey 1939: 453), but also the views that (2) imperative logic is uninteresting without being isomorphic to standard logic (cf. Turnbull 1960: 380–1) and that (3) imperative logic is interesting despite being isomorphic to standard logic (cf. Castañeda 1974: 85).

[10] Instead of saying (as I do) that the conditional prescription is *avoided* in the third case, one could say that it is *bypassed* (Rescher 1966: 83–4), *inapplicable* (Hamblin 1987: 87), *inoperative* (cf. Belnap 1969: 125, 1972: 336; Belnap & Steel 1976: 102; Rescher 1966: 25), *neutral* (Sosa 1964: 76, 1966c: 230, 1967: 62, 1970: 216; cf. Zellner 1971: 53), or *void* (Kenny 1975: 75). Cf. Kelsen 1979: 174–5, 1979/1991: 220–1; Niiniluoto 1986: 120; van Fraassen 1973: 16, 1975: 51. Hall (1947: 341, 1952: 147; cf. Storer 1946: 29–30) also accepts the view that there are more than two possible values for prescriptions, whereas Castañeda (1974: 84–5, 1975: chap. 4) and Chellas (1971: 116–7) reject this view.

[11] Cf. Clarke 1975: 419. On the point that a conditional prescription is a conditional whose antecedent is a proposition and whose consequent is a prescription see: Castañeda 1975: 112; Clarke 1973: 198, 1975: 418–9, 1985: 102; Hall 1947: 341, 1952: 144; Ramírez 2003: 16; Storer 1946: 34; Weinberger 1957: 121, 1958b: 154; contrast Beardsley 1944: 183. This point suggests that there is no useful distinction between *pure* imperative logic (which would deal *only* with prescriptions) and *mixed* imperative logic (which would deal with *both* prescriptions and propositions). (Standard logic would not be isomorphic to mixed imperative logic—cf. Weinberger 1972: 151–2—but might have been thought to be isomorphic to pure imperative logic.)

[12] One might object: "It seems as difficult to hold that there are commands which have never been issued as it is to hold that there are headaches that no-one has ever had" (Harrison 1991: 105; cf. Dubislav 1937: 335; Engisch 1963: 4; Kelsen 1979: 3, 23, 162, 187–8, 1979/1991: 3, 29, 204, 234–5; Moser 1956: 200; Rescher 1966: 10; Ross 1968: 80). I reply with another analogy: there are *unstated statements* if a statement is understood as a proposition rather than as a declarative utterance, and similarly there are *uncommanded commands* if a command is understood as a prescription rather than as an imperative utterance. One might respond: "If there were [uncommanded commands], every individual, every moment of his life, would either be obeying or disobeying an infinite number of unexpressed commands, . . . [but] it is not the

case that I am either obeying the command 'Sit in your chair' or disobeying it" (Harrison 1991: 105; cf. Rescher 1966: 77; Wellman 1961: 238). I reply that either I sit in my chair or I don't, so the above uncommanded command is either *satisfied* or violated—even if it is intentionally neither *obeyed* nor disobeyed (cf. note 6). Note also that different people can express not only the same proposition, but also the same prescription: father can tell me at 1pm and mother can tell me at 2pm "be at the airport by 3pm" (cf. Adler 1980: 27–8; Rescher 1966: 28–9; Sosa 1964: 23; contrast Castañeda 1960a: 24–5). One might object that at 1pm I may still be able, but at 2pm I may no longer be able, to reach the airport by 3pm (cf. Hamblin 1987: 82, 218). It does not follow, however, that father and mother express different prescriptions: possibly they express the same prescription, which at 1pm I can satisfy but at 2pm I cannot.

[13] The satisfaction proposition of this prescription is the first proposition in the pair on the reasonable assumption that the proposition expressed by the concatenated sentence $\ulcorner S$ or V, and $S\urcorner$ is *identical* with (not just necessarily equivalent to) the proposition expressed by S; similarly for the violation proposition. (To be precise, I enclose concatenated sentences in corners rather than quotation marks; see Quine 1961: 35–6.)

[14] (For a related idea see: Makinson 1999: 36; Makinson & van der Torre 2000: 392, 2001: 159.) This identification has the consequences that (1) "square the circle" and "trisect the angle" express the same prescription (or at least "identified" prescriptions; I omit such qualifications in the sequel) *if* necessarily equivalent propositions are identical (cf. Weinberger 1957: 121, 1958b: 149), and that (2) "Oedipus, marry Jocasta" and "Oedipus, marry your mother" express different prescriptions *if*, although Jocasta is the mother of Oedipus, "Oedipus marries Jocasta" and "Oedipus marries his mother" express different propositions (see: Lemmon 1965: 56, 65; Sosa 1966a; Stalley 1972: 25; Wedeking 1969: 56–61). The identification has also the consequence that father and mother express the same prescription if father *orders* me and mother *requests* me to be at the airport by 3pm (cf. notes 2 and 12). This consequence might be considered objectionable by those who emphasize the differences between ordering, requesting, instructing, etc. (see: Aune 1977: 176–7; Bell 1966: 134–5, 141; Gensler 1996: 185–6; Good 1986: 314–7; Raz 1977: 83; Warnock 1976: 296–8; cf. Belnap, Perloff, & Xu 2001: 92–4; Davies 1986: 34–46; Gauthier 1963: 52–63; Hamblin 1987: chap.1; Hart 1994: 18–20, 280–1; Perloff 1995: 77–9; Ross 1968: 38–60; Searle & Vanderveken 1985: 198–205; Wellman 1961: 233–4). I reply, following Sosa (1964: 21–2, 54, 1967: 57; cf. Hare 1952: 4, 1965: 174; Warnock 1976: 298–9), with an analogy: father and mother express the same proposition if father *asserts* and mother *conjectures* that I will be at the airport by 3pm, although there are differences between asserting, conjecturing, admitting, explaining, reporting, etc.

[15] On the distinction—due to Hofstadter and McKinsey (1939: 446)—between fiats and directives see: Adler 1980: 18–9; Clarke 1979: 606; Edwards 1955: 124; Hall 1952: 157 n. 1; Hamblin 1987: 139–40, 143–4; Hilpinen 1973: 140, 144–6; Kenny 1966: 68–9; Wedeking 1969: 15–8, 25–40; Weinberger 1958a: 28. I understand the distinction in terms of whether a prescription has a *prescriptee* (namely an agent or group of agents who is—maybe conditionally—required by the prescription to do something), not in terms of whether a sentence or utterance expressing the prescription has an *addressee* (namely an agent or group of agents to whom the sentence or utterance is addressed). For example, although the sentence "let it be the case that Lou turns on the light" has no addressee, it expresses a prescription (also expressed by "Lou, turn on the light"; cf. Bergström 1962: 17–8; contrast Beardsley 1944: 177) which has a prescriptee (namely Lou) and which is thus a directive, not a fiat. (I don't need to take a stand on whether prescriptees and addressees can differ when they both exist; i.e., on whether "third-person imperatives" exist. On this issue see: Davies 1986: 140–1; Gauthier 1963: 51; Hamblin 1987: 51–3; Hare 1952: 189–90; Rescher 1966: 14; Schachter 1973: 639–47; Sosa 1964: 11–2. Similarly, I don't need to take a stand on whether prescriptees and *issuers*—namely those who express a prescription—can coincide when they both exist; i.e., on whether "first-person imperatives" exist. On this issue see: Castañeda 1960a: 25; Clark 1993: 81; Gauthier 1963: 51; Grant 1968: 185–6; Hamblin 1987: 36–9; Hare 1952: 189; Kelsen 1979: 23–4, 1979/1991: 29–30; Rescher

1966: 11–2; Sosa 1964: 12–3; Wellman 1961: 234; Wittgenstein 1953/1958: §243; Zellner 1971: 8–12; cf. Hall 1952: 156–7; Katz 1966: 132, 135–8.)

[16] On whether unsatisfiable or unviolable prescriptions exist see: Adler 1980: 54, 105–6; Clark 1993: 85; Grant 1968: 192–4; Hall 1952: 151; Menger 1939: 58–9; Rescher 1966: 17, 29–30; von Wright 1963: chap. 7; Warnock 1976: 296; Wedeking 1969: 40, 48, 59; Weinberger 1957: 105, 121, 1958a: 22, 1958b: 149; Zellner 1971: 83–97. One might argue that "disobey this order" expresses the *empty* (i.e., *both* unsatisfiable and unviolable) prescription, but I think it is more plausible to say that this sentence expresses no prescription at all; arguably the empty prescription is expressed instead by, e.g., "if it both rains and doesn't rain, close the window".

[17] This prescription is satisfiable—i.e., not unsatisfiable—even if it is impossible to change the past: it is possible that my son survived yesterday's battle. Some people may be unsympathetic to the idea of prescriptions about the past (see: Clarke 1973: 191, 1985: 89; Clarke & Behling 1998: 281; Gauthier 1963: 51; Hall 1952: 156; Ibberson 1979: 156–8; Montefiore 1965: 105, 107; Prior 1971: 71, 74; Rescher 1966: 34–5; Searle & Vanderveken 1985: 16, 56; Sellars 1963: 180; Sosa 1964: 16, 74 n. 2; Wedeking 1969: 34–40; Wellman 1961: 238, 243), but other people may be sympathetic to this idea (see: Bergström 1962: 20; Bolinger 1967: 349–51, 1977: 168–70; Bosque 1980; Davies 1986: 16; Dummett 1964: 341–4; Duncan-Jones 1952: 191; Hare 1949: 25–7, 1952: 187–9, 1979: 162–4; Kenny 1966: 69; Wilson & Sperber 1988: 81; Zellner 1971: 25, 95–6). See also: Chellas 1969: 90–3, 1971: 126–7; Hamblin 1987: 50, 80–2; Johanson 2000: 248; Lemmon 1965: 60 n. 12.

[18] This concept of satisfaction is *timeless* (if the concept of truth is timeless) and *impersonal* (in particular, it does not incorporate intention). A *time-indexed* (and *personal*) concept of satisfaction can also be defined: a prescription is satisfied *at* a given time (*by* a given person) exactly if its satisfaction proposition is *made true* (cf. Sosa 1964: 60, 62–5, 1967: 59) at that time (by that person). (Similarly for violation and avoidance.) If there is a time at which a prescription is satisfied, then the prescription is also timelessly satisfied. Not conversely, however: the prescription expressed by "let 2 + 2 be 4" is satisfied timelessly but at no given time. Although every prescription timelessly takes one of the three possible satisfaction values (satisfaction, violation, avoidance), at some times it takes none of the corresponding time-indexed-satisfaction values; e.g., if you reach the airport at 2pm, then at every later time the prescription expressed by "be at the airport by 2pm" is not satisfied, violated, or avoided (but it has no fourth value either).

[19] Cf. Belnap 1966: 30; Weinberger 1957: 121; Zellner 1971: 19. The distinction between conditional and unconditional prescriptions differs from a distinction, inspired by Kant (*Groundwork* 4: 412–20), between *hypothetically* and *categorically* binding prescriptions: the unconditional prescription expressed by "don't smoke" can be hypothetically binding (e.g., binding conditionally on your having health as an end), and the conditional prescription expressed by "if you make a promise, keep it" can be categorically binding (cf. Darwall 1998: 155; Mackie 1977: 28–9; Wood 1999: 61). Note also that imperative sentences of the form "if you want A, then B" need not (although they can) express hypothetically binding or conditional prescriptions: "if you want to kill your father, then see a therapist" normally does not express a hypothetically binding prescription (seeing a therapist is normally not a means of killing your father; cf. Mackie 1977: 28), and "if you want water to boil, then heat it to 100°C" normally expresses the *proposition* that water boils at 100°C (see most references at the end of note 3; also Adler 1980: 42; Hare 1952: 33–8; Moser 1956: 194–6; Ross 1968: 44–5; Turnbull 1960: 379).

[20] Cf. Cohen 1983: 30; Harrison 1991: 107; Moritz 1954: 100–1, 1973: 112–3; Moser 1956: 194; Niiniluoto 1986: 116–8; Rescher 1966: 38–9; Searle & Vanderveken 1985: 5, 158; Sosa 1966b: 223 n. 20; Weinberger 1957: 120; Zellner 1971: 19; contrast: Cornides 1969: 1223–4; Ross 1968: 168. Kenny (1975: 75–6) argues in effect that, if the prescription expressed by "if he proposes, marry him" were satisfied in every case in which he doesn't propose, it would still not be identical with the prescription expressed by "make it the case that if he proposes you marry him": the latter prescription is not satisfied if he doesn't propose (and you don't marry him)

"through no fault of yours". I reply that my point in the text remains unaffected: the former prescription would still be identical with the prescription expressed by "*let* it be [as opposed to: *make* it] the case that if he proposes you marry him" (cf. note 29 and corresponding text).

[21] Cf. Harrison 1991: 108; Kenny 1975: 75; Niiniluoto 1986: 119–21; Searle & Vanderveken 1985: 5, 197. Dummett (1959: 150; cf. 1973: 339–40; McArthur & Welker 1974: 232) argues that the analogy with conditional bets fails when it is in the prescriptee's power to make the antecedent true or false: the prescription expressed by "if you go out, wear your coat" is satisfied if, unable to find your coat, you stay in so as to comply with the prescription (cf. Manor 1971: 154–5). I reply that if you stay in then the prescription is "complied" with in the sense of being *nonviolated*; it does not follow that it is *satisfied* (see also Holdcroft 1971: 130–1). Dummett argues also that the above prescription is identical with the prescription expressed by "don't go out without wearing your coat" (cf. Downing 1961: 497) and is thus satisfied if you stay in. In reply I deny the alleged identity: if you wear your coat but you stay in then the prescription expressed by "don't go out without wearing your coat" is satisfied but it seems wrong to say that the prescription expressed by "if you go out, wear your coat" is satisfied (cf. Holdcroft 1971: 131–2; Moser 1956: 194). (It is important to note that I don't *need* to deny the alleged identity: for my purposes what matters is that *some* imperative sentences of the form "if A, then B" express prescriptions that can be neither satisfied nor violated, not that *every* such sentence does. Cf. Holdcroft 1971: 130–1.) Dummett finally argues in effect that, even when it is not in the prescriptee's power to make the antecedent true or false, the distinction between satisfaction and avoidance is "void of significance" because satisfaction and avoidance have the same consequences: no liability to punishment and no right to a reward (contrast Williams 1966: 4). I reply that without this distinction one would be unable to distinguish, in terms of logical structure, between the prescriptions expressed by "if it rains at noon, close the window at noon" and "if you don't close the window at noon, let it not rain at noon" (cf. Holdcroft 1971: 131). So the distinction between satisfaction and avoidance is *not* "void of significance" (see also Holdcroft 1971: 132–4); in any case, Dummett's move implicitly grants that the distinction *exists*.

[22] Cf. Harrison 1991: 108. Why not say that if he doesn't propose you (trivially) keep your promise? As Kagan notes, that seems wrong: it seems more natural to say that—under the circumstances—you don't *have* to keep your promise (1998: 121; cf. Nelson 1993: 156). (Contrast Sellars 1983: 202–6; my replies to Sellars would be analogous with my replies to Dummett in note 21.)

[23] (So bets might also be identified with ordered pairs of logically incompatible propositions: *winning* propositions and *losing* propositions. Similarly for promises, predictions, etc.) The above discussion presupposes that "if he proposes, marry him" expresses a prescription even if he doesn't propose. This presupposition might be contested (cf. Holdcroft 1971: 136–7; Manor 1971: 153): one might claim that a conditional imperative sentence whose antecedent is false expresses no prescription at all (rather than expressing a prescription which is neither satisfied nor violated). To support this claim, one might use an analogy with *conditional assertions* (cf. Belnap 1970: 1–4, 1973: 48–51; Cohen 1983: 19–35, chap. 6, 1986: 124, 1992: 472; Dunn 1975: 383; Holdcroft 1971: 124, 136–9; Jeffrey 1963: 37–8; Manor 1971: 1, 27, 1974: 37, 45; Quine 1953: 12; van Fraassen 1975: 50; see also: Dummett 1959: 151–3, 1973: 338–47; Long 1971; von Wright 1957: 130, 134–5). For example, one might claim that a weather forecaster who says "if the wind drops, I predict rain" makes no assertion if the wind does not drop. It seems clear to me, however, that the forecaster does make an assertion, namely that she predicts rain on the condition that the wind drops (cf. Dunn 1970). One might argue that the forecaster makes no *prediction* (rather than no *assertion*) if the wind does not drop, but I think it is more natural to say that she does make a prediction, namely a conditional one. (This conditional prediction is neither accurate nor inaccurate if the wind does not drop, but the forecaster's assertion is true—if sincere—regardless of whether the wind drops.) Similarly, if you are advised to "marry him if he proposes" but he doesn't propose, then although it is *as if* no (piece of) advice had been

given, strictly speaking (conditional) advice *has* been given but has turned out to be inoperative. Note that similar issues arise concerning conditional *interrogative* sentences: if you pay no rent, does "if you pay rent, how much do you pay?" express no question at all or does it express a *conditional question*? (Cf. Åqvist 1965/1975: 48–9, 70; Belnap 1969: 124–6, 1972: 335–7; Belnap & Steel 1976: 15–6, 101–4; Cohen 1983: 31–2; Dummett 1973: 338–9; Holdcroft 1971: 129; Manor 1971: 161; Prior & Prior 1955: 52–5.) It seems more natural to say the latter, and this is in line with the common identification of questions with prescriptions ("if you pay rent, tell me truly how much you pay"; cf., e.g., Åqvist 1983; Belnap 1972: 335; Lewis & Lewis 1975: 45–54).

[24] If what I said about conditional prescriptions is correct, then the main rivals to my model of prescriptions are inadequate. These rival models are based on (various versions of) the claim that every imperative sentence can be considered as containing two factors: a factor indicating *that* something is being prescribed, and a factor indicating *what* is being prescribed (Jørgensen 1938: 291, 1938/1969: 12; cf. Mally 1926: 12). The former factor, which is supposed to be common to all imperative sentences, is variously called a *mood indicator* (Clarke 1985: 99–100; Hornsby 1986: 96; McGinn 1977: 306–7), a *mood determiner* (Clarke & Behling 1998: 280), a *mood-setter* (Davidson 1979/2001: 119), a *modal element* (Green 1998: 718; Stenius 1967: 254; Žarnić 2002: 9, 2003), a *dictor* (Hare 1949: 28), a *neustic* (Hare 1952: 18), or a *tropic* (Hare 1970: 11, 20–1, 1989: 23–5). The latter factor, which is supposed to be either (1) the declarative sentence that corresponds to a given imperative sentence (e.g., "you will do it" corresponds to "do it") or (2) something that is not a sentence but is common to both a given imperative sentence and its corresponding declarative sentence, is variously called a *sentence radical* (Clarke 1985: 99–100; Clarke & Behling 1998: 280; Green 1998: 718; Lewis 1970/1983: 220–1; McGinn 1977: 306–7; Stenius 1967: 254; Žarnić 2002: 9, 2003; cf. Wittgenstein 1953/1958: §23), an *indicative core* (Hornsby 1986: 96; cf. Sosa 1964: 36–40, 1967: 57–8), a *theme of demand* (Ross 1941: 56, 1941/1944: 33; cf. 1968: 34–5), a *theoretical content* (Husserl 1913/1970: 81–2), a *modally indifferent substrate* (Kelsen 1979/1991: 60–1, 195), a *descriptor* (Hare 1949: 27), or a *phrastic* (Hare 1952: 18, 1970: 21, 1989: 34). (On the contrast between (1) and (2) see: Aldrich 1943: 656; Davidson 1979/2001: 116; Hall 1952: 141; Hare 1949: 30, 1952: 21, 1969/1972: 70, 1989: 36–7 n. 18; Kelsen 1979: 155–7, 314–8 n. 138, 1979/1991: 195–7, 377–81 n. 138; Opałek 1970: 175, 1986: 33–4; Prior 1971: 70; Weinberger 1957: 117–8.) The models of prescriptions that are based on the above claim are subject to various objections (see: Bhat 1983: 454; Huntley 1980; Mayo 1957: 166; Mitchell 1957: 176–9; Sorainen 1939); in particular, these models assume that a *single* proposition corresponds to any given prescription and are thus inadequate if (as I argued) *pairs* of propositions correspond to conditional prescriptions (see: Hamblin 1987: 111; Rescher 1966: 38–9; Weinberger 1958a: 70, 73; contrast Åqvist 1967: 21). In response one might modify the above models so as to associate pairs of propositions with conditional prescriptions, but then the modified models would be isomorphic to my model.

[25] The term 'negation' can be used to refer to (1) a function from *propositions* to propositions (*declarative* negation), (2) a function from *prescriptions* to prescriptions (*imperative* negation), or (3) a specific *value* of the above functions (e.g., a specific prescription which negates a given prescription); I shift back and forth between these three uses, trusting that the context disambiguates. Given that in this paper I do not deal with syntactic aspects of imperative logic, I do *not* use 'negation' to refer to (4) a function from—declarative or imperative—*sentences* to sentences (similarly for 'conjunction' etc.); so it might have been better to talk about logical *operators* rather than *connectives*, but I chose to stick with the more common terminology.

[26] This definition of imperative negation corresponds to that proposed by Storer (1946: 31; cf. Hall 1952: 145), and also to Rescher's (1966: 105–6) *weak countermand.* It is analogous to the definition of declarative negation proposed by Łukasiewicz (1920/1970: 88), Kleene (1938: 153), and Bochvar (*internal* negation; see: Malinowski 1993: 54–5, 2001: 316; Rescher 1969: 30) in three-valued logic, and for *unconditional* prescriptions it corresponds to a widely proposed definition of imperative negation (on variants of that widely proposed definition see: Belnap, Perloff, & Xu 2001: 89; Clarke 1973: 193, 1985: 100; Clarke & Behling 1998: 283; Engliš 1964:

306–7; Fisher 1962a: 197; Gensler 1990: 191, 1996: 182; Hall 1952: 125; Hamblin 1987: 64; Hofstadter & McKinsey 1939: 448; Perloff 1995: 76; Ramírez 2003: 126–30; Rand 1939: 316, 1939/1962: 245; Reichenbach 1947: 342; Ross 1941: 60, 64, 1941/1944: 37, 40; Weinberger 1957: 122–3, 1958a: 90–1).

[27] 'Viol.' stands for 'violated' (a predicate that corresponds to the satisfaction *value* of violation), whereas *V* is a violation *set*; similarly for other symbols. Note that the three kinds of negation in Table 1 have different satisfaction values only when the negated prescription is avoided. Satisfaction negation is analogous to the *external* negation proposed by Bochvar (Malinowski 1993: 54–5, 2001: 316; Urquhart 2001: 253), and violation negation is analogous to the "intuitionist" negation proposed by Heyting (1930: 56; cf. Gödel 1932: 65; Gottwald 2001: 85; Malinowski 1993: 88; Rescher 1969: 124), in three-valued logic. The satisfaction negation of *I* can be expressed by "let *I* not be satisfied" *if* one identifies—as I do—propositions with sets (and thus identifies, e.g., the satisfaction proposition of *I* with the proposition that *I* is satisfied); similarly for violation negation etc.

[28] Another reason for not dwelling on satisfaction or violation negation in what follows is that these two kinds of negation have certain properties I consider undesirable. First, the law of double negation does not hold for them: if one starts with a conditional prescription and applies satisfaction or violation negation twice, one ends up with an unconditional prescription (and thus not with the starting prescription). Second, different prescriptions (for example, those expressed by "if you do *A*, do *B*" and "if you do *B*, do *A*") can have the same satisfaction negation ("don't do both *A* and *B*"); similarly for violation negation. (It can be shown that the second point entails the first but not vice versa.) Third, the satisfaction or violation negation of a single-agent prescription can be a multi-agent prescription. For example, the violation negation of the prescription expressed by "if he proposes, marry him" is expressed by "let it be the case that he proposes and you don't marry him"; the negated prescription does not (even conditionally) require him to do anything, but its violation negation does.

[29] Unlike Hamblin (1987: 66–7), throughout this paper I use 'let' impersonally (cf. note 15), *not* in the sense of *allow* (something to happen which without your intervention will happen). (Cf. Davies 1986: 229–31.) The distinction between the two prescriptions in the text can be made even if, as Hamblin (1987: 64) in effect claims, "be here at lunch" typically expresses the second prescription.

[30] For further examples see: Adler 1980: 63; Belnap, Perloff, & Xu 2001: 89–90; Castañeda 1963: 231; Hamblin 1987: 66–8; Lemmon 1965: 57–9; Moser 1956: 203–4; Perloff 1995: 76; Tammelo 1975: 40–1.

[31] (1) On variants of permissive negation see: Bergström 1962: 23–9; Downing 1961: 497; Fisher 1962a: 197; Gensler 1996: 185; Hall 1952: 125–6; Hamblin 1987: 68–9 (cf. Belnap, Perloff, & Xu 2001: 90; Perloff 1995: 76); Hare 1967: 319–21; Rescher 1966: 105; Tammelo 1975: 40. (2) On variants of illocutionary negation see: Garner 1971; Hamblin 1987: 70 (cf. Belnap, Perloff, & Xu 2001: 90; Perloff 1995: 76); Hare 1969: 465, 1970: 12, 1995: 277 (cf. 1967: 321); Hoche 1995; Peetz 1979; Price 1979: 346–7; Searle 1969: 32–3; Searle & Vanderveken 1985: 4–5, 152–5; Sloman 1970: 57–8; see also Menger 1939: 61 (cf. Hall 1952: 133 n. 5). (3) On variants of bindingness negation see: Hall 1952: 121; Ross 1941: 64, 1941/1944: 40; Weinberger 1957: 125–7, 1958a: 90; Zellner 1971: 74. (4) Distinct (though not always distinguished) from both illocutionary and bindingness negation is the *cancellation* (abrogation, revocation, withdrawal, voiding) of a prescription, namely an act which makes true the proposition that the prescription is *no longer* binding. On cancellation see: Bohnert 1945: 312–3; Cornides 1969; Downing 1961: 497; Engliš 1964: 306; Hall 1952: 126; Hamblin 1987: 70–1; Kelsen 1979: 84–92, 1979/1991: 106–14; Rescher 1966: 111; Sellars 1963: 199–200.

[32] One might object that I have misrepresented illocutionary and permissive negation. (a) According to Searle, it is a mistake to think that illocutionary negation "leaves us with a negative assertion about the speaker, concerning his non-performance of some illocutionary act" (1969: 33). As Sloman puts it, "[Searle] does not translate 'I do not promise to come' as 'It is not

the case that I am now promising to come': rather, he says it is a *refusal* to make a promise" (1970: 57). I reply that, if illocutionary negations are understood as *speech acts* (e.g., of refusing to command or request), then it seems natural to say that they are negations of speech acts (e.g., of commanding or requesting), but it seems gratuitous to say that they are negations of *prescriptions*: prescriptions are not speech acts, and arguably they exist even if they are never expressed by speech acts (see note 12). (b) Some authors grant that permissive sentences (like "you may kiss me") typically do not express prescriptions, but claim that such sentences typically express *permissions*, and insist that permissions are negations of prescriptions (and vice versa). (See: Bergström 1962: 28; Hamblin 1987: 69; Lewis & Lewis 1975: 54; Tammelo 1975: 40.) In reply I grant that, *if* permissions, understood as what permissive sentences typically express, were entities distinct from both propositions and prescriptions, it might be natural to say that permissions negate prescriptions. But I see no reason to believe that such entities exist: permissive sentences are declarative, and apparently they typically express propositions. Alternatively, if permissions are understood as speech acts (cf. Hare 1967: 319), then I refer to what I just said about illocutionary negation; and if permissions are understood as unviolable prescriptions ("do as you like"; cf. Reichenbach 1947: 343), then at most they negate unsatisfiable prescriptions.

[33] On attempts to reduce prescriptions to propositions (or imperatives to declaratives) see: Bergström 1962: 11–6; Bohnert 1945: 311; Broad 1950: 62–5; Chomsky 1966: 46; Duncan-Jones 1952: 191–2; Gibbons 1960: 112–8; Green 1998: 719; Hall 1952: 131–2, 158–61; Hamblin 1987: chap. 3; Hare 1952: 5–10; Lewis 1970/1983: 222; Moutafakis 1975: 31; Opałek 1970: 183–4, 1986: 14–7; Prior 1971: 66.

[34] Here are three further examples, one with overlapping and two with nested contexts; I leave the details to the reader. (a) The conjunction of the prescriptions expressed by "if you kiss Jane, hug her" and "if you kiss Joan, hug her" is expressed by "if you kiss Jane or Joan, don't kiss either of them without hugging her". (b) The conjunction of the prescriptions expressed by "kiss me" and "if you kiss me, hug me" is expressed by "kiss me and hug me". (c) The conjunction of the prescriptions expressed by "kiss me" and "if you don't kiss me, hug me" is expressed by "kiss me"; this is indeed the *thin* prescription that the concatenated sentence "kiss me, and if you don't kiss me, hug me" with some redundancy expresses. (This concatenated sentence normally expresses a *thick* prescription, but let me repeat that the scope of the present paper excludes such prescriptions. This is also why in the present paper I don't deal with the point (see Hamblin 1987: 73–5) that "kiss me and hug me" can express the thick prescription expressed by "kiss me and hug me; but if you don't kiss me, at least hug me, and if you don't hug me, at least kiss me".)

[35] My definition of imperative conjunction is analogous to the definition of declarative conjunction proposed by Cooper (1968: 305) in three-valued logic. Cooper's definition is unusual (maybe because it violates a condition which, according to Gottwald (2001: 66–7), it is widely agreed that "reasonable candidates for conjunction connectives should satisfy"); a more usual definition of declarative conjunction in three-valued logic—proposed by Łukasiewicz (1920/1970: 88) and Kleene (1938: 153)—is analogous to Storer's (1946: 31; cf. Hall 1952: 146 n. 2) definition of imperative conjunction as, in my notation, $<S \cap S', V \cup V'>$. (Storer's proposal is subject to the same counterexample I gave to Rescher's fusion.) For unconditional prescriptions, both my definition and Storer's (as well as Rescher's fusion) correspond to a widely proposed definition of imperative conjunction (on variants of that widely proposed definition see: Castañeda 1974: 89, 1975: 119; Clarke 1973: 193, 1985: 100; Clarke & Behling 1998: 283; Espersen 1967: 74; Hofstadter & McKinsey 1939: 448; Ramírez 2003: 125; Reichenbach 1947: 343; Ross 1968: 163).

[36] For further examples of disjunctions, take the three pairs of prescriptions in the three examples of note 34; the disjunctions are expressed respectively by (a) "if you kiss Jane or Joan, kiss and hug at least one of them", (b) "kiss me", and (c) "don't kiss me without hugging me". Definition 3 is analogous to Cooper's (1968: 305) definition of declarative disjunction in

three-valued logic; a more usual definition of declarative disjunction is analogous to Storer's (1946: 31) definition of imperative disjunction as, in my notation, $<S \cup S', V \cap V'>$. For unconditional prescriptions, both my definition and Storer's correspond to a widely proposed definition of imperative disjunction (cf. Castañeda 1975: 110–1; Clarke 1973: 193, 1985: 100; Clarke & Behling 1998: 283; Hofstadter & McKinsey 1939: 448; Rand 1939: 316, 1939/1962: 246; Ramírez 2003: 123–4; Ross 1968: 158–60). Note that conjunction and disjunction are *not* distributive with respect to each other: in general, $I\&(I' \vee I'') \neq (I\&I') \vee (I\&I'')$ and $I \vee (I'\&I'') \neq (I \vee I')\&(I \vee I'')$.

[37] On this distinction see: Adler 1980: 59–60; Aloni 2003; Åqvist 1965: 182–3; Bennett 1970: 316; Espersen 1967: 95–6; Hamblin 1987: 75–7; Rescher 1966: 113–5; Ross 1968: 161; Sosa 1966b: 213 n. 3; Wedeking 1969: 71–81; Zellner 1971: 35–6, 75–6. Following Åqvist (1965: 183), one might suggest that what my utterance expresses on the choice-offering interpretation is what it expresses on the alternative-presenting interpretation conjoined with the claim that you may go right and you may go left. A problem with this suggestion is that the two "conjuncts" are in tension with each other: if on the alternative-presenting interpretation I mean that only one of the two ways leads to the library, then I am denying that you both may go right and may go left. Note also that *non*-disjunctive imperative sentences and utterances are sometimes similarly ambiguous: if I say "don't go straight ahead", does it matter or not what you do (e.g., whether you go right or left) as long as you don't go straight ahead?

[38] Indeed, the prescription expressed by "if you neither go right nor go left, go both right and left" is avoided exactly if you go right or left and is otherwise violated (because it is never satisfied).

[39] One can also define the *exclusive* disjunction of two prescriptions as the prescription whose context is the union of the contexts of the disjuncts and whose satisfaction set is the *symmetric difference* of the satisfaction sets of the disjuncts. In symbols: $<S, V> \underline{\vee} <S', V'> = <S \Delta S', (C \cup C') - (S \Delta S')>$ (where $S \Delta S' = (S - S') \cup (S' - S) = (S \cup S') - (S \cap S')$). The exclusive disjunction [as opposed to the disjunction] of two prescriptions can be expressed by "let *exactly* one [as opposed to: let *at least* one] of the prescriptions be satisfied if it is not the case that both prescriptions are avoided". The only difference between the satisfaction tables for disjunction and for exclusive disjunction is that the disjunction is satisfied but the exclusive disjunction is violated if both disjuncts are satisfied.

[40] Cf. Clarke 1973: 199, 1975: 421; Clarke & Behling 1998: 290–1. One might suggest defining $P \rightarrow I$ as $\sim <P, P^c> \vee I$ (cf. Hofstadter & McKinsey 1939: 448–9; also Castañeda 1963: 229, 1975: 114); equivalently, as $\sim(<P, P^c> \& \sim I)$ (cf. Gensler 1996: 182 n. 1). I reply that, as I argued in note 21, "if you go out, wear your coat" and "don't go out without wearing your coat" do not express the same prescription (the latter sentence expresses an *unconditional* prescription).

[41] For doubts about the possibility or the usefulness of conjoining or disjoining propositions with prescriptions see: Adler 1980: 126–7 n. 117; Altham 1976: 240; Clarke 1973: 199, 1975: 420–1 (cf. 1979: 610); Clarke & Behling 1998: 290; Downing 1961: 497; Kenny 1975: 79; Schachter 1977: 89. Contrast Castañeda 1975: 162–3. For examples similar to "I know you are tired, but try again" see: Aune 1977: 155; Davies 1986: 152–61; Gensler 1990: 191, 1996: 182; Morscher & Zecha 1971: 211; Ramírez 2003: 270. Here are also three further examples of sentences that express both a proposition and a prescription. (1) "Close the door because it's cold" (cf. Clarke 1975: 420; Moutafakis 1975: 97; Ramírez 2003: 270). (2) "You own a car; drive it home" (cf. Rescher 1966: 92). (3) "Come closer and I'll give you five coins", interpreted *positively*, as "come closer; if you do, I'll give you five coins" (cf. Clark 1993: 92). Note that some sentences similar to the third (e.g., "come closer and I'll shoot you") are naturally interpreted *negatively* ("*don't* come closer; if you do, I'll shoot you"; cf. Clark 1993; Hamblin 1987: 84; Hare 1952: 35–6), whereas other such sentences express only a *proposition* (see the end of note 3).

[42] In support of the view that no conditional exists whose antecedent is a prescription see: Beardsley 1944: 183–4; Clarke 1973: 198, 1975: 418–9 (cf. 1985: 102); Clarke & Behling 1998:

289; MacKay 1971: 95. Against the view see: Castañeda 1974: 47, 87, 1975: 113; Gensler 1996: 182 n. 1; Rand 1939: 316, 1939/1962: 246. On the observation that no grammatical imperative clause begins with a conditional subordinator see: Adler 1980: 65; Castañeda 1963: 235, 1968: 35, 1971: 13, 1974: 47, 87, 1975: 111; Gensler 1990: 191; Warnock 1976: 293; Wedeking 1969: 166. Contrast Hare 1952: 34.

[43] (Cf. Castañeda 1970: 442–3; Clarke 1973: 199; Clarke & Behling 1998: 291.) The last equality may not be obvious, but I omit the proof. Note that the biconditional $P \leftrightarrow I$ is also the *disjunction* of the conditionals $P \rightarrow I$ and $P^c \rightarrow \sim I$; this is a consequence of the general claim (which follows from my definitions of conjunction and disjunction) that the conjunction of any two prescriptions with disjoint contexts is the same as their disjunction.

[44] To be explicit: given any nonempty set A of prescriptions, the conjunction of the prescriptions is $<\cup_{I \in A} S_I - \cup_{I \in A} V_I, \cup_{I \in A} V_I>$ and their disjunction is $<\cup_{I \in A} S_I, \cup_{I \in A} V_I - \cup_{I \in A} S_I>$.

[45] Hamblin (1987: 169) agrees that two inconsistent prescriptions can be both binding (cf. Kelsen 1979: 168, 172, 1979/1991: 213, 218), but infers that imperative inconsistency is more tolerable than declarative inconsistency: at least one of two inconsistent propositions must be rejected as false, but none of two inconsistent prescriptions need be rejected as non-binding (cf. Williams 1966: 6–14). I reply that, although two inconsistent prescriptions can be both *pro tanto* (i.e., *prima facie*) binding, it is doubtful whether they can be both *all-things-considered* binding; if they cannot, then at least one of them must be rejected as all-things-considered non-binding. Following Warnock (1976: 296–8), Hamblin argues also that inconsistent prescriptions may be expressed "without disaster" if they are of different kinds, for example an order and a piece of advice: "I am obliged to order you to [shoot the prisoners], and I hereby do so. But my private advice to you is not to" (1987: 169–70). I reply again that it is doubtful whether the order and the piece of advice can be both all-things-considered binding.

[46] Specifically, given any prescriptions whose conjunction is $<\emptyset, C>$ (with $C^c \neq \emptyset$), adding to them the prescription $<C^c, C>$ results in a consistent set of prescriptions (because $<\emptyset, C> \& <C^c, C>$ is $<C^c, C>$ and is thus satisfiable). Note that no analogous argument shows that some prescriptions whose conjunction is *omniviolable* are consistent: the conjunction of an omniviolable prescription with *any* prescription is unsatisfiable.

[47] My definition of imperative inconsistency is to my knowledge novel; although some authors give similar definitions (cf. Beardsley 1944: 182; Hare 1952: 23; Warnock 1976: 295), they are talking about unconditional prescriptions, and so they are in effect adopting the common definition of imperative inconsistency as joint unsatisfiability (on that common definition see: Adler 1980: 74; Espersen 1967: 71 n. 35; Frey 1957: 443; Hare 1967: 311; Lemmon 1965: 55; Marcus 1980: 128–9; Ramírez 2003: 122; Rescher 1966: 59; Wedeking 1969: 151; Williams 1966: 2; also Cornides 1969: 1222; Hare 1969/1972: 70–1; Hilpinen 1973: 143; MacIver 1948: 316–7). On whether a conditional prescription and its negation are consistent see: Castañeda 1970: 445; Downing 1961: 497; Hamblin 1987: 87; Rescher 1966: 107; Sosa 1964: 82–3, 1970: 221; cf. Cooper 1968: 304). Although $I \& \sim I$ need not be omniviolable, there are two imperative analogues of the "law of contradiction" (cf. Rescher 1969: 143–8): (1) $I \& \sim I$ is always unsatisfiable, and (2) $I \& \sim_V I$ is always omniviolable ($\sim_V I$ being the violation negation of I; see §3.1).

[48] It can be shown that a consistent set of personal prescriptions directed to a given agent is controllably consistent exactly if it is not uncontrollably inconsistent. A related distinction can be drawn in terms of whether a proposition's being made true at some time guarantees that at least one of the prescriptions is violated *at* (see note 18) some later time (cf. Hamblin 1972: 79–81, 1987: 178–81). Compare, for example, the prescriptions expressed by "if it rains today, kiss me tomorrow" and "don't kiss me tomorrow" with the prescriptions expressed by "if it rains today, kiss me tomorrow" and "kiss me tomorrow". If it rains today, then it is guaranteed that tomorrow one of the former two prescriptions will be violated; but (barring determinism) no matter what happens today (or earlier), it is not guaranteed that tomorrow at least one of the latter two prescriptions will be violated.

[49] Can a *proposition* be inconsistent with a prescription? It certainly seems so: it seems self-contradictory to say "Paul has no sister, but kiss one of Paul's two sisters", so the proposition that Paul has no sister seems inconsistent with the prescription expressed by "kiss one of Paul's two sisters". One might propose, however, an alternative explanation of the apparent self-contradictoriness: the proposition that Paul has no sister is inconsistent with a *presupposition* of the prescription expressed by "kiss one of Paul's two sisters", namely with the proposition that Paul has two sisters (cf. Sosa 1964: 5, 80; Warnock 1976: 294; Wedeking 1969: 38). Here are two further examples of sentences which might be thought to show that a proposition can be inconsistent with a prescription: (1) "the door is open, but open the door"; (2) "I permit you to refrain from opening the door, but open the door" (cf. Alston 1964: 43; Bergström 1970: 422; Hare 1967: 311; Rescher 1966: 105; Warnock 1976: 294; also Sosa 1964: 92; Williams 1963: 31–2; Zellner 1971: 36–8). But I don't think that uttering (1) or (2) is self-contradictory; we have here instead what, following Hare (1995: 275–8), one may call *illocutionary inconsistency*, akin to what is exhibited by "the door is open, but I don't believe that it is open".

[50] I understand *declarative*—but not *standard*—quantifiers as including *plural* quantifiers (cf. Boolos 1984, 1985), but I don't deal with plural quantification in this paper. Note that in '$\sim(Rx\rightarrow Kx)$' I use the tilde for a function from propositional functions to propositional functions (rather than from propositions to propositions); similarly, sometimes below in the text I use the tilde for a function from prescriptional functions to prescriptional functions. On prescriptional functions see Castañeda 1974: 94, 1975: 123.

[51] For example: $\forall x(\exists y<Sxy,\ Vxy>) = \forall x<\exists ySxy,\ \exists yVxy\&\sim\exists ySxy> = <\exists x\exists ySxy\&\sim\exists x(\exists yVxy\&\sim\exists ySxy),\ \exists x(\exists yVxy\&\sim\exists ySxy)>$. Note also that for the special case of *unconditional* prescriptive functions, and on the standard assumption that the domain or universe is nonempty, the above definitions yield: $\forall x<Sx,\ \sim Sx> = <\forall xSx,\ \sim\forall xSx>$ and $\exists x<Sx,\ \sim Sx> = <\exists xSx,\ \sim\exists xSx>$.

[52] Proof of (1): $\forall x<Ax\rightarrow Bx,\ \sim(Ax\rightarrow Bx)> = <\exists x(Ax\rightarrow Bx)\&\sim\exists x\sim(Ax\rightarrow Bx),\ \exists x\sim(Ax\rightarrow Bx)> = <\exists x(Ax\rightarrow Bx)\&\forall x(Ax\rightarrow Bx),\ \sim\forall x(Ax\rightarrow Bx)> = <\forall x(Ax\rightarrow Bx),\ \sim\forall x(Ax\rightarrow Bx)>$ since, on the assumption that the domain is nonempty, $\forall x(Ax\rightarrow Bx)$ entails $\exists x(Ax\rightarrow Bx)$. Proof of (3): $\forall x(Ax\rightarrow <Bx,\ \sim Bx>) = \forall x<Ax\&Bx,\ Ax\&\sim Bx> = <\exists x(Ax\&Bx)\&\sim\exists x(Ax\&\sim Bx),\ \exists x(Ax\&\sim Bx)> = <\exists x(Ax\&Bx)\&\forall x(Ax\rightarrow Bx),\ \exists x(Ax\&\sim Bx)> = <\exists xAx\&\forall x(Ax\rightarrow Bx),\ \exists xAx\&\exists x(Ax\&\sim Bx)> = \exists xAx\rightarrow<\forall x(Ax\rightarrow Bx),\ \exists x(Ax\&\sim Bx)>$. Note in the left-hand side of (4) the arrow instead of an ampersand (cf. Belnap 1972: 340; contrast: Clarke 1973: 201, 1975: 423; Clarke & Behling 1998: 293; Gensler 1996: 186): I see no useful way to define conjunctions of propositional with prescriptional functions (cf. note 41 and corresponding text).

[53] Fourteen volumes have been published so far, but in the remaining volumes no chapter on imperative logic is planned (Dov M. Gabbay, personal communication, October 5, 2004).

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