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14972 # The Semantics of Imperatives

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14979 ## 1 Introduction

14980 Imperatives are typically taken to express commands. Syntactically, some
14981 languages mark imperatives with a particular mood. In English, they are
14982 essentially subject-less sentences with a bare verb stem. For example (1)
14983 expresses the command that someone shut the door, or that the door be shut.

14984 (1) *"Shut the door!"*

14985 The target of the command is not specified in the linguistic expression.
14986 Other languages may permit a subject, and English allows the intended
14987 target to be affixed *"John, shut the door!"*, *"Shut the door, John!"*. In the case
14988 of (1), one would anticipate that the addressee is expected to comply by
14989 performing an action that results in the door being shut.[1]
14990 Some sentences have the form of imperatives, but are not usually in-
14991 terpreted as overt commands. For example, (2) appears to express a wish
14992 or hope, or "optative", (cf. *"May you live long and prosper"*). And (3), as
14993 a "(co)hortative", expresses encouragement, or a proposal for joint action.
14994 Neither are commands as such (Schmerling, 1982; Mastop, 2005).

14995 (2) *"Live long and prosper!"*

14996 (3) *"Let us sing!"*

14997 It might be argued that there is an ambiguity here given that these dif-
14998 ferent moods have no distinct syntactic formulation in English. In some

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[1] In some cases, an agent other than the addressee may be expected to perform the appropriate action or activity (Schmerling, 1982; Zanuttini, 2008; Kaufmann, 2012).

cases, the nature of the verb may help to resolve any such ambiguity. Imperatives normally only appear to express felicitous commands with verbs that describe things which can be changed by the agent concerned (Han, 1999).

But there are cases were it seems syntax alone cannot distinguish between (unconditional) commanding and non-commanding uses. For example, imperatives that have the appearance of commands can be used to provide answers to certain kinds of questions, as in (4).

(4) a. "*How do I get to Harlem?*"

b. "*Take the A Train*" (cf. Kratzer, 1981)

The different grounds for issuing an imperative, and the context in which they appear, and the precise nature of the verb, may all play a role in determining its status as (i) a command ("*Shut the door!*"), (ii) a suggestion ("*Try asking Peter!*") or advice ("*Take care!*"), (iii) an invitation ("*Come to our party!*"), (iv) a request, or (v) grant of permission ("*Have some fruit!*"), (vi) an hortative ("*Let's go!*", Sadock, 1974; Schmerling, 1982; Mastop, 2005), (vii) an optative hope ("*May you live long and prosper*"), or (viii) an instruction ("*Carefully remove the lid*", Sadock, 1974). There may be other dimensions in which imperatives might be distinguished, such as whether the "command" is being issued in the interests of the speaker, or the addressee (Hamblin, 1987).

One question to consider is whether a formal analysis of the semantics of imperatives should address these distinct uses and characterisations from the outset, as an essential, inseparable part of their meaning. The alternative is to consider them as having a core meaning (e.g. as a command, or at least something that has satisifaction conditions). How an agent then chooses to act upon them (or intend to have them acted upon) may then vary depending on various contextual, pragmatic factors, including the agents' goals and desires (or perceived desires).

For example, some combinations of the context and agents desires may lead to some imperatives being interpreted as granting *permission* rather than imposing an *obligation*, for example because the "commands" appear to be in conflict with other commands, or with pre-existing norms (Portner, 2012, cf. Kamp, 1979; Lewis, 1979), or because of other considerations that transform the command into some other kind of speech act (see Charlow, 2011, for example).

Although there are counter arguments, a case can be made that it is appropriate to treat imperatives as semantically expressing commands (or at least, expressions that can be "satisified"). This is akin to the way that assertions are assumed to have a core meaning that is intimately related to propositions (and truth). In effect we can follow Huntley (1984), Portner

(2007), Kaufmann (2012) and others in assuming that different speech act classifications need play no role in the core analysis.[2]

1.1 Imperatives and Entailment

One key issue is that, as with questions (Wiśniewski, 2015[3]), the core meaning of imperatives does not appear to be truth-conditional in nature, at least not in any straight-forward sense: it seems infelicitous to assert "*it is the case that 'shut the door!'*". Intuitively, however, there appears to be some notion of entailment between imperatives. For example, the commands to "*close the window!*" and "*shut the door!*" appear to have similar import as the single command "*close the window and shut the door!*", suggesting that there is a pattern of entailment as in (5).

(5)
$$\frac{\text{"}\textit{close the window!}\text{"}\ \ \text{"}\textit{shut the door!}\text{"}}{\text{Therefore: "}\textit{close the window and shut the door!}\text{"}}$$

Furthermore, there appear to be entailments that relate or combine propositions and imperatives, as in the practive inferences of Aristotle (6).

(6)
$$\frac{\text{"}\textit{Heal the sick!}\text{"}\ \ \text{"}\textit{John is sick}\text{"}}{\text{Therefore: "}\textit{Heal John}\text{"}}$$

This may seem odd if we assume that such entailments are always concerned with judgements that are essentially truth conditional in nature (Jørgensen, 1937–38), and that the entailment here is characterising the preservation of truth (that is, if the premises are *true*, then the conclusion is *true*).

A number of questions can be posed. What is the most appropriate notion of "entailment" for imperatives? What is the nature of the judgement involved that is being preserved if it is not that of truth? Is there more than one such notion? Given a particular notion of entailment, what are our intuitions about which rules should be supported? Are our intuitions coherent, or do they have counter-intuitive or paradoxical consequences? Can they be said to form a *logic* as such? Are the same notions of entailment applicable for all pragmatic uses of imperatives?

We may also wonder what the appropriate interpretation of an imperative is in itself. For example, are they related directly or indirectly to propositions? Are they (disguised) modal expressions, perhaps related to deontic expressions?[4] Are they constraints, or preferences, over the space of possible

[2] "In the case of declarative sentences, which similarly have the potential for a number of different illocutionary uses, semanticists have few reservations about abstracting from the variety of such uses and working with a propositional core meaning identified as common to them all." (Huntley, 1984).

[3] Chapter 9 of this volume.

[4] For example, they might be performative obligations (Kaufmann, 2012).

eventualities? Can we consider the logical entailment patterns of imperatives independently of any specific interpretation?

If we wish to take seriously patterns entailment of the form in (5), then we should reflect on the nature of the judgements involved, if only to have answers to some of the potential problems raised in Section 3, including Jørgensen's dilemma (Section 3.1, Jørgensen, 1937–38), and Ross's Paradox (Section 3.2, Ross, 1941, 1945).

1.2 Structure of this Chapter

In this chapter we do not intend to provide a comprehensive compositional analysis of all of the semantic and pragmatic data relating to imperatives. In the case of propositions, propositional logic can be conceived of as imbuing sentential connectives with meaning in terms of their structural behaviour with respect to truth. Here, one objective is to consider the meaning of sentential connectives when used to combine imperatives, given an appropriate "proxy" for truth.

We will first consider how imperatives may be combined with each other, and with propositions (Section 2). The goal will then be to consider how the meaning of the more complex imperative relates to the constituent expressions in these examples (Section 5). Along the way we will review some of the conundrums and paradoxes presented in the literature (Section 3), and preëxisting analyses of imperatives (Section 4). An argument will be made that some of the difficulties identified in the literature arise because different kinds of judgements are conflated.

2 Examples of imperatives

2.1 Introduction

As mentioned above (Section 1), imperatives need not be exclusively interpreted as commands. When reflecting on various examples of imperatives, all kinds of pragmatic uses could be considered. Here, however, we will idealise the data, and generally treat imperatives as having a command-like interpretation. This can be seen to be akin to idealising assertoric utterances as proposition-like, even though pragmatically they may support a broader range of interpretations.

There will be some cases, however, were it appears unavoidable to consider imperatives as contributing to something other than a command, such as a wish, threat or promise, as with pseudo-imperatives (Section 2.6).

Imperatives can be combined with each other through disjunction (7b, and Section 2.4) and conjunction (7a, and Section 2.3). They can also be negated (7c, and Section 2.2) — although this does not indicate the absence of a command — and combined with propositions in certain limited ways, as

in the case of conditional imperatives (7d, Section 2.5), and so-called pseudo imperatives (Clark, 1993) (as in 7e, 7f, Section 2.6).[5]

(7) a. "*Close the window and shut the door!*"
b. "*Watch television, or go to the beach!*"
c. "*Don't watch television!*"
d. "*If you have finished your homework, do the washing up!*"
e. "*Have another drink, or you will be thirsty!*"
f. "*Have another drink and you will be happy!*"
g. "*Have another drink and you will die!*"

In order to determine the nature of the semantic interpretation of imperatives, we need to consider our intuitions about the meanings of these more complex expressions, and how they relate to the meanings of their constituent parts. We also have to consider whether those cases in which an imperative is combined with a proposition (7d–7g) are imperatives as such. We will now considered some of these cases in more detail.

Here we will consider these different composite imperatives in isolation. But a competent analysis should predict appropriate interpretations when they are combined. For example, the analyses of disjoined imperatives and negated imperatives should predict appropriate interpretations for negated disjoined imperatives. We may also favour a parsimonious account that captures, or predicts, the appropriate entailment behaviour for the connectives in all contexts in which they may appear, regardless of the kinds of entities that are being combined.

Here we are considering relatively straight-forward basic imperatives. We do not consider cases where an imperative may have a subject that differs from the addressee (Schmerling, 1982; Zanuttini, 2008; Kaufmann, 2012).

2.2 Negation

If we negate an imperative, the result is an imperative. The negation does not signal the absence of an imperative.

(8) "*Do not eat the cheese!*"

The example (8) does not mean that you are simply not being commanded to eat cheese; it is an imperative that requires you to refrain from eating cheese. If imperative force is expressed in terms of some sentential operator, this suggests that such an operator has wide scope over any negation operator.

[5] Pseudo imperatives are also referred to as "imperative-like conditionals" (Davies, 1986).

If we were to take the view that imperatives are concerned with specifying desirable actions, then we might need to take care with negated imperative if we wish to avoid difficulties in formulating the notion of a negative action.

As with all the sentential operators that can be applied to imperatives, ideally we need any formal account to be able to deal with all such cases systematically, regardless of their context.

2.3 Conjunction

Consider the cases of conjunctive imperatives (9).

(9) a. "*Turn on the light and close the curtains!*"

b. "*Jump out of the window and land on the mattress!*"

We may wonder whether these are equivalent to the case where two distinct commands are issues, corresponding to the individual conjuncts (10).

(10) a. "*Turn on the light!*", "*Close the curtains!*"

b. "*Jump out of the window!*", "*Land on the mattress!*"

While it seems acceptable to say that we can infer (9) from (10) — as in (5) — we may wonder whether we can independently infer the conjuncts in (10) from the conjunctions in (9). That, is while there may be some sense in which imperatives support conjunction introduction, can they also be seen to support conjunction elimination, as in (11)?

(11) $$\frac{\text{"}\textit{Jump out of the window and land on the mattress!}\text{"}}{\text{"}\textit{Jump out of the window!}\text{"}}$$

There have been arguments that such entailments should not hold, as partial satisfaction may not be desirable, and might even be ruled out "*... But don't* just *jump out of the window, ...!*" without contradicting the conjoined imperative (Jackson, 1985). The person issuing the command may never dream of uttering "*Jump out of the window!*" without qualification. Whether we support this view may depend on the precise nature of the proposed entailment, in particular the nature of the judgements involved (e.g. whether such rules are concerned with deducing what has actually been *commanded*, or with the *satisfaction conditions* of such commands).

One explanation for this behaviour is that "*and*" in these contexts has a sequential interpretation, like "*and then*". In this case it could interpreted as specifying a composite action. It is this composite action that is desired. If "*A and then B!*" is desired, it does not mean that *A* or *B* are desired without qualification. In effect, this sequential interpretation/use of "*and*" does not, in

general, support conjunction elimination. Following Charlow (2011), the non-sequential uses of "*and*" might be regarded as some form of "discourse-level" conjunction.[6]

2.4 Free choice and weak disjunction

When occuring with disjunction, imperatives typically appear to be interpreted as some form of free-choice as to how they are to be satisfied (Kamp, 1973, 1979). As with other connectives, a disjunction might occur at the sentential level, or within some constituent phrase.

(12) "*Go to the beach, or play in the park!*"

(13) "*Have some apple or bananas!*"

(14) "*Sleep on the bed, or on the couch!*"

It appears that the addressee of such imperatives is expected to decide which disjunct to satisfy, for example to go to the beach, or to play in the park. The choice often appears to be exclusive; to both go to the beach and play in the park might not properly satisfy (12).[7]

It could be said that imperatives with an indefinite noun phrase also present a form of free choice. With (15), the choice is in which apple to eat.

(15) "*Eat an apple.*"

Formally, this might correspond to the disjunctive imperative

(16) "*Eat apple A or eat apple B or eat apple C or . . .* "

Again, it would seem questionable whether eating more than one apple would be a felicitous way of complying with the imperative.

There may be cases where disjunction could be considered to provide a degree of underspecification as to the precise command. That is, the speaker intends there to be a specific command, but the details are not (yet) clear. In this case, the choice might belong to the authority behind the imperative rather than the addressee.[8] This is sometimes referred to as a *weak* disjuntive reading. Such readings may appear more natural when their utterance is forced, as in answer to a question, or if some other external means of making the choice is indicated, as in (17) and (18).

(17) a. "*What do I need to do?*"

[6] Such an analysis might explain some of the examples of Starr (2013), as in "*Go home and I'll go to the grocery store*" where they are not interpreted as threats or promises (cf. Section 2.6).

[7] There are cases of free-choice permission where the inclusive reading does appear natural (Barker, 2010).

[8] For symmetry with the conjunction (Section 2.3), we might consider this to be some form of discourse-level disjunction.

15209 b. *"Buy some teak or mahogany, depending on which is in stock."*

15210 (18) a. *"Which way should I go?"*

15211 b. *"Go north over the mountains or south along the coast [it depends on the*
15212 *time of year]"*

15213 The latter case might be taken to be a form of conditional command (Section
15214 2.5), perhaps involving implicit "modal subordination" (Kratzer, 1981, 1991,
15215 also see Section 4.2.2, and Kaufmann & Kaufmann, 2015[9]).

15216 One question is whether expressions involving disjunction should always
15217 have the same import regardless of the syntactic level at which the disjunction
15218 occurs.

15219 (19) a. *"Have some tea or have some coffee!"*

15220 b. *"Have some tea, or coffee!"*

15221 c. *"Have some tea or coffee!"*

15222 Given an imperative, we may have a free choice in how to satisfy it, and
15223 we might assume that we have been given implicit permission to take actions
15224 necessary to satisfy it (*modulo* overriding considerations). With disjunction,
15225 we may assume that there is permission to satisfy either disjunct. Such
15226 permissive readings also arise with regular imperatives, not just disjunction.

15227 (20) *"Take a piece of fruit"*!
15228 ⇒ *"You may take this apple."*/*"You may take that pear."*
15229 (example from Portner, 2012)

15230 ## 2.5 Conditional

15231 A sentence of the form (21) is a conditional imperative.

15232 (21) *"If you see John, say hello!"*

15233 This may be interpreted as meaning that the consequent imperative becomes
15234 salient in the event that the antecedent is true. There are some pertinent
15235 questions. Do we take (21) to be an imperative regardless of the truth of the
15236 antecedent proposition, or does it just become an imperative in the event
15237 that the antecedent proposition is true? If it is not an imperative, then what
15238 kind of thing is it?[10] If the entire construction is an imperative, then might
15239 there be other ways that it could be satisfied, for example by ensuring that
15240 that the antecedent is, and remains, false (for example, by avoiding John)?

15241 While this might be considered a perverse approach to satisfying (21),
15242 such kinds of readings may appear more natural with other examples, such
15243 as (22).

[9] Chapter 8 of this volume.

[10] We may wonder whether it makes sense to ask what kind of expression the consequent is when the antecedent is false.

(22) *"If you break the window, repair the damage."*

The intended, or felicitous modes of satisfaction may depend upon subjective value judgements about the antecedent and the consequent (cf. pseudo imperatives, Section 2.6).

2.6 Pseudo imperatives

Like conditional imperatives, pseudo imperatives (Clark, 1993) — or "imperative-like conditionals" (Davies, 1986) — combine a propositional and imperative part as in (23).

(23) a. *"Take another step and I will kill you."*

b. *"Take another step or I will kill you."*

c. *"Have more fruit or you will become ill."*

d. *"Have more fruit and you will become ill."*

e. *"Have more fruit and you will get better."*

We may question whether these expressions are imperatives, some form of proposition, or perhaps even both. The salient interpretation appears to be dependent on the nature of the construction; whether it involves conjunction or disjunction, and whether the proposition is deemed to describe something good, or something bad (or rather, the relative desirability of the proposition compared to the cost of complying with the imperative).

In those cases where the propositional constituent describes something relatively bad, the pseudo imperative can be characterised as a threat; something unpleasant will arise if the imperative is satisfied (in the case of conjunction) or not (in the case of disjunction). In conjunctive cases with a positive proposition, the pseudo imperative can be characterised as a promise. It seems hard to form felicitous examples involving disjunction when the "outcome" is positive (24).

(24) *"Have more fruit or you will get better."*

On the face of it, only the disjunctive cases may be genuinely imperative in nature (Franke, 2005). The conjunctive forms appear to express hypothetical propositions about possible outcomes rather than imperatives as such (Han, 1999).[11] This appears to be born out by languages that have overt imperative markings (such as Greek, Hebrew and Japanese, for example) where imperative marking is only felicitous for disjunctive cases. But even in the disjunctive case, it could be argued that there is still some propositional content — a form of "explanation" as to why it is appropriate to comply with the imperative — in addition to the imperative force.

[11] Bolinger (1977) calls these examples "conditions" and Russell (2007) calls them "conditional conjunctions".

As with conjunction between imperatives (and propositions), there may be distinct notions here, with both a "sequential" and "discourse level" interpretation (Section 2.3). A discourse level interpretation of (25) might mean just that there is an imperative (to go home) syntactically combined with a proposition, but with no intention to threaten or promise (Starr, 2013).[12]

(25) *"[You] go home, and I will go shopping."*

We may wonder whether there is a uniform analysis of conjunction that can obtain these different readings for different kinds of conjuncts (Section 4.1.6).

2.7 Relationship to Deontic Modals

Looking at English examples, with their bare verb stems, we might be tempted to consider "imperatives" to be expressions with an ellided deontic modal (26), and where the source of the obligation/expectation is the speaker.[13]

(26) a. *"[I insist that you should] close the door"*

b. *"[I suggest that you ought to] turn on the light"*

But other languages have an impertive-mood morphology that, syntactically at least, suggests the interpretation of imperatives as elliptic for deontic expressions may be inappropriate.[14]

Imperatives also appear to be essentially performative in nature, at least in the case of commands. In such cases, the utterance of an imperative *is* the command. It seems that we cannot normally use imperatives to *describe* what commands are, or are not, currently in effect. In contrast, deontic expressions need not be performative; they *can* simply describe obligations (and permissions) that are currently assumed to be in force: they can be given truth conditions. The use of "insist" and "suggest" in (26) are intended to make the performative reading more salient.

Syntactically, deontic modals may express notions other than obligation (and permission), particularly if they occur with verbs other than activity predicates or stage-level statives, such as the individual stative in (27) (Han, 1999).

(27) *"You must be intelligent."*

[12] Charlow (2011) observes that there may be distinct levels of conjunction. A comma, or pause, following the conjunction appears to make this reading more accessible.

[13] We are not considering cases where an imperative may have a subject that differs from the addressee (Schmerling, 1982; Kaufmann, 2012; Zanuttini, 2008).

[14] Although in general we may want to be cautious about using syntactic evidence as a definitive guide to semantic analysis.

In summary, if there is a semantic connection between imperatives and deontic modals, it may not be a direct one.

3 Problematic cases

Some potentially problematic issues have already been discussed relating to the nature of imperatives, and the interpretation of imperatives when combined with other imperatives and with propositions (Section 2), as with pseudo imperatives (Section 2.6), conditionals (Section 2.5), conjunction (Section 2.3), and disjunction and free-choice (Section 2.4). Here we will mention some more specific problematic cases for imperatives that arise in the literature on commands and obligations. In particular, we review Jørgensen's dilemma (Section 3.1), Ross's Paradox (Section 3.2), and The Good Samaritan (Section 3.3). The Good Samaritan, was originally conceived as a puzzle for deontic logic, but is also relevant in the case of imperatives. Other deontic puzzles may also be reformulated in terms of imperatives, but we do not consider them here.

In addition to such puzzles, there is also a question about conflicting commands. While the problem is perhaps not quite so stark for imperatives as it is for truth-conditional deontic expressions (Lemmon, 1962) we need to ensure that any formalisation of imperatives can entertain conflicting commands without resulting in inconsistency in the logic itself.[15]

Here we focus on issues that need to be considered by any proposed semantic account of imperatives as commands. There are other linguistic and pragmatic issues — such as the interpretation of imperatives as things other than commands, the role of commands and imperatives in discourse, the uniformity of the analysis of the sentential connectives across different categories of expressions — which are not considered here (Section 2). This is not to say that such questions are unimportant, merely that the primary focus here is on some of the problems that arise with the semantic interpretation of imperatives as commands, rather than in their pragmatic use. Whether this is a legitimate approach may boil down to a question of the sense in which imperatives are considered to have a core semantic meaning that is independent of specific use (cf. Section 1), and a potentially distinct pragmatic interpretation that depends upon the context of use.[16]

[15] See for example Sartre's Dilemma (Sartre, 1957/1946), Chisholm's contrary to duty obligtions (Chisholm, 1963), and Plato's Dilemma (*Republic*, I, 331c).

[16] An alternative methodology would be to take the pragmatic interpretation as the primary goal, but it may be difficult to formulate such an account without appealing to context independent semantic notions.

3.1 Jørgensen's dilemma

As we have already seen (5, and Section 2) it seems possible to reason with imperatives. A couple of examples of arguments that we might draw are given in (28, 29) (Jørgensen, 1937–38).

(28) *"Love your neighbour as you love yourself." "Love yourself."*
Therefore: *"Love your neighbour."*

(29) *"Keep your promises." "This is one of your promises."*
Therefore: *"Keep this promise."*

However, according to Jørgensen (1937–38) such kinds of inferences are usually only considered in the case of truth judgements. It might then be argued that this means imperatives have truth values. But this seems odd in most cases. There is then an apparant dilemma if imperatives support inferential behaviour while lacking truth values.[17] We will argue that it is wrong to presuppose that rules of entailment need be restricted just to judgements of truth (Section 5), which means there is no dilemma.

The issue of the nature of inference with imperatives also arises in the next example (Section 3.2).

3.2 Ross's Paradox

Ross (1941, 1945) considered the judgements of *validity* and *satisfaction* (cf. Beardsley, 1944). Essentially *validity* is concerned with what other imperatives may be implied, or entailed, when a command is issued, perhaps as in (5). In contrast, *satisfaction* is concerned with the question of what other imperatives may be deemed to be satisfied when a given imperative is satisfied.

In the case of (30) we might say that (30b) follows from (30a) in the sense that if we satisfy the (30a) we also satisfy (30b). This follows the same pattern of entailment as disjunction introduction in propositional logic.

(30) a. *"Post the letter!"*

b. *"Post the letter or burn the letter!"*

But it is odd to say, through some notion of "validity", that the command (30a) itself entails the command (30b), as the latter command can be satisfied by burning the letter — and moreover requires that the letter be burnt in the event that it cannot be posted — but that would not satisfy (30a).[18]

[17] The argument is also applied in the case of deontic logic, where some take it to undermine the possibility of being able to reason with obligations.

[18] Portner (2012) uses the term *warrant* rather than *entailment* for the inferential relationship between commands as such: an imperative does not *warrant* a disjunction between itself and another imperative.

What we can conclude from this is that the desired patterns of entailment for satisfaction and validity appear to be at odds with each other; they cannot both be characterised by the very same rules of inference.

When described in the literature, Ross's so-called paradox is sometimes simplified to the question of whether or not disjunction introduction should be valid in a logic of imperatives; that is, whether a logic of imperatives should support entailments of the form given in (30). Some writers assume that Ross's arguments suggest that disjunction introduction must be blocked. But this is not quite the point that Ross made. Whether the inference is appropriate depends on what judgements are being made about the imperatives. If we are taking about *commanding* (or *validity*, in Ross's terminology), then disjunction introduction seems inappropriate. But if we are taking about *satisfaction* then it does not seem so problematic. Indeed, the real concern here is the nature of the judgements in the inferences. Ross notes the problem arises if we have a single system of inference that aims to capture the behaviour of distinct kinds of judgements of *validity* (or *commanding*) and *satisfaction*. The supposed impossibility of a logic of imperatives stems from the conflation of two distinct judgements with distinct patterns of behaviour. If we are careful to distinguish between the judgements, perhaps by making the intended judgement explicit in each case, then some progress can be made towards a logic of imperatives.[19]

Whether or not disjunction introduction is appropriate depends upon what kind of judgement we wish to formalise. Some of the arguments used to support the claim that disjunction introduction itself is the source of all these problems could be applied to propositional logic. For example given the truth of (31a) we may infer the truth of (31b).

(31) a. "*It is raining*"

b. "*It is raining or it is snowing*"

But this does not mean that if (31a) is asserted that it means (31b) has been asserted. And in particular, it does not mean that one way for (31a) "*it is raining*" to be judged true is if the second disjunct of (31b) "*it is snowing*" is

[19] Rose argues that the different intuitions we have about the behaviour of *valditiy* and *satisfaction* suggests they ought not be conflated in a logical formalisation. Unfortunately he also appears to presuppose that any individual putative logical rules for imperatives must simultaneously satisfy our intuitions for both notions. That this appears impossible is the essence of the contradiction. This implicit presupposition might go some way to explaining the apparent confusion in the literature about the appropriate corollaries that should be drawn from Ross's example. In the author's view, the intuitively contradictory outcome of conflating distinct notions in a logic simply means that they should not be conflated. It does not mean there can be no formalisation. Nor does it mean that those patterns of behaviour on which judgements of *validity* and *satisfication* diverge must then be excluded from the formalisation, regardless of our intuitions.

true. That would be to misunderstand the nature of the judgements involved. Hare (1967) makes a similar point[20], arguing that disjunction introduction is fine if we consider it to be concerned with the notion of "compliance".While Ross's Paradox might be characterised as a basic logical misunderstanding (Føllesdal & Hilpinen, 1971), it is perhaps more generous to note that in the absence of truth conditions for imperatives, we are free to determine what kinds of judgements are appropriate, whilst having a responsibility to avoid conflating fundamentally different notions.

3.3 Good Samaritan

The Good Samaritan paradox arises in the literature on deontic logic (Prior, 1958). There are various forms of this paradox, and a number of other related problematic cases (e.g. "the Gentle Murderer", Goble, 1991). In imperative form, the paradox can be illustrated by (32).

(32) "*Help an injured man!*"

This is intended to be general injunctions about how to behave when a particular circumstance arises. But in any formalisation of imperatives, we would prefer it if an analysis of (32) did not to force us to conclude that we are under an obligation to injure a man in order to help him. In this case, this is a question as to whether the notion of what is being commanded should distribute to the constituent parts of the putative command. This can be disambiguated somewhat by using the form of words in (33).

(33) "*If a man is injured, help him!*"

Indeed, we might consider it best to act in a way that avoids the injury taking place, cf. (34), although in other cases this might not be relevant (35).[21]

(34) "*If you offend someone, say sorry!*"

(35) "*If you see John, say hello!*"

This suggests there may be some implicit value judgements that are relevant to the interpretation of the "Good Samaritan" paradox and related examples. For example, in the context of cooking (36) does not have the same import as (37).

(36) "*Use a clean knife.*"

(37) "*If a knife is clean, use it.*"

Rather, the meaning might be more like (38a) or (38b).

[20] Hare also appeals to Gricean maxims, but these do not appear to be essential to this argument.

[21] Example (21) of Section 2.5.

(38) a. "*When using a knife, first ensure it is clean.*"

b. "*Use a knife, which should be clean.*"

Whereas, as noted above, it would be surprising for (32) to be interpreted as meaning

(39) "*When helping a man, first ensure he is injured.*"

So, unlike the injured man example of the Good Samaritan paradox (32), we might regard (36) as expressing the expectation that the knife be cleaned in order for it to be used (Fox, 2010).[22]

Focus-related contextual effects and value judgements appear to be playing a role here (as with pseudo-imperatives, Section 2.6). With (36), arguably we are more likely to be using, or expecting to use, a knife. The imperative is then most naturally intepreted as urging us to ensure that the knife is clean. Both using and cleaning a knife are typically morally neutral activities. In constrast, with (32), injuring a man is usually considered a bad thing to do, so the charitable preference is to assume there is no expectation that an act of injury to take place in order to satisfy the command.

While the Good Samartian paradox itself highlights cases where some formalisations may be too strong, another conclusion to be drawn from this is that care needs to be taken to avoid assuming that specific examples — such as (32) — represent genuinely universal behaviour for all expressions of that form. We need to be aware of how moral preferences and other linguistic and non-linguistic aspects might influence and constrain our judgements about what can constitute appropriate satisfaction criteria.

One salient question is then whether a formal treatment of imperatives should account for inferences that appear to involve value judgements and other contextual factors, or whether such a theory can and should remain silent in cases, such as (32) and (36), with conflicting intuitions. These perspectives are not necessarily incompatible with each other: we can formulate a weak core theory that can then be extended by additional rules that take into account value judgements and other pragmatic factors — assuming that value judgements are not an essential core feature of how we reason with imperatives at the most abstract level. What is clear is that the nuances of specific examples, together with pragmatic and contextual factors, can sometimes make it difficult to formulate general rules about the relevant semantic behaviour.

[22] It might be argued that the different entailments arise because (36) is to be interpreted as an *instruction*, rather than a *command* as-such. But it is not hard to conceive of a context in which it is issued as a command (or at least, where there are no independent criteria for determining the difference, other than the patterns of entailment that we seek to explain).

4 Survey of proposals

Here we sketch some existing proposals for the formal analysis of imperatives, after first considering a number of the key issues and criteria that can be used to classify these accounts.

4.1 Issues and Criteria

Broadly speaking, existing approaches to imperatives can be characterised and categorised by a number of general criteria, including: the semantic or pragmatic perspective; the notion of entailment; the ontology; the formal framework; the aspect of imperatives that is under consideration; and the parsimony of the account.

4.1.1 Perspective: Semantic or Pragmatic

A theory might adopt a conventional *semantic* approach, ascribing logical behaviour to expressions in some generic "objective" sense, independent of pragmatic concerns. Or it might model the *pragmatic* meaning of imperatives from the perspective of an agent, who treats commands as potentially providing a guide to plans and action. While the primary focus of these different perspectives may differ, there should be some agreement between them. For example, we might expect there to be a way of interpreting the pragmatic accounts as providing a model of the semantic behaviour.

4.1.2 Entailment Behaviour

Many formal accounts seek to embody some formal notion of entailment. These might include what, in principle, it would take to satisfy a command, and what commands, in principle, subsume other commands. Consideration may be given to the notion of apparently contradictory or contrary commands.

4.1.3 Ontology

Formal accounts may be predicated on certain ontological assumptions such as whether an imperative has underlying, or related, propositional content that characterises a desirable *state of affairs* that satisfies an imperative, or whether the imperative characterises an *action* that would satisfy it. Some even consider whether there is some more fundamental common notion that underlies both propostions and imperatives,[23] as well as the status of *agents* as such. Lappin (1982) argues for a generalisation of the notion of satisfaction conditions, which applies across speech-act types. The chosen ontological

[23] Examples include Hare's (1952) notions of *neustic* and *phrastic*.

perspective may be used to motivate and justify a particular approach to the formal analysis. But if the primary concern is to capture patterns of behaviour, we may question whether all such distinctions are significant.

4.1.4 Framework

Most accounts assume a particular formal framework for their analysis. This might be motivated by ontological considerations and practical questions concerning the intended nature of the analysis. Those accounts that seek to consider how an agent satisfies imperatives adopt an agent-based model that needs to decide how to fulfil the commands it has accepted. These include the *to-do lists* of Piwek (2000) and Portner (2005), where the (goal of) an imperative, if accepted, is added to an agents plan.

Other accounts may vary, but often assume some form of Kripkean possible-worlds model (Carnap, 1947; Kripke, 1963). In such a model, states are modelled by worlds. Worlds are related by one or more accessibility relations. These relations can model different semantics notions, particularly modal operators. Such modal operators include those involved in deontic statements: statements about obligations and permissions (this is perhaps first made explicit by von Wright, 1963). Superficially at least, these seem to be related to imperatives. One difference is that deontic propositions have truth values, while imperatives do not — at least not directly; we might however consider the truth conditions of judgements about an imperative, such as whether it was *commanded* or *satisfied*.[24]

The connection with deontic expressions motives giving imperatives a possible-worlds based modal interpretation (e.g. Kaufmann, 2012). To a first approximation, in such accounts, "*Close the door!*" means "*See to it that the door is closed*", which then fulfils the obligation "*It should be the case that the door is closed (by you)*".

Possible worlds model can capture a notion of action, with an accessibility relation that links worlds to those worlds that would result if the given action were performed (for example, the world that results from performing the action of closing the door). This is relevant if imperatives are interpreted as specifying actions. We can take "*Close the door!*" to specify the action of the addressee closing the door, which is then modelled by an accessibility relation that takes us to worlds in which the door is closed (*module* appropriate felicity conditions).

4.1.5 Issues under investigation

As with other aspects of semantics, different accounts of imperatives also approach the subject matter from different perspectives. For some the key

[24] Furthermore, we might also question whether possible worlds provides an appropriate model for deontic statements (cf. Fox, 2009, for example).

interest is in philosphical questions about the nature of imperatives and their relationship to other notions, such as propositions. Others may be more concerned with how particular linguistic phenomena should be interpreted, and the role of pragmatics. And some will have a more formalist perspective, with an interest in determining the properties of formal systems that model imperatives. These different interests may be associated with varying degrees of rigour when it comes to the formal analysis, and coverage of linguistic data.

4.1.6 Parsimonious Analysis

We may prefer formal accounts of meaning that provide some uniformity in their analysis of common words and structures. For example, we might tend to favour accounts that provide a uniform interpretation of conjunction, disjunction, implication etc. that is independent of the nature of the constituents that are combined. From a methodological perspective, we may need to consider how much emphasis should be placed on providing such uniformity, particularly if it is in conflict with other desiderata. There is also the question of whether such uniformity has to be embodied by parsimonious rules and interpretations within the formal theory, or whether it is sufficient for the rules and interpretations of such words to display a "similar" behaviour at some level of abstraction.[25]

4.1.7 Summary

The above issues and criteria can help characterise the different accounts. Things are not always clear cut however, and there is some overlap and interdependence between these different criteria. Furthermore, in some cases, the precise intended nature of a formal account may not always be immediately apparent. As an example, it may not always be clear whether the objective of a given account is to model a notion of *validity* (entailment relations about what has been commanded) or one of *satisfaction* (entailment relations about the satisfaction conditions of commands) (Section 3.2). This may be due to lack of perspicuity. In some cases such lack of precision may muddy the water when it comes to evaluating the intuitions that inform that formal analysis. In other cases, an account may fail to address a concern that appears crucial for those approaching the subject matter from a different perspective.

4.2 Some existing accounts

Next we consider some existing accounts, including Lewis's modal account (Section 4.2.1), accounts that adopt and adapt some form of modal subordination analysis (Section), those that deal explicitly with actions (Section 4.2.3),

[25] This issue arises even if we only consider propositional sentences: "*and*", and "*or*" can be used to combine expressions of various types — the semantic correlates of sentences, nouns, noun phrases, verbs, verb phrases, adjectives, adverbs.

and dynamic accounts, that consider the impact imperatives have on discourse participants (Section 4.2.4). The aim here is to give examples of the various approaches, rather than an exhaustive survey.

It is worth noting that there is no consistent terminology for naming the distinct approaches. Some consider "to do lists" (e.g. Portner, 2005) to be "property-based" approaches (e.g. Starr, 2013), as the imperatives are represented by properties (Hausser, 1978; Portner, 2005, 2007, 2012), but others may consider them to be a variety of "dynamic" approach, as they deal with the pragmatics of what happens when an imperative is uttered, or accepted (Charlow, 2011).[26] The term "dynamic" could also be applied to a semantic analysis that treats imperatives as specifying required actions as opposed to required outcomes (e.g. Pérez-Ramírez & Fox, 2003). Theories that are more preoccupied by semantic rather than pragmatic issues may be termed "static" (Charlow, 2011), but they have also been referred to as "modal" (e.g. Starr, 2013), as they are typically formulated in terms of possible worlds style modalities. However dynamic accounts (of both flavours) have also been formulated within possible-worlds frameworks.

4.2.1 Lewis's Modal Account

Lewis (1979) models a master-slave relationship. For the slave, there are accessible worlds that capture possible states of how the world might be — the worlds that the slave might bring about through action. Commands are associated with propositions. When the master issues a command this is interpreted as constraining those worlds that might be brought about by the slave to those in which the associated proposition holds. Imperatives thus guide the actions of the slave.

This account relates the meaning of imperatives to modal notions, and underlying propositional content. The modal framework provides an interpretation of connectives between imperatives. If the accessibility relationship is interpreted as modelling actions, the account provides a link between proposition content and actions. Furthermore, if we consider how the possibilities for the slave change as commands are imposed, the approach can also be construed as a "dynamic" account of discourse.

There are some drawbacks to the account. For example, it does not allow us to entertain contradictory or contrary commands, nor does it overtly consider various ways in imperatives may be combined with propositions.

4.2.2 Modal Subordination

There are other accounts that relate imperatives to modals. For example, Kaufmann & Schwager (2011) adopt Kratzer's (1981) analysis of modal

[26] See also Veltman (2011).

subordination (see Kaufmann & Kaufmann, 2015[27]). Essentially, the modal subordination account seeks to (i) incorporate some context-sensitivity in the interpretation of modals, and (ii) acapture different modal notions by distinct "rankings" of worlds. The term *modal base* is used to refer to worlds that are under consideration, and the term *ordering source* is used to refer to rankings of the possibilities given by the modal base with regard to their "relevance", "plausibility" or "desirability" etc. Different ordering sources reflect different modal notions, such as desires, and ethical and legal obligations, for example.

The ordering source can be used to provide a model of imperatives; those worlds that are satisfy an imperative (or a collection of imperatives) will be ranked higher than those that do not. For imperatives at least, we might take the modal base to characterise the "conversational background" of what is known to be the case. If an agent's goal is to satisfy imperatives, then the agent should take actions that leads to a world that is highly ranked according to the relevant ordering, against a background of what is known.

In principle, this allows contradictory imperatives to be modelled, e.g. by using a (partial) ordering for the ranking. Not all commands need be satisfied in the most desirable world(s). It might also provide the machinery for an account of "instructional" uses of imperatives, where the imperatives provide an ordering for a modal base that captures the context in which the instructions are intended to be applied, including modal antecedents (Kratzer, 1981).

(40) *"If you want to get to Harlem, then take the A train."*

If one accepts the view that possible worlds provide the most appropriate account of the modal antecedent, then it may be parsimonious to try to model the imperative consequences in terms of possible worlds. It has however been questioned whether existing possible worlds accounts of modal subordination capture the appropriate behaviour in all cases (Zvolenszky, 2002).

4.2.3 Imperatives and Actions

Imperatives can be thought of as characterising a desirable action, either "directly", in some sense, or by way of the post-conditions of the desired action. The post-conditions of an action are those things that are true as a result of performing that action.

This is related to accounts of the semantics of programming languages — or the specification of computer programs — as with Hoare Logic (Hoare, 1978) or some variant (e.g. Pratt, 1976). In this setting, we can talk about when an action is applicable (its "weakest pre-conditions") and those things that necessarily follow from the action (its "strongest post-conditions"). We can also formulate operations that apply directly to actions, and then model their

[27] Chapter 8 of this volume.

"meaning" by considering how the post-conditions of the constituent actions are to be combined. Such operations might include sequencing, choice, and conditionals. We can then consider modelling imperatives either in terms of the desired post-conditions, or in terms of actions.

Negation is something that does not typically arise in a programming context, so expressing the intent of (41) requires some thought: it seems wrong to say that the imperative is satisfied by an action that is a "*not-biting-the-apple*" action.

(41) "*Don't bite the apple!*"

This is not a demand to engage in an action, or produce a particular outcome. Rather, it is a demand to refrain from an action, and avoid a particular outcome (cf. Section 2.2).[28] One approach is to say that the imperative is satisfied if (in the salient context), the action does not take place, or the outcome does not arise.

A comprehensive analysis along these lines would have to pay attention to the issues such as concurrency and non-determinism. Typically there may be side-effects of some operations. These can be challenging to capture, and present a fundamental problem in the field of Artificial Intelligence (McCarthy & Hayes, 1969).

Possible-worlds accounts may tacitly assume that the accessibility relation between worlds characterises the actions available to an agent. It is appropriate to consider whether this can be made more systematic, with suitable constraints on how actions should be characterised individually and when combined.

Some examples where actions feature overtly in a possible worlds analysis of imperatives include Segerberg (1990), and Lascarides & Asher (2004). Lascarides & Asher essentially build on the work of Segerberg, but are concerned with blocking disjunction introduction (among other things), which they consider to be problematic according to their interpretation of Ross's Paradox (Section 3.2).[29]

4.2.4 Dynamic–Pragmatic Accounts

Instead of considering the satisfaction of imperatives, we can instead study the performative aspects of their meaning. This involves considering the dynamic impact that imperatives have on the participants in a discourse. For example, in Lewis's (1979) account we might consider the change that is brought about in the slaves perception of possibilities on receiving a new

[28] Other issues arise here, such as whether we are concerned with passively avoiding an outcome as opposed to actively preventing it.

[29] Lascarides & Asher (2004) block disjunction introduction by adopting a very weak logic; one that does not support other patterns of entailment that might be considered desirable.

command. Examples of such an approach include those of Charlow (2011), and the to-do lists of Piwek (2000) and Portner (2005).[30]

Independent of any agent-centric perspective, as exemplified by "to-do" lists, the imperatives themselves still require some kind of representation, and interpretation. One representation is that of a property (Hausser, 1978; Portner, 2005, 2007, 2012). We may then consider the meaning of various relationships between such representations, and whether they might be interpreted as providing some form of logic of imperatives. A candidate for consideration is that of "containment"; when one property is (extensionally) *contained* within another. Thus if $R(x)$ implies $Q(x)$, we might say that in some sense R entails Q. If R, Q are intended to be interpreted as imperatives, we can consider how the relationship behaves in the context of more complex imperatives. We can also consider our intuitions about what such an entailment relation might mean.

When presented with a new imperative, an agent may either ignore it or adopt it, in effect consenting to comply with it. To be able to do so, an agent needs to be able to assess whether an imperative is consistent with existing imperatives that have been adopted, and revise how and whether other previously adopted imperatives are to be complied with in light of the new imperative.[31]

Methodologically there are two perspectives that might be adopted here. One is that the reasoning of an agent has to be informed by some independent characteristation of the logical behaviour of imperatives, including free-choice and conditional imperatives. The other is the effect that imperatives have on an agent's plans defines, or at least informs, the formal properties and entailments of imperatives.

Some pragmatic accounts seek to consider the non-command interpretation of imperatives. This may be achieved either by maintaining that there is a single core meaning that has different import in different contexts (see Huntley, 1984; Portner, 2007, 2012; Kaufmann, 2012; Hare, 1952, for example), or by arguing that there is some accommodation effect that renders an indirect speech act more salient (without completely cancelling the primary meaning Charlow, 2011).[32]

Charlow (2011) and others also argues that imperatives can bring an issue to an agent's attention. Even "logically" vacuous imperatives (both commanding and permissive) add information by making an agent "aware" of

[30] See also Veltman (2011).

[31] This update process can be thought of as similar in kind to "belief revision" (see Alchourrón *et al.*, 1985; Fermé & Hansson, 2011; Hansson, 1999, 2003, for example).

[32] Charlow, for example, argues that this kind of defeasibility is required in order to account for certain interpretations of strong permission. Whether an imperative is interpreted as defeasible is also a matter of context, and general reasoning.

an issue, or choice. This is akin to the notion of a Question under Discussion (Ginzburg & Sag, 2000; Cooper & Ginzburg, 2015[33]; Wiśniewski, 2015[34]).[35]

5 A Judgmental Approach

Here we present a non-reductive analysis of imperatives which seeks to avoid some of the dilemmas and paradoxes of Section 3 by being explicit about the nature of the judgements that given rules of inference seek to characterise. By "non-reductive" we mean that we aim to capture patterns of behaviour directly in the form of proof rules, rather than finding, or defining, a mapping from imperatives into some set-theoretic interpretation.

This account is essentially a version of the theory presented in Fox (2012).[36] It aims to illustrate how we can formulate rules about judgements concerning imperatives without being required to consider the "truth" of imperatives (and without resorting to some set-theoretic interpretation). It is not intended to be a complete formalisation; only a selection of rules for imperatives are given. In particular, this presentation restricts itself to a quasi-propositional analysis, without quantifiers, properties or relations. Aspects of the relationship between (judgements about) imperatives and propositions are also left unanalysed.

5.1 In defense of a non-reductive analysis

Much contemporary work in formal semantics uses, or presupposes, a possible worlds analysis. One potential problem of moving directly to such interpretations is that it imposes an ontological reduction. Everything is just a set. This may unintensionally lead to the conflation of distinct notions, and unintended side-effects, dilemmas, and paradoxes due to contingent properties of the chosen model (Fox & Turner, 2012; Fox, 2014).

A case can be made that what is required is a clear formalisation of the intuitive behaviour of imperatives — and actions, if appropriate — independent of any particular model. Without that "gold-standard" it can be hard to evaluate whether a particular interpretation in a given model is appropriate, as the relationship to our intuitions might be inperspicuous. Regardless of the chosen framework, most analyses of imperatives include

[33] Chapter 12 of this volume.

[34] Chapter 9 of this volume.

[35] In the possible-worlds framework, the notion of "awareness of the Question under Discussion" might be modelled through some form of partitioning of the space of possibilities. Awareness of an issue/question is then modelled by the existence of an appropriate partition (cf. Groenendijk & Stokhof, 1984).

[36] In Fox (2012), there are additional illustrations of how the analysis addresses some of the problematic cases given above.

some conceptual intuitions about the data that are being captured, it is just that those intuitions are often contained in the narrative, rather than being made explicit in the formalisation.

5.2 Nature of judgements

We proceed by observing that rules of inference for classical logic are actually rules concerning judgements. When we write a rule of inference such as (42) we are really saying that if a is true and b is true, then $a \wedge b$ is also true.

$$(42)\ \frac{a \quad b}{a \wedge b}$$

We can make this explicit, as in (43).

$$(43)\ \frac{a \text{ True} \quad b \text{ True}}{(a \wedge b) \text{ True}}$$

Furthermore, a, b and $(a \wedge b)$ are assumed to be propositions. We can also make this explicit, as in (44).

$$(44)\ \frac{a \text{ Prop} \quad b \text{ Prop} \quad (a \wedge b) \text{ Prop} \quad a \text{ True} \quad b \text{ True}}{(a \wedge b) \text{ True}}$$

It seems appropriate to infer $(a \wedge b)$ Prop directly from a, b Prop, as with (45a), simplifying the rules for truth (45b).

$$(45)\ \text{a.}\ \frac{a \text{ Prop} \quad b \text{ Prop}}{(a \wedge b) \text{ Prop}}$$

$$\text{b.}\ \frac{a \text{ Prop} \quad b \text{ Prop} \quad a \text{ True} \quad b \text{ True}}{(a \wedge b) \text{ True}}$$

If there is only one kind of judgement, as in conventional presentations of classical logic (that of *being true*) — or more generally, that anything that is true must be a proposition — then it is redundant to make this explicit. Similarly if there is only one kind of semantic object (a proposition), then it would be redundant to make explicit the "side condition" that both a and b are propositions. In most presentations of formal logic, some independent rules of syntax will tell us that $a \wedge b$ is a proposition if a and b are propositions.

Taking all these assumptions together allows us to simplify the rule to (42). But just because the assumptions about the nature of types and judgements can be ellided does not mean they are absent, or unimportant. Here we wish to introduce other kinds of judgements, such as "being an imperative", and "being satisfied". So it is appropriate to make the relevant judgements explicit. Even so, if the theory is set up in way that allows us to proof that only propositions have their truth conditions considered, then the typing assumptions a Prop and b Prop in (45b) could be dropped.

We can go one step further in our elaboration of entailment rules, and introduce a notion of a *context* Γ with respect to which we make the judgements a Prop or a True, illustrated in (46a).

(46) a. $$\frac{\Gamma \vdash a \text{ Prop} \quad \Gamma \vdash b \text{ Prop}}{\Gamma \vdash (a \wedge b) \text{ Prop}}$$

b. $$\frac{\Gamma \vdash a \text{ Prop} \quad \Gamma \vdash b \text{ Prop} \quad \Gamma \vdash a \text{ True} \quad \Gamma \vdash b \text{ True}}{\Gamma \vdash (a \wedge b) \text{ True}}$$

The use of such sequents simplifies the presentation of rules involving (discharged) assumptions. In the case of implication introduction (47b), for example, the context Γ, a can be used to represent the assumption that the antecedent a is true. If the consequent b is true with that assumption, then we can infer that $a \to b$ is true in the original (possibly empty) context Γ.

(47) a. $$\frac{\Gamma \vdash a \text{ Prop} \quad \Gamma \vdash b \text{ Prop}}{\Gamma \vdash (a \to b) \text{ Prop}}$$

b. $$\frac{\Gamma \vdash a \text{ Prop} \quad \Gamma \vdash b \text{ Prop} \quad \Gamma, a \text{ True} \vdash b \text{ True}}{\Gamma \vdash (a \to b) \text{ True}}$$

c. $$\frac{\Gamma \vdash a \text{ Prop} \quad \Gamma \vdash b \text{ Prop} \quad \Gamma \vdash a \to b \text{ True} \quad \Gamma \vdash a \text{ True}}{\Gamma \vdash b \text{ True}}$$

The presence of "a True" in the context for the main premise corresponds to the assumption of the truth of a. Its absence in the context for the conclusion corresponds to the "discharging" of that assumption.

If our notion of proposition is completely independent of the notion of truth, then it might appear strange to incorporate these judgements within the inference rules.[37] But if we wish to make different judgements about different kinds of expressions (such as judgements of *satisfaction* of expressions that are judged to be *imperatives*), then it seems appropriate to include the behaviour of these categorial judgements within a uniform framework.

In effect, what we have described here is fragment of propositional logic formulated in a style similar to Turner's (2009) Typed Predicate Logic (TPL).[38]

[37] Note that syntactic judgements need not be independent of judgements about truth. For example, we can consider a weak characterisation of implication where we can only show $(a \to b)$ is a proposition in the context in which a is true.

[38] The logic presented above can be thought of as the propositional fragment of the base logic C_0 of Turner (2005). Because there are no variables or quantifiers, we do not need to rely on the more general analysis of types that is supported by TPL. Turner (2005) builds a stratified intensional logic — within TPL — on top of the base logic C_0. An alternative approach is taken by Fox & Lappin (2014), which gives a reformulation of Property Theory with Curry Typing (PTCT) in TPL (cf. Lappin, 2015 — Chapter 13 of this volume — Section 3).

We can also give the rules for disjunction (48), as well as propositional inconsistency (Ω) and classical negation (49).[39]

(48) a. $$\frac{\Gamma \vdash a \text{ Prop} \quad \Gamma \vdash b \text{ Prop}}{a \vee b \text{ Prop}}$$

b. $$\frac{\Gamma \vdash a \text{ True} \quad \Gamma \vdash b \text{ Prop}}{\Gamma \vdash a \vee b \text{ True}}$$

c. $$\frac{\Gamma \vdash a \text{ Prop} \quad \Gamma \vdash b \text{ True}}{\Gamma \vdash a \vee b \text{ True}}$$

d. $$\frac{\Gamma, a \text{ True} \vdash c \text{ True} \quad \Gamma, b \text{ True} \vdash c \text{ True} \quad \Gamma \vdash a \vee b \text{ True}}{\Gamma \vdash c \text{ True}}$$

(49) a. $$\frac{}{\Omega \text{ Prop}}$$

b. $$\frac{\Gamma \vdash \bot \quad \Gamma \vdash p \text{ Prop}}{\Gamma \vdash p \text{ True}}$$

c. $\neg a =_{def} a \to \Omega$

d. $$\frac{\Gamma, \neg a \vdash \Omega \text{ True}}{\Gamma \vdash a \text{ True}}$$

A full formalisation of predicate logic should also include appropriate structural rules such as assumption and thinning, as in (50).

(50) a. $$\frac{\Gamma \vdash p \text{ Prop}}{\Gamma, p \text{ True} \vdash p \text{ True}}$$

b. $$\frac{\Gamma \vdash p \text{ True} \quad \Gamma \vdash q \text{ Prop}}{\Gamma, q \text{ True} \vdash p \text{ True}}$$

In cases where the context is fixed, the notation "$\Gamma \vdash$" may be omitted. Similarly, the propositional truth judgement may be omitted, so "$\Gamma \vdash a$ True" might be written as just "a". Assuming appropriate rules for syntax, then type constraints on the terms in the assumptions of a proof rule can be derived rather than stated. As an example, using these abbreviations and eliminating redundant assumptions, the *modus ponens* rule of (47c) can be simplified to the more familiar form given in (51).

(51) $$\frac{a \to b \quad a}{b}$$

The important point is that this rule is now explicitly an abbreviation for particular kinds of judgement (that of truth), for terms that are of an appropriate type (namely, propositions).

[39] An intuitionistic theory results if we remove the last of these rules (49d).

5.3 A framework for imperative judgements

We can build on the logic of the previous section, and introduce a judgement that syntactically characterises quasi-propositional imperatives, and judgements corresponding to the satisfaction, or not, of such imperatives (cf. Fox, 2012). Here, imperatives, propositions, truth and satisfaction are treated on a par, at least within the notation.

5.3.1 Basic judgements

In the atomic judgements of the theory, (52) illustrates the parallels between propositions and imperatives.

(52) *Judgements for propositions and imperatives*

	Propositions	Imperatives
"Syntax"	p Prop	i Imp
"Semantics"	p True	i Satisfied$_\sigma$
	p False	i unSatisfied$_\sigma$

We use a Satisfied$_\sigma$ and a unSatisfied$_\sigma$ to express the judgements that imperative a has been satisfied, or not, by subject σ. For this account, we will keep the subject σ fixed.

Here we are assuming that i Satisfied$_\sigma$ (i unSatisfied$_\sigma$) are judgements on a par with other judgements in TPL, such as proposition, truth, and type-membership. An alternative approach it to consider Satisfied (unSatisfied) to be a predicate that holds of imperatives when they are satisfied (unsatisfied).

5.4 Satisfaction

It is inconsistent to assert that the same imperative had both been satisfied and not satisfied.

(53) $$\frac{a \text{ Satisfied}_\sigma \quad a \text{ unSatisfied}_\sigma}{\bot}$$

Note that in the presentation of the rules given here, we elide the contextual judgement, and write a in place of $\Gamma \vdash a$, and we omit the categorial judgement that a is an imperative.

In order to provide a complete analysis, the meaning of $\bot$ in (53) needs to be formalised. If we interpret Satisfied and unSatisfied as predicates, then it is natural to interpret $\bot$ as the propositional inconsistency Ω, as characterised by (49). If a Satisfied$_\sigma$ and a unSatisfied$_\sigma$ are primitive judgements, then we would need to further elaborate the relationship between judgements about imperatives and judgements about propositions in such cases.

While a $\mathsf{Satisfied}_\sigma$ and a $\mathsf{unSatisfied}_\sigma$ are contrary, they need not be contradictory — so on the propositional interpretation, $\mathsf{unSatisfied}(a)$ does not correspond to $\neg\,\mathsf{Satisfied}(a)$.[40] As a consequence, it is sometimes necessary to formulate rules for both the positive and negative cases explicitly, as in (54). Just as we can consider the truth conditions of a proposition without claiming the proposition is a fact, or has been asserted, we can also consider the satisfaction conditions of imperatives without claiming the imperative has indeed been commanded.

5.4.1 Conjunction

Conjunction is subject to the expected rules for satisfaction. Both conjuncts must be satisfied for their conjunction to be satisfied. The conjunction is judged to be unsatisfied if either conjunct is not satisfied.

(54) *Conjunction*

$$\frac{a\ \mathsf{Imp} \quad b\ \mathsf{Imp}}{(a \wedge b)\ \mathsf{Imp}}$$

a. $$\frac{a\ \mathsf{Satisfied}_\sigma \quad b\ \mathsf{Satisfied}_\sigma}{(a \wedge b)\ \mathsf{Satisfied}_\sigma}$$

b. $$\frac{a\ \mathsf{unSatisfied}_\sigma}{(a \wedge b)\ \mathsf{unSatisfied}_\sigma}$$ c. $$\frac{b\ \mathsf{unSatisfied}_\sigma}{(a \wedge b)\ \mathsf{unSatisfied}_\sigma}$$

d. $$\frac{(a \wedge b)\ \mathsf{Satisfied}_\sigma}{a\ \mathsf{Satisfied}_\sigma}$$ e. $$\frac{(a \wedge b)\ \mathsf{Satisfied}_\sigma}{b\ \mathsf{Satisfied}_\sigma}$$

f. $$\frac{(a \wedge b)\ \mathsf{unSatisfied}_\sigma \quad a\ \mathsf{Satisfied}_\sigma}{b\ \mathsf{unSatisfied}_\sigma}$$

g. $$\frac{(a \wedge b)\ \mathsf{unSatisfied}_\sigma \quad b\ \mathsf{Satisfied}_\sigma}{a\ \mathsf{unSatisfied}_\sigma}$$

Sequential "*and then*" conjunction is considered in Section 5.6.

5.4.2 Free Choice

The core behaviour of free-choice disjunction is given by (55), where the disjunction is satisfied if either one of the disjunctions is satisfied (and the other is not), and is not satisfied if both are not satisfied.

(55) *Basic Free Choice*

$$\frac{a\ \mathsf{Imp} \quad b\ \mathsf{Imp}}{(a \vee_{FC} b)\ \mathsf{Imp}}$$

[40] Alternatively, if we wished to equate $\mathsf{unSatisfied}(a)$ with $\neg\,\mathsf{Satisfied}(a)$ we would need to consider allowing truth-value gaps in the basic propositional logic.

15905 a. $\dfrac{a\ \mathsf{Satisfied}_\sigma \quad b\ \mathsf{unSatisfied}_\sigma}{(a \vee_{FC} b)\ \mathsf{Satisfied}_\sigma}$ b. $\dfrac{a\ \mathsf{unSatisfied}_\sigma \quad b\ \mathsf{Satisfied}_\sigma}{(a \vee_{FC} b)\ \mathsf{Satisfied}_\sigma}$

15906 c. $\dfrac{(a \vee_{FC} b)\ \mathsf{Commanded}_\alpha \quad a\ \mathsf{unSatisfied}_\sigma \quad b\ \mathsf{unSatisfied}_\sigma}{(a \vee_{FC} b)\ \mathsf{unSatisfied}_\sigma}$

15907 d. $\dfrac{(a \vee_{FC} b)\ \mathsf{Satisfied}_\sigma \quad b\ \mathsf{unSatisfied}_\sigma}{a\ \mathsf{Satisfied}_\sigma}$

15908 e. $\dfrac{(a \vee_{FC} b)\ \mathsf{Satisfied}_\sigma \quad a\ \mathsf{unSatisfied}_\sigma}{b\ \mathsf{Satisfied}_\sigma}$

15909 f. $\dfrac{(a \vee_{FC} b)\ \mathsf{unSatisfied}_\sigma}{a\ \mathsf{unSatisfied}_\sigma}$ g. $\dfrac{(a \vee_{FC} b)\ \mathsf{unSatisfied}_\sigma}{b\ \mathsf{unSatisfied}_\sigma}$

15910 We can strengthen this core behaviour by adopting an exclusive interpretation of free-choice, where satisfying both disjuncts leads to an explicit failure to satisfy the free-choice imperative. This captures the intuition that both *going to the beach* and *playing in the park* would not satisfy the exclusive interpretation of (12) "*Go to the beach or play in the park!*". Alternatively, we can formulate rules for an inclusive interpretation (see Fox, 2012).

15916 5.4.3 Negation

15917 The judgements of $a\ \mathsf{Satisfied}_\sigma$ and $a\ \mathsf{unSatisfied}_\sigma$ are exclusive.

15918 (56) *Negation*

15919 $$\frac{a\ \mathsf{Imp}}{(\neg a)\ \mathsf{Imp}}$$

15920 a. $\dfrac{a\ \mathsf{Satisfied}_\sigma}{(\neg a)\ \mathsf{unSatisfied}_\sigma}$ b. $\dfrac{a\ \mathsf{unSatisfied}_\sigma}{(\neg a)\ \mathsf{Satisfied}_\sigma}$

15921 c. $\dfrac{(\neg a)\ \mathsf{Satisfied}_\sigma}{a\ \mathsf{unSatisfied}_\sigma}$ d. $\dfrac{(\neg a)\ \mathsf{unSatisfied}_\sigma}{a\ \mathsf{Satisfied}_\sigma}$

15922 With these rules, the judgements of being satisfied or unsatisfied are not
15923 exhaustive — a may be neither satisfied or unsatisfied. This potential "limbo"
15924 may be appropriate if an imperative is not *yet* satisfied, but is still potentially
15925 satisfiable.

15926 Note that (53) already rules out the possibility that an imperative is both
15927 satisfied and unsatisfied.

15928 5.4.4 Conditionals

15929 Initially we give a very weak analysis of conditional imperatives. As con-
15930 ditionals have propositional content, the rules that govern them involve
15931 judgements of truth, in addition to satisfaction.

(57) *Conditionals*

$$\frac{p\ \mathsf{Prop} \quad a\ \mathsf{Imp}}{(p \rightarrow a)\ \mathsf{Imp}}$$

a. $\dfrac{p\ \mathsf{True} \quad a\ \mathsf{Satisfied}_\sigma}{(p \rightarrow a)\ \mathsf{Satisfied}_\sigma}$ b. $\dfrac{p\ \mathsf{True} \quad a\ \mathsf{unSatisfied}_\sigma}{(p \rightarrow a)\ \mathsf{unSatisfied}_\sigma}$

c. $\dfrac{p\ \mathsf{True} \quad (p \rightarrow a)\ \mathsf{Satisfied}_\sigma}{a\ \mathsf{Satisfied}_\sigma}$ d. $\dfrac{p\ \mathsf{True} \quad (p \rightarrow a)\ \mathsf{unSatisfied}_\sigma}{a\ \mathsf{unSatisfied}_\sigma}$

We could strengthen this to allow an inference that the conditional is satisfied when the antecedent is false (Section 2.5; also see Fox, 2012).

5.4.5 Pseudo-Or

Disjunctive pseudo-imperatives have the same satisfaction criteria as their imperative constituent.

(58) *Pseudo-Or*

$$\frac{a\ \mathsf{Imp} \quad p\ \mathsf{Prop}}{(a \vee p)\ \mathsf{Imp}}$$

a. $\dfrac{a\ \mathsf{Satisfied}_\sigma}{(a \vee p)\ \mathsf{Satisfied}_\sigma}$ b. $\dfrac{a\ \mathsf{unSatisfied}_\sigma}{(a \vee p)\ \mathsf{unSatisfied}_\sigma}$

c. $\dfrac{(a \vee p)\ \mathsf{Satisfied}_\sigma}{a\ \mathsf{Satisfied}_\sigma}$ d. $\dfrac{(a \vee p)\ \mathsf{unSatisfied}_\sigma}{a\ \mathsf{unSatisfied}_\sigma}$

5.5 Truth

We need to consider the judgements of truth, even for imperatives: such judgements are required for the analysis of pseudo-imperatives and conditional imperatives.[41]

(59) *Standard Connectives:* As for classical logic (as exemplified in Section 5.2).

(60) *Pseudo-And*

$$\frac{a\ \mathsf{Imp} \quad p\ \mathsf{Prop}}{a \wedge p\ \mathsf{Prop}}$$

a. $\dfrac{(a \wedge p)\ \mathsf{True} \quad a\ \mathsf{Satisfied}_\sigma}{p\ \mathsf{True}}$

b. $\dfrac{a\ \mathsf{Satisfied}_\sigma \quad p\ \mathsf{True}}{(a \wedge p)\ \mathsf{True}}$ c. $\dfrac{a\ \mathsf{Satisfied}_\sigma \quad p\ \mathsf{False}}{(a \wedge p)\ \mathsf{False}}$

[41] Classical interpretations of conditional and disjunctive propositions are given here, although they do not necessarily provide the most appropriate foundation for the analysis of phenomena such as counter-factuals and free-choice disjunction.

(61) *Pseudo-Or*

$$\frac{a\ \mathsf{Imp} \quad p\ \mathsf{Prop}}{a \vee p\ \mathsf{Prop}}$$

a. $$\frac{(a \vee p)\ \mathsf{True} \quad a\ \mathsf{unSatisfied}_\sigma}{p\ \mathsf{True}}$$

b. $$\frac{p\ \mathsf{True}}{(a \vee p)\ \mathsf{True}}$$ c. $$\frac{a\ \mathsf{Satisfied}_\sigma}{(a \vee p)\ \mathsf{True}}$$

5.6 Sequential Commands

Sequential commands (Segerberg, 1990) were alluded to in Section 2.3. Some rules that are relevant for formalising the behaviour of imperatives of the form "*Do a and then do b!*" are given in (62).

(62) $$\frac{a\ \mathsf{Imp} \quad b\ \mathsf{Imp}}{a\ \&\ {}_T b\ \mathsf{Imp}}$$

a. *Initial Coherence*

$$\frac{(a\ \&\ {}_T b)\ \mathsf{Commanded}_\alpha \quad \neg a\ \mathsf{Commanded}_\alpha}{\alpha\ \mathsf{Incoherent}}$$

b. *Consequent Coherence (Strong)*

$$\frac{(a\ \&\ {}_T b)\ \mathsf{Commanded}_\alpha \quad \neg b\ \mathsf{Commanded}_\alpha}{\alpha\ \mathsf{Incoherent}}$$

c. *Consequent Coherence (Weak)*

$$\frac{a\ \mathsf{Satisfied}_\sigma \quad (a\ \&\ {}_T b)\ \mathsf{Commanded}_\alpha \quad \neg b\ \mathsf{Commanded}_\alpha}{\alpha\ \mathsf{Incoherent}}$$

d. *Satisfaction*

i. $$\frac{(a\ \&\ {}_T b)\ \mathsf{Satisfied}_\sigma}{a\ \mathsf{Satisfied}_\sigma}$$ ii. $$\frac{(a\ \&\ {}_T b)\ \mathsf{Satisfied}_\sigma}{b\ \mathsf{Satisfied}_\sigma}$$

iii. $$\frac{a\ \mathsf{Satisfied}_\sigma\ \textsc{and then}\ b\ \mathsf{Satisfied}_\sigma}{(a\ \&\ {}_T b)\ \mathsf{Satisfied}_\sigma}$$

This assumes some appropriate interpretation of "AND THEN" in the language of judgements.

A more refined approach could be to add a temporal dimension to systems of commands and their satisfaction — perhaps within the framework of Fernando (2015)[42] — thus providing the means to formalise dynamic command systems.

[42] Chapter 7 of this volume.

5.7 A comment on the formalisation

The objective here is not to give a comprehensive analysis of all patterns of behaviour, or capture all the various contextual, pragmatic, and linguistic factors that constrain the salient interperations and rules of entailment for imperatives. Rather, the aim is to show how we can use the notion of an explicit judgement to present a formal analysis that avoids confusion about what kinds of judgements are at stake, and allows us to consider semantic insights, and the impact of various factors in the interpretation, independent of any particular reductive analysis.

Other rules can be formulated, and various contextual effects might be modelled to constrain which rules are applicable. We can extend the analysis to include consideration of the question of whether a collection of imperatives is coherent or not, as determined by whether it is logically possible for all the imperatives to be satisfied simultaneously, without contradiction (Fox, 2012).

Furthermore, we can model the idea that some form of *transgression* arises in the event that something has been commanded that has not been satisfied (Anderson, 1958; Fox, 2009; Wyner, 2008). Such a transgression can be specific to the imperatives in question, thus avoiding some of the problems of a generic transgression.

One key area that is left unformalised here is the relationship between an imperative being satisfied (unsatisfied) and some propositional correlate (and its logical consequences) being true (or false). If "*Close the door!*" is satisfied, then at some point that means the door is closed. One approach that could be adopted formalise something akin to Hare's (1952) notions of *neustic* and *phrastic*. In relation to this, to the language of imperatives (and propositions) presented here would need to be generalised beyond the (quasi) propositional level to include quantification, properties and relations.

The same framework could be used to deal with other semantic and pragmatic phenomenon, including the interpretation and logical behaviours of speech acts, and satisfaction acts. What is given is essentially an abstract characterisation of just one aspect of the formal interpretation of imperatives.

5.8 Models for Imperative Theories

Here we give no model of the proposed rules. On the account being advocated here, the notion of a model provides one means of checking that any proposed system of rules has a consistent interpretation. It does not necessarily play any role in capturing the intended interpretation of the formalism, or in understanding the subject matter of the theory. Clearly once a comprehensive analysis is formulated, or extensions are proposed, it is appropriate to ensure that the final system is coherent. Constructing a model is one way in which this can be achieved.

In the case of the framework proposed here, one approach would be to model the propositions P and imperatives I, and the operators that can

combine them, as classes of terms. Closure rules would then need to be given to reflect the syntax of P and I (so that, for example, the representation of a conjunction of imperatives was also in the class representing imperatives). Further classes and closure rules could then be added to model the judgements.

If appropriately constructed, the interpretation and the closure rules would demonstrate that there is a consistent interpretation of the proposed collection of inference rules. In effect this would be a generalisation of a set-theoretic model for propositional logic.

5.9 Summary

The formalisation sketched above addresses a number of concerns about the logic of imperatives. By making it explicit that the entailments are generally concerned with *judgements* about expressions rather than just *truth* within a logic, we deal with Jørgensen's dilemma (Section 3.1). By also making explicit exactly which judgements are in question, we avoid Ross's Paradox (Section 3.2). Within such a framework of judgements, we can give an account of conditional imperatives. We can also allow expressions to have both propositional and imperatives interpretations, as with the pseudo-imperatives (Section 2.6), with truth conditions and satisfaction conditions.

Some things that are not taken up include instructional uses of imperatives (cf. 36 in Section 3.3), and the value judgements that appear to be required to distinguish threats from promises (Section 2.6), and a comprehensive analysis of examples such as the Good Samaritan (Section 3.3). Instead, we have captured something like Huntley's (1984) notion of a core meaning for imperatives (Section 1).

Clearly more work is required to include pragmatic effects. The hope is that these can be expressed in a general way that can build on these core interpretations, within the same language of judgements.

6 Conclusions

We have touched on some of the issues that have to be considered by a semantic theory of imperatives, as well as some questions concerning the pragmatics of imperatives. While not intending to offer a definitive account, this chapter advocates a proof-theoretic methodology for formulating intuitions about imperatives.

The formalisation offered is not intended to capture *the* rules that govern imperatives, but instead it suggests how we might go about formalising our intuitions in a way that allows us to reflect more carefully on whether they are coherent, and can be given a consistent interpretation. It also enables us to identify where they make problematic predictions. This then provides grounds for amending or enriching the ontological notions required.

Adopting this axiomatic (proof-theoretic) approach may also help us to see whether formal problems are due to shortcomings in the analysis, as opposed to artifacts of a reduction to some model, such as possible worlds.

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List of Index Terms