A New Dimension of Imperative Logic

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Abstract. A full-fledged theory of imperative logic is found in the writings of Peter Vranas. An unconditional prescription is an ordered pair with satisfaction as the first member, and violation as the second member. A conditional prescription is a set of mutually exclusive and jointly exhaustive three values – satisfaction, violation and avoidance. An argument is valid, only if, necessarily, if its premises merit endorsement, then its conclusion merits endorsement. The phrase "meriting endorsement" is interpreted as 'supported by a proposition/prescription'. Among different schools of Indian philosophy, the Mīmāṁsā system offers an analysis of imperative sentences, where actions, guided by instructions, play an important role. *Vidhi* or normal injunctive statements is studied intensely and recently arguments involving '*vidhi'* has been used in special education and in the domain of Robotics. Imperative, discussed in this sense, is however not the only type of imperatives, it is only one variety of different kinds of imperative. Such varieties are very well recognized by Indian grammarians and philosophers as well as by western thinkers. These imperatives also deserve the status of the premise or the conclusion of an inference. The present paper focuses upon unveiling such varieties of imperative sentences from both perspectives—Indian and Western.

Keywords: Imperative · Advice · Prayer · Acceptance-table · Validity

Conversation – verbal or written – is a main source of communication. A necessary condition of proper communication is the use of reason or argument. So,it is language, which plays a vital role even in the field of logic. As argument is primarily inferential, a study of the nature of sentences constituting such inferences is required. Towards the end of the 20th century, attention has been given to inferences constituted of sentences, which are not declarative in nature. Instead of reductionism – imperative sentences reduced to declarative sentences – the standpoint of non-reductionism has been successfully developed in the West, though it was already present in some schools of Indian tradition.

1 Logic of Imperatives - Western

A full-fledged theory of imperative logic is found in the writings of Peter B. M. Vranas [1–4]. An imperative sentence, occurring either as premise or as conclusion of an inference expresses a prescription, which is neither true nor false. Vranas introduced three values to study prescriptions. An unconditional prescription, however, is an ordered pair with satisfaction as the first member, and violation as the second member –

$$I = <s, v>$$

A conditional prescription is a set of three values – viz., satisfaction, violation and avoidance, which are mutually exclusive and jointly exhaustive. The condition is treated as context, which is the union of the set of satisfaction and that of violation. A conditional imperative "If you trust him, help him" is

i)   satisfied if you trust him and help him,
ii)   violated if you trust him but don't help him,
iii) avoided if you don't trust him, no matter whether you help him or not.

In the vocabulary of the system formulated by Vranas,
Conditional prescription = $<s, v, a>$ or $<<s, v>, a>$

context = (s ʋ v)

avoidance = ~ (s ʋ v)

We can represent the unconditional prescription using the identical symbolic form, instead of limiting it to an ordered pair of s and v i.e., $<s, v>$.
Let me prove the case with illustrations of all connectives:

Negation
Unconditional prescription– "help her".
negation– "Don't help her"

you don't help her (satisfied),

you help her (violated),

you remain indifferent (avoided).

It is to be noted that this state of indifference is not the same as being unmindfully indifferent to a passer-by, who may need some help. I may be indifferent to her, because I am mentally otherwise engaged at that moment. But the present case of indifference is a state of conscious indifference, even after hearing somebody giving me the instruction "help her".

Conjunction
Unconditional prescription: "Trust me and touch me".
You trust me and you touch me (satisfied),
you do not trust me or you do not touch me or both (violated)
[i.e., you neither trust me, nor touch me],
you are simply present as a stranger, who denies all
acquaintance (avoided).
In the case of avoidance, the presence of the person for whom the imperative is uttered is important. This presence is accompanied by an awareness of the conjunctive imperative without having a deliberation to violate it. So it is not to be understood as violation, though it appears to be so. In fact, in understanding an imperative statement, it is not enough to depend only on physical observation of the worldly affairs. Unlike descriptive or declarative proposition, it connects us with the total attitude of the agent – utterer or hearer – of the imperative statement.

Disjunction

Unconditional prescription - "Write to me or talk to me".

You write to me or you talk to me (satisfied),

you do not write to me and you do not talk to me (violated),

you are simply present as a stranger, who denies all

acquaintance (avoided).

Here, the case is the same as found in the case of conjunction. The illustrations offered, if found cogent, show nevertheless the distinction between imperative logic and standard two-valued logic in a sharper way. This is the status of unconditional prescriptions.

The definition of validity is technically stated in the following way:

D(2) An argument is valid, only if, necessarily, if its premises merit endorsement, then its conclusion merits endorsement. The phrase "meriting endorsement" is interpreted as 'supported by a proposition/prescription'. This interpretation can be made clear if we consider the original definition of validity mentioned by Vranas in a comparatively naive way:

An argument is valid exactly if, necessarily, every fact that sustains every premise of the argument also sustains the conclusion of the argument. Since a conditional imperative premise normally has a proposition as antecedent and prescription as a consequence, "meriting endorsement" in the sense of "being sustained by a fact" is understood in the following way:

a)   guaranteed by some fact (in case of a proposition),
b)   supported by some reason (in case of a prescription).

Now the term 'reason' covers different cases of application of reason, i.e. reasons for acting, feeling, believing etc. It implies that an imperative does not pertain to direct action only, it also involves feeling, believing and other attitudes which precede an action.

2   Logic of Imperatives - Indian

Among different schools of Indian philosophy, the Mīmāṁsā system, which provides the rules for interpreting Vedic sentences, offers an analysis of imperative sentences; where actions, guided by instructions, play an important role [5]. There are five types of Vedic sentences, of which only the first is in the imperative form:

 (i)   *Vidhi* or normal injunctive statements (dictating one to perform actions)
(ii)   *Mantra* or hymns (recited during sacrifice)
(iii)   *Nāmadheya* or titles of the sacrifice (account of names of sacrifices)
(iv)   *Niṣedha* or prohibitions (prohibiting the performance of an action)
 (v)   *Arthavāda* or corroborative statements (encouraging performance of actions that are enjoined by *vidhi,* and discouraging performance of actions that are prohibited by *niṣedha*).

The distinction between narratives and injunctions is distinctly made [6]. *Vidhi* is classified into five types:

1. Principal injunction (*Utpattividhi*): Injunction enjoining an act that is either principal, or auxiliary, or a procedure.
2. Injunction enjoining auxiliaries (*Guṇavidhi).*
3. Restrictive injunction (*Niyamavidhi*): Injunctions making one method mandatory, out of two or more methods which are available for reaching a goal.
4. Exclusive injunction (*Parisaṅkhyāvidhi)*: Injunctions excluding one item from a number of items which are simultaneously present.
5. Injunction setting forth result (*Phalavidhi)*: Injunctions that indicate results. For example, "One who desires heaven should perform fire-sacrifice".

The Mīmāṁsakas are more concerned about the explanation of *Vidhivākya*-s (imperatives/prescriptions) in the context of ritualistic sacrifice [7]. So the imperative here is authoritative (*prāmāṇyavākya)* in nature. Unlike the western thought, the Indian thinkers opine that an imperative points both to the person to whom the command is given, and to the action that is supposed to be produced by that command. The Bhāṭṭas consider *bhāvanā* (not to be confused with motivation) as the meaning of the statement. It is something that is conducive to the execution of the expected result. The causative verbal noun *bhāvanā* ("causing to be") was introduced into Mīmāṁsā hermeneutics by Śabara [8]. The term is a causative verbal noun which denotes the undertaking of an activity by a person. According to the Prābhākaras, what is to be done (ought) is prescribed by the Vedic injunctions. This 'ought' is something, such that it cannot be known (Apūrva) by any other means of knowledge [9].

The inspiration derived from the Vedic sacrifices (MIRA formalism) has been aptly used by in special education [10], and in the domain of Robotics [11], as shown by Bama Srinivasan and Ranjini Parthasarathi. In this interpretation, imperatives are treated either as conditional or as unconditional. From another perspective, imperatives may be affirmative or negative. Conditional imperatives often speak of goal, reason, or sequence of actions. Imperatives are expressed sometimes in terms of binary connectives, viz., conjunction, mutually exclusive disjunction, implication, etc.

Let i and m be two imperatives

(a) Conjunction: $i \wedge m$ [Do i and do m]
(b) Disjunction: $i \vee m$ [Do i or do m]
(c) Sequence of action: $i => im$ [Do i, then do m]
(d) Ground for performing an action: $Ṭ \to r \varphi$ [If Ṭ then φ]
    (where Ṭ is a ground for an action to be performed indicated by the imperative φ)
(e) Imperative regarding actions to be performed for achieving a goal: $\varphi \to p \theta$ [Do φ in order to do θ]
    (if φ is an imperative indicating an action, such that when performed, it leads to the goal θ)

Three values of imperatives have been suggested, viz., "S" (satisfaction), "V" (violation), and "Gn" (absence of goal). Let us take an example to illustrate the ascription of values:

Take a pen to write.

S is the evaluation if the intention to reach the goal of writing is present, and the action is performed.

V is the value ascribed to the imperative A, if the said intention is present, and the action is not performed.

Gn is the ascribed value, if the intention is not present, irrespective of the performance of the action.

This system has introduced the third value "absence of goal" (which is the same as absence of intention to reach the goal) in place of "avoidance" introduced by Vranas, and, unlike Vranas, it enjoys the facility of applying three values both to the unconditional and conditional imperative.

The syntax consists of a language of imperatives, which includes a set of imperatives I such that $\{i_1, i_2, \ldots i_n\}$, a set of reasons R $\{r_1, r_2, \ldots r_n\}$, and a set of purpose in terms of goals P $\{p_1, p_2, \ldots p_n\}$. There are formation rules and several deduction rules including introduction and elimination rules in respect of the connectives. The semantics has been developed in respect of imperatives enjoining goals ($\varphi \rightarrow p\theta$), reason ($\tau \rightarrow r\varphi$), and temporal actions ($i_1 \rightarrow i\, i_2$), respectively. By repeated application of deduction rules, a conclusion ψ can be deduced from a set of premises $\varphi_1, \varphi_2, \ldots \varphi_n$. It is shown in the following way:

$$\varphi_1, \varphi_2, \ldots \varphi_n \vdash \psi$$

Soundness and completeness of this system have been proved to show that any imperative provable by MIRA formalism (2014) is also satisfied during the performance of action. In proving soundness, it attempts to show that the deduction of a conclusion from a set of premises is valid in terms of the values held by the premises and conclusion.

Soundness Theorem 1.
Let $\varphi_1, \varphi_2, \ldots \varphi_n$ and ψ be imperative or propositional formulas. If $\varphi_1, \varphi_2, \ldots \varphi_n \vdash \psi$, then $\varphi_1, \varphi_2, \ldots \varphi_n \models \psi$ Holds.

The proof for soundness includes one inductive step and proofs for each of the deduction rules.

Completeness Theorem 2.
Let $\varphi_1, \varphi_2, \ldots \varphi_n$ and ψ be imperative or propositional formulas. If $\varphi_1, \varphi_2, \ldots \varphi_n \models \psi$, then the property of a plan $\varphi_1, \varphi_2, \ldots \varphi_n \vdash \psi$ holds.

The proof for completeness is constructed on the basis of induction and being supported by action performance tables and deduction rules.

Imperative, as discussed both in Indian and Western context, is however not the only type of imperatives, it is only one variety of different kinds of imperatives. Such varieties are very well recognized by Indian grammarians and philosophers as well as by western thinkers. They also deserve the status of premise or conclusion of inference. The present paper focuses upon unveiling such varieties of imperative sentences from both perspectives.

3 Interpretation of Imperatives - Indian

In the texts of Sanskrit grammar and of different schools of Indian Philosophy, an in-depth analysis of (i) imperatives (sentences employed for strongly encouraging someone for doing something) and of (ii) prohibitions (for preventing someone from doing something) is found. Such sentences occur profusely in Sanskrit grammar (*Aṣṭādhyāyī* of Pāṇini), and (i) the Vedic texts (*Brāhmaṇa* and *Upaniṣad*), (ii) Smṛti texts (*Manusaṃhitā*, *Yājñavalkya Saṃhitā* etc.,) (iii) Epics (*Rāmāyana*, *Mahābhārata*, *Bhagavadgītā*), *Purāṇa*-s (*Viṣṇupurāṇa*, *Skandapurāṇa*, *Bhagavatapurāṇa* etc.) and didactic literature (*Hitopadeśa*, *Pañcatantra*, *Cāṇakyaśloka* etc.)

Sanskrit grammar provides us with some rules governing the formation of injunctions and prohibitions. Like German, Sanskrit is an inflected language, where word-order is free, barring a few exceptions. Sentences are collections of words that are characterized by (i) mutual expectancy (*ākāṅkṣā*) (ii) contiguity (*āsatti*). (iii) compatibility (*yogyatā*) and (iv) import (*tātparya*). Words again are primarily of two types – nouns and verbs. Without entering into much details of grammar, we can focus upon what is relevant for the present paper. Imperative sentences are usually formed in three ways:

 (i)   by employing the verb in the imperative mood, e.g., *'satyaṃ vada'*(i.e., 'speak the truth' where the termination '*loṭ*' has been used)
 (ii) by employing the verb in the potential mood, e.g., *'svargakāmo yajeta'* (one who desires to attain heaven should perform sacrifice, where the termination *lin* has been used),
 (iii) by using, instead of such words, nouns that have been formed by adding to the verbs concerned, any one of the verbal suffixes known as '*kṛtyapralyaya*', that are used for forming potential/future participles; e.g., '*satataṃ kāryaṃ karma samācara*' [i.e., 'always perform the obligatory duty', where the work ' *kārya'* has been formed by the addition of the suffix '*ṇyat',* which is a *'kṛtyapratyaya'*].

Moreover, from rule no. 3/4/7 (liṅarthe leṭ), and the comment on it by Bhaṭṭojī Dīkṣita in his '*Siddhāntakaumudī*' [12], it can be known that in Vedic texts, instead of 'liṅ' or 'loṭ' another verbal ending called 'leṭ', which expresses subjunctive mood, may be used for forming imperative sentences. An example of this is '*agnihotraṃ juhoti*' (i.e., 'one should perform the agnihotra sacrifice') [13], where the verbal ending 'leṭ' has been used.

We now proceed to discuss the semantic aspects of them, as found by grammar, as well as rules of interpretation. Some consideration of pragmatics will also be undertaken, by considering

 (i)   the specific context in which a certain imperative or prohibition is being employed;
 (ii) the manner in which an imperative can urge the listener/reader to perform the recommended action, and
 (iii) the manner in which a prohibition makes the listener/reader desist from performing the prohibited action.

The rule no 3/3/161 of *Aṣṭādhyāyī* [14] (*vidhi-nimantraṇāmantranādhīṣṭa-sampraśna-prārthaneṣu liṅ*) means that the verbal termination called 'liṅ' can be employed for forming sentences that can express

(i)   *vidhi* or *ājñā*, i.e., command,(e.g. a master asking his servant to close the door),
(ii) *nimantraṇā*, i.e., an invitation, (such that it is obligatory for the invited person to abide by it),
(iii) *āmantrana*, i.e., an invitation, (such that the invited person can either accept or decline it),
(iv) *adhīṣṭa*, i.e., an entreaty or supplication, where someone is respectfully requested to perform a duty or honour (e.g., investing a boy with the sacred thread)
(v)   *sampraśna*, i.e., a polite question about what is to be done in the near future (e.g., a student asking the teacher – should I now read grammar?)
(vi) *prārthanā*, i.e., prayer where some request is made with the expectation of receiving some favour (a student saying " this is my prayer that I be permitted to study grammar")

Besides*,* the rule no. 3/3/162 (*loṭ ca*) means that the termination *loṭ,* which usually expresses permission (*anujñā/anumiti*), can also be used for expressing *vidhi* etc., that are expressed by *liṅ*. All these cases are exhortations *(preraṇā*-s), the aim of which is to produce in the listener/reader some activity that was not so far present in him. Pāṇini was interested in pointing out the varieties of exhortations, which is very relevant for the present paper.

It is not, however, difficult to distinguish between these forms of exhortation. In all such cases, X tells Y to perform the action A; but the status of X and Y is not the same on all these cases. In the case of command, the speaker is superior as compared to the listener. The situation is not the same in the case of invitation – X, who is inviting Y, may or may not be superior to Y. In the case of *adhīṣṭa*, or respectful entreaty, X and Y may be of the same stature, or Y may be superior to X. In the case of questioning and prayer, Y is definitely superior as compared to X. In the case of command, invitation, entreaty and prayer, prior to the utterances of the concerned sentences by the speaker (i.e., X), there is no desire in the listener (i.e., Y) for performing the act A that Y is asked to perform. The very purpose of uttering such imperatives is to produce in Y such a desire; which, in its turn, would lead to the performance of A by Y. In the case of permission [e.g., '*yathecchasi tathā kuru'*, i.e., 'do as you like', where the termination '*loṭ*' has been used], even prior to the utterance of the sentence concerned by X, the desire for performing the act A is already present in Y; even though the latter cannot perform A, unless the required permission is given by the former. Thus the utterance of permission, so to say, merely removes the preventive factor (*pratibandhaka*), due to which the performance of the action A had not taken place previously – it is unlike order etc. that positively produces some activity in the person to whom they are addressed.

Here we may note another difference of opinion regarding the nature of injunctions and prohibitions that are found in scriptures like *Veda*-s and *Smṛti*-s. According to Mammaṭa [15], the author of *Kāvyaprakāśa*, scriptures are '*prabhusammita*', i.e., entities that act as taskmasters, since scriptural injunctions and prohibitions are inviolable commands that are carried out by us out of our reverence for the scriptures. But this view

does not seem to be admitted by Jaimini [16], the author of *Mīmāṃsāsūtra*-s, and Gautama [17], the author of *Nyāyasūtra*-s, both of whom have employed the word '*upadeśa*' (i.e. advice) while defining verbal testimony (*śabdapramāṇa*). Since the scriptures are prime examples of verbal testimony for both these authors, according to both of them, the scriptural injunctions and prohibitions must also be regarded as advices, and not as commands.

A question may arise: what is the basic difference between a command and an advice? The answer has been given in clear terms by Maṇḍana Miśra [18], a follower of the Bhāṭṭa school of Mīmāṃsā. In his *Vidhiviveka*, he has explained the nature of advice, and in the sequel, also distinguished it from command, prayer and permission. In the cases of all these sentences, some person (say X) utters a sentence S, that prompts another person (say Y) to perform some action (say A). According to Maṇḍana Miśra, when S is either a command or a prayer, the performance of A directly leads to some purpose of X being served; but the interest of Y is not taken into account by X. But in the case of advice, the situation is just the opposite; since in this case, performance of A directly serves some purpose of Y, and not of X. In some instances, this may be true of permission as well, but in such cases, Y is already motivated to perform A, even before Y has been granted the required permission. Advice, however, prompts a person to do something; and before listening to this advice, that person was not already so motivated.

What is implied by this discussion is that imperative logic, so far developed, cannot cover all the kinds of imperatives.

4   Interpretation of imperatives - Western

The study of imperatives, which has been conducted since several decades is regarded as interesting because of two reasons [19]:

i)   New theoretical tools are needed to understand the semantically encoded linguistic meaning of an imperative.
ii) In a natural language, the necessity of retaining truth-condition may be reviewed in respect of imperative sentences.

The primary point to note in this study is that imperatives don't determine a function from world to truth-values. In Castañeda [20], imperatives are studied as part of practical thinking, as distinct from theoretical thinking. Practical thinking deals with duties and the conflict between duties. It tends to guide other people regarding their conduct and decision to act. 'Practitions' are the basic units of practical thinking, which is of two kinds—prescriptions and intentions. According to Castañeda, though the prescription i.e., the thought-content of order, command, request, suggestion, or advice is the common structure of a relation between an agent and his action, the mandates are different in each case. An intention is the first person correspondent to a prescription.

An imperative is a sentence of the form '!p'. In case of a conditional sentence, the antecedent and the consequent cannot both be prescriptions. It is customary to treat the whole compound sentence as an imperative sentence. In order to understand the significance of different varieties of imperatives separately, it is necessary to refer to the

speech-act theory of Austin and Searle. A speech-act is a combination of three acts- an utterance-act a locutionary-act and an illocutionary-act. In Austin, the locutionary act is the act of expressing a certain content. This content has two elements [21]:

i) It is the act of using words with a determinate sense and a determinate reference. In Austin's opinion, context and speaker's intentions play a crucial role in making them determinate.
ii) A broad type of illocutionary force is encoded by the sentence mood.

It shows that only at the illocutionary level, the force is made contextually determinate. Searle however deviates from it, but that discussion is avoided here because of fear of digression. Force-content distinction is defended by Frege and Geach [22, 23] It is never the case that all the occurrences of a sentence expressing the same content ought to have the same force, if force is a part of the content of a sentence.

On the other hand, force-neutral content is considered as a myth according to Hanks [24]. He is of the opinion that the 'unity of the proposition' requires something to tie together the ingredients of content. It is the 'intentional action of the speaker' acts as the glue to provide the unity of the proposition. It depends on a condition that the act is neutral with regard to the issue of illocutionary force. Accordingly to Soames [25], the glue is the act of predication which is performed irrespective of whether the proposition is asserted or not.

An imperative and a declarative have two different illocutionary forces, though they may have different types of the same content. Imperatives express a wide range of speech acts, which are beyond commands. Likewise, different types of imperatives may have the same content, though the type of illocutionary force is different in them. The content is force-neutral. Charlow has referred to several kinds of such expressions [26]:

a. Go ahead, take the day off (permission)
b. Talk to your advisor more often (suggestion, advice)
c. Have a piece of fruit (invitation)
d. Get well soon (well-wish)
e. To get the Union Square, take Broadway (instruction)
f. Go on, throw it, Just you dare, (threat)
g. Complete these by tomorrow (command)
h. Enjoy it!
i. Choose your friends wisely (advice)
j. Shall we sleep? (interrogative permission)
k. Consider the red dress (suggestion)
    Charlow also referred to some border line cases [27]:
l. Complete your syllabus by the next month, although you may complete it by this month.
m. Take rest for a day, although of course you may prepare for the next travel unierruptedly.
n. Although she must be at her friend's place tonight, is she helping her mother in preparing dinner?
o. I know you are able to, but can you open the window?

5   Attempt to Accommodate All Imperatives in Logic

Let us now see whether arguments containing imperatives, other than commands, in order to act as premise or conclusion can receive the same treatment in the sphere of existing system of imperative logic as is received by the arguments containing commands. We may consider one argument where an imperative(in the sense of command) is used either as a premise or as a conclusion:

A.   Either feel a concern for the needy or remain non-commital.
        Do not remain non-commital.
        Therefore, feel a concern for the needy.

We may consider another example which has an advice as a part of the premise of an argument:

B.   Choose your friends wisely or you will invite trouble.
        You will not invite trouble.
        Therefore, choose your friends wisely.

In example A, both disjuncts 'Feel a concern for the needy' and 'remain non-committal' are imperative separately. So also the whole disjunctive sentence that occurs as premise. The conclusion also is fully imperative. But in B, only the disjunct 'Choose your friends wisely' is imperative in the first premise since the other disjunct 'you will invite trouble' is a descriptive sentence. So imperative in example B occurs as a part of a premise.The first case is intuitively valid, and it is justified by the definition of validity provided by Vranas. The second, however is neither intuitively valid, nor is it justified by the definition of validity. So, it is not the structure, but the meaning which is important for deciding the status of the argument.

Another point to note is that in many cases of advice, there may be a temporal element and it deserves a different rule of validity, in case it appears as a premise. It may be made clear by citing two examples. The first example contains a premise, which is a command:

C.   Wait for me and don't go alone.

   i)   Therefore, wait for me.
   ii) Therefore, don't go alone.

In this case, both the conclusions are derivable by simplification from the premise, because, in both the cases, the reason that sustains the premise, also sustains the conclusion. Both are valid arguments. Consider another argument containing advice as a premise:

D.   You should wash your hand and eat.

   i)   Therefore, You should wash your hand.

ii) Therefore, you should eat.

Here, the portion 'you should wash your hand' may also be replaced by ' wash your hand', the difference between a command and an advice being discernible from the tone in which the sentence is uttered. In the case of first conclusion, the reason sustaining the premise, sustains the conclusion, and it is intuitively valid. But it is not the case with the second conclusion. As per the definition of validity introduced by Vranas, the argument containing (ii) as the conclusion is valid, though it is not intuitively valid. This is so, because if the addressee begins to eat without washing his/her hand, he/she cannot be said to abide by the advice given to him/her. There is an inbuilt temporal element, which does not allow (ii) to be derived from the premise.

The case is similar with making a wish or request, which is another variety of imperative:

E. Enjoy the art-exhibition, and write a comment in the record-book!

i) Therefore, enjoy the art-exhibition.
ii) Therefore, write a comment in the record-book.

Here, too, we cannot say that the request made by the speaker has been abided (or honoured) by the addressee, if the latter writes a comment in the record book without even visiting the art-exhibition.

In fact, the three criteria attached to a command-imperative is not always applicable in case of other imperatives, i.e., suggestion, invitation, request or advice. The reason is this. In all cases of imperatives, the dictates are connected with actions. But the demand for execution of the acts is different in different cases of imperatives. The same spirit is found in Indian thought also. As in suggestion, invitation, request and advice, so in case of *āmantraṇa*, *adhīṣṭa* and *prārthanā*, there is no inbuilt compulsion to execute the act. So, in case of the action being executed or obeyed, the criterion of satisfaction is fulfilled, but nobody can meaningfully employ the term 'violated' if advice or *prārthanā* is not followed or granted respectively. The deeper reason lies in the fact that some purpose of the addressee is fulfilled by uttering advice or prayer, while no such purpose of the addressee is fulfilled in command-imperative. Secondly, there is a subtle difference between the motivation with which the imperative is fulfilled. Keeping in mind these two factors, an attempt may be made to bring imperatives of all types under a single interpretation.

It is better to suggest here four values of imperatives which are hierarchically arranged in the following way:

Four values of imperatives I (Command, request, prayer, advice etc.).

RA (rational or strong acceptance)

CA (Courtesy or weak acceptance) I = <RA, CA, AV, V>

AV (Avoidance or weak denial)

D (Denial or strong denial)

Negation

RA ------ D
CA ------ AV
AV ------ CA
D ------ RA

Conjunction   Enjoy the show and be happy

	RA	CA	AV	D
RA	RA	CA	AV	D
CA	CA	CA	AV	D
AV	AV	AV	AV	D
D	D	D	D	D

Disjunction (inclusive)   Be attentive to the lecture or take notes of the lecture

	RA	CA	AV	D
RA	RA	RA	RA	RA
CA	RA	CA	CA	CA
AV	RA	CA	AV	AV
D	RA	CA	AV	D

Disjunction (exclusive)   Choose your friends wisely or you will suffer

	RA	CA	AV	D
RA	D	AV	CA	RA
CA	AV	AV	CA	CA
AV	CA	CA	AV	AV
D	RA	CA	AV	D

Disjunction (Inclusive)

	~ p	v	p
	D	RA	RA
	AV	CA	CA
	CA	CA	AV
	RA	RA	D

Disjunction (exclusive)

	~ p	v	p
	D	RA	RA
	AV	CA	CA
	CA	CA	AV
	RA	RA	D

The acceptance table in the case of both inclusive and exclusive 'Or' is the same. The final column of ' ~p v p' in both the cases shows the value 'acceptance'.

From the acceptance tables mentioned before it is obvious that

a) X or Y = max of X and Y,
      X & Y = min of X and Y.
b) The rule of double negation is not accepted as a rule for this system.

In respect of (a) it is clearly mentioned that this is applicable for X and Y in some cases of imperatives. Often we get such cases where both disjuncts are imperative, and not a combination of declarative and imperative. For example,

Be attentive to the lecture or take notes of the lecture.

Here both or any one of the two can be satisfied. But it can not happen in case of the following case:

Choose your friends wisely or you will suffer.

Here the connective 'Or' can only be meaningfully used exclusively.It is to be further noted that though there are two uses of 'Or' in respect of imperative sentences, but a conditional sentence need not be interpreted in terms of acceptance table of any of the two uses of 'Or', for a conditional statement is a combination of declarative and imperative sentences. For such a statement we need separate table which will be given later.

As we have referred earlier, an imperative statement may have a declarative constituent part, e.g., the first premise in argument B. So we have to know also the conjunction and disjunction table for declarative and imperative statement together.

Let us take a statement C & T (C = declarative, T = Imperative)

Conjunction

	RA	CA	AV	D
T	RA	CA	AV	D
F	D	D	D	D

Disjunction

	RA	CA	AV	D
T	RA	CA	CA	AV
F	RA	CA	D	D

Implication

	RA	CA	AV	D
T	RA	CA	D	D
F	RA	CA	CA	AV

Now let us take the previous argument B. The symbolic form of the argument is as follows:

$$C \vee T$$
$$\sim T/\text{Therefore, } C.$$

So far of the issues of deduction and validity are concerned, i.e., 'x → y' represents premise-conclusion relation, it is to be noted that deduction in imperative logic can not be interpreted in the same way as that in case of ordinary two valued logic which is concerned with descriptive statements. In case of a valid inference 'x → y' in two valued logic, it can be said that y is deduced from x. But here deduction is understood in terms of truth. In case of a valid inference 'x → y', if x is true, y can not be false. In case of imperative inference, validity is defined in terms of satisfaction. If an inference 'x → y' is valid, then satisfaction of x is definitely followed by satisfaction of y.

Now we can test the validity of the argument by constituting a hypothetical statement containing conjunction of the premises as antecedent and the conclusion as the consequent. We may, however, retain the rules of inference and the definition of validity as proposed by Vranas. But it is important to note that it is not at all an extension of Vranas's theory. As per our present criterion of four-value measurement, the requirement of a valid argument is that the value 'D' is not present in the final column of the measurement-table of a valid argument. Let us consider the following table:

[(C	v	T)	&	~T]	⟶	C
RA	RA	T	D	F	RA	RA
RA	RA	F	RA	T	RA	RA
RA	CA	T	D	F	RA	CA
RA	CA	F	CA	T	CA	CA
AV	CA	T	D	F	RA	AV
AV	D	F	D	T	RA	AV
D	AV	T	D	F	RA	D
D	D	F	D	T	RA	D

In the same manner we can test all arguments involving imperative of any type by applying the values mentioned before. It is possible to justify the acceptance tables by applying them to other standard tautologies i.e., p → p, or [p → (q → r)] → [(p → q) → (p → r)] etc. The task remains to show the soundness and completeness of the system, which will be undertaken in future.

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