JOURNAL OF SOUTH ASIAN LINGUISTICS

Volume 11 March 2021

Journal of South Asian Linguistics

CSLI PUBLICATIONS

Contents

Editorial statement

It is our pleasure to introduce volume 11 of the *Journal of South Asian Linguistics*, bringing together three articles published in 2020. What a remarkable year this has been, upending all of our lives in ways small and large. The pandemic has impacted our contributors, reviewers, and editors based around the world. Many of us saw unprecedented action advocating for racial and social justice and transformative geopolitical change. Many took on new roles and responsibilities and responded to new challenges. The editorial team would like to celebrate the fact that our discipline, our research, and our community remains strong. We now look ahead to a return to field research, to in-person conferences and classes, and to building on the connections that are so vital to our scholarly lives. In the meantime, please join us in congratulating the authors whose articles appear here.

In the first paper, entitled “Ergativity and stage/individual level predications in Nepali and Manipuri”, Tikaram Poudel (University of Kathmandu) explores typological variation in ergative systems across a range of South Asian languages. There are Tibeto-Burman languages with consistent ergative systems, and there are Tibeto-Burman and Indo-Aryan languages with split ergativity by aspect as well as by person. Poudel also addresses a pattern found in Manipuri (Tibeto-Burman) and Nepali (Indo-Aryan) in which the ergative aligns with individual-level predications and the nominative with stage-level predications. The findings are significant in that they provide new perspective on typological and analytical generalizations on patterns of ergativity and case marking systems.

The second paper, “The effect of phonological and morphological overlap on the processing of Bengali words” by Hilary Suzanne Zinsmeyer Wynne (Oxford University), Sandra Kotzor (Oxford University and Oxford Brookes University), Beinan Zhou (PwC), and Aditi Lahiri (Oxford University) reports on a psycholinguistic investigation of processing of words overlapping in form with and without morphological relatedness in Bengali. Their findings reveal that form-related items elicited less priming than morphologically-related items, and that form-related items differing in length by a single segment did not prime one another, but morphologically-related items did. However, they found that form-related items matched in length but differing in a single segment did prime, suggesting that the relationship between form-related words is not straightforward.

The third paper, “Productivity and argument sharing in Hindi light verb constructions” authored by Ashwini Vaidya (IIT Delhi) and Eva Wittenberg (UC San Diego), contributes to the substantial body of literature on light verb constructions in South Asian languages generally and Hindi in particular through comparative psycholinguistic experimentation. Vaidya & Wittenberg ask whether a Hindi speaker’s experience with light verb constructions aids in speakers in the co-composition operation in which argument structures of noun and light verb merge. Their results reveal that Hindi speakers are much more adept at the process of using light verb constructions to verbalize predicates than are speakers of Germanic languages. They propose that this data supports the view that specific linguistic experiences shape cognition and underline that cost disappears with practice.

These three papers represent important current directions in the field, and stress the unique contribution South Asian languages can make to linguistics more broadly. Two of these (Poudel; Vaidya & Wittenberg), bring new data and new perspectives to bear on issues long under investigation in a South Asian context: ergativity and light verb structures. Furthermore, two papers (Wynne et al.; Vaidya & Wittenberg) employ psycholinguistic research techniques to address theoretical questions, reflecting a wider analytical trend. As a volume, the research reported on here reveals South Asian linguistics to be addressing questions of pressing importance to the wider discipline.

In closing, we would like to thank our senior advisor Miriam Butt (University of Konstanz), who served as an editor for one of the three papers in this volume, our editorial team colleague, Mythili Menon (Wichita State University), another senior advisor and Rajesh Bhatt (University of Massachusetts at Amherst), Sebastian Sulger (University of Konstanz) for setting up our website, and Sebastian Danisch (KIM at the University of Konstanz) for maintaining it. Special thanks also are due to the anonymous reviewers for their attention to this body of work.

We look forward to our upcoming volumes as we look forward to reconnecting as a global community. We are proud of our contributors and reviewers and grateful for our open-access platform as we strive to bring excellent research in linguistics of South Asian languages to a wide audience. We submit this volume to our readership with best wishes for a productive and healthy 2021.

Emily Manetta, University of Vermont & Sameer ud Dowla Khan, Reed College

Ergativity and Stage/Individual-level Predications in Nepali and Manipuri

TIKARAM POUDEL, *Kathmandu University*

Received JANUARY 2009; Revised MAY 2020

ABSTRACT

The ergative systems of Tibeto-Burman and Indo-Aryan languages have drawn the attention of scholars because of their interesting variations. The tense/aspect based split ergative system (Dixon 1994) found in languages like Hindi-Urdu and other Western Indo-Aryan languages have dominated the ergative literature of South Asian linguistics (Klaiman 1978, Hock 1986, Hook 1992, Mohanan 1994, Butt 2006, Deo & Sharma 2006, etc.). In the Central and the Eastern regions, in contrast, some Tibeto-Burman languages such as Tamang (Mazaudon, 2003) and Bhujel (Regmi 2007) are consistently ergative, i.e., they have ergative marking on the subjects of all transitive clauses and nominative marking on the subjects of all intransitive clauses. Some Tibeto-Burman languages of this region such as Kham (Watters 1973) display NP-hierarchy split ergativity (Silverstein 1976). In addition to these ergative systems of South Asian languages, Nepali, an Indo-Aryan language from the Pahari group (Grierson 1928) and Manipuri, a Tibeto-Burman language (Chelliah 1997), show split ergative system based on individual-level and stage-level predications, i.e. individual-level predicates align with ergative marking and stage-level predicates align with nominative marking. With the synchronic data from Nepali and Manipuri, this study systematically demonstrates that these languages employ the ergative case to distinguish individual-level predications from stage-level ones.

1 Introduction

South Asia is home to four different language families, namely Indo-Aryan, Tibeto-Burman, Dravidian, Austro-Asiatic, as well as some language isolates such as Kusunda. There is no ergative case in Austro-Asiatic, Dravidian and the language isolate, Kusunda, whereas many Indo-Aryan and Tibeto-Burman languages have ergative case systems. The Western Indo-Aryan languages such as Hindi-Urdu tend to have tense/aspect based split ergative systems (Klaiman 1978, Hock 1986, Hook 1999, Mohanan 1994, Butt 2006). In a split ergative system, the ergative is obligatory in some contexts but not in other contexts (Dixon 1994). These langauges show ergative marking on the subject as well as in the agreement system (Deo and Sharma 2006). For example, in Hindi-Urdu, the ergative appears on agents of transitive verbs and the verb agrees with the object but only when the verbal morphology is past or perfective. Consider the examples in (1).

(1) a. rām pətra likh-tā həi[1]
Ram.MASC.SG letter.FEM write-IPFV.MASC.SG be.PRS.3SG
'Ram writes letters.' (Hindi-Urdu)

JSAL Volume 11, Issue 1, May 2020.

b. rām=ne pətra likh-ī həi
Ram.MASC.SG=ERG letter.FEM write-PFV.FEM be.PRS.3SG
'Ram has written letters.' (Hindi-Urdu)

Another split ergative system found among ergative languages is based on the NP hierarchy (Silverstein 1976). Some Tibeto-Burman languages, such as Kham (Watters 1973), spoken in Western Nepal, have a split ergative system based on the NP hierarchy. In Kham, the first and second person subject arguments of transitive clauses receive nominative marking and the third person pronouns and the full NPs of transitive clauses receive ergative marking. Consider the following examples from Kham[2] (data from Watters 1973).

(2) a. ŋā nan-lāɪ ŋa-poh-ni-ke
1 SG.NOM you-ACC 1SG-hit-2-PFV
'I hit you.' (Kham)

b. no-e nan-lāɪ poh-na-ke-o
3 SG-ERG you-ACC hit-2-PFV-3SG
'He hit you.' (Kham)

Some other Tibeto-Burman languages such as Tamang (Mazaudon 2003) and Bhujel (Regmi 2007) are reported to have consistent ergative systems. In a consistent ergative language, the subjects of transitive clauses are all marked with the ergative case and the subjects of intransitive clauses with the nominative case. The following data from Tamang (Mazaudon 2003) illustrate the consistent ergative system, with the transitives in (3)a, (3)b and (3)c. (perfective, imperfective and future, respectively) and intransitives in (3)d and (3)e (perfective and imperfective, respectively).

(3) a. naka=se tap ca-ci
chicken=ERG vegetable eat-PFV
'The chicken ate the vegetable.' (Tamang)

b. mam=se kol_kat=ta paŋ-pa
grandma=ERG children=DAT scold-IPFV
'Grandma is scolding the children.' (Tamang)

c. ai=se pwi/pwi-pa=ri kham-la
2SG=ERG carry/carry-NMLZ=LOC can-FUT
'Will you be able to carry it?' (Tamang)

d. mi kha-ci
man.NOM come-PFV
'Someone came.' (Tamang)

[1] Abbreviations: ACC=accusative, ANT=anterior, CAUS=causative, CLF=classifier, CNTR=contrastive, COMPA=comparative, COP=copula, DAT=dative, DEF=definite, DET=determiner, DIR=directional, DES=desiderative, DST=distal, DUR=durative, ERG=ergative, EVD=evidential, FEM=feminine, FIN=finiteness marker, GEN=genitive, HAB=habitual, HON=honorific, IPFV=imperfective, INF=infinitive, INS=instrumental, INT=intentive, IRR=irrealis, LOC=locative, MASC=masculine, NEG=negative, NMLZ=nominalizer, NOM=nominative, NPST=non-past, OBL=oblique, PFV=perfective, PL=plural, POL=polite, PROG=progressive, PROX=proximate, PRS=present, PTR=past time reference, REAL=realis, RFLX=reflexive, SG=singular.

[2] In a transitive clause in Kham, the first and second person subject agreement affixes are prefixes. The third person subject agreement affix fills the right most slot after the tense/aspect markers. The second person object agreement suffixes occur between the stem and the tense/aspect marker.

e. ai nanakar ni-pa
2SG.NOM tomorrow go-IPFV
'Are you going tomorrow?' (Tamang)

Besides these attested South Asian split ergative systems, some South Asian languages such as Nepali show an ergative/nominative alternation in non-past tenses, this is illustrated in (4).

(4) a. rām (āja) gāṛi calāũ-cha
Ram (today) car drive-NPST.3SG.MASC
'Ram will drive a car (today).' (Nepali)

b. rām=le (*āja) gāṛi calāũ-cha
Ram=ERG (*today) car drive-NPST.3.SG.MASC
'Ram drives cars (that is what he does).' (Nepali)

This type of alternation between ergative and nominative on subjects in non-past is also found in Tibeto-Burman languages such as Manipuri. In Manipuri the subjects of verbs inflected with realis mood[3] alternate between ergative and nominative case, as shown in (5).

(5) a. naunā pokpa aŋāŋ (ŋasi) tum-mi
newly born baby (today) sleep-REAL
'A newly born baby is sleeping (today).' (Manipuri)

b. naunā pokpa aŋāŋ-na (*ŋasi) yām tum-mi
newly born baby-ERG (*today) much sleep-REAL
'Newly born babies sleep much (*today).' (Manipuri)

The nominative-ergative alternation exemplified in (4) for Nepali and in (5) for Manipuri is the concern of the present paper. This paper argues that this nominative-ergative alternation in Nepali and Manipuri must be understood in terms of primarily semantic factors, in particular, stage-level vs. individual-level predications. A close look at the data reveals that the uses of an ergative subject in clauses with present time references in Nepali and Manipuri correlates mainly with individual-level predication.

The data presented in this paper were elicited and/or taken from published works. The author, being native speaker of Nepali, also used his own intuitions and cross-checked these with other native speakers. Although the author has near native competence in Manipuri, native speakers from Imphal, the capital city of Manipur and from Kakching, a small town about 45 kilometers to the south of Imphal, the capital of Manipur, have been consulted for verification and authentication of the data. This paper is organized as follows. Section 2 outlines the standard conception of ergativity (Plank 1979, Dixon 1979, 1994) and the data from both Nepali and Manipuri[4] demonstrate that these languages should be classified as ergative languages. Section 3 presents an overview of ergative distribution in these two languages. Section 4 begins with the discussion on individual-level and stage-level distinction that is relevant for the present paper. As this distinction is more salient in copula sentences, I establish that such a distinction really exists in the grammars of Nepali and Manipuri. Then I demonstrate that these languages make use of case markers to encode the distinction of individual-level vs. stage-level in non-copular action sentences because copulas are not available for the distinction in this sentence type. Finally, Section 5 summarizes the findings of this study.

[3]Manipuri finite verbs inflect for realis and irrealis moods. The realis mood that distinguishes between past time reference and present time reference is marked with the suffixes *-la.e* and *-i*, respectively. The irrealis mood distinguishes semantic fields such as future (*-kani*), future negation (*-loi*), benefactive (*-piyu*), command (*-o*), prohibitative (*-kanu*), optative (*-ke*), hortative (*-si*), etc. For details see Poudel (2007).

[4]Nepali ergativity has been established for some time. However, in Manipuri linguistics the term ergativity is not common. Bhat and Ningomba (1997) call it nominative and Chelliah (1997, 2009) calls it agentive.

2 Ergativity: The Standard Concept

In the literature, the distinction between ergative and accusative languages is conceived of as in terms of how languages group subjects of transitive vs. intransitive clauses and the objects of the transitive clauses (Dixon 1979, Plank 1979, a.o.). Plank (1979, 4) summarizes the idea as:

> A grammatical pattern or process shows ergative alignment if it identifies intransitive subjects (Si) and transitive direct objects (dO) as opposed to transitive subjects (St). It shows accusative alignment if it identifies Si and St as opposed to dO.

Dixon (1979, 9) formulates this basic idea as: In an ergative language, the A argument of a transitive clause is marked differently from the O argument of transitive clause and the S argument of an intransitive clause. On the other hand, in an accusative language, the O argument is marked differently from the A and S arguments. In a later work, Dixon (1994) presents the distinction diagrammatically as in (6). In (6), A stands for the subject of transitive clause, S stands for the subject of intransitive clause and O for the direct object of a transitive clause. Following Butt (2006), I use the term nominative case for both nominative and absolutive because both of them are unmarked cases in the languages discussed in this study.

(6)

nominative {	A	ergative
	S }	absolutive
accusative	O }	

Given these definitional criteria both Nepali and Manipuri have ergative patterns. Previous studies (Abadie 1974, Abdulky 1974, Clark 1963, Wallace 1982, Klaiman 1978, Masica 1991, Li 2006) have established that Nepali is a morphologically ergative language. However, the earlier studies on Manipuri used nominative (Hodson 1908, Pettigrew 1912) instead of ergative. More recent works such as Sharma (1987) and Bhat and Ningomba (1997) also follow the same tradition. However, Chelliah (1997) used the term agentive instead of ergative. This usage of the term nominative for ergative can also be found by nineteenth century authors such as Beames (1872–79) and Kellogg (1893) with respect to the split-ergative language Hindi-Urdu. Consider the following examples from Nepali and Manipuri:

(7) a. rām=le bhāt khā-yo
Ram.MASC.SG=Erg rice eat-PST.3SG.MASC
'Ram ate rice.' (Nepali)

b. rām sut-yo
Ram sleep-PST.3SG.MASC
'Ram slept.' (Nepali)

(8) a. tombā=na cāk cā-re
Tomba=ERG food eat-ANT.REAL
'Tomba ate food.' (Manipuri)

b. tombā tum-me
Tomba sleep-ANT.REAL
'Tomba slept.' (Manipuri)

Note that the A arguments i.e., *Ram* in (7a) and *Tomba* in (8a) the subjects of transitive verbs *khā-* 'eat' and *cā-* 'eat' are marked with the ergative case markers =*le* and =*na*, respectively. On the other hand, the O arguments i.e., *bhāt* ‘rice’ in (7a) and *cāk* ‘food’ in (8a) and the S arguments i.e., *Ram* in (7b) and *Tomba* in (8b) all have nominative case, which is unmarked for both languages. The O argument may receive dative marking to distinguish the unmarked form from semantically marked cases. In Nepali, it receives dative marking if it is animate or socially important (O-high) (Bickel 2013), as shown in (9).

(9) mai=le prembahādur=lāi dekh-ẽ
1SG=ERG Prem Bahadur=DAT see-PST.1SG
‘I saw Prem Bahadur.’ (Nepali)

In Manipuri, the O receives locative marking if it is specific or definite, as shown in (10). The locative is form identical with the dative in Manipuri.

(10) a. tombā=na tebal theŋ-i
Tomba=ERG table touch-REAL
‘Tomba touched a table.’ (Manipuri)

b. tombā=na tebal=da theŋ-i
Tomba=ERG table=LOC touch-REAL
‘Tomba touched the table.’ (Manipuri)

Hence, the marking of the O arguments is semantically, not syntactically oriented, in both languages.

3 Ergative distributions in Nepali and Manipuri: An Overview

This section provides an overview of general ergative distribution in Nepali and Manipuri. The ergative marker in Nepali is *=le*, which is form identical with the instrumental and the marker of a ‘reason clause’, as shown in (11)a and (11)b, respectively.

(11) a. rām=**le** ghan=**le** murti phuṭ-ā-yo
Ram=ERG hammer=INS statue break-CAUS-PST.3SG.MASC
‘Ram broke the statue with a hammer.’ (Nepali)

b. pāhun-ā ā-ekā=**le** ma timro bihā-mā āu-na
guest-PL come-PTCP.PL=ERG/INS Pron.1SG your wedding=LOC come-INF
pā-ĩ-na
get-PST.1SG-NEG
‘Because of guests coming, I could not come to your wedding.’ (Nepali)

Also in Manipuri, the ergative marker *=na* is form identical with the markers of instrumental, shown in (12)a, and causal subordination, as in (12)b.[5]

(12) a. tombā=**na** nuŋthəŋ=**na** murti thugāi-re
Tomba=ERG hammer=INS statue break-ANT.REAL
‘Tomba broke the statue with a hammer.’ (Manipuri)

b. noŋ tāba=**na** ma-hāk bazār=da cat-t-e
rain fall=ERG/INS Pron.3SG-POL market=LOC go-NEG-ANT.REAL
‘Because of rain falling, he did not go to the market.’ (Manipuri)

In (11)b and (12)b the ergative/instrumental is used to mark reason clauses in Nepali and Manipuri, respectively. This we take as the semantic extension of the ergative/instrumental because the notion

[5]Manipuri distinguishes long and short mid low vowels. I use /ā/ for long mid low vowel and /a/ for short mid low vowel, very close to schwa /ə/.

of cause is semantically very close to that of agency, for which the ergative is apt.

In Nepali, the agents of transitive verbs obligatorily receive ergative case if the verbal morphology is past or perfective (13)a. However, the agents of transitive verbs receive either ergative (13)b or nominative (13)c case if the verbal morphology is imperfective.

(13) a. mahes=le upanyās lekh-yo
Mahesh=ERG novel write-PST.3SG
'Mahesh wrote a novel.' (Nepali)

b. mahes=le upanyās lekh-cha
Mahesh=ERG novel write-NPST.3SG
'Mahesh writes novels.' (Nepali)

c. mahes upanyās lekh-tai cha
Mahesh novel write-IPFV AUX.NPST.3SG
'Mahesh is writing a novel.' (Nepali)

Manipuri also has a similar distribution. Consider the followiing example where the agent of the transitive verb *thaʔ-* 'drink', which has perfective morphology, is marked with the ergative in (14)a. However, the agents of the verb *thaʔ-* 'drink' with realis morphology indicating habitual or progressive aspectual senses are marked with ergative and nominative in (14)b and (14)c, respectively.

(14) a. tombā=na curup amā thaʔ-le
Tomba=ERG cigarette one drink-ANT.REAL
'Tomba has smoked a cigarette.' (Manipuri)

b. tombā=na curup thaʔ-i
Tomba=ERG cigarette drink-REAL
'Tomba smokes cigarettes.' (Manipuri)

c. tombā curup amā thaʔ-i
Tomba cigarette one drink-REAL
'Tomba is smoking a cigarette.' (Manipuri)

In Nepali the agents of transitive verbs are obligatorily marked with the ergative case if the verbal morphology is past or perfective. However, in Manipuri the semantic notion of volitionality determines the case on the subject of a transitive verb if the verb has past time reference. Bhat and Ningomba (1997, 104) note that the ergative entails a volitional act and the nominative entails a non-volitional act on the part of the subject. They provide the minimal pair in (15) as an illustration.

(15) a. ai=na tebal=da theŋ-i
Pron.1SG=ERG table=LOC touch-REAL
'I touched the table (volitionally).' (Manipuri)

b. ai tebal=da theŋ-i
Pron.1SG table=LOC touch-REAL
'I touched the table (involuntarily).' (Manipuri)

In both Nepali and Manipuri inanimate subjects such as natural forces of transitive verbs obligatorily receive ergative case. In such contexts the tense/aspect morphology of the verb does not determine the choice of case on subjects. This is illustrated in (16) and (17).

(16) a. bhuĩcālā=le ghar bhatkā-yo
earthquake=ERG house collapse-PST.3SG
'The earthquake collapsed houses.' (Nepali)

b. bhuĩcālā=le ghar bhatkā-cha
earthquake=ERG house collapse-NPST.3SG
'The earthquake collapses houses.' (Nepali)

(17) a. noŋlainuŋsit=na yum mayām thudek-le
wind storm=ERG house many break-ANT.REAL
'The wind-storm broke many houses.' (Manipuri)

b. noŋlainuŋsit=na yum mayām thudek-ka-ni
wind storm=ERG house many break-IRR-COP
'The wind-storm will break many houses.' (Manipuri)

c. noŋlainuŋsit=na yum thudek-i
wind storm=ERG house break-IRR
'The wind-storm breaks houses.' (Manipuri)

Sharma (1987, 147) states that the ergative in Manipuri is obligatory for the subject of causative verbs, no matter whether the verbal morphology is perfective or imperfective. In the examples below, the sentences (18)b and (18)c, which are in perfective and in imperfective aspects respectively, are the causative forms of (18)a.

(18) a. mināi kap-pe
servant weep-ANT.REAL
'The servant wept.' (Manipuri)

b. ma-pu-du=na mināi=du kap-hal-le
3SG-master-DET.DST=ERG servant-DET.DST weep-CAUS-ANT.REAL
'The master made the servant weep.' (Manipuri)

c. ma-pu-du=na mināi=du kap-hal-li
3SG-master-DET.DST=ERG servant-DET.DST weep-CAUS-REAL
'The master makes the servant weep.' (Manipuri)

Chelliah (1997, 111–112) also provides similar examples, as illustrated in (19).[6]

(19) a. ma-pā=na dāktar=bu mā=gi ma-cā nu-pi-du
3SG-father=ERG doctor=ACC 3SG=GEN 3SG-small person-FEM-DST.DET
lāi-yeŋ-hal-li
disease-look-CAUS-REAL
'The father makes the doctor treat his daughter.' (Manipuri)

b. ma-pā=na tomba=da mā=gi ma-cā nu-pi-du
3SG-father=ERG Tomba=LOC 3SG=GEN 3SG-small person-FEM-DST.DET
lāi-yeŋ-hal-le
disease-look-CAUS-ANT.REAL
'Her father made Tomba treat his daughter.' (Manipuri)

The ergative marking is also associated with several modal senses. One of the ways of expressing

[6] Chelliah (1997) uses the term agentive, instead of ergative.

modality in Nepali is with the light verb *par-* 'fall' and the main verb in the *–nu* infinitive form.[7] The obligation sense is available only with the subject in ergative case. The same sentence with nominative subject expresses the desire of the speaker. Consider the minimal pair in (20) from Pokharel (1998, 166).

(20) a. mai=le jā-nu par-yo
Pron1SG=ERG go-INF fall-PST.3SG
'I must/ have to go.' (Nepali)

b. ma jā-nu par-yo
Pron.1SG go-INF fall-PST.3SG
'I wish to go.' (Nepali)

In Manipuri the ergative-nominative alternation entails different modal sense as well. In the following near minimal pair in (21), the speaker expresses prior fixed and planned activities of the referent. In (21)a the speaker is certain that the activity takes place at the scheduled place and time. On the other hand, such planned activity is not inferred from (21)b.

(21) a. binodini=na olimpik=ta hoki sāna-ga-ni
Binodini=ERG olimpik=LOC hockey play-IRR.COP
'Binidini will certainly play hockey in the Olympics.' (Manipuri)

b. binodini hoki sāna-ga-ni
Binodini hockey play-IRR.COP
'Binidini will play hockey.' (Manipuri)

In Nepali, ergative and nominative are said to be used to contrast the pragmatic notions of focus and topic (Bickel 2013). Bickel argues that the nominative-ergative alternation on the subjects *mero sāthii* 'my friend' in (22)a and *karmi-haru* 'the workmen' in (22)b is because of the topic and focus status of the respective subjects.

(22) a. mero sāthi momo khāi-rahe-cha
my friend Tibetan dumplings eat-IPFV-NPST.3SG
'My friend is eating *momos* (Tibetan dumplings).' (Nepali)

b. bāhira ke=ko khalbal
outside what=GEN noise
karmi-haru=le chāno hāli-rahe-chan
worker-PL=ERG roof lay-IPFV-NPST.3PL
'What is the noise outside? — It is the workmen laying the roof.' (Nepali)

However, all subject arguments with topic status do not receive nominative case. The subject argument *mauri* 'honey-bee' in example (23), taken from a school textbook, fulfills the criterion of the topic status i.e., an anchoring point for the new information (Lambrecht 1994), but it takes an ergative case. This indicates that in Nepali the topic status of subject argument does not determine nominative vs. ergative case marking.

[7] A light verb is the second verb in a sequence of at least two verbs, where the first verb is the main predicating verb and the second verb, although homophonous with an independent verb in the language, does not appear with its primary lexical meaning and it occurs in the sequence to mark different meanings such as aspectual, modal or attitudinal.

(23) mauri=le āphno kām ucit samaya=mā gar-chan
honey-bee=ERG RFLX work right time=LOC do-NPST.3PL
'Honey-bees perform their duties in time.' (Nepali)

For Manipuri, Bhat and Ningomba (1997, 143) argue that the ergative has extended its use to denote the contrastive focus that distinguishes a pragmatically marked context from a pragmatically unmarked one. The minimal pair in (24) illustrates the contrast.

(24) a. ai mā=bu yeŋ-e
Pron.1SG Pron.3SG=LOC see-ANT.REAL
'I looked at him.' (Manipuri)

b. ai=na mā=bu yeŋ-e
Pron.1SG=ERG Pron.3SG=LOC see-ANT.REAL
'I looked at him (but others did not).' (Manipuri)

Chelliah (1997) also distinguishes two uses of *=na* in Manipuri: the agentive (=ergative) use and the contrastive use. She argues that the lexical semantics of the verb subcategorizes for the agentive use and the contrastive use is signaled by pragmatic information. In the following examples, she glosses the causer arguments *Chaoba* in (25)a and *Tomba* in (25)b as agentive and contrastive respectively and the causee argument *nupā* 'person' in (25)b as agentive (Chelliah 1997, 123). I consider that the causer arguments in these examples receive ergative case, but that the causee argument in (25)b receives instrumental case, which Chelliah glosses as agentive.[8]

(25) a. cāoba=na aŋāŋ-du ŋaw-hal-lam-mi
chaoba=ERG child-DST.DET white-CAUS-PFV-REAL
'Chaoba caused the child to appear fair (by powdering her face).' (Manipuri)

b. tomba=na lāirik-tu nu-pā-du=na pā-hal-lam-mi
Tomba=ERG book-DST.DET person male-DST.DET=INS read-CAUS-PFV-REAL
'Tomba made the man read the book.' (Manipuri)

Chelliah (2009) argues that the agents of non-stative verbs are marked in those instances where the speaker wishes to indicate the involvement of agent in a noteworthy or unexpected instance of an activity, as in (26)a, and that subjects of states receive contrastive focus if marked with *=na* as in (26)b.[9,10] She argues that in (26)a the agent Tomba receives ergative case because the speaker took Tomba to be a vegetarian so that Tomba's eating meat is unexpected.

(26) a. tomba=na sā cā-i
Tomba=ERG meat eat-REAL
'Tomba ate meat.' (Manipuri)

b. ai=na rām=da nuŋsi-i
Pron.1SG=ERG Ram=LOC love-REAL
'I — not you — love Ram.' (Manipuri)

In Nepali, as noted by Pokharel (1998, 157), the subjects of intransitive verbs referring to body function of emission such as 'cough', 'spit', 'urinate', 'vomit' always receive ergative case if the verbal

[8] In (25)b the causee argument *nupā* 'person' receives instrumental case marking. This is a common feature of South Asian languages and a feature that has been common since the time of Classical Sanskrit (Hock 1991).

[9] I do not see any reason to consider the sentence in (26)b to necessarily contain a contrastive focus because it is equally suitable to just mean 'I love Ram'. Section 4 provides some discussion on ergative and stative predicates.

[10] However, Chelliah's (2009) observations cannot be extended if the sentences have present time reference. I discuss this and related issues in next section.

morphology is perfective. The examples in (27) from Pokharel (1998, 166) are illustrative.

(27) a. bhāi=le chād-yo
brother=ERG vomit-PST.3SG
'The brother vomited.' (Nepali)

b. mai=le khok-ẽ
Pron.1SG=ERG cough-PST.1SG
'I coughed.' (Nepali)

This section has shown that the distribution of the ergative in Nepali and in Manipuri is both obligatory (syntactic) and optional (semantic). It is obligatory on the subject of a transitive verb that inflects for past tense or perfective aspect. On the other hand, it alternates with nominative case on the subject of a transitive verb inflecting for non-past tense or progressive aspect in Nepali and realis mood in Manipuri. Ergative is also found with modal senses of obligation in Nepali and with planned activity on the part of referent in Manipuri, respectively. In Manipuri, the ergative-nominative alternation also distinguishes volitional and non-volitional acts on the part of the subject. In Nepali, there is a small set of intransitive predicates denoting body functions ('cough', 'urinate', 'vomit', etc.) that require ergative case on their subjects.

In addition to these, the following type of contrast is also coded by a ergative-nominative alternation both in Nepali and in Manipuri:

(28) a. harke=le nepāl bhāsā jān-da-cha
Harke=ERG Nepal Bhasa know-IPFV-NPST.3SG
'Harke knows Nepal Bhasa.' (Nepali)

b. harke sabhā=mā bol-cha
Harke meeting=LOC speak-NPST.3SG
'Harke will speak in the meeting. (≠Harke speaks in meetings).' (Nepali)

(29) a. māibi=na lāiharāoba jagoi ha-i
shaman=ERG Laiharaoba dance know-REAL
'The shaman knows the Laiharaoba dance.' (Manipuri)

b. māibi lāiharāoba jagoi sā-i
shamans Laiharaoba dance make-REAL
'Shamans dance/are dancing the Laiharaoba dance.' (Manipuri)

Native speakers of both Nepali and Manipuri agree that such an ergative-nominative alternation exists, but they fail to suggest the exact semantic contrast coded by the case alternation on the subjects. I suggest the difference lies in individual-level vs. stage-level predications. This aspect of ergative semantics in Nepali and Manipuri linguistics has so far not received much attention and has not been fully understood. Therefore, the systematic investigation of this aspect of the ergative in Nepali and in Manipuri is the main concern of this paper.

4 Stage vs. Individual-level Distinction

This section begins with discussions of the stage/individual-level predication distinction. Based on the theoretical distinction of stage-level vs. individual-level distinction, I establish the case for a stage vs. individual-level distinction in Nepali and Manipuri copular sentences because the distinction is more salient in this sentence type. Since the copulas are not available for stage-level and individual-level distinction in non-copular sentences, I demonstrate that both Nepali and Manipuri employ the nominative-ergative alternation to distinguish stage-level predication from the individual-level predication, but only if the verbal morphology is non-past in Nepali and denotes present time reference in Manipuri. Milsark (1977) distinguished two types of predicates—state-descriptive and property predicates. A state-descriptive predicate denotes states, conditions in which an entity finds itself and which are subject to change without their being any essential alternation of the entity. On the other hand, a property predicate denotes properties of the entities. Property predicates describe some traits possessed by the entity, which are assumed to be more or less permanent, or at least to be such that some significant change in the character of the entity will result if the description is altered (as cited in Kearns 2003). Carlson (1977) analyzed property predicates as individual-level predicates and state-descriptive predicates as stage-level predicates. He argued that an individual-level predicate is true throughout the existence of an individual. On the other hand, a stage-level predicate is true of a temporal stage of its subject. For example:

(30) a. Individual-level predicate
John is intelligent.
b. Stage-level predicate
John is hungry.

According to Carlson, the property of John's intelligence lasts his entire lifespan, but this is not the case with the property 'hungry' because John's state of being hungry lasts a certain amount of time i.e., when he eats, he does not remain hungry anymore. Carlson's terminology for the distinction has become standard. Since Carlson's (1977) study different diagnostics have been developed to distinguish a stage-level predicate from an individual-level one. Based on Chierchia (1995), the stage-level predicates, not individual-level ones, are compatible with temporal adverbials, locatives, perception sentences, and *there*-sentences:

(31) (In)compatibility with individual/stage-level predicates (Chierchia 1995, 177–179)
a. **Temporal adverbials:**
*John was tall yesterday/ a month ago/ last year. (Individual-level)
John was drunk yesterday/ a month ago/ last year. (Stage-level)
b. **Locatives:**
*John is intelligent in France. (Individual-level)
John is sick in France. (Stage-level)
c. **Perception sentences:**
*I saw John tall. (Individual-level)
I saw John drunk. (Stage-level)
d. **There-sentences:**
*There are two men intelligent. (Individual-level)
There are two men drunk. (Stage-level)

Chierchia (1995, 179) further argues that individual-level predicates select the universal or generic readings of bare plurals (32)a, but stage-level predicates select existential ones (32)b.

(32) a. Dogs hate cats. (Individual-level)
b. Dogs are barking in the courtyard. (Stage-level)

Kratzer (1995) notes that clauses headed by an individual-level predicate cannot serve as the restrictor in *when*-conditionals, provided its arguments are definite.

(33) a. *When John knows Latin, he always knows it well,
b. When John speaks Latin, he always speaks it well.

Krifka et al. (1995) argue that generic sentences are generalization over particular objects or particular events or facts.[11] In the case of an NP argument, the generic reading implies a "kind" denoting

[11] Following Chierchia (1995), I take all individual-level predications to be generics.

interpretation (Carlson 1977), while the non-generic reading implies an "object" denoting interpretation. In case of predicates, the generic reading contrasts with an episodic reading. The set of sentences in (34) from Krifka et al. (1995) illustrates these possibilities.

(34) a. The potato was first cultivated in South America. (Kind denoting NP; episodic predicate)
b. John smokes a cigar after dinner. (Object denoting NP; generic predicate)
c. The potato is highly digestible. (Kind denoting NP; generic predicate)

The definite singular NP *the potato* receives an episodic interpretation in (34)a but a generic one in (34)c. The predicate smokes in (34)b is generic (characterizing) because it is a generalization over several episodic events of *John's smoking*. The predicate *be highly digestible* in (34)c is generic because it is lexically stative. A sentence in which the predicate is generic is called a characterizing sentence. A characterizing sentence stands in contrast to a particular sentence that has an episodic predicate, i.e., the potato being first cultivated in (34)a.

All characterizing sentences have generic interpretation and all individual-level predicates, as argued by Chierchia (1995), are inherently generics. Hence, a characterizing sentence has individual-level interpretation. The key properties that bind Milsark's (1977) property predicates, Carlson's (1977) individual-level predicates and Krifka et al's (1995) characterizing sentences are as in (35).

(35) **Common properties of property, individual-level predicates and characterizing sentences:**
a. The verbal predicate describes an "essential" property of some entity mentioned in the sentence.
b. The verbal predicate is stative and it expresses a property of the referent and it never reports a specific event.
c. The verbal predicate requires strong NPs as subjects.[12]

4.1 The copulas and stage/individual-level distinction

In many South Asian languages, two different forms of the verbs for 'be' express the distinction between individual-level and stage-level interpretation (Mahapatra 2002). For example, Oriya, an Indo-Aryan language of eastern India, has two different forms of the verb for 'be' to express individual-level and stage-level predications. The Oriya verbs *aṭ*-'be' and *ach*- 'be' express individual-level and stage-level predications, respectively.

(36) a. rām mo=ra bhāi **aṭ**-e
Ram.NOM my=GEN brother COP-PRS.3SG
'Ram is my brother.' (Oriya; Mahapatra 2002, 17–18)

b. rām ghar=e ach-i
Ram home=LOC COP-PRS.3SG
'Ram is at home.' (Oriya; Mahapatra 2002, 17–18)

In Nepali, the copula verbs *ho* and *cha* have individual-level and stage-level interpretations, respectively, as shown in (37).

(37) a. sarubhakta kabi hun
sarubhakta poet COP.NPST.3SG.HON
'Sarubhakta is a poet.' (Nepali)

[12] A strong NP has definite referential expression, i.e., names and definite pronouns. It can be modified by presuppositional determiners such as *every, the, most, all* and it refers to a referent familiar in the discourse context. On the other hand, a weak NP has cardinal pronominals such as *one, a, few*, etc. and can take a cardinal determiner.

b. sarubhakta khusi chan
sarubhakta happy COP.NPST.3SG.HON
'Saru Bhakta is happy today.' (Nepali)

Similarly, the Manipuri copula *ni* encodes individual-level and the other copula *lai* expresses stage-level interpretation, as illustrated in (38).

(38) a. tomba ojā ni
Tomba teacher COP.REAL
'Tomba is a teacher.' (Manipuri)

b. tomba ma-yum=da lai
Tomba 3SG-house=LOC COP.REAL
'Tomba is at home.' (Manipuri)

As in (31) above, it has been established that the individual-level predicates are ruled out as predicates of perception verbs. Accordingly, the predicates in the (a) sentences of (37)–(38) are ruled out when used as the complements of perception verbs because they have individual-level interpretations (39), whereas the predicates in the (b) sentences of (37)–(38) can function as the complements of perception verbs because they have a stage-level interpretation (39).

(39) a. *mai=le sarubhakta=lāi kabi dekh-ẽ
1SG=ERG sarubhakta=DAT poet see-PST.1SG
'*I saw Sarubhakta a poet.' (Nepali)

b. *ai=na tomba=da ojā ui
1SG=ERG Tomba=LOC teacher see.REAL
'*I saw Tomba a teacher.' (Manipuri)

(40) a. mai=le sarubhakta=lāi khusi dekh-ẽ
1SG=ERG sarubhakta=DAT happy see-PST.1SG
'I saw Sarubhakta happy.' (Nepali)

b. ai=na tomba ma-yum=da ui
1SG=ERG Tomba 3SG-house=LOC see.REAL
'I saw Tomba in his house.' (Manipuri)

The insertion of spatio-temporal adverbs turns the (a) sentences in (37)–(38) ungrammatical because of their individual-level status (41), whereas the (b) sentences in (37)–(38) accept such adverbs because of their stage-level status (42).

(41) a. *sarubhakta āja pokharā=mā kabi hun
sarubhakta today Pokhara=LOC poet COP.NPST.3SG.HON
'*Today Sarubhakta is a poet in Pokhara.' (Nepali)

b. *bhariyā āja yahā̃ parisrami hun-chan
laborers today here hard-working COP-NPST.3PL
'*Today labors are hard-working here.' (Nepali)

c. tomba ŋasi imphāl=da ojā ni
Tomba today Imphal=LOC teacher COP.REAL
'*Today Tomba is a teacher in Imphal.' (Manipuri)

(42) a. sarubhakta āja pokharā=mā khusi chan
sarubhakta today Pokhara=LOC happy COP.NPST.3SG.HON
'Today Sarubhakta is happy in Pokhara.' (Nepali)

b. *bhariyā āja yahā̃ upalabdha chan
Labors today here available COP.NPST.3PL
'Today laborers are available here.' (Nepali)

c. tomba ŋasi ma-yum=da lai
Tomba today 3SG-house=LOC COP.REAL
'Tomba is at home.' (Manipuri)

Hence, these diagnostics establish that in Nepali and Manipuri the distinction between stage-level and individual-level is grammatically encoded.

4.2 The ergative and individual-level predicate correlation

The previous section has established that the different forms of copula verbs and generic or existential interpretation of the referent lead to stage-level vs. individual-level interpretation in Nepali and Manipuri. But the non-copular i.e., action sentences lack copula verbs for this distinction. In that case, case marking is employed to distinguish the individual-level predicates from stage-level predicates. Considering the ergative-nominative case alternation in (28) and (29), I hypothesize the correlation in (43).

(43) The ergative is correlated with individual-level interpretation and the nominative with the stage-level interpretation.

4.2.1 Ergativity, Stative predicates and individual-level predication

Stative verbs such as *know, resemble, weigh, believe*, etc.[13] have individual-level interpretation and non-stative verbs such as *speak, dance, run*, etc. have stage-level interpretation (Carlson 1977). In (28) and (29), I have noted that the agents of stative predicates such as *jān-* 'know' in Nepali and *hai-* 'know' in Manipuri get the ergative case and the agents of non-stative predicates such as *bol-* 'speak' and *sā-* 'make' in Manipuri have nominative. The examples are repeated in (44) and (45).

(44) a. harke=le nepāl bhāsā jān-da-cha
Harke=ERG Nepal Bhasa know-IPFV-NPST.3SG
'Harke knows Nepal Bhasa.' (Nepali)

b. harke sabhā=mā bol-cha
Harke meeting=LOC speak-NPST.3SG
'Harke will speak in the meeting. (≠Harke speaks in meetings).' (Nepali)

[13] I am aware that the English stative verbs like *know* can be translated with different verbs depending on different contexts, e.g., the verb *know* in the phrase *know a person* translates to *cin-* in Nepali and *khaŋ* in Manipuri and the verb *know* in the phrase *know English* translates to *jān-* in Nepali and *hai-* in Manipuri. Very often the verbs *cin-* in Nepali and *khaŋ-* in Manipuri are interpreted as inchoative because they are often translated into English as 'recognize'. However, these verbs only have a stative sense if the verbal morphology is non-past/imperfective. In this sense, the subjects of these verbs take ergative case because of their individual level interpretation.

i. rām=le ma=lāi cin-cha
Ram=ERG 1SG=ACC know-NPST.3SG
'Ram knows me.' (Nepali)

ii. tomba=na ai khaŋ-ŋi
Tomba=ERG 1SG know-REAL
'Tomba knows me.' (Manipuri)

Here I am not dealing with the inchoative sense of these verbs.

(45) a. māibi=na lāiharāoba jagoi ha-i
shaman=ERG Laiharaoba dance know-REAL
'The shaman knows the Laiharaoba dance.' (Manipuri)

b. māibi lāiharāoba jagoi sā-i
shamans Laiharaoba dance make-REAL
'Shamans dance/are dancing the Laiharaoba dance.' (Manipuri)

Note that the (a) sentences in (44) and (45) have ergative case, but the (b) sentences in (44) and (45) have nominative case on their subjects in spite of same transitivity status and tense-aspect morphology. I attribute this distinction to the individual-level and stage-level interpretations of these sentences. The individual-level status of Nepali verb *jān-* 'know' and Manipuri verb *hai-* 'know' can be established through the following diagnostics. The (a) sentences in (44) and (45) pass the diagnostic tests for individual-level and (b) sentences for stage-level. Only the (b) sentences, not the (a) sentences, in (44) and (45) accept spatio-temporal adverbs.

(46) a. *harke=le āja nepāl bhāsā jān-da-cha
Harke=ERG today Nepal Bhasa know-IPFV-NPST.3SG
'*Harke knows Nepal Bhasa today.' (Nepali)

b. harke āja sabhā=mā nepali bol-cha
Harke today meeting=LOC Nepali speak-NPST.3SG
'Harke will speak Nepali in the meeting today.' (Nepali)

(47) a. *māibi=na ŋasi lāiharāoba jagoi ha-i
shaman=ERG today Laiharaoba dance know-REAL
'*The shaman knows the Laiharaoba dance today.' (Manipuri)

b. māibi ŋasi lāiharāoba jagoi sā-i
shamans today Laiharaoba dance make-REAL
'Shamans are dancing the Laiharaoba dance today.' (Manipuri)

Kratzer (1995) argues that transitive *when*-conditionals need to have at least one of their arguments be non-specific in individual-level predications. This can be used as a diagnostic for the distinction between stage and individual-level predications. The sentences in (48) are thus ruled in, but the sentences in (49) are ruled out. The sentences in (48) have one non-specific argument of the conditional clause (Newars and Shamans, respectively), whereas the sentences in (49) have both the arguments in conditional clause be specific (*Harke/Nepali* and *Carulata/Laiharaoba dance*, respectively).

(48) a. newār=le nepāl bhāsā jān-dā rāmrari jān-da-chan
Newar=ERG Nepal Bhasa know-IPFV well know-IPFV-NPST.3PL
'When Newars know Nepal Bhasa, they know it well.' (Nepali)

b. māibi=na lāiharāoba jagoi hai-ba kānda phajana hai-i
shaman=ERG Laharaoba dance know-INF when well know-REAL
'When shamans know Laiharaoba dance, they know it well.' (Manipuri)

(49) a. *harke=le nepali jān-dā rāmrari jān-da-cha
Harke=ERG Nepali know-IPFV well know-IPFV-NPST.3SG
'*When Harke knows Nepali, he knows it well.' (Nepali)

b. *cārulata=na lāiharāoba jagoi hai-ba kānda phajana hai-i
Carulata=ERG Laharaoba dance know-INF when well know-REAL
'*When Carulata knows the Laiharaoba dance, she knows it well.' (Manipuri)

This test establishes that the Nepali predicate 'know a language' (44)a, and Manipuri predicate 'know a dance' (45)a are individual-level predicates. As expected by (43), the subjects of these predicates are marked with the ergative.

4.2.2 Ergativity, generic reference and individual-level predications

Note that the previous section demonstrated Nepali verbs like *jān-* 'know' and Manipuri verbs like *hai-* 'know' are individual-level predicates. In contrast, Nepali verbs like *bol-* 'speak' and Manipuri verbs like *jagoi sā-* 'dance a dance' are stage-level predicates. However, an inherently stage-level predicate such as *bol-* 'speak' and *jagoi sā-* 'dance a dance' can have stage-level or individual-level interpretation depending on the generic or existential interpretation of its referent arguments. Carlson (1977) has argued that NPs with generic reference are the arguments of individual-level predicates by default. Kearns (2003, 621) has also noted that strong subjects and generic nouns correlate with individual-level predicates. Note that the subjects in the (a) sentences in (50) and (51) have generic reference and the subjects in the (b) sentences (50) and (51) have existential reference.[14]

(50) a. newār=le (*āja) nepāli bol-chan
Newar=ERG (*today) Nepali speak-NPST.3PL
'(All) Newars speak Nepali (*today).' (Nepali)

b. newār (āja) nepāli bol-chan
Newar (today) Nepali speak-NPST.3PL
'(Some) Newars will speak Nepali (today).' (Nepali)

(51) a. māibi=na (*ŋasi) lāiharāoba jagoi sā-i
shaman=ERG (*today) Laiharaoba dance dance-REAL
'(All) shamans dance Laiharaoba dance (*today).' (Manipuri)

b. māibi (ŋasi) lāiharāoba jagoi sā-i
shaman (today) Laiharaoba dance dance-REAL
'(Some) shamans danced Laiharaoba dance (today).' (Manipuri)

The (a) sentences in (50) and (51) have individual-level interpretation as shown by the fact that these sentences do not accept the temporal adverb 'today'. As expected, the ergative case on the subjects marks the individual-level status of these sentences. This is evident since when we exchange the ergative case with the nominative one, the subject NPs have existential interpretation leading to the stage-level status of the (b) sentences in (50) and (51). This reasoning is further supported by the acceptability of the temporal adverb 'today' in these sentences. Carlson (1977) observes that the plural forms of indefinite singular nouns that appear with weak determiners like *a/an* express existential reference. However, the singular forms of plural nouns with generic reference appear with strong determiners such as *the*. As both Nepali and Manipuri do not have an overt strong determiner such as English *the*, the NPs with generic reference appear with ergative marking (52). Both in Nepali and in Manipuri the singular form of NPs with existential reference is expressed with *ek* 'one' and *amā* 'one', respectively (53).[15]

[14] Carlson (1977) distinguishes between generic and existential reference. The generic reference works akin to a universal quantifier, although it admits exceptions, and it appears to have the force of *most*, whereas the existential reference lacks the universal flavor of the generic reference and appears to have the force of *some*.

[15] Nepali has an inflectional plural exponent only with o-ending nouns e.g., *keṭo* 'boy' vs. *keṭā* 'boys'. With other

(52) a. rāuṭe=le (*āja) jaŋgal=ko kandamul khān-cha
Raute=ERG (*today) forest=GEN edible eat-NPST.3SG
'The Raute eats edibles of the forest (*today).' (Nepali)

b. māibi=na (*ŋasi) lāiharāoba jagoi sā-i
shaman=ERG (*today) Laiharaoba dance dance-REAL
'The shaman dances the Laiharaoba dance (*today).'[16] (Manipuri)

(53) a. ek-ṭā rāuṭe (āja) jaŋgal=ko kandamul khān-cha
one-CLF Raute (today) forest=GEN edible eat-NPST.3SG
'A (particular) Raute will eat edibles of the forest (today).' (Nepali)

b. māibi amā (ŋasi) lāiharāoba jagoi sā-i
shaman one (today) Laiharaoba dance dance-REAL
'A (particular) shaman danced/ is dancing the Laiharaoba dance (today).' (Manipuri)

The distinction between the sentences in (52) and the sentences in (53) is significant. The subject NPs in (53) have existential interpretation because they can be modified with cardinal numbers such as 'two', e.g., *two Rautes* or *two shamans*; whereas the subject NPs in (52) cannot be similarly modified. Following Kearns (2003), I argue that the transitive predicates *khā* 'eat' in Nepali (52)a and *jagoi sa-* 'dance' in Manipuri (52)b have individual-level interpretation for the subject NPs because these have generic interpretation. On the other hand, the same predicates in (53) have a stage-level interpretation because of the existential reference of the subject NPs. Both Nepali and Manipuri encode this distinction through the ergative-nominative alternation.

The discussion so far shows that a predicate along with its arguments determines its stage-level or individual-level interpretation. The individual-level interpretation of human generic subject NPs in (52) also applies with respect to abstract and inanimate subject NPs, as shown in (54).

(54) hāwā=le lugā sukāũ-cha
wind=ERG washing dry-NPST.3SG
'The wind dries the washing.' (Nepali)

However, the ergative marking on the subject of the sentence in (54) and the nominative marking on the subject of (53)a and (55)b have been explained differently in literature. Bickel (2013) argues that the A arguments of transitive verbs receive ergative marking in non-past contexts if this argument is an A-low argument and nominative marking if this argument is an A-high argument. An A-high or an A-low argument is determined on the basis of a person and animacy hierarchy called 'hierarchy of inherent lexical content' (Silverstein 1976, 113). According to this hierarchy, human nouns are prototypically agentive and receive the default nominative case. These are termed as A-high arguments. On the other hand, inanimate nouns prototypically function as patient arguments. When prototypical patient arguments function as A-arguments of transitive verbs, they get a marked case, in this case an ergative one. These are termed as A-low argument. However, this explanation does not seem to be valid because we have sentences as in (55)a with A-high arguments with ergative case.

---

nouns a clitic-like morpheme *=haru* is added for plural marking, but it actually has a meaning of denoting the referent and others, e.g., *āmā=haru* means 'mother and father, aunts, sisters, etc.', not simply mothers. Similarly, Manipuri does not have an inflectional plural marker on either nouns or verbs. Grammar books often gloss as plural the morphemes *siŋ* (for non-humans, e.g., *lārik-siŋ* 'book-PL') and *–khoi* (for human nouns, e.g. *imā-khoi* 'mother-PL'). However, these morphemes more often have the meaning of 'N and others' i.e., *lārik-siŋ* actually means 'books and other such things like pens, pencils, etc.' and *imā-khoi* actually means 'mother and father, sisters, aunts, etc. Hence, the bare plural 'shamans' and the generic 'shaman' are realized by identical forms in Manipuri.

[16] The sentence is ambiguous between the readings of past time and present time references. The temporal adverb 'today' is, of course, only compatible with present time reference.

(55) a. rām=le (*āja) lugā sukāū̃-cha
Ram=ERG (*today) washing dry-NPST.3SG
'Ram dries washing (*today).' (Nepali)

b. rām (āja) lugā sukāū̃-cha
Ram (today) washing dry-NPST.3SG
'Ram will dry washing (today).' (Nepali)

Under the analysis proposed in this paper, Nepali requires the ergative marking in non-past contexts when an individual-level predication is to be expressed. This is the case in (55)a, where an appropriate context would be one in which Ram works in a laundry and his job is to dry washings. In contrast, the nominative is used to signal stage-level predications as in (55)b. The stage vs. individual-level readings are further confirmed by the acceptability of the temporal adverb 'today' in (55)b and its non-acceptability in (55)a.

4.2.3 Ergativity, characterizing predicates and individual-level predications

A characterizing predicate corresponds to an individual-level predicate (Krifka et al. 1995). A characterizing predicate predicates its referents as a whole and describes the more permanent traits or property of the referents. Consider the Manipuri sentences in (56).

(56) a. hui=na khoŋ-i
dog=ERG bark-REAL
'The dog barks (=Dogs bark).' (Manipuri)

b. hui-du thau-i
dog-DET.DIST attack-REAL
'That dog attacks.' (Manipuri)

The important point to note here is that the predicate 'barking' describes the inherent property of the referent 'dogs'. If dogs do not to bark, they cease to be dogs at least in our concept of dogs. However, such a characterizing property is not predicated in (56)b because if a dog stops attacking someone it is still a dog. Such predicates are called episodic. As has been noted before, the arguments of an individual-level predicates have generic reference, this is also true for the arguments of characterizing predicates. However, the argument of a characterizing predicate need not be generic.

(57) cāme=le gauthali=lāi gāli gar-cha
Chame=ERG Gauthali=DAT abuse do-NPST.3SG
'Chame abuses Gauthali.' (Nepali)

A sentence like (57) expresses a generalization over a series of 'Chame abusing Gauthali' events, and this has become a part of their life. Both the arguments Chame and Gauthali are specific but the predicate is non-distributive, which leads to an individual-level interpretation. Note that temporally non-distributive predicates are classed as individual-level for the event (Kearns 2003, 596). But once we change the temporally non-distributive event into a temporally distributive one with an 'in process progressive' interpretation as in (58), the sentence ceases to have an individual-level interpretation. As expected by (43), the agent is marked nominative in this case.

(58) cāme gauthali=lāi gāli gar-dai-cha
Chame Gauthali=DAT abuse do-PROG-NPST.3SG
'Chame is abusing Gauthali.' (Nepali)

A similar explanation holds for the Manipuri data. Let's consider some examples from real life situations. For example, take a situation in which a person named Yaswant is a professor of linguistics at Manipur University. In this case (59)a is appropriate. Similarly, if Sri Biren is a well-known

Manipuri poet, (59)b is appropriate. And if Mary Kom is a well-known sports personality, (59)c is appropriate.

(59) a. yasawanta=na liŋwistik tāʔ-i
Yasawanta=ERG linguistics teach-REAL
'Yasawanta teaches linguistics.' (Manipuri)

b. srī biren=na saireŋ í-i
Sri Biren=ERG poem write-REAL
'Sri Biren writes poems.' (Manipuri)

c. meri kom=na boksiŋ sāna-i
Mary Kom=ERG boxing play-REAL
'Mary Kom plays boxing (Mary Kom is a boxer).' (Manipuri)

Changing these temporally non-distributive predicates into temporally distributive requires nominative case on the subjects because then the individual-level interpretation is not available any more. Temporally distributive predicates are classed as stage-level.

(60) a. yasawanta liŋwistik tāʔ-i
Yasawanta linguistics teach-REAL
'Yasawanta is teaching linguistics.' (Manipuri)

b. srī biren saireŋ í-i
Sri Biren poem write-REAL
'Sri Biren is writing a poem.' (Manipuri)

c. meri kom boksiŋ sāna-i
Mary Kom boxing play-REAL
'Mary Kom is boxing.' (Manipuri)

Chelliah (2009, 386) argues: "... agents are marked in those instances where the speaker wishes to indicate agent involvement in a noteworthy or unexpected instance of an activity." However, the sentences in (59) express usual and expected instances of activities and have marked agents. As per the hypothesis in this paper, the sentences in (59) have the ergative on their subjects because they are characterizing sentences (Krifka et al. 1995) i.e., have individual-level interpretation. On the other hand, the sentences in (60) are episodic and as expected the subjects receive nominative case.

The ergative and individual-level correlation is stronger with stative predicates. As stative verbal predicates are non-distributive, the stage-level reading is not available with them in present time reference. Consider the sentences in (61).

(61) a. maitei=na ŋā pām-mi
Manipuri=ERG fish like-REAL
'Manipuri people like fish.' (Manipuri)

b. raghumani=na ibempishak nuŋsi-i
Raghumani=ERG Ibempishak love-REAL
'Raghumani loves Ibempishak.' (Manipuri)

c. sanamahi=na pānthoibi thāja-i
Sanamahi=ERG Panthoibi believe-REAL
'Sanamahi (a traditional religious group of Manipur) believe in Panthoibi.' (Manipuri)

Replacing the ergative case with nominative case on the subjects of (61) makes the sentences ungrammatical. The reason is simple. In present time reference nominative is acceptable only with stage-level interpretation but stative predicates have individual-level interpretation by default. Hence, there is a contradiction. However, this has got different explanation in literature. More particularly, Chelliah (2009) argues "…subjects of states cannot be marked with -*nə*, but rather, receive a reading of contrastive focus if marked with -*nə*." However, there is nothing contrastive with the subject NPs in (61) and the ergative case on these NPs is not pragmatically determined. These are different from a pragmatically focused NP as in (62).

(62) cāoba=na wāŋ-ŋi
Chaoba=CNTR tall-REAL
'Chaoba is taller (than say Tomba)'. (Manipuri)

An appropriate context for a sentence like (62) could be: someone is talking about the height of two boys called Chaoba and Tomba and the speaker thinks Chaoba is taller than Tomba.

5 Conclusions

A closer examination of the earlier studies on ergativity in Nepali and Manipuri revealed that ergative marking on the subjects of transitive verbs with past tense or perfective aspectual morphology is fairly consistent. On the other hand, with respect to the clauses with non-past and imperfective aspectual morphology, the marking on the subjects alternates between the nominative and the ergative. This alternation is semantically oriented. In Manipuri, the semantic domains of volitionality and non-volitionality determine the marking of the ergative and the nominative respectively on the subjects of transitive verbs. Both Nepali and Manipuri distinguish modal senses with nominative and ergative alternations. Obligatory senses align with the ergative whereas the sense of desire is expressed with the nominative in Nepali. Similarly, in Manipuri, the ergative is compatible with a future planned action, whereas for an accidental future action the nominative is apt.

The ergative-nominative alternation on the subjects of transitive verbs with non-past tense and imperfective aspectual morphology in Nepali and Manipuri has been a puzzle for a long time. The data presented in this paper indicate that a great deal of the pattern can be explained with reference to the notions of stage-level vs. individual-level predication. Crosslinguistically, it has been established that stative predicates (Carlson 1977), NPs with generic reference (Kearns 2003) and characterizing predicates (Krifka et al. 1995) are prime candidates for individual-level predication. Stative predicates such as 'know a language' in Nepali and 'know to dance a dance' in Manipuri align with the ergativity. Non-stative predicates such as 'speak' and 'dance' get individual-level interpretation provided that their subject NPs have generic, non-existential reference. Both Nepali and Manipuri non-stative predicates with generic subject NPs align with the ergative, but with the nominative if the subjects have existential reference. A characterizing predicate such as one expressing an inherent property of the referent, for example such as a dog's barking or the expression of a series of events over a long period of time aligns with the ergative. On the other hand, episodic predicates such as an attack of a dog are compatible with the nominative. The correlation of the ergative and individual-level predicates discussed in this paper, though typologically unexpected, can provide a new perspective on our understanding of the functioning of the ergative patterns of the languages of this region.

Acknowledgments

This research was supported by the DFG (Deutsche Forschungsgemeinschaft) via the SFB 471, Project A24 at the Department of Linguistics, University of Konstanz, Germany. I am thankful to Gillian Ramchand for suggesting this analysis to me. I express my gratitude to the editors of JSAL for their insightful comments for rewriting some sections of this paper for greater clarity. I am also thankful to two anonymous JSAL reviewers for their helpful comments. I am also grateful to Miriam Butt for constant encouragement and support during the preparation of this paper. The useful comments of audience from different workshops and conferences in Germany, India and Nepal, more particularly, Helen de Hoop, Frans Plank, Tafseer Ahmed, Yashawanta Singh, Naorem Sarju, Yogendra Yadava also helped me to shape this paper in this form.

References

Abadie, Peggy. 1974. Nepali as an ergative language. *Linguistics of the Tibeto-Burman Area* 1:156–177.

Abdulky, Vicki June. 1974. *A Formational Approach to the Semantic Structure of Nepali*. Ph.D. thesis, Cornell University.

Beames, John. 1872–79. *A Comparative Grammar of the Modern Aryan Languages of India*. Delhi: Munshiram Manoharlal. Republished 1966.

Bhat, D.N.S. and M.S. Ningomba. 1997. *Manipuri Grammar*. Munich: Lincom Europa.

Bickel, Balthasar. 2013. Grammatical relations typology. In J. J. Song, ed., *The Oxford Handbook of Linguistic Typology*. Oxford: Oxford University Press. DOI: 10.1093/oxfordhb/9780199281251.013.0020.

Butt, Miriam. 2006. *Theories of Case*. Cambridge: Cambridge University Press.

Carlson, Greg. 1977. *Reference to Kinds in English*. Ph.D. thesis, University of Massachusetts at Amherst.

Chelliah, Shobhana L. 1997. *A Grammar of Meithei*. Berlin: Mouton de Gruyter.

Chelliah, Shobhana L. 2009. From semantic role to pragmatic markers. In J. Barðdal and S. L. Chelliah, eds., *The Role of Semantic, Pragmatic and Discourse Factors in the Development of Case*, pages 377–400. Amsterdam: John Benjamins.

Chierchia, Gennaro. 1995. Individual predicates as inherent generics. In G. Carlson and F. J. Pelletier, eds., *The Generic Book*, pages 176–223. Chicago: Chicago University Press.

Clark, Thomas Welbourne. 1963. *Introduction to Nepali: A First Course*. Cambridge: Heffer and Sons.

Deo, Ashwini and Devyani Sharma. 2006. Typological variation in the ergative morphology of Indo-Aryan languages. *Linguistic Typology* 10(3):369–418.

Dixon, R. M. W. 1979. Ergativity. *Language* 55:59–138.

Dixon, R. M. W. 1994. *Ergativity*. Cambridge: Cambridge University Press.

Grierson, George A. 1928. *Linguistic Survey of India*. Delhi: Motilal Banarasidass. Indo-Aryan Family: Central Group, Vol. IX Part IV.

Hock, Hans Henrich. 1986. *P*-oriented Constructions in Sanskrit. In B. Krishnamurti, ed., *South Asian Languages: Structure, Convergence and Diglossia*. Delhi: Motilal Banarsidass.

Hock, Hans Henrich. 1991. Possessive Agents in Sanskrit? In H. H. Hock, ed., *Studies in Sanksrit Syntax*, pages 55–70. Delhi: Motilal Banarsidass Publishers.

Hodson, Thomas Callan. 1908. *The Meitheis*. Delhi: Low Price Publications.

Hook, Peter Edwin. 1999. On Identifying the Conceptual Restructuring of the Passive as Ergative in Indo-Aryan. In M. M. Deshpande and S. Bhate, eds., *Pāṇinian Studies*, pages 177–199. Ann Arbor, Michigan: Center for South and Southeast Asian Studies, University of Michigan.

Kearns, Kate. 2003. Durative achivements and individual-level predicates on events. *Linguistics and Philosophy* 26:595–635.

Kellogg, S. H. 1893. *Grammar of the Hindi Language*. Delhi: Munshiram Manoharlal Publishers Pvt. Ltd. Second Edition, reprinted 1990.

Klaiman, M. H. 1978. Arguments Against a Passive Origin of the IA Ergative. In *The Proceedings of the 14th Meeting of the Chicago Linguistic Society*, pages 204–216.

Kratzer, Angelika. 1995. Stage-Level and Individual-Level Predicates. In G. N. Carlson and F. J. Pelletier, eds., *The Generic Book*. Chicago: The University of Chicago Press.

Krifka, Manfred, Francis Jeffry Pelletier, Gregory N. Carlson, Alice ter Meulen, Gennaro Chierchia, and Godehard Link. 1995. Genericity: An introduction. In G. N. Carlson and F. J. Pelletier, eds., *The Generic Book*, pages 1–124. Chicago: The University of Chicago Press.

Lambrecht, Knut. 1994. *Information Structure and Sentence Form: Topic, Focus and the Mental Representations of Discourse Referents*. Cambridge: Cambridge University Press.

Li, Chao. 2006. Split ergativity and split intransitivity in Nepali. *Lingua* 117(8):1462–1482.

Mahapatra, B. B. 2002. *Stage-level vs.Iindividual-Level Predicates and the Four Copulas in Oriya*. Ph.D. thesis, Central Institute of English and Foriegn Languages, Hydrabad.

Masica, Colin. 1991. *The Indo-Aryan Languages*. Cambridge: Cambridge University Press.

Mazaudon, Martine. 2003. Tamang. In G. Thurgood and R. J. Lapolla, eds., *The Sino-Tibetan Langauges*, pages 291–314. New York: Routledge.

Milsark, Gary. 1977. Towards an explanation of certain peculiarities in the existential construction in English. *Linguistic Analysis* 3:1–30.

Mohanan, Tara. 1994. *Argument Structure in Hindi*. Stanford: CSLI Publications.

Pettigrew, William. 1912. *Manipuri Grammar*. Allahabad: Pioneer Press.

Plank, Frans. 1979. Ergativity, syntactic typology and universal grammar: Some past and present viewpoints. In F. Plank, ed., *Ergativity: Towards a Theory of Grammatical Relations*, pages 3–36. New York: Academic Press.

Pokharel, M. P. 1998. *Nepāli Vākya Vyākaran [Nepali Syntax]*. Kathmandu: Royal Nepal Academy.

Poudel, Tikaram. 2007. *Tense, Aspect and Modality in Nepali and Manipuri*. Munich: Lincom Europa.

Regmi, Dan Raj. 2007. *The Bhujel Language*. Ph.D. thesis, Tribhuvan University.

Sharma, Nand Lal. 1987. *Manipuri Grammar*. Imphal: R. K. Book Agency.

Silverstein, Michael. 1976. Hierarchy of features and ergativity. In R. M. W. Dixon, ed., *Grammatical Categories in Australian Languages*, pages 112–171. Canberra: Australian Institute of Aboriginal Studies.

Wallace, William. 1982. The evolution of ergative syntax in Nepali. *Studies in the Linguistic Sciences* 12(2):147–211.

Watters, David. 1973. Clause patterns in Kham. In A. Hale, ed., *Clause, Sentence and Discourse Patterns in Selected Langauges of Nepal*, pages 39–202. Summer Institute of Linguistics.

The effect of phonological and morphological overlap on the processing of Bengali words

HILARY S. Z. WYNNE, *Oxford University*
SANDRA KOTZOR, *Oxford University, Oxford Brookes University*
BEINAN ZHOU, *PwC*
ADITI LAHIRI, *Oxford University*

Received JULY 2019; Revised NOVEMBER 2019

ABSTRACT

In normal language processing, we are continuously analyzing the form and structure of incoming speech signals in order to understand their meaning. At the same time, we unavoidably encounter situations in which words are contained within other words (e.g. *ham* in *hammer*). Since morphologically-related words often have a certain amount of phonological overlap, it is essential to understand the relevance of this overlap while investigating morphological processing. The current study provides a psycholinguistic investigation of the processing consequences of Bengali words overlapping in form both with and without being morphologically related. Overall, form-related items elicited significantly less priming than morphologically-related items. Form-related items differing in length by a single segment did not prime one another, while morphologically-related items did. However, form-related items matched in length but differing in a single segment did prime, indicating that relationships between form-related words are not always straightforward.

1 Introduction

In everyday language processing in most languages, we unavoidably encounter word-within-word situations; that is, where there is a certain degree of overlap between segments in words. Segments can overlap in a number of ways: they can overlap in form but not meaning (e.g. *tax* ~ *taxi*), or in both form and meaning (e.g. *write* ~ *writer*). This second case can be of several types: (i) identical consonants but different vowel quality e.g. *sing* ~ *sang*, *goose* ~ *geese*; (ii) identical consonants but different vowel length e.g. *meet* ~ *met*, *feed* ~ *fed*; (iii) identical vowels but different consonant length e.g. Bengali ফে'লো ~ ফেলল, [p^helo] ~ [p^helːo], 'throw-2FAM.FUT.IMP[1]' ~ 'throw-3.PST'; (iv) the addition of a final consonant e.g. *walk* ~ *walks*; (v) the addition of final vowel e.g. *hand* ~ *handy*; or (vi) the addition of a final vowel and a consonant e.g. *horse* ~ *horses*, *dine* ~ *diner*. While these examples only cover a small subset of such possibilities, it is clear that, in normal language processing, we frequently contend with situations where words that are not only related morphologically also exhibit an overlap in form.

It is therefore essential to understand the effect of phonological overlap when investigating morphological processing: namely, to what extent can the morphological effect be attributed to phonological overlap versus to morphological structure alone? Understanding the effect of phonological overlap can help to better answer the question of whether morphology should have a separate level of representation. Earlier research (cf. Rastle et al. 2000, Frost et al. 2000) has revealed that the effect of morphology cannot be attributed purely to semantic relatedness or phonological overlap. This suggests that morphological structure is an essential component in lexical organization, a notion that in turn has further implications for lexical access and processing (Frost & Grainger 2000).

When considering the processing of word forms, the following question arises: how much of the relatedness of words is linked to an overlap in form alone versus an overlap in both form and

[1] Abbreviations used: 1/2/3 = 1st/2nd/3rd person, ADJ = adjective, F = feminine, FAM = familiar, FUT = future tense, HON = honorific, IMP = imperative, INT = intimate, LOC = locative, M = masculine, N = noun, PRES = present tense, PST = past tense, VBN = verbal noun

morphology, particularly when the overlap constitutes a complete lexical item (e.g. *bull* ~ *BULLET*)? As we demonstrate in 1.1 below, although a substantial amount of research (cf. Amenta & Crepaldi 2012) has looked into the effect of phonological overlap, most studies employ embedded word priming[2] to address the question of whether a longer carrier word activates a shorter embedded word (e.g. *bullet* ~ *BULL*). Limited research has been carried out to investigate the opposite priming configuration, e.g. *bull* ~ *BULLET*, and those that do rarely employ real words as primes (e.g. *bull*).[3] Instead, the focus in these studies has predominantly been on whether segments activate form-related words (i.e. whether the segment [bʊ] can prime *BULL*). However, if there is a predicted difference in the direction of priming, it follows that both configurations should be examined using real-word primes. If words are represented in phonological form and this is how they are activated in the mental lexicon, then they will follow a particular phonological structure in the way they are produced.

In this study, we are concerned with the effect of full-word activation and priming in cases of direct form overlap. Word-within-word configurations exist in most languages and often, as the word length increases, the overlap also increases (whether meaningful or not). Word games are frequently developed on the basis of this element, e.g. the Japanese game 'Shiritori', in which one player must think of a word beginning with the final part of another player's previous word (e.g. トマト 'toma**to**' > トンカツ '**to**nkatsu'). The questions we ask are the following: first, will a longer word activate a shorter word if that shorter word is contained in the longer word? That is, once a full word (e.g. *hammer*) has been activated, do other candidates with phonological overlap (e.g. *ham*, *hammy*) remain viable, or are they deselected? Second, will a shorter word activate a longer one (e.g. *ham* ~ *HAMMER*)? Is the direction of priming crucial to activation?

In a strict Cohort Model analysis (cf. Marslen-Wilson 1987, 1990) and in purely phonological terms, an incoming speech signal activates words longer than the perceived signal: thus, on hearing *pen,* words such as *pen, pencil, penthouse* etc. will be activated. Once *pencil* has been recognized, however, any shorter words (e.g. *pen*) fall out of the cohort. Crucially, this phonological cohort effect does not hold for a morphological paradigm i.e. for word forms that all have the same stem, e.g. *cool, cooler, cooling.* While it could be likely that candidates remain activated if the item encountered first is a shorter word (e.g. *bull* ~ *BULLET*), there may be no remaining activation for the opposite configuration (e.g. *bullet* ~ *BULL*) because *bull* is no longer a viable candidate for the acoustic input. This issue is further complicated by the fact that it is often difficult to systematically compare the degree of phonological overlap between two conditions due to language internal phonological constraints.

Our third question asks, what is the effect of overlap in words that have equal length but differ by a final vowel (e.g. পরী ~ পোরা, [pori] ~ [porɑ], 'fairy' ~ 'fill.VBN' in Bengali)? Namely, how do overlapping phonological segments affect word recognition? Our final and overarching question is, are form-related words (e.g. *ham* ~ *HAMMER*) processed differently than words related in both form and morphology (e.g. *run* ~ *RUNNER*)? Ultimately, we want to understand the processing of underlying phonological priming effects and how it compares to that of morphological processing.

To investigate this, we conducted two sets of cross-modal[4] lexical decision experiments in Bengali. The reasons for using Bengali are two-fold: first, little has been done on the effect of phonological overlap in this language, which made even more interesting by the complexity of written forms. Secondly, in order to create balanced experimental conditions where segments (both vowels and consonants) could be added in a strictly controlled stepwise manner in both form-related **and** morphologically-related items, we needed a language which allows for the addition of individual

---

[2] Such cases, where the target is embedded in the prime (*bullet* ~ *BULL*), have been widely referred to as "embedded word priming". In the current study, we are also investigating the priming configuration in which a prime word is embedded in a target (e.g. *bull* ~ *BULLET*). For this reason, we will use the terms LONG → SHORT to refer to embedded word priming and SHORT → LONG to refer to the opposite direction.

[3] Reasons for the LONG → SHORT preference are unclear from the literature but it is worth noting that this asymmetry in attention is also found in studies investigating the relationships between stems and affixes, where the majority of priming studies employ the affixed word → stem configuration (e.g. *helpful* ~ *HELP*, cf. Diependaele et al. 2011).

[4] Cross-modal designs present stimuli in different modalities, e.g. auditory primes and visual targets.

segments without concomitant changes in stress and vowel quality. While English does not allow for the creation of such a set of stimuli, Bengali does. As observed in examples given earlier, the language contains a large number of word pairs that exhibit identical segmental structure regardless of whether they are morphologically simple or complex. This is due to the fact that word stress in Bengali is fixed initially and morphological complexity does not lead to vowel reductions, e.g. কাল ~ কালি, [kɑl] ~ [kɑli], 'tomorrow' ~ 'ink' vs. নাক ~ নাকী, [nɑk] ~ [nɑk-i], 'nose' ~ 'nasal'.

The first set of experiments in this study (1a, 1b, and 1c) examined the relationships between three different types of solely phonologically-related pairs (e.g. কাল ~ কালি, [kɑl] ~ [kɑli], 'yesterday' ~ 'ink'), and the second set (2a, 2b, and 2c) examined the relationship between three types of morphologically-related pairs (e.g. দাগ ~ দাগী, [d̪ɑg] ~ [d̪ɑg-i], 'mark, stain' ~ 'mark-ADJ, stained'). Within these sets of experiments, we manipulated the priming configurations systematically by examining the addition/deletion of one vowel (CVC ~ CVCV), the addition/deletion of one consonant (CVCV ~ CVCVC), or a change of final vowel ($CVCV_1$ ~ $CVCV_2$). This stepwise examination was done to maintain as much homogeneity as possible between the stimuli, as well as to facilitate an examination of the effect of priming direction (i.e. whether LONG → SHORT primed significantly more than SHORT → LONG). We also manipulated syllable structures systematically, designing comparable experiment conditions for both the phonologically-related and morphologically-related pairs.

Before presenting our findings, it is necessary to consider the existing literature on the effect of direct phonological priming (as opposed to mediated/semantic priming) with word primes (as opposed to pseudo-word primes or segment of a word). Section 1.1.1 presents studies investigating the LONG → SHORT priming configuration, as this is where the majority of evidence for form overlap is found. Section 1.1.2 discusses studies employing the SHORT → LONG configuration, and Section 1.1.3 provides a summary of tasks in which the stimuli have overlapping segments.

1.1 Phonological priming

The main focus in this section is on studies where the prime or target is a completely embedded word; nevertheless, some studies which investigated partial form overlap are included. There is also substantial literature on the effect of rhyme priming (e.g. Praamstra et al. 1994, Bölte & Coenen 2002) which is not listed here (but see Zwisterlood 1986, Radeau et al. 1995, and Dufour 2008 for comprehensive reviews; see also Zhang & Samuel 2015 for a review of embedded word priming).

1.1.1 Is there a *bull* in *bullet*? (LONG → SHORT priming)

As shown in Table 1, the favored priming configuration in studies examining phonological overlap between full words priming is the LONG → SHORT configuration (e.g. *bullet* ~ *BULL*). Jakimik et al. (1985) found that words sharing both orthographic and phonological segments (e.g. *message* ~ *MESS*) primed in an auditory–auditory configuration and, more recently, Zhang & Samuel (2015) reported analogous findings using a similar paradigm. In their study, Zhang & Samuel (2015) further manipulated the proportion of overlap between the prime and the target, and found that the degree of the priming increased with the proportion of overlap between the prime and the target: e.g. a combination which had a 2/3 syllable match (e.g. *property* ~ *PROPER*) showed a stronger priming effect than pairs which had a 1/2 syllable match (e.g. *hamster* ~ *HAM*).

There are also studies that fail to find such an effect. Although words sharing both orthographic and phonological segments primed, Jakimik et al. (1985) did not find priming for word pairs that only shared initial phonological segments (e.g. *definite* ~ *DEAF*) or initial orthographic segments (*legislature* ~ *LEG*). In a cross-modal experiment employing word pairs such as *bullet* ~ *BULL*, Marslen-Wilson et al. (1994) also found no priming; if anything, an inhibition effect was observed.[5]

[5] Aside from the fact that this study was presented cross-modally, it is worth noting that the phonologically-related words were interspersed with trials in which word pairs also shared morphological relationships. Thus, for some of the trials, both semantic and phonological relationships were present whereas in other trials, primes and targets were only phonologically related. Accordingly, it is difficult to tease apart what precisely drove the priming effect.

Study	Direction	Example	Finding	Modality
Jakimik et al. (1985)	L > S	*message ~ MESS* *definite ~ DEAF* *legislature ~ LEG*	priming no priming no priming	auditory intramodal
Marslen-Wilson et al. (1994)	L > S	*bulletin ~ BULLET*	no priming	cross-modal
Vroomen & de Gelder (1997)	L > S	*velg ~ VEL* *(Du. 'rim' ~ 'skin')*	no priming[6]	cross-modal
Zhang & Samuel (2015)	L > S	*property ~ PROPER* *brownie ~ BROWN* *studio ~ STEW*	priming priming priming	auditory intramodal
Marslen-Wilson (1990)	S > L (early prime) N/A	*[dɔ] ~ DOG* *feel ~ FEED*	priming inhibition	cross-modal
Spinelli et al. (2001)	S > L N/A	*ver ~ VERTIGE* *(Fr. 'worm' ~ 'vertigo')* *verger ~ VERTIGE* *(Fr. 'orchard' ~ 'vertigo')*	priming no priming	auditory intramodal and cross-modal
Dufour & Peereman (2003)	S > L N/A	*cou ~ COULISSE* *(Fr. 'neck' ~ 'slide')* *couture ~ COULISSE* *(Fr. 'sewing' ~ 'slide')*	priming no priming	auditory intramodal (shadowing)
Friedrich et al. (2013)	S > L	*[ano] ~ ANORAK* *[ana]~ ANORAK*	priming no priming[7]	cross-modal and ERP
Radeau et al. (1989)	2 segment overlap 1 segment overlap	*palais ~ PARURE* *(Fr. 'palace' ~ 'set')* *poulet ~ PARURE* *(Fr. 'chicken' ~ 'set')*	inhibition inhibition	auditory intramodal
Goldinger et al. (1992)	N/A	*bang ~ BONE*	priming	auditory intramodal (shadowing)
Slowiaczek & Hamburger (1992)	3 segment overlap 2 segment overlap 1 segment overlap	*stiff ~ STILL* *steep ~ STILL* *smoke ~ STILL*	inhibition no priming no priming	auditory and visual intramodal
Praamstra et al. (1994)	N/A	*beeld ~ BEEST* *(Du. 'statue' ~ 'animal')*	no priming	auditory intramodal
Radeau et al. (1995)	N/A	*pote ~ POCHE* *(Fr. 'mate' ~ 'poached')*	no priming	auditory intramodal
Dufour & Peereman (2003)	'high' lexical cohort 'low' lexical cohort	*banque ~ BANDE* *(Fr. 'bank' ~ 'band')* *batte ~ BASE* *(Fr. 'bat' ~ 'base')*	inhibition no priming	auditory intramodal
McQueen & Sereno (2005)	N/A	*zeep ~ ZOON* *(Du. 'soap' ~ 'son')* *knak ~ KNAP* *(Du. 'snap' ~ 'handsome')*	no priming priming	auditory intramodal
Dufour et al. (2007)	N/A	*moule ~ MOUCHE* *(Fr. 'mussel' ~ 'fly')*	inhibition	auditory intramodal
Dufour & Peereman (2009)	4 segment overlap 3 segment overlap 2 segment overlap	*canal ~ CANARD* *(Fr. 'canal' ~ 'duck')* *crème ~ CRÈCHE* *(Fr. 'cream' ~ 'nursery')* *crème ~ CRASSE* *(Fr. 'cream' ~ 'dirt')*	inhibition inhibition no priming	auditory intramodal

Table 1. Overview of previous priming studies examining phonological overlap (divided into LONG → SHORT (L > S), SHORT → LONG (S > L), and segment overlap in chronological order).

[6] In the same study, a priming effect was reported when a nonword prime was used.
[7] There was "a trend" (p = .05) towards inhibition.

1.1.2 Priming *bullet* with *bull* (SHORT → LONG priming)

Limited research has been carried out to investigate the SHORT → LONG priming configuration for form-related words: i.e. whether a shorter phonological form activates a longer one (e.g. *bull* ~ *BULLET*). In one of the most well-known studies of phonological overlap, Zwitserlood (1989) and Zwitserlood & Schiefers (1995) found that Dutch word segments (e.g. [kapit]) auditorily primed words that shared the same initial disyllabic sequence (e.g. *kapitein* 'captain' and *kapitaal* 'financial capital') as well as semantically-related targets (e.g. *schip* 'ship', semantically related to 'captain' and *geld* 'money', related to *kapitaal* 'financial capital'). Once the auditory prime included a final vowel, e.g. [kapitɛɪ], only *schip* 'ship' was activated and primed; *geld* 'money' was not, as the vowel [aː] in the word *kapitaal* no longer matched the auditory input. These findings have had crucial implications for theories regarding the perception of a spoken word, particularly with regards to the effect of cohort competitors during lexical processing.

However, attention must be drawn to the fact that the primes in these experiments were word segments, not words in their own right.[8] In Marslen-Wilson's seminal work (Marslen-Wilson & Welsh 1978, Marslen-Wilson 1987), findings suggest that perception of a partial string of phonemes is sufficient to activate longer lexical items; e.g. hearing the string [bæt] will activate the words *batter* or *battle*. A further study investigating the effect of partial initial form overlap (Marslen-Wilson 1990) found that hearing the segment [dɔ] facilitated the speed of lexical decision on the visual probe *dog*, whereas hearing *dock* resulted in no priming effect. To what extent this effect can be extended to direct phonological overlap remains unclear, as the mapping between phonological and semantic representation does not occur on a one-to-one basis (cf. Bölte & Coenen 2002).

In one of the few studies employing real word primes, Spinelli et al. (2001) found facilitation for French word pairs that shared initial segments (e.g. *ver* ~ *VERTIGE*, 'worm' ~ 'vertigo'). This effect was present in both auditory intramodal and cross-modal (auditory–visual) modalities.[9] However, when an initial overlap of segments occurred in a disyllabic prime (e.g. *verger* ~ *VERTIGE*, 'orchard' ~ 'vertigo'), this facilitation disappeared.

1.1.3 Overlapping segments in form priming

In studies where the number of phonological segments in prime and target words were uniform (e.g. *stiff* ~ *still*), most reported no priming or inhibition. These findings are in line with theories of lexical competition, which assume mismatch due to the fact that the primes are not fully embedded in the targets. Marslen-Wilson (1990) reported inhibition for English word pairs such as *feel* ~ *FEED* in the auditory–visual modality, and this was replicated both in cross-modal and auditory intramodal conditions in Slowiaczek and Hamburger (1992). Inhibition was also found for French word pairs such as *crème* ~ *CRÈCHE*, 'cream' ~ 'nursery' (Dufour & Peereman 2009), *moule* ~ *MOUCHE*, 'mussel' ~ 'fly' (Dufour et al. 2007), and a lack of priming was found for pairs such as *pote* ~ *POCHE*, 'mate' ~ 'poached' (Radeau et al. 1995). The difference between word pairs that fail to prime and those that produce inhibition has been ascribed to the number of overlapping segments (cf. Radeau et al. 1989, Slowiaczek & Hamburger 1992, Dufour & Peereman 2009) as well as number of lexical competitors (cf. Dufour & Peereman 2003).

Thus, three key points can be drawn from the previous evidence presented above. First, many of the previous studies only used monosyllabic word pairs as their stimuli, meaning that the effect of syllabification on an overlap in form has not yet been thoroughly investigated. Secondly, there is a distinct difference between patterns of facilitations for items with form overlap depending on whether a cross-modal or intra-modal paradigm is used: this may reflect the effects of modality-specific versus modality-independent processing. Finally, both lexical status of the prime (that is, whether it is a segment or a full word in its own right) and the direction of presentation (SHORT →

---

[8] Furthermore, targets were associatively/semantically related to the input signal.

[9] Interestingly, final overlap pairs (e.g., French *tige* ~ *PRESTIGE,* 'stem ~ prestige') only generated significant priming effects in the auditory–auditory modality; when presented in cross-modal conditions, these items did not prime one another.

LONG vs. LONG → SHORT) may affect processing due to differences in cohort competition. These points have been considered in the present study and the lack of systematic investigation of some of the aspects above have motivated our experimental design.

1.2 Questions and hypotheses

Our study is concerned with the role of phonological priming and how it relates to morphological processing. To this end, we conducted two sets of cross-modal lexical decision experiments. In first set (Experiments 1a–1c), stimuli consisted of three different types of monomorphemic, phonologically-related Bengali word pairs (e.g. কাল ~ কালি, [kɑl] ~ [kɑli], 'yesterday' ~ 'ink'), while three types of morphologically-related Bengali stimuli (e.g. দাগ ~ দাগী, [d̪ɑg] ~ [d̪ɑg-i], 'mark, stain' ~ 'mark-ADJ, stained') were used in Experiments 2a–2c. We chose to employ auditory–visual cross-modal priming in order to investigate the activation of modality-independent lexical representations. If prime and target are presented in the same modality, any effect might be subject to the influence of modality-specific memory traces or episodic memory. In addition, the use of cross-modal priming avoids further complications caused by orthographic factors, which can also affect the degree of phonological priming (cf. Ferrand & Grainger 1994).

In this study, we raised three related questions. First, will phonologically-related sequences activate one another? Findings for priming in phonologically-related word pairs are incongruent: as we saw in Section 1.1, some studies find priming for form-related words while others find none (cf. Marslen-Wilson et al. 1994 and Zhang & Samuel 2015). In pure form priming, the semantics of the target will not match the input semantics (e.g. *bat* ~ *BATTLE*). Hence, it is possible that phonological overlap alone is insufficient to achieve facilitation, or if any activation does occur, this is subsequently blocked due to phonological competitors. If this is the case, we predict that we will find no priming effect for our form-related conditions.

Our second question is based on the order of presentation of the stimuli; namely, will a shorter word activate a longer one as the Cohort Model predicts, or will a longer word activate the shorter? Is the direction of priming crucial to activation? To address this question, we presented stimulus pairs in both orders (SHORT → LONG and LONG → SHORT) in those experiments where the pairs differ in the number of segments. Thus, each member of a stimulus pair was used as prime and target to establish whether the order of presentation affects facilitation.

As discussed above, most research has followed the pattern of presenting the complex item as the prime and the simple(r) item as the target (i.e. the LONG → SHORT configuration, *bullet* ~ *BULL*). These studies have elicited disparate results: some find priming while others do not (cf. Jakimik et al. 1985, Marslen-Wilson et al. 1994, Zhang & Samuel 2015). In the few studies that employ the SHORT → LONG configuration (e.g. *mess* ~ *MESSAGE*), priming effects have been observed between segments and full word forms in mediated priming (cf. Zwitserlood 1989, Zwitserlood & Schriefers 1995, Marslen-Wilson 1990). This has led to the hypothesis that, in hearing a segment of a word (e.g. [bæ]), the cohort is activated and related lexical representations (e.g. *bad, back, bat*) are accessed along with related semantic information. Therefore, when the semantic target is consistent with the auditory stimulus (e.g. [bæ] ~ *AWFUL*), a priming effect will be observed.

However, if there is merely a form relationship between items, a longer item which constitutes a real word may not activate a phonologically-related shorter item since, according to models such as the Cohort Model, the shorter item is no longer a competitor and would have fallen out of the cohort. That is, *bullet*, for instance, could still be extended to *bulletin* but once *bulletin* has been heard, *bullet* is no longer in contention. If Cohort Model predictions are borne out, we may see facilitation in the SHORT → LONG form-related conditions but none in the LONG → SHORT form-related conditions. And while we expect strong facilitation for all morphologically-related pairs, there may be a difference in the degree of priming between the two orders of presentation.

Our third question focuses on the difference between phonologically- and morphologically-related words: using precisely the same structural overlap, does the introduction of a semantic relationship result in priming and does this depend on the type of stimulus? To examine this, we selected morphologically-related words which were also semantically related, with segmental structures parallel to those in the purely phonologically-related condition. Following a wealth of evidence for the priming of morphologically-related words (cf. Marslen-Wilson et al. 1994), we expect to observe a priming effect for all configurations in Experiments 2a–2c.

2 Experiments 1a–1c: Form priming

The first set of experiments investigates the relationship between phonologically-related Bengali word pairs that differ in a single segment. Below we present the findings from three types of word pairs that involved either the addition/deletion of one vowel (Experiment 1a: CVC ~ CVCV), the addition/deletion of one consonant (Experiment 1b: CVCV ~ CVCVC), or a change of a final vowel (Experiment 1c: $CVCV_1 \sim CVCV_2$). For the types where the prime and target differ in word length (i.e. Experiments 1a–1b), we also investigated the effect of directionality; that is, whether short words will prime longer words (e.g. কাল ~ কালি, [kɑl] ~ [kɑli], 'yesterday' ~ 'ink'), or if employing longer words as primes (কালি ~ কাল, [kɑli] ~ [kɑl], 'ink' ~ 'yesterday') will result in a different pattern of facilitation.

2.1 Method

2.1.1 Participants

64 Bengali native speakers took part in this set of experiments. All participants were undergraduate students at Jadavpur University and Bethune College, Kolkata University, in Kolkata, India. None of the participants reported either hearing difficulties or dyslexia and all subjects were compensated accordingly for their participation.

2.1.2 Materials

In this experiment, the stimuli were comprised of either monomorphemic nouns or adjectives. In terms of their structure, three different types of word pairs were used (Table 2). In the first type (CVC ~ CVCV), the prime and the target differed by the addition of a final vowel. This also resulted in a difference in the number of syllables: CVC. ~ CV.CV. In second type (CVCV ~ CVCVC), prime and target differed by a consonant with the number of syllables remaining constant, but a change in the type of syllable (open vs. closed syllable) was introduced (CV.CV ~ CV.CVC). In the $CVCV_1 \sim CVCV_2$ type, the number and the type of syllable remained the same (CV.CV) but the final vowel was different. The full stimulus lists for Experiments 1a–1c are found in Appendix A.

32 test pairs were selected for each type. All words were morphologically simple and thus each word pair was related only in form. In addition, 16 control words and 32 pseudo-word pairs with matching syllable structure were chosen for each type. Half of the pseudo-word pairs were related in form and the other half were unrelated. Primes were always real words.

Condition	**CVC ↔[10] CVCV**	**CVCV ↔ CVCVC**	**$CVCV_1 \leftrightarrow CVCV_2$**
Critical word pair (gloss)	kɑl ↔ kɑli *yesterday ↔ ink*	d̪ɑli ↔ d̪ɑlim *basket ↔ pomegranate*	d̪ɑbi ↔ d̪ɑbɑ *claim ↔ chess*
Pseudo-word (gloss)	keʃ → *koʃɑ *hair → –*	nit̪i → *nit̪ik *law → –*	mɑne → *mɑnu *meaning → –*

Table 2. Sample word pairs used in Experiments 1a–1c (form priming).

2.1.3 Recording

Auditory stimuli were recorded by a female native speaker of Bengali in a sound-attenuated room, using the software Audacity with a Roland R-26 WAV recorder at a sampling rate of 44.1kHz. The auditory stimuli were then extracted using the acoustic analysis software PRAAT (Boersma & Weenink 2011). The volume of all items was equalized.

---

[10] Note: the double arrow '↔' in the table indicates testing in both directions.

2.1.4 Design

There were two within subject factors: *Relatedness* (i.e. whether the prime and the target are related or unrelated) and *Direction* of priming (i.e. whether the prime was the shorter or longer word). Table 3 provides an example of the design for the CVC ~ CVCV type. The CVCV ~ CVCVC type followed an identical design. A Latin-Square design was used to create four lists: in each list, each word pair appeared only once. Each list contained equal numbers of all four conditions with equal number of trials. All visual targets appeared only once. As shown in Table 3, for each critical stimuli pair, each word served as the target twice, paired once with a related prime and once with an unrelated prime. Experiments 1a–1c were always run first as we wanted to avoid the spreading of a possible effect of the morphologically rich stimulus set in Experiments 2a–2c which may have led to an inflation of the form priming effect.

List	Prime	Target	Direction	Relatedness
List 1	kɑl 'yesterday'	kɑli 'ink'	SHORT → LONG	related
List 2	d̪oʃ 'mistake'	kɑli 'ink'	SHORT → LONG	unrelated
List 3	kɑli 'ink'	kɑl 'yesterday'	LONG → SHORT	related
List 4	kẽʧo 'snail'	kɑl 'yesterday'	LONG → SHORT	unrelated

Table 3. Sample design of the CVC ~ CVCV type for pure form priming.

For the $CVCV_1$ ~ $CVCV_2$ type, four lists were created in a similar manner. Here, *Direction* was not relevant as the items were of the same length. Thus, only *Relatedness* was coded (Table 4).

List	Prime	Target	Direction	Relatedness
List 1	d̪ɑbi 'claim'	d̪ɑbɑ 'chess'	N/A	related
List 2	ʧʰɑpɑ 'print'	d̪ɑbɑ 'chess'	N/A	unrelated
List 3	d̪ɑbɑ 'chess'	d̪ɑbi 'claim'	N/A	related
List 4	ʃiʃi 'bottle'	d̪ɑbi 'claim'	N/A	unrelated

Table 4. Sample design of the experiment $CVCV_1$ ~ $CVCV_2$ for pure form priming.

Previous research suggests that strategic processing may bias responses in a phonological priming paradigm (cf. Radeau et al. 1989, Goldinger et al. 1992, Dufour 2008). Therefore, to reduce the likelihood of predictive responses by strategy, all three prime-target types were combined into a comprehensive sequence, e.g. List 1 of CVC ~ CVCV, CVCV ~ CVCVC, and $CVCV_1$ ~ $CVCV_2$ were combined into one list. This was done so as to avoid prediction of the syllable structure of the target. Four combined lists were created in total. The order within each list was pseudo-randomized with the constraint that no more than four consecutive trials required the same lexical-decision response or were of the same syllable type.

2.1.5 Procedure

The experiment started with a practice task of ten trials. This practice task was repeated until the experimenters were satisfied that the task was understood. Then each group of participants completed one list of the phonological priming sequence (ca. 8min) and, after a break, they completed one list of a second unrelated experiment (again ca. 8min). The stimuli were presented with experimental software developed by Reetz & Kleinmann (2008). Each trial started with a 'beep' tone. The auditory primes were played through closed-ear headphones (Sennheiser PX200) 200ms after the offset of the beep. Visual targets in Bengali regular font were then displayed for 800ms immediately at the offset of the auditory primes. The inter-trial interval was 1500ms. Participants were instructed to make a lexical decision on the visual target as quickly and as accurately as possible. Reaction time was measured from the onset of stimulus display.

2.1.6 Data cleaning and analysis

The data cleaning and analysis procedures were the same for all three experiments (N = 12277) reported here. Items and participants with less than 60% accuracy were excluded: this resulted in a loss of 13.9% of the data (1707 data points). In addition, to enhance the normality of the RT distribution, RT of less than 200ms and those above/below two standard deviations of each participant were excluded. This resulted in a further loss of 5.7% of data (620 data points).

Statistical analyses were performed by fitting a linear mixed-effects model to reaction times (RTs). Using the lmer function from the lme4 package, RTs were modeled as a function of the main fixed effect factors, *Relatedness* and (where applicable) *Direction*. These fixed effects were sum-coded. Goodness of fit was established by model comparison and normality of residuals. Following Baayen et al. (2008), all t-values greater than 2 or less than -2 were treated as significant. Subjects and Items were treated as random factors.

We are aware of the suggestion that the random effect structure should be kept maximal (Barr et al. 2013) and thus chose to follow the recommendations by Matuschek et al. (2017) to determine the random effect structure, that is to select the model where the complexity of the random effect structure is supported by the dataset (Bates et al. 2015, Matuschek et al. 2017). A likelihood ratio test (LRT) is used to test whether reducing the random effect harms the model fit. αLRT = 0.2 is used which gives more weight to more complex models (Matuschek et al. 2017).

2.2 Results

We next report on the findings for each word-pair type.

2.2.1 Experiment 1a: CVC ~ CVCV

Experiment 1a tested the relationship between phonologically-related word pairs that differed in the presence/absence of a final vowel. In an analysis containing both fixed effects[11], neither *Relatedness* (Est. = 3.59, SE = 3.42, t = 1.05) nor *Direction* (Est. = 1.85, SE = 5.99, t = 0.31) showed a significant effect on RT. Following this, the optimal model[12] for this data was the null model. This was confirmed in model comparison, where there was no significant difference between the null model and a model containing either *Relatedness* ($\chi^2(1) = 1.64$, p = 0.20) or *Direction* ($\chi^2(1) = 0.11$, p = 0.74).

This experiment elicited no effect of *Relatedness* on RT; that is, RTs to the form related condition (e.g. কাল ~ কালি, [kɑl] ~ [kɑli], 'yesterday' ~ 'ink') were no faster than those for the unrelated condition (ধান ~ কালি, [d̪ʱɑn] ~ [kɑli], 'rice grain' ~ 'ink'). Likewise, there was no effect of *Direction*: RTs for the SHORT → LONG priming direction (e.g. কাল ~ কালি, [kɑl] ~ [kɑli], 'yesterday ~ ink') were no faster than those for the LONG → SHORT direction (e.g. কালি ~ কাল, [kɑli] ~ [kɑl], 'ink' ~ 'yesterday') (Table 5). An error analysis indicated no interaction between *Relatedness* and error ($\chi^2(1) = 0.20$, p = 0.67), nor were errors significantly different between the two directions of priming, ($\chi^2(1) = 0.54$, p = 0.46).

Direction	Related		Control		Effect
	RT	SE	RT	SE	(in ms.)
SHORT → LONG (CVC ~ CVCV)	591	14.4	601	14.5	10
LONG → SHORT (CVCV ~ CVC)	589	14.3	604	14.2	15

Table 5. Mean reaction times (in ms) for Experiment 1a (N = 1590).

2.2.2 Experiment 1b: CVCV ~ CVCVC

Experiment 1b tested the relationship between phonologically-related word pairs that differed in the

[11] ReacTime~Relatedness +Direction+ (1 +Relatedness|Date.Time.SJ) + (1 |Target))
[12] ReacTime~1 + (1 |Date.Time.SJ) + (1 |Target))

presence/absence of a final consonant. In an analysis containing the fixed effects[13], neither *Relatedness* (Est. = 1.76, SE = 2.89, t = 0.63) nor *Direction* (Est. = -3.50, SE = 6.18, t = -0.57) showed a significant effect on RTs. Following this, the optimal model for this data was the null model.[14] This was confirmed through model comparison, where there was no significant difference between the null model and a model containing either *Relatedness* ($\chi^2(1) = 0.50$, p = 0.48) or *Direction* ($\chi^2(1) = 0.31$, p = 0.58).

The model showed no effect of prime on RTs; that is, RTs to the form-related condition (e.g. বাটি ~ বাটিক, [bɑt̪i] ~ [bɑt̪ik], 'bowl' ~ 'wax dye') were no faster than those for the unrelated condition (বাটি ~ কুমির, [bɑt̪i] ~ [kumir], 'bowl' ~ 'crocodile'). Likewise, there was no effect of *Direction*: RTs for the SHORT → LONG direction (বাটি ~ বাটিক, [bɑt̪i] ~ [bɑt̪ik], 'bowl' ~ 'wax dye') were no faster than for the LONG → SHORT direction (বাটিক ~ বাটি, [bɑt̪ik] ~ [bɑt̪i], 'wax dye' ~ 'bowl').

Direction	Related		Control		Effect
	RT	SE	RT	SE	(in ms.)
SHORT → LONG (CVCV ~ CVCVC)	607	14.3	609	14.3	-2
LONG → SHORT (CVCVC ~ CVCV)	605	14.4	596	14.4	9

Table 6. Mean reaction times (in ms) for Experiment 1b (N = 1478).

2.2.3 Experiment 1c: CVCV$_1$ ~ CVCV$_2$

Experiment 1c tested the relationship between phonologically-related word pairs that differed in change of a final vowel. For this priming configuration, only one fixed effect was relevant: *Relatedness*. The optimal model[15] contained *Relatedness* as a significant fixed effect (Est. = 25.63, SE = 9.53, t = -2.69), random slopes and intercepts between *Relatedness* and subjects, and random slopes and intercepts between *Relatedness* and targets. Reducing *Relatedness* from the model structure significantly affected goodness of fit ($\chi^2(5) = 54.94$, p < .0001*). Therefore, *Relatedness* was a significant predictor. This model appeared homoscedastic when inspected visually. In this analysis, we found a significant priming effect of *Relatedness*: RTs for the form-related condition (e.g. পরি ~ পোরা, [pori] ~ [porɑ], 'fairy' ~ 'fill.VBN') were on average 23ms faster than those for the unrelated condition (e.g. তুলি ~ পোরা, [t̪uli] ~ [porɑ], 'brush' ~ 'fill.VBN').

	Related		Control		Effect
	RT	SE	RT	SE	(in ms.)
CVCV$_1$ ~ CVCV$_2$	595	11.6	618	11.6	23*

Table 7. Mean reaction times (in ms) for Experiment 1c (N = 1461).

2.3 Discussion

The first set of experiments tested the effect of pure phonological overlap in cross-modal priming in three different pairs of phonologically-related Bengali words. In Experiment 1a, the prime and the target differed by the presence/absence of a final vowel (e.g. কাল ~ কালি, [kɑl] ~ [kɑli], 'yesterday' ~ 'ink'). In Experiment 1b, prime and target differed by the presence/absence of a final consonant (বাটি ~ বাটিক, [bɑt̪i] ~ [bɑt̪ik], 'bowl' ~ 'wax dye'). In Experiment 1c, the word pairs differed in final vowel quality (পরি ~ পোরা, [pori] ~ [porɑ], 'fairy' ~ 'fill.VBN'). We examined not only the relationship between the pairs, but also whether directionality of priming affected this relationship.

There has been much discussion about the contribution of overlapping phonological segments to the inhibition of priming (cf. Slowiaczek & Hamburger 1992, Praamstra et al. 1994, Dufour &

13 ReacTime~Relatedness +Direction+ (1+Relatedness|Date.Time.SJ) + (1 |Target)
14 ReacTime~1 + (1 |Date.Time.SJ) + (1 |Target))
15 ReacTime~Relatedness + (1+Relatedness|Date.Time.SJ) + (1+Relatedness|Target)

Peereman 2003, 2009).[16] It has been suggested that the inhibitory effect grows as the number of overlapping segments grows. Thus, as the number of initial shared segments increases so does the competition, resulting in a lack of priming for words such as *steep ~ STILL* and inhibition for words such as *stiff ~ STILL* in Slowiaczek and Hamburger (1992). Evidence from recent masked priming and eye-tracking studies also supports the existence of such an inhibition effect (cf. Frisson et al. 2014a, 2014b).

In Experiments 1a and 1b, where word length differed by a single segment, no priming effect was observed. In addition, there was no interaction between *Relatedness* and *Direction* in either experiment, indicating a lack of priming for both LONG → SHORT and SHORT → LONG configurations. In Experiment 1c, where the word length of the prime and target were the same (e.g. পরি ~ পোরা, [pori] ~ [porɑ], 'fairy' ~ 'fill.VBN'), a significant priming effect was observed. We first discuss the findings related to the experiments in which word length differed, i.e. SHORT → LONG and LONG → SHORT configurations (Experiments 1a and 1b).

2.3.1 Findings for SHORT → LONG priming configurations

As discussed in Section 1.1, the phonological priming literature has largely focused on the LONG → SHORT configuration. Little is known concerning the reverse configuration: SHORT → LONG. In the experiments which examined direction of priming (Experiments 1a and 1b), we found no priming for either configuration, whether consisting of the addition of a vocalic segment in Experiment 1a (CVC ~ CVCV) or a consonantal segment in Experiment 1b (CVCV ~ CVCVC). At first glance, this finding is contradictory to the predictions made by most speech recognition models (e.g. Cohort) as hearing shorter words should, in theory, activate a cohort of words which begin with those segments (cf. Zwitserlood 1989, Zwitserlood & Schriefers 1995, Marslen-Wilson 1990). However, the current experiment deviated from previous studies in several ways: 1) our targets did not share semantic information with the primes, 2) the visual targets were very close in form to the auditory primes (e.g. বাটি ~ বাটিক, [bɑt̪i] ~ [bɑt̪ik], 'bowl' ~ 'wax dye'), and 3) the primes were real words. This third factor, in particular, conceivably causes strong lexical competition. Word fragments such as [dɔ] are incomplete and unspecified: they are neither a real word, nor do they have a distinctive meaning. Therefore, the likelihood that they will activate lexical competitors sharing the same initial segments (e.g. *dog* or *dock*) is much higher than a prime [dɔg], which initiates a mismatch for many items sharing initial segments (other than longer words such as *doghouse* or *doggy*). Furthermore, a full-word prime (*dog*) activates associated semantic information that will presumably mismatch with that of *dock.* As discussed above, evidence for full word priming is scant.[17]

2.3.2 Findings for LONG → SHORT priming configurations

No priming effect was observed for the LONG → SHORT condition, either for the CVCV ~ CVC type (কালি ~ কাল, [kɑli] ~ [kɑl], 'ink' ~ 'yesterday') or the CVCVC ~ CVCV type (বাটিক ~ বাটি, [bɑt̪ik] ~ [bɑt̪i], 'wax dye' ~ 'bowl'). This finding agrees with predictions made by models such as the Cohort model: when the prime is the longer form (e.g. কালি, [kɑli], 'ink'), any shorter forms (e.g. কাল, [kɑl], 'yesterday') should theoretically be excluded from the cohort. However not all findings suggest inhibition: recall that Jakimik et al. (1985) and Zhang & Samuel (2015) found priming for configurations in which a longer word was presented as prime, e.g. *message ~ MESS* and *property ~ PROPER.* Zhang & Samuel (2015) attributed this finding to their use of the auditory–auditory

[16] In addition to lexical competition effects, it has been widely suggested (cf. Goldinger 1999, Pitt & Shoaf 2002) that inhibition between phonological pairs sharing segments could also be attributed to task effects; that is, participants developing anticipatory responses to the word pairs.

[17] A notable exception is the *ver ~ VERTIGE* 'worm ~ vertigo' pairs in Spinelli et al. (2001), which elicited strong priming in both auditory–auditory and cross-modal conditions. However, it is worth noting here that the targets in these experiments actually contained two embedded words (e.g. *CRITIQUE* which contains both *cri* 'shout' and *tique* 'tick'); this was done in order to measure effects of phonological overlap of both initial and final segments.

priming paradigm, and suggested that intramodal auditory conditions induce more sensitivity to words embedded initially (e.g. ***proper**ty)*. Correspondingly, our finding mirrors those found in other cross-modal experiments in Marslen-Wilson et al. (1994) and Vroomen & de Gelder (1997): hearing a word that contains a longer embedded word (e.g. *bullet*) will not facilitate responses to a shorter target word, even though it exists within the prime word (e.g. *bull*).

2.3.3 Findings for final segment mismatch

Finally, we observed a significant priming effect for word pairs that differed in final vowel in Experiment 1c (CVCV$_1$ ~ CVCV$_2$, e.g. পরি ~ পোরা, [pori] ~ [porɑ], 'fairy' ~ 'fill.VBN'). This was perhaps the most surprising finding of all, as the majority of similar studies usually result in either inhibition or a lack of priming (cf. Radeau et al. 1989, Slowiaczek & Hamburger 1992, and Dufour & Peereman 2003, 2009). One notable exception is found in McQueen & Sereno (2005), who found that Dutch word pairs differing in a final consonant (e.g. *knak* ~ *knap*, 'snap' ~ 'handsome') induced priming. We have attributed the lack of priming in Experiments 1a and 1b to effects of real-word primes and cross-modal priming paradigm; however, Experiment 1c was conducted with the same stimuli in the same conditions. What, then, could be driving these results?

Syllabic influences have been shown to be important in word priming (cf. Emmorey 1989, Dumay & Content 2012). Ferrand & Grainger (1996) found that word pairs in which syllable structure was matched in the initial syllable (e.g. French *ba.lade* ~ *ba.lance,* 'ride' ~ 'balance') elicited significantly faster naming latencies than word pairs exhibiting syllable mismatch (e.g. *ba.lade* ~ *bal.con*, 'ride ~ balcony'). As Vroomen & de Gelder (1997) have suggested, metrical information plays a crucial role in lexical segmentation during lexical activation and this seems to be borne out by the data in the present study. In our CVC ~ CVCV word pairs (Experiment 1a), the addition of a vocalic segment also resulted in an additional syllable (i.e. [kɑl]$_\sigma$ ~ [kɑ]$_\sigma$[li]$_\sigma$, not *[kɑl]$_\sigma$[i]$_\sigma$) and therefore a change in syllable type (open to closed) and misalignment of boundaries between the prime and target. In the CVCV ~ CVCVC type (Experiment 1b), the number of syllables remained constant, but a change in the **type** of syllable (open to closed) was introduced in the second syllable: [bɑ]$_\sigma$[t̪i]$_\sigma$ ~ [bɑ]$_\sigma$[t̪ik]$_\sigma$, not *[bɑt̪]$_\sigma$[ik]$_\sigma$. Both of these syllabic changes conceivably enhance the effect of mismatch between the word pairs, further facilitating exclusion of cohort competitors. In Experiment 1c (the CVCV$_1$ ~ CVCV$_2$ type), the syllabic structure of both prime and target was the same: [po]$_\sigma$[ri]$_\sigma$ ~ [po]$_\sigma$[rɑ]$_\sigma$. Thus, there was no syllable mismatch, feasibly making it harder to reduce the number of lexical competitors for these word pairs.

3 Experiments 2a–2c: Morphological priming

The aim of this second set of experiments was to compare the effect of morphologically-related pairs to those of purely phonologically-related pairs. As seen in Experiments 1a–1c, with pure form overlap, we found significantly less priming. For the morphologically-related pairs, however, we do predict to observe priming effects. Below we present the findings from three types of morphologically-related word pairs that involved either the addition/deletion of one vowel (Experiment 2a: CVC ~ CVCV), the addition/deletion of one consonant (Experiment 2b: CVCV ~ CVCVC), or a change of a final vowel (Experiment 2c: CVCV$_1$ ~ CVCV$_2$). For the types where the prime and target differ in word length (i.e. Experiments 2a and 2b), we also investigated the effect of directionality; that is, whether there was an effect of using short words as primes for longer words (e.g. দাগ ~ দাগী, [d̪ɑg] ~ [d̪ɑg-i], 'mark, stain' ~ 'mark-ADJ, stained') as well as longer words as primes for shorter ones (দাগী ~ দাগ, [d̪ɑg-i] ~ [d̪ɑg], 'mark-ADJ, stained' ~ 'mark, stain').

3.1 Method

3.1.1 Participants

Participants were the same as those in Experiments 1a–1c. All participants completed the form-priming experiments first, followed by the morphological-priming experiments.

3.1.2 Materials

32 morphologically-related word pairs matching the segmental structure of the form-related stimuli were selected (Table 8; stimuli for Experiments 2a–2c are listed in Appendix B). For each word pair, each word was used as a prime as well as a target in different lists. As languages very rarely allow for completely matched sets of stimuli in all aspects, there are some differences between the stimulus types in the three experiments regarding their morphological relationship and word class.

Stimuli for the CVC. ↔ CV.CV type (Experiment 2a) consisted of derivationally-related noun ~ adjective pairs. The stimulus sets for the remaining two groups, CV.CV ↔ CV.CVC (Experiment 2b: 1.PRES ~ 2INT.PRES) and CV.CV_1 ↔ CV.CV_2 (Experiment 2c: 3.PRES ~ 2FAM.PRES), inflectional targets were used due to the fact that these structural relationships cannot be found in sufficient quantity in derivationally-related items in Bengali. As in Experiments 1a–1c, 16 control words and 32 pseudo-word pairs with matching syllable structure were chosen for each type and half of the pseudo-word pairs were related in a similar way to the real word pairs, the rest unrelated.

Condition	CVC ↔ CVCV	CVCV ↔ CVCVC	$CVCV_1$ ↔ $CVCV_2$
Critical word pair (gloss)	d̪eb ↔ d̪eb-i *deity.M ↔ deity-F*	d̪ekʰ-i ↔ d̪ekʰ-iʃ *see-1.PRES ↔ see-2INT.PRES*	kʰol-e ↔ kʰol-o *open-3.PRES ↔ open-2FAM.PRES*
Pseudo-word (gloss)	t̪il → *t̪ilo *sesame → –*	ʤit̪-i → *ʤit̪ɑʃ *win-1.PRES → –*	ʧɑp-i → *ʧɑpu *press-1.PRES → –*

Table 8. Sample word pairs used in Experiments 2a–2c.

3.1.3 Design and procedure

The design and procedure were the same as those in Experiments 1a–1c. The only difference is that, instead of purely phonologically-related critical word pairs, morphologically-related word pairs were used. Hence, four versions of the morphological priming sequence were created and distributed across four lists with the same pseudo-randomization procedure as explained in 2.1.4 to ensure minimization of strategic processing effects.

3.2 Results

Data were cleaned and analyzed in a similar manner as reported in 2.1.6. Items and participants with less than 60% accuracy were excluded: this resulted in a loss of 13.6% of the data (1678 data points). To enhance the normality of the RT distribution, RTs of less than 200ms and those above/below two standard deviations of each participant were excluded. This resulted in a further loss of 4.2% of data (445 data points). We next report on the findings for each type.

3.2.1 Experiment 2a: CVC ~ CVC-V

Experiment 2a tested the relationship between morphologically-related word pairs that differed in the presence/absence of a final vowel (e.g. দেব ~ দেবী, [deb] ~ [deb-i], 'deity.M' ~ 'deity-F'). The optimal model[18] contained an interaction between the two main effects *Relatedness* and *Direction* and random intercepts for subjects and targets. This interaction was significant (Est. = -5.70, SE = 2.39, t = -2.38), and removing the interaction from the analysis affected goodness of fit ($\chi^2(1) = 5.67$, p = .02*). This interaction was investigated in a post-hoc analysis through the *lsmeans* package (Tukey adjustment), in which both conditions were found to prime; however, SHORT → LONG configurations exhibited a stronger priming effect (Est. = 42.30, SE = 6.96, t = 6.07) than LONG → SHORT configurations (Est. = -27.33, SE = 10.27, t = 2.97) (Table 9).

The model showed a significant effect of prime on RTs (Table 9); that is, RTs to the related

[18] ReacTime~Relatedness*Direction+ (1|Date.Time.SJ) + (1|Target)

condition (e.g. দেব ~ দেবী, [d̪eb] ~ [d̪eb-i], 'deity.M' ~ 'deity-F') were faster than those for the unrelated/control condition (e.g. দেব ~ বেণী, [d̪eb] ~ [beni], 'deity.M' ~ 'braid'). Furthermore, there was an interaction between *Relatedness* and *Direction*: the SHORT → LONG direction (e.g. দেব ~ দেবী, [d̪eb] ~ [d̪eb-i], 'deity.M' ~ 'deity-F') primed more than the LONG → SHORT direction (e.g. দেবী ~ দেব, [d̪eb-i] ~ [d̪eb], 'deity-F' ~ 'deity.M').

Direction	Related		Control		Effect
	RT	SE	RT	SE	(in ms.)
SHORT → LONG (CVC ~ CVC-V)	560	10.4	602	10.5	42**
LONG → SHORT (CVC-V ~ CVC)	555	10.2	576	10.2	21*

Table 9. Mean reaction times (in ms) for Experiment 2a (N = 1509).

3.2.2 Experiment 2b: CVC-V ~ CVC-VC

Experiment 2b tested the relationship between inflectionally-related word pairs that differed in the presence/absence of a final consonant (e.g. দেখি ~ দেখিস, [d̪ekʰ-i] ~ [d̪ekʰ-iʃ], 'see-1.PRES' ~ 'see-2INT.PRES'). The optimal model[19] contained an interaction between the two main effects *Relatedness* and *Direction*, random slopes and intercepts between *Relatedness* and *Direction* and subjects, and random intercepts for targets. This interaction was significant (Est. = 5.98, SE = 2.43, t = 2.407), and removing the interaction from the analysis affected goodness of fit ($\chi^2(1) = 5.78$, p = 0.02*).

This interaction was investigated in a post-hoc analysis through the *lsmeans* package (Tukey adjustment), in which both conditions were found to prime; however, as the interaction indicated, LONG → SHORT configurations exhibited stronger priming (Est. = 42.5, SE = 6.82, t = 6.27) than SHORT → LONG configurations (Est. = -18.6, SE = 7.48, t = 2.48) (Table 10).

The model showed a significant effect of prime on RTs; that is, RTs to the related condition (e.g. দেখি ~ দেখিস, [d̪ekʰ-i] ~ [d̪ekʰ-iʃ], 'see-1.PRES' ~ 'see-2INT.PRES') were faster than those for the unrelated/control condition (e.g. দেখি ~ খাটিস, ([d̪ekʰ-i] ~ [kʰɑʈ-iʃ], 'see-1.PRES' ~ 'work hard-2INT.PRES'). Furthermore, there was an interaction between *Relatedness* and *Direction*: RTs for the LONG → SHORT direction (e.g. দেখিস ~ দেখি, [d̪ekʰ-iʃ] ~ [d̪ekʰ-i], 'see-2INT.PRES' ~ 'see-1.PRES') primed more for the SHORT → LONG direction (দেখি ~ দেখিস, [d̪ekʰ-i] ~ [d̪ekʰ-iʃ], 'see-1.PRES ~ see-2INT.PRES').

Direction	Related		Control		Effect
	RT	SE	RT	SE	(in ms.)
SHORT → LONG (CVCV ~ CVCVC)	596	11.0	616	11.0	20*
LONG → SHORT (CVCVC ~ CVCV)	532	10.7	575	10.7	43**

Table 10. Mean reaction times (in ms) for Experiment 2b (N = 1459).

3.2.3 Experiment 2c: CVC-V_1 ~ CVC-V_2

Experiment 2c tested the relationship between morphologically-related word pairs that differed in the change of a final vowel (e.g. খোলে ~ খোলো, [kʰol-e] ~ [kʰol-o], 'open-3.PRES' ~ 'open-2FAM.PRES'). For this priming configuration, only one fixed effect was relevant: *Relatedness*. The optimal model[20] contained *Relatedness* as a significant (Est. = -24.24, SE = 5.73, t = -4.22) fixed effect, and random slopes and intercepts for subjects and targets. Reducing *Relatedness* from the model structure significantly affected goodness of fit ($\chi^2(5) = 17.68$, p < .0001*). This model ap-

[19] ReacTime ~ Relatedness*Direction+ (1+Relatedness*Direction|Date.Time.SJ) + (1|Target)
[20] ReacTime ~ Relatedness + (1 |Date.Time.SJ) + (1 |Target)

peared homoscedastic when inspected visually. In this analysis, we found a significant priming effect of *Relatedness*: RTs for word pairs in the morphologically-related condition (e.g. খোলে ~ খোলো, [kʰol-e] ~ [kʰol-o], 'open-3.PRES' ~ 'open-2FAM.PRES') were significantly faster those for the unrelated condition (খোলে ~ পুষিস, [kʰol-e] ~ [puʃ-iʃ], 'open-3.PRES' ~ 'keep pets-2FAM.PRES').

	Related		Control		Effect
	RT	SE	RT	SE	(in ms.)
$CVCV_1 \sim CVCV_2$	589	11.6	609	11.6	20*

Table 11. Mean reaction times (in ms) for Experiment 2c (N = 1302).

3.3 Discussion

The motivation for conducting a series of experiments parallel to the three pure phonological priming experiments was to test whether introducing morphological, and thus semantic, relatedness would lead to the emergence of priming effects. As in Experiments 1a–1c, we examined both different degrees of overlap and directionality of priming, and found that all three types of morphologically-related word pairs showed strong facilitation, as demonstrated in the literature (cf. Marslen-Wilson et al. 1994).

In Experiment 2a (CVC ~ CVC-V, e.g. দেব ~ দেবী, [deb] ~ [deb-i], 'deity.M' ~ 'deity-F') both morphologically-related configurations primed, but the SHORT → LONG direction exhibited stronger priming than the LONG → SHORT direction. This is in line with expectations from the Cohort model (Marslen-Wilson 1987, Marslen-Wilson & Tyler 1980, Marslen-Wilson & Welsh 1978): hearing দেব [deb] 'deity.M' activates a set of matching candidates, including the target দেবী [deb-i] 'deity-F'.

Experiment 2b tested the relationship between morphologically-related CVC-V ~ CVC-VC items that differed by the presence/absence of a final consonant. Once again, both configurations primed in this experiment; however, the LONG → SHORT configuration primed more than the SHORT → LONG configuration. This is initially a perplexing finding, as priming patterns were expected to be similar to those in Experiment 2a. While this could be, in part, ascribed to the difference in vowel length in the first syllable of the words, there is also the fact that the stimuli for this experiment consisted of inflectional items (e.g. দেখি ~ দেখিস, [d̪ekʰ-i] ~ [d̪ekʰ-iʃ], 'see-1.PRES' ~ 'see-2INT.PRES'). Bengali has three levels of politeness forms in second person pronouns which is also reflected in the inflectional marking on verbs: intimate (2INT, addressing children, animals, siblings, childhood friends), familiar (2FAM, addressing familiar people), and honorific (2HON, addressing less familiar adults, elders, etc.). Suffixes of the form VC are rare. We opted for the inflectional 2INT.PRES suffix /-iʃ/ which is perfectly regular; out of context, however, the word would appear unanticipated and perhaps even startling due to the very informal contexts in which it would be expected. Thus, as a lone word, forms such as দেখিস [d̪ekʰ-iʃ] 'see-2INT.PRES' would be unexpected, leading to the observed pattern with slower RTs.

Finally, the morphologically-related word pairs in Experiment 2c, which differed in a single final vocalic segment ($CVC\text{-}V_1 \sim CVC\text{-}V_2$, e.g. খোলে ~ খোলো, [kʰol-e] ~ [kʰol-o], 'open-3.PRES' ~ 'open-2FAM.PRES'), also exhibited strong priming. All three experiments above display strong facilitation effects overall which is in line with previous findings using morphologically-related stimuli in cross-modal designs. Thus, adding the additional morphological and semantic relations to the pure form overlap results in significantly stronger activation of the target when the prime is processed. This applies to all conditions and all directions of priming. The difference in the degree of priming observed in Experiments 2a and 2b most likely results from the difference in the type of morphological relationship exhibited by the word pairs (derivational vs. inflectional) as well as the distribution of those forms in the language.

4 General discussion

In normal language processing, we are continuously analyzing the form and structure of incoming speech signals to understand their meaning. At the same time, we unavoidably encounter situations in which words are contained within other words (e.g. *ham* in *hammer*). Such instances can overlap in form only without sharing meaning (e.g. *corn* ~ *corner*) or overlap in both form and meaning (e.g. *write* ~ *writer*). This study was concerned with the degree to which form overlap activates related items in the lexicon compared to overlap which is also morphological. We investigated three related central issues concerning the effect of phonological overlap on word recognition: the effect of modality on the processing of form overlap, the role of segmental and syllable structure, and the question whether the lexical status of the prime (i.e. fragment vs. full word) plays a role in activation of related targets. To this end, we designed two sets of cross-modal priming experiments in which the pattern of overlap between primes and targets was controlled and matched. Experiments 1a–1c investigated the effect of phonological form overlap on the degree of activation and facilitation, while Experiments 2a–2c contained items which were morphologically (and thus semantically) related.

The experiments were conducted using Bengali, a language which offered a suitably balanced set of stimuli. Importantly, the Bengali lexicon contains large numbers of purely phonologically- as well as morphologically-related word pairs with otherwise identical segmental structure. Moreover, Bengali morphology allows for both single vowel suffixes and single consonantal suffixes: e.g. নাক ~ নাকী, [nɑk] ~ [nɑk-i], 'nose' ~ 'nasal', মাখ ~ মাখে, [mɑkʰ] ~ [mɑkʰ-e], 'mix.2INT.IMP' ~ 'mix-3.PRES', ছোঁ ~ ছোঁন, [ʧʰõ] ~ [ʧʰõ-n], 'touch.2INT.IMP' ~ 'touch-2HON.PRES', and জমা ~ জমাট, [ʤɔmɑ] ~ [ʤɔmɑ-ʈ], 'collection' ~ 'collection-ADJ, collected'). Such existing word pairs offer an ideal opportunity to systematically investigate the effect of adding or deleting a single consonantal or vocalic segment, and thus a comparison can be made between word pairs which are either purely form-related and those which also have a morphological relationship.

In Experiments 1a–1c, we tested the effect of pure phonological overlap using strictly manipulated segmental structures that involved either the addition/deletion of one vocal (Experiment 1a: CVC ↔ CVCV), one consonant (Experiment 1b: CVCV ↔ CVCVC), or a change of a final vowel (Experiment 1c: $CVCV_1 \rightarrow CVCV_2$). We also investigated the effect of directionality; i.e. whether using shorter words as primes for longer words (e.g. কাল ~ কালি, [kɑl] ~ [kɑli], 'yesterday' ~ 'ink') resulted in different patterns of facilitation that the other direction (e.g. কালি ~ কাল, [kɑli] ~ [kɑl], 'ink' ~ 'yesterday'). We predicted, based on evidence for full-word priming in similar cross-modal conditions (cf. Marslen-Wilson et al. 1994), that phonologically-related items would not prime one another. This prediction was borne out in Experiments 1a and 1b, where no facilitation for cases involving an increase or decrease of one segment were found in either direction (e.g. কাল ~ কালি, [kɑl] ~ [kɑli], 'yesterday' ~ 'ink' and ডালি ~ ডালিম, [ɖɑli] ~ [ɖɑlim], 'basket' ~ 'pomegranate'; Table 12). Experiment 1c, however, which examined priming between form-related pairs differing by a single vocalic element ($CV.CV_1 \sim CV.CV_2$), elicited significant priming results.

Condition	**Experiment**	**Configuration**	**Priming?** SHORT → LONG	**Priming?** LONG → SHORT
form-related	1a	CVC ~ CV.CV কাল ~ কালি [kɑl] ~ [kɑ.li] 'yesterday' ~ 'ink'	×	×
	1b	CV.CV ~ CV.CVC ডালি ~ ডালিম [ɖɑ.li] ~ [ɖɑ.lim] 'basket' ~ 'pomegranate'	×	×
	1c	$CV.CV_1 \sim CV.CV_2$ পরি ~ পোরা [po.ri] ~ [po.rɑ] 'fairy' ~ 'fill.VBN'	✓	

Table 12. Summary of findings for form-related word pairs.

As discussed in Section 1.1, studies examining the LONG → SHORT form priming configuration have elicited varied results: Jakimik et al. (1985) and Zhang & Samuel (2015) found priming for phonologically- and orthographically-related word pairs (e.g. *message* ~ *MESS*), while Marslen-Wilson et al. (1994) and Vroomen & de Gelder (1997) found none. Our results in Experiments 1a and 1b (CVC ~ CVCV and CVCV ~ CVCVC, respectively) mirror those from the latter studies and this applies to both priming directions.

These findings seem to be attributable, in part, to the cross-modal paradigm (auditory prime, visual target). Throughout the literature, cross-modal experiments (e.g. Marslen-Wilson et al. 1994, Vroomen & de Gelder 1997, Marslen-Wilson 1990) have regularly failed to elicit priming between form-related words, in either the SHORT → LONG or LONG → SHORT configurations. Two processes are involved when processing a visual target: on the one hand, input from the prime boosts the activation level of its phonologically-related target; on the other hand, the prime, which was just activated, competes strongly for selection (Grainger et al. 1991, Drews & Zwisterlood 1995). Therefore, the priming effect can be viewed as the net effect of the faciliatory cohort activation and the inhibitory lexical competition (as compared to the control condition). Auditory intramodal and auditory shadowing tasks (e.g. Jakimik et al. 1985, Radeau et al. 1989, Spinelli et al. 2001, Zhang & Samuel 2015) have generated significant priming effects for form-related words. Zhang & Samuel (2015) attribute their finding to the use of the auditory–auditory priming paradigm, which conceivably generates more sensitivity to words embedded in the beginning of other words (e.g. *PROPERty)*. Following this, an embedded target (e.g. *proper*) may be easier to recognize when its modality-specific representation is activated by the auditory signal, but less so when the target is in a different modality. Thus, the lack of priming in cross-modal paradigms can be explained if the degree of cohort activation is at par with the degree of lexical competition.

A secondary contribution to lexical competition relates to the lexical status of the primes in our experiments. Much of the evidence of facilitation in the SHORT → LONG priming configurations (e.g. *bull* ~ *BULLET*) comes from experiments employing segment priming; i.e. where primes were segments and not real words (e.g. [dɔ] in Marslen-Wilson 1990, and [ɑno] in Friedrich et al. 2013). In the present study, all primes are real words and, as discussed in Section 2.3.1, conceivably contribute a competition effect that is absent in segment priming experiments: that is, a real word (e.g. *dog*) will generate more competition than a word segment (e.g. [dɔ]). Therefore, any relationship that may exist between form-related words is inhibited not only by the cross-modal design but also by the semantic information activated by real-word primes.

However, despite the cross-modal design and the use of real word primes, pairs in Experiment 1c ($CVCV_1$ ~ $CVCV_2$, e.g. দাবি ~ দাবা, [d̪ɑbi] ~ [d̪ɑbɑ], 'claim' ~ 'chess') primed readily. This finding deviates from others employing this configuration (cf. Radeau et al. 1989, Slowiaczek & Hamburger 1992, Dufour & Peereman 2003, 2009), with the exception of McQueen & Sereno (2005). One likely explanation for the facilitation effect found in our data is that form priming is sensitive not only to segmental overlap but also syllable structure, as syllabification has been shown to play a significant role in word priming (cf. Emmorey 1989, Mehler et al. 1981, Dumay & Content 2012).

In Experiment 1a (CVC ~ CVCV), the addition of a vocalic segment resulted in syllable mismatch between prime and target: CVC ~ CV.CV, (e.g. কাল ~ কালি, [kɑl] ~ [kɑ.li], 'yesterday' ~ 'ink'. In Experiment 1b (CVCV ~ CVCVC), the number of syllables remained constant (CV.CV ~ CV.CVC) but a change in the type of syllable (open to closed) was introduced in the second syllable (e.g. ডালি ~ ডালিম, [ɖɑ.li] ~ [ɖɑ.lim], 'basket' ~ 'pomegranate'). The misalignment in syllable boundaries in these two experiments contributed to an additional difference between prime and target, further facilitating exclusion of any cohort competitors and thus reducing their level of activation. In Experiment 1c, there was no boundary misalignment between prime and target (e.g. পরি ~ পোরা, [po.ri] ~ [po.rɑ], 'fairy' ~ 'fill.VBN') which likely resulted in greater facilitation as competitors remained more strongly activated. In summary, our results show that relationships between form-related words are not straightforward. Modality, and thus the experimental paradigm used and syllable structure, as well as the lexical status of the prime all play a role in addition to the degree of segmental overlap and these effects deserve closer examination in order to ascertain the contribution of each individual factor.

In Experiments 2a–2c, where prime and target were not only related in form but also in morphological structure, strong facilitation was predicted in all conditions for items with identical segmental structures to those in Experiments 1a–1c. As expected, all three types of word pairs demonstrated strong priming effects, thus supporting findings from previous studies where morphologically-related (and semantically-transparent) items led to reliable facilitation of the target (Table 13). In other words, hearing the complex form activated the stem and vice versa.

<table>
<tr><th rowspan="2">Condition</th><th rowspan="2">Experiment</th><th rowspan="2">Configuration</th><th colspan="2">Priming?</th></tr>
<tr><th>SHORT → LONG</th><th>LONG → SHORT</th></tr>
<tr><td rowspan="3">morph-related</td><td>2a</td><td>CVC ~ CV.C-V
দেব ~ দেবী
[d̪eb] ~ [d̪e.b-i]
‘deity.M’ ~ ‘deity-F’</td><td>✓*</td><td>✓</td></tr>
<tr><td>2b</td><td>CV.C-V ~ CV.C-VC
দেখি ~ দেখিস
[d̪e.k^{h}-i] ~ [d̪e.k^{h}-iʃ]
‘see-1.PRES’ ~ ‘see-2INT.PRES’</td><td>✓</td><td>✓*</td></tr>
<tr><td>2c</td><td>CV.C-V$_{1}$ ~ CV.C-V$_{2}$
খোলে ~ খোলো
[k^{h}o.l-e] ~ [k^{h}o.l-o]
‘open-3.PRES’ ~ ‘open-2FAM.PRES’</td><td colspan="2">✓</td></tr>
</table>

Table 13. Summary of findings for morphologically-related word pairs (* denotes more priming for a configuration).

In Experiment 2a (CVC ~ CV.C-V), morphologically-related derived words and their root forms primed one another, and there was an interaction between word relatedness and priming direction: SHORT → LONG word pairs (e.g. দেব ~ দেবী, [d̪eb] ~ [d̪eb-i], ‘deity.M’ ~ ‘deity-F’) exhibited stronger priming than the LONG → SHORT word pairs (e.g. দেবী ~ দেব, [d̪eb-i] ~ [d̪eb], ‘deity-F’ ~ ‘deity.M’). These findings are in line with expectations for lexical retrieval set out by major speech recognition models (e.g. Cohort), in which a shorter word will activate a longer related word, e.g. *dark* activates *darkness*, *darker*, *darkly*, and *darken.*

Experiment 2b (CV.C-V ~ CV.C-VC, দেখি ~ দেখিস, [d̪ek^{h}-i] ~ [d̪ek^{h}-iʃ], ‘see-1.PRES’ ~ ‘see-2INT.PRES’) elicited priming for inflectionally-related word pairs, with the priming effect stronger for the LONG → SHORT (e.g. দেখিস ~ দেখি, [d̪ek^{h}-iʃ] ~ [d̪ek^{h}-i], ‘see-2INT.PRES’ ~ ‘see-1.PRES’) pairs than the SHORT → LONG word pairs. This finding is contradictory to what we would expect for morphologically-related word pairs; however, it is likely that the unexpectedness of the 2INT forms is driving this effect.

Finally, Experiment 2c (CV.C-V$_{1}$ ~ CV.C-V$_{2}$, e.g. খোলে ~ খোলো, [k^{h}ol-e] ~ [k^{h}ol-o], ‘open-3.PRES’ ~ ‘open-2FAM.PRES’) also generated strong priming for inflectionally-related pairs that differed by the quality of the single vocalic segment.

We acknowledge that the prime and the target for the morphological pairs are phonologically, morphologically, and semantically related; hence the effect cannot be attributed to any one of these levels alone. What is important, though, is that using the exact same degree of phonological overlap, we observed a priming effect in all conditions which was absent in all but one of the pure phonological priming experiments.

The results of the form priming experiments (Experiments 1a–1c) underline the importance of considering differences in patterns of facilitation resulting from employing a particular experimental paradigm. While form-related items differing by the presence/absence of a single additional segment (Experiments 1a and 1b) failed to prime one another in the cross-modal (auditory–visual) paradigm, these findings are in opposition to those associated with intramodal lexical decision and shadowing tasks in which words related only in form largely generate more priming overall (cf. Jakimik et al. 1985, Dufour & Peereman 2003, Zhang & Samuel 2015). It seems that segmental overlap can result in priming **provided** there are no additional differences such as in terms of syllable structure (cf. Experiments 1a and 1b). In the form-priming experiments, the direction of priming, i.e. whether the longer or shorted item was used as the prime, did not result in any differences in the degree of facilitation (or lack of facilitation). Experiments 2a–2c showed that the addition of a morphological relationship did, indeed, result in strong facilitation between all prime–target pairs in both directions which corroborates earlier findings using cross-modal lexical decision tasks. The examination of the direction of priming, however, also contributes a further methodological caveat to our findings which relates to the precise morphological relationship of the stimuli (i.e. inflection vs. derivation) and, even more specifically, the distribution and connotations of these forms within the language.

This study has underlined how important it is to understand the interaction of morphology and phonology in priming tasks. We began by questioning whether words are represented in the mental lexicon with their phonological shape, and to what extent does the pure phonology activate a phonologically-related word once we add the morphological element to it. Previous priming studies have employed stimuli taken from languages in which stress alternations are crucial (e.g. English), and it is therefore almost impossible to compare phonological word-within-words without also changing other phonological properties. By using Bengali, we were able to more tightly control our stimuli; e.g., we could alternate word final vowels with no change in stress শোলা ~ ষোল [ˈʃolɑ] ~ [ˈʃolo] ‘cork wood’ ~ ‘sixteen’ and add a final full vowel and not just a schwa কল ~ কলা, [kɔl] ~ [kɔlɑ] ‘tap’ ~ ‘banana’. Results indicated that there are a number of different factors which come to bear when related items are activated in the lexicon, and targeted investigations are necessary to establish the precise contributions of each factor during the process of lexical access and the activation of a phonological cohort of items.

Acknowledgements

This study has received funding from the European Research Council (ERC) under the European Union’s Horizon 2020 research and innovation programme grant awarded to Professor Aditi Lahiri (Grant agreement number: 695481). We would also like to express our thanks to Professor Henning Reetz for his assistance with the design and run of these experiments. The fieldwork this research is based on would not have been possible without the participation of the staff and students at Jadavpur University and Bethune College, Kolkata University.

References

Amenta, Simona and Davide Crepaldi. 2012. Morphological processing as we know it: an analytical review of morphological effects in visual word identification. *Frontiers in Psychology* 3:232. [https://www.frontiersin.org/articles/10.3389/fpsyg.2012.00232]

Baayen, R. Harald, Doug J. Davidson, and Douglas M. Bates. 2008. Mixed-effects modeling with crossed random effects for subjects and items. *Journal of Memory and Language* 59:390–412. [https://doi.org/10.1016/j.jml.2007.12.005]

Barr, Dale J., Roger Levy, Christoph Scheepers, and Harry J. Tily. 2013. Random effects structure for confirmatory hypothesis testing: keep it maximal. *Journal of Memory and Language* 68:255–78. [https://www.sciencedirect.com/science/article/pii/S0749596X12001180]

Bates, Douglas, Reinhold Kliegl, Shravan Vasishth, and R. Harald Baayen. 2015. Parsimonious mixed models. *arXiv preprint*. arXiv:1506.04967. [https://arxiv.org/abs/1506.04967]

Boersma, Paul and David Weenink. 2015. Praat: doing phonetics by computer [Computer program]. Version 5.4.08, retrieved October 2015 from http://www.praat.org/.

Bölte, Jens and Else Coenen. 2002. Is phonological information mapped onto semantic information in a one-to-one manner? *Brain and Language* 81:384–97. [https://www.sciencedirect.com/science/article/pii/S0093934X01925325]

Diependaele, Kevin, Jon Andoni Duñabeitia, Joanna Morris, and Emmanuel Keuleers. 2011. Fast morphological effects in first and second language word recognition. *Journal of Memory and Language* 64:344–35. [https://doi.org/10.1016/j.jml.2011.01.003]

Drews, Etta and Pienie Zwitserlood. 1995. Morphological and orthographic similarity in visual word recognition. *Journal of Experimental Psychology: Human Perception and Performance* 21:1098–116.

[https://psycnet.apa.org/journals/xhp/21/5/1098.html?uid=1996-93306-001]
Dufour, Sophie. 2008. Phonological priming in auditory word recognition: when both controlled and automatic processes are responsible for the effects. *Canadian Journal of Experimental Psychology* 62:33–41. [https://psycnet.apa.org/record/2008-05131-004]
Dufour, Sophie, Ulrich H. Frauenfelder, and Ronald Peereman. 2007. Inhibitory priming in auditory word recognition: Is it really the product of response biases? *Current Psychology Letters: Behaviour, Brain & Cognition* 22:1–12. [https://journals.openedition.org/cpl/2622]
Dufour, Sophie and Ronald Peereman. 2003. Inhibitory priming effects in auditory word recognition: When the target's competitors conflict with the prime word. *Cognition* 88:B33–44. [https://www.sciencedirect.com/science/article/abs/pii/S0010027703000465]
Dufour, Sophie and Ronald Peereman. 2009. Competition effects in phonological priming: The role of mismatch position between primes and targets. *Journal of Psycholinguistic Research* 38:475–90. [https://link.springer.com/content/pdf/10.3758/PBR.16.2.363.pdf]
Dumay, Nicolas and Alain Content. 2012. Searching for syllabic coding units in speech perception. *Journal of Memory and Language* 66:680–94. [https://doi.org/10.1016/j.jml.2012.03.001]
Emmorey, Karen D. 1989. Auditory morphological priming in the lexicon. *Language and Cognitive Processes* 4:73–92. [https://doi.org/10.1080/01690968908406358]
Ferrand, Ludovic and Jonathan Grainger. 1994. Effects of orthography are independent of phonology in masked form priming. *Quarterly Journal of Experimental Psychology* 47:365–82. [https://www.tandfonline.com/doi/pdf/10.1080/14640749408401116]
Ferrand, Ludovic and Jonathan Grainger. 1996. List contest effects on masked phonological priming in the lexical decision task. *Psychonomic Bulletin & Review* 3:515–9. [https://link.springer.com/content/pdf/10.3758/BF03214557.pdf]
Friedrich, Claudia K., Verena Felder, Aditi Lahiri, and Carsten Eulitz. 2013. Activation of words with phonological overlap. *Frontiers in Psychology* 4:556. [https://www.frontiersin.org/articles/10.3389/fpsyg.2013.00556/full]
Frisson, Steven, Hannah Koole, Louisa Hughes, Andrew Olson, and Linda Wheeldon. 2014a. Competition between orthographically and phonologically similar words during sentence reading: evidence form eye movements. *Journal of Memory and Language* 73:148–73. [https://www.sciencedirect.com/science/article/pii/S0749596X14000205]
Frisson, Steven, Nathalie N. Bélanger, and Keith Rayner. 2014b. Phonological and orthographic overlap effects in fast and masked priming. *Quarterly Journal of Experimental Psychology* 67:1742–67. [https://doi.org/10.1080/17470218.2013.869614]
Frost, Ram and Jonathan Grainger. 2000. Cross-linguistic perspectives on morphological processing: An introduction. *Language and Cognitive Processes* 15:321–8. [https://www.tandfonline.com/doi/pdf/10.1080/01690960050119616]
Frost, Ram, Avital Deutsch, and Kenneth I. Forster. 2000. Decomposing morphologically complex words in a nonlinear morphology. *Journal of Experimental Psychology: Learning, Memory, and Cognition* 26:751–65. [https://psycnet.apa.org/record/2000-03416-013?doi=1]
Goldinger, Stephen D. 1999. Only the shadower knows: Comment on Hamburger and Slowiaczek (1996). *Psychonomic Bulletin & Review* 6:347–51. [https://link.springer.com/content/pdf/10.3758/BF03212340.pdf]
Goldinger, Stephen D., Paul A. Luce, David B. Pisoni, and Joanne K. Marcario. 1992. Form-based priming in spoken word recognition: the roles of competition and bias. *Journal of Experimental Psychology: Learning, Memory and Cognition* 18:1211–38. [https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3514873]
Grainger, Jonathan, Pascale Colé, and Juan Segui. 1991. Masked morphological priming in visual word recognition. *Journal of Memory and Language* 30:370–84. [https://www.sciencedirect.com/science/article/pii/0749596X9190042I]
Jakimik, Jola, Ronald A. Cole, and Alexander I. Rudnicky. 1985. Sound and spelling in spoken word recognition. *Journal of Memory and Language* 24:165–78. [https://www.sciencedirect.com/science/article/pii/0749596X85900221]
Marslen-Wilson, William D. 1987. Functional parallelism in spoken word-recognition. *Cognition* 25:71–102. [https://www.sciencedirect.com/science/article/pii/0010027787900059]
Marslen-Wilson, William D. 1990. Activation, competition and frequency in lexical access. In G. T. M. Altmann, ed., *Cognitive models of speech processing*, pages 148–72. Cambridge, MA: MIT Press.
Marslen-Wilson, William D. and Lorraine Komisarjevsky Tyler. 1980. The temporal structure of spoken language understanding. *Cognition* 8:1–71. [https://doi.org/10.1016/0010-0277(80)90015-3]
Marslen-Wilson, William D., Lorraine Komisarjevsky Tyler, Rachelle Waksler, and Lianne Older. 1994. Morphology and meaning in the mental lexicon. *Psychological Review* 101:3–33. [https://psycnet.apa.org/journals/rev/101/1/3/]
Marslen-Wilson, William D. and Alan Welsh. 1978. Processing interaction and lexical access during word recognition in continuous speech. *Cognitive Psychology* 10:29–63.

[https://www.sciencedirect.com/science/article/pii/001002857890018X]
Marslen-Wilson, William D. and Pienie Zwitserlood. 1989. Accessing spoken words: the importance of words onsets. *Journal of Experimental Psychology: Human Perception and Performance* 15:576–85. [https://psycnet.apa.org/journals/xhp/15/3/576.html?uid=1990-00328-001]
Matuschek, Hannes, Reinhold Kliegl, Shravan Vasishth, R. Harald Baayen, and Douglas Bates. 2017. Balancing Type I error and power in linear mixed models. *Journal of Memory and Language* 94:305–15. [https://www.sciencedirect.com/science/article/pii/S0749596X17300013]
McQueen, James M. and Joan Sereno. 2005. Cleaving automatic processes from strategic biases in phonological priming. *Memory and Cognition* 33:1185–209. [https://link.springer.com/article/10.3758/BF03193222]
Mehler, Jacques, Jean Yves Dommergues, Uli Frauenfelder, and Juan Segui. 1981. The syllable's role in speech segmentation. *Journal of Verbal Learning and Verbal Behavior* 20:298–305. [https://www.sciencedirect.com/science/article/pii/S0022537181904503]
Pitt, Mark A. and Lisa Shoaf. 2002. Revisiting bias effects in word-initial phonological priming. *Journal of Experimental Psychology: Human Perception and Performance* 28:1120–30. [https://psycnet.apa.org/record/2002-04477-007]
Praamstra, Peter, Antje S. Meyer, and Willem J. M. Levelt. 1994. Neurophysiological manifestations of phonological processing: latency variation of a negative ERP component timelocked to phonological mismatch. *Journal of Cognitive Neuroscience* 6:204–19. [https://www.mitpressjournals.org/doi/abs/10.1162/jocn.1994.6.3.204]
Radeau, Monique, José Morais, and Agnès Dewier. 1989. Phonological priming in spoken word recognition: task effects. *Memory and Cognition* 17:525–35. [https://link.springer.com/article/10.3758/BF03197074]
Radeau, Monique, José Morais, and Juan Segui. 1995. Phonological priming between monosyllabic spoken words. *Journal of Experimental Psychology: Human Perception and Performance* 21:1297–311. [https://psycnet.apa.org/record/1996-16333-001]
Rastle, Kathleen, Matt H. Davis, William D. Marslen-Wilson, and Lorraine K. Tyler. 2000. Morphological and semantic effects in visual word recognition: a time-course study. *Language and Cognitive Processes* 15:507–37. [https://www.tandfonline.com/doi/abs/10.1080/01690960050119689]
Reetz, Henning and Achim Kleinmann. 2008. Multi-subject hardware for experiment control and precise reaction time measurement. In M. J. Solé, D. Recasens, and J. Romero, eds., *Proceedings of the 15th International Congress of Phonetic Sciences*, pages 1489–92. Barcelona. [https://www.internationalphoneticassociation.org/icphs-proceedings/ICPhS2003/papers/p15_1489.pdf]
Slowiaczek, Louisa M. and Marybeth Hamburger. 1992. Prelexical facilitation and lexical interference in auditory word recognition. *Journal of Experimental Psychology: Learning, Memory and Cognition* 18:1239–50. [https://psycnet.apa.org/record/1993-04341-001]
Spinelli, Elsa, Juan Segui, and Monique Radeau. 2001. Phonological priming in spoken word recognition with bisyllabic targets. *Language and Cognitive Processes* 16:367–92. [https://www.tandfonline.com/doi/abs/10.1080/01690960042000111]
Vroomen, Jean and Beatrice de Gelder. 1997. Activation of embedded words in spoken word recognition. *Journal of Experimental Psychology: Human Perception and Performance* 23:710–20. [https://psycnet.apa.org/record/1997-04590-009]
Zhang, Xujin and Arthur G. Samuel. 2015. The activation of embedded words in spoken word recognition. *Journal of Memory and Language* 79:53–75. [https://www.sciencedirect.com/science/article/pii/S0749596X14001521]
Zwitserlood, Pienie. 1989. The locus of the effects of sentential-semantic context in spoken-word processing. *Cognition* 32:25–64. [https://www.sciencedirect.com/science/article/pii/0010027789900139]
Zwitserlood, Pienie and Herbert Schriefers. 1995. Effects of sensory information and processing time in spoken word recognition. *Language and Cognitive Processes* 10:121. [https://www.tandfonline.com/doi/abs/10.1080/01690969508407090]

Appendix A: Form-related stimuli (Experiments 1a–1c)

Experiment 1a: CVC ~ CVCV

CVC words			**CVCV words**		
টাক	t̪ɑk	bald spot	টাকা	t̪ɑkɑ	rupee
কান	kɑn	ear	কানা	kɑnɑ	blind
কাক	kɑk	crow	কাকী	kɑki	father's younger brother's wife (aunt)
কাঁচ	kɑ̃ʧ	glass	কাঁচা	kɑ̃ʧɑ	raw
ঝোল	ʤʱol	gravy	ঝোলা	ʤʱolɑ	bag
ধন	d̪ʱon	wealth	ধনে	d̪ʱone	coriander
কল	kɔl	tap	কলা	kɔlɑ	banana
মাছ	mɑʧʰ	fish	মাছি	mɑʧʰi	fly
ফুল	pʰul	flower	ফুলো	pʰulo	swollen
ছিপ	ʧʰip	fishing rod	ছিপি	ʧʰipi	(bottle) cork
দান	d̪ɑn	donation	দানা	d̪ɑnɑ	seed
ভিড়	bʱiɽ[21]	crowd	ভীরু	bʱiru	coward
পুর	pur	stuffing (food)	পুরো	puro	full
তাল	t̪ɑl	palm fruit	তালা	t̪ɑlɑ	lock
পিঠ	piʈʰ	back (body)	পিঠে	piʈʰe	rice cake
মাল	mɑl	load.N	মালা	mɑlɑ	garland
মোড়	moɽ	crossing	মোড়া	moɽɑ	cane seat
ছুঁচ	ʧʰũʧ	needle	ছুঁচো	ʧʰũʧo	musk-rat
গোল	gol	round	গলি	goli	small lane
চান	ʧɑn	bath	চানা	ʧɑnɑ	chickpea
কাল	kɑl	yesterday, tomorrow	কালি	kɑli	ink
বাড়	bɑɽ	increase.N	বাড়ি	bɑɽi	house
প্যাঁচ	pæ̃ʧ	twist.N	প্যাঁচা	pæ̃ʧɑ	owl
ভোর	bʱor	dawn	ভোরী	bʱori	gold unit
ঝাল	ʤʱɑl	spicy hot	ঝালা	ʤʱɑlɑ	solder.VBN
তাক	t̪ɑk	shelf	তাকা	t̪ɑkɑ	see.VBN
ঘর	gʱɔr	room	ঘরা	gʱɔrɑ	vat
পাত	pɑt̪	dinner place	পাতা	pɑt̪ɑ	leaf
খাল	kʰɑl	ditch	খালি	kʰɑli	empty
হাত	hɑt̪	hand	হাতি	hɑt̪i	elephant
চাঁদ	ʧɑ̃d̪	moon	চাঁদা	ʧɑ̃d̪ɑ	subscription
ভিত	bʱit̪	foundation	ভিতু	bʱit̪u	coward

[21] Although Kolkata Bengali distinguishes three rhotics orthographically (i.e. dental/alveolar র [r], retroflex ড় [ɽ], and an aspirated retroflex rhotic ঢ় [ɽʱ]), the two retroflex rhotics have long been neutralized into [ɽ]. Furthermore, in normal running speech, this generation does not really differentiate [r] and [ɽ]. Still, prejudice to maintain 'correct' Bengali pronunciation prevails and we have maintained the difference in IPA to match with the orthography. For the fourth author, there is no real difference.

Experiment 1b: CVCV ~ CVCVC

CVCV words			**CVCVC words**		
মশা	mɔʃa	mosquito	মশাল	mɔʃal	torch
পোষা	poʃa	pet, keep pets.VBN	পোশাক	poʃak	clothing
গোলা	gola	cannonball	গোলাপ	golap	rose
ডালি	ɖali	basket	ডালিম	ɖalim	pomegranate
গ্রহ	groho	planet	গ্রহণ	grohon	receiving
পাশা	paʃa	dice	পাষাণ	paʃan	stone, weight
বাটি	baʈi	bowl	বাটিক	baʈik	wax dye
পুরু	puru	thick	পুরুষ	puruʃ	male
মাসী	maʃi	mother's sister (aunt)	মাসিক	maʃik	monthly
মালি	mali	gardener	মালিক	malik	boss
গড়া	gɔɽa	form.VBN	গরাদ	gɔrad̪	window grating
চালা	ʧala	thatched roof	চালাক	ʧalak	shrewd
চুমু	ʧumu	kiss	চুমুক	ʧumuk	sip, draught
জবা	ʤɔba	china rose	জবাব	ʤɔbab	reply
টিকি	ʈiki	little pigtail	টিকিট	ʈikiʈ	ticket
তালি	t̪ali	clap	তালিম	t̪alim	instruction
তিমি	t̪imi	whale	তিমির	t̪imir	darkness
আশা	aʃa	hope	আষাঢ়	aʃaɽ	(third month of Bengali calendar)
কাঠি	kaʈʰi	small stick	কাঠিম	kaʈʰim	bobbin, reel
কুলি	kuli	laborer	কুলীন	kulin	Brahmin
বাজা	baʤa	play.VBN (a sound)	বাজার	baʤar	market
মাতা	mat̪a	mother	মাতাল	mat̪al	drunk
নাগা	naga	Naga (ethn.)	নাগাল	nagal	proximity
ডাকা	ɖaka	call.VBN	ডাকাত	ɖakat̪	robber
বরা	bɔra	boar	বরাত	bɔrat̪	fate
বন্ধ	bɔnd̪ʱo	closed	বন্ধক	bɔnd̪ʱok	mortgage, pawning
বড়	bɔɽo	large	বরণ	bɔron	formal welcoming
বালি	bali	sand	বালিশ	baliʃ	pillow
মধু	mod̪ʱu	honey	মধুর	mod̪ʱur	pleasant voice
তরু	t̪oru	plant, tree	তরুণ	t̪orun	young man
মানী	mani	proud	মানিক	manik	ruby
হাজা	haʤa	chilblain	হাজার	haʤar	thousand

Experiment 1c: CVCV$_1$ ~ CVCV$_2$

CVCV$_1$ words			**CVCV$_2$ words**		
পরী	pori	fairy	পোরা	porɑ	fill.VBN
কচু	koʧu	taro root	কচি	koʧi	tender, young
মেজো	meʤo	second eldest	মেজে	meʤe	floor
বাটা	bɑʈɑ	paste, grind.VBN	বাটি	bɑʈi	bowl
ছোট	ʧʰoʈo	small	ছোটা	ʧʰoʈɑ	run.VBN
নাড়ু	nɑɽu	coconut sweet	নারী	nɑri	woman
মুড়ি	muɽi	puffed rice; hem	মুড়ো	muɽo	head (of a fish)
ছানি	ʧʰɑni	cataract	ছানা	ʧʰɑnɑ	curd
জালি	ʤɑli	trellis	জ্বালা	ʤɑlɑ	burning sensation
ঝাঁপা	ʤʱɑ̃pɑ	jump	ঝাঁপি	ʤʱɑ̃pi	small basket
গালি	gɑli	obscenity	গালা	gɑlɑ	lac, sealing wax
বিধি	bid̪ʱi	edict	বিধু	bid̪ʱu	moon
শাড়ী	ʃɑɽi	sari	সাড়া	ʃɑɽɑ	response
গুলি	guli	bullet	গুলো	gulo	(collective suffix)
ছাতা	ʧʰɑt̪ɑ	umbrella	ছাতু	ʧʰɑt̪u	barley meal
জানু	ʤɑnu	knee	জানা	ʤɑnɑ	know.VBN
ঘড়ি	gʱoɽi	clock	ঘোড়া	gʱoɽɑ	horse
তুলো	t̪ulo	cotton wool	তুলি	t̪uli	brush
শোলা	ʃolɑ	cork wood	ষোল	ʃolo	sixteen
আলো	ɑlo	light	আলু	ɑlu	potato
কোটি	koʈi	crore	কটু	koʈu	acrid, bitter
পালা	pɑlɑ	(one's) turn	পালী	pɑli	margin
গুঁড়ি	gũɽi	tree stump	গুঁড়ো	gũɽo	powder
পেটি	peʈi	belt, fish belly	পেটা	peʈɑ	beaten
আঁটি	ɑ̃ʈi	bundle	আঁটা	ɑ̃ʈɑ	tightly closed
ফুটি	pʰuʈi	muskmelon	ফুটা	pʰuʈɑ	hole, crack
বাসা	bɑʃɑ	home, house	বাসী	bɑʃi	stale
মাঝি	mɑʤʱi	boatman	মাঝে	mɑʤʱe	sometimes, in the middle
দাবি	d̪ɑbi	claim	দাবা	d̪ɑbɑ	chess
আড়া	ɑɽɑ	crooked	আড়ি	ɑɽi	quarrel
কালো	kɑlo	black	কালি	kɑli	ink
ভারি	bʱɑri	heavy	ভারা	bʱɑrɑ	scaffolding

Appendix B: Morphologically-related stimuli (Experiments 2a–2c)

Experiment 2a: CVC ~ CVC-V

CVC words			**CVC-V words**		
জ্ঞান	gæn	knowledge	জ্ঞানী	gæn-i	wise person
সুখ	ʃuk^{h}	happiness, joy	সুখী	ʃuk^{h}-i	happy, joyful
দেব	d̪eb	deity.M	দেবী	d̪eb-i	deity-F
ঢাল	ɖ^{ɦ}ɑl	shield	ঢালী	ɖ^{ɦ}ɑl-i	shield bearer
রাজ	rɑʤ	kingdom	রাজা	rɑʤ-ɑ	king
দাঁড়	d̪ɑ̃ɽ	oar	দাঁড়ী	d̪ɑ̃ɽ-i	oarsman
দাস	d̪ɑʃ	servant	দাসী	d̪ɑʃ-i	maid
ঢাক	ɖ^{ɦ}ɑk	drum	ঢাকী	ɖ^{ɦ}ɑk-i	drummer
ভুল	b^{ɦ}ul	wrong	ভুলো	b^{ɦ}ul-o	mistake
জল	ʤɔl	water	জলা	ʤɔl-ɑ	swamp
তাঁত	t̪ɑ̃t̪	loom	তাঁতী	t̪ɑ̃t̪-i	weaver
গুণ	gun	quality, talent	গুণী	gun-i	talented
তেল	t̪el	oil	তেলা	t̪el-ɑ	oily
কাঠ	kɑʈ^{h}	wood	কাঠি	kɑʈ^{h}-i	small stick
ফাঁক	p^{h}ɑ̃k	gap	ফাঁকা	p^{h}ɑ̃k-ɑ	empty
দূর	d̪ur	far	দূরে	d̪ur-e	far-LOC
ব্যাঁক	bæ̃k	bend	ব্যাঁকা	bæ̃k-ɑ	bent
নাক	nɑk	nose	নাকী	nɑk-i	nasal
দাগ	d̪ɑg	mark, stain	দাগী	d̪ɑg-i	mark-ADJ, stained
চাষ	ʧɑʃ	plow	চাষী	ʧɑʃ-i	farmer
নাচ	nɑʧ	dance.N	নাচা	nɑʧ-ɑ	dance-VBN
প্রাণ	prɑn	life	প্রাণী	prɑn-i	living being
রাগ	rɑg	anger	রাগী	rɑg-i	angry
সাজ	ʃɑʤ	dress, outfit	সাজা	ʃɑʤ-ɑ	dress-VBN
পাপ	pɑp	sin	পাপী	pɑp-i	sinner
খুন	k^{h}un	murder	খুনী	k^{h}un-i	murderer
বেশ	beʃ	enough	বেশী	beʃ-i	more
দেশ	d̪eʃ	country	দেশী	d̪eʃ-i	domestic
জাত	ʤɑt̪	born, caste	জাতী	ʤɑt̪-i	people, nation
নীচ	niʧ	low	নীচু	niʧ-u	bow (down)
জট	ʤɔʈ	tangle	জটা	ʤɔʈ-ɑ	matted hair

Experiment 2b: CVC-V ~ CVC-VC

CVC-V words			**CVC-VC words**		
নাচি	nɑʧ-i	dance-1.PRES	নাচিস	nɑʧ-iʃ	dance-2INT.PRES
দেখি	d̪ekʰ-i	see-1.PRES	দেখিস	d̪ekʰ-iʃ	see-2INT.PRES
চলি	ʧol-i	walk-1.PRES, wander-1.PRES	চলিস	ʧol-iʃ	walk-2INT.PRES, wander-2INT.PRES
শিখি	ʃikʰ-i	learn-1.PRES	শিখিস	ʃikʰ-iʃ	learn-2INT.PRES
ঢুকি	ɖʱuk-i	enter-1.PRES	ঢুকিস	ɖʱuk-iʃ	enter-2INT.PRES
হাঁটি	hɑ̃ʈ-i	walk-1.PRES	হাঁটিস	hɑ̃ʈ-iʃ	walk-2INT.PRES
ফেলি	pʰel-i	throw-1.PRES	ফেলিস	pʰel-iʃ	throw-2INT.PRES
চিনি	ʧin-i	recognize-1.PRES	চিনিস	ʧin-iʃ	recognize-2INT.PRES
লিখি	likʰ-i	write-1.PRES	লিখিস	likʰ-iʃ	write-2INT.PRES
শুঁকি	ʃũk-i	smell-1.PRES	শুঁকিস	ʃũk-iʃ	smell-2INT.PRES
মারি	mɑr-i	hit-1.PRES	মারিস	mɑr-iʃ	hit-2INT.PRES
করি	kor-i	do-1.PRES	করিস	kor-iʃ	do-2INT.PRES
পড়ি	poɽ-i	read-1.PRES	পড়িস	poɽ-iʃ	read-2INT.PRES
মুছি	muʧʰ-i	wipe-1.PRES	মুছিস	muʧʰ-iʃ	wipe-2INT.PRES
খুঁজি	kʰũʤ-i	search-1.PRES	খুঁজিস	kʰũʤ-iʃ	search-2INT.PRES
পারি	pɑr-i	be able-1.PRES	পারিস	pɑr-iʃ	be able-2INT.PRES
বেলি	bel-i	roll pastry-1.PRES	বেলিস	bel-iʃ	roll pastry-2INT.PRES
বলি	bol-i	say-1.PRES	বলিস	bol-iʃ	say-2INT.PRES
ছিঁড়ি	ʧʰĩɽ-i	tear-1.PRES	ছিঁড়িস	ʧʰĩɽ-iʃ	tear-2INT.PRES
ঝুলি	ʤʱul-i	swing-1.PRES	ঝুলিস	ʤʱul-iʃ	swing-2INT.PRES
বাঁধি	bɑ̃d̪ʱ-i	tie up-1.PRES	বাঁধিস	bɑ̃d̪ʱ-iʃ	tie up-2INT.PRES
হাসি	hɑʃ-i	laugh-1.PRES	হাসিস	hɑʃ-iʃ	laugh-2INT.PRES
ঠেলি	ʈʰel-i	push-1.PRES	ঠেলিস	ʈʰel-iʃ	push-2INT.PRES
মিশি	miʃ-i	mix-1.PRES	মিশিস	miʃ-iʃ	mix-2INT.PRES
ঘুরি	gʱur-i	turn around-1.PRES	ঘুরিস	gʱur-iʃ	turn around-2INT.PRES
জানি	ʤɑn-i	know-1.PRES	জানিস	ʤɑn-iʃ	know-2INT.PRES
বেচি	beʧ-i	sell-1.PRES	বেচিস	beʧ-iʃ	sell-2INT.PRES
বসি	boʃ-i	sit-1.PRES	বসিস	boʃ-iʃ	sit-2INT.PRES
ফিরি	pʰir-i	return-1.PRES	ফিরিস	pʰir-iʃ	return-2INT.PRES
খুলি	kʰul-i	open-1.PRES	খুলিস	kʰul-iʃ	open-2INT.PRES
জাগি	ʤɑg-i	wake up-1.PRES	জাগিস	ʤɑg-iʃ	wake up-2INT.PRES
ছাড়ি	ʧʰɑɽ-i	release-1.PRES	ছাড়িস	ʧʰɑɽ-iʃ	release-2INT.PRES

Experiment 2c: CVC-V$_1$ ~ CVC-V$_2$

CVC-V$_1$ words			**CVC-V$_2$ words**		
নাচে	nɑʧ-e	dance-3.PRES	নাচো	nɑʧ-o	dance-2FAM.PRES
কাঁদে	kɑ̃d̪-e	cry-3.PRES	কাঁদো	kɑ̃d̪-o	cry-2FAM.PRES
হাঁটে	hɑ̃ʈ-e	walk-3.PRES	হাঁটো	hɑ̃ʈ-o	walk-2FAM.PRES
খোলে	kʰol-e	open-3.PRES	খোলো	kʰol-o	open-2FAM.PRES
রাখে	rɑkʰ-e	keep-3.PRES	রাখো	rɑkʰ-o	keep-2FAM.PRES
ছেঁড়ে	ʧʰẽɽ-e	tear-3.PRES	ছেঁড়ো	ʧʰẽɽ-o	tear-2FAM.PRES
চেনে	ʧen-e	recognize-3.PRES	চেনো	ʧen-o	recognize-2FAM.PRES
ফেরে	pʰer-e	return-3.PRES	ফেরো	pʰer-o	return-2FAM.PRES
সেঁকে	ʃæ̃k-e	dry fry-3.PRES	সেঁকো	ʃæ̃k-o	dry fry-2FAM.PRES
শোবে	ʃo-b-e	sleep-FUT-3, lie down-FUT-3	শোবো	ʃo-b-o	sleep-FUT-1, lie down-FUT-1
গোঁজে	gõʤ-e	tuck in-3.PRES	গোঁজো	gõʤ-o	tuck in-2FAM.PRES
ধোবে	d̪ʱo-b-e	wash-FUT-3	ধোবো	d̪ʱo-b-o	wash-FUT-1
গোলে	gol-e	mix liquid-3.PRES	গোলো	gol-o	mix liquid-2FAM.PRES
তোলে	t̪ol-e	hold up-3.PRES	তোলো	t̪ol-o	hold up-2FAM.PRES
ঠেলে	ʈʰæl-e	push-3.PRES	ঠেলো	ʈʰæl-o	push-2FAM.PRES
খেলে	kʰæl-e	play-3.PRES	খেলো	kʰæl-o	play-2FAM.PRES
দেখে	d̪ækʰ-e	see-3.PRES	দেখো	d̪ækʰ-o	see-2FAM.PRES
ফেলে	pʰæl-e	throw-3.PRES	ফেলো	pʰæl-o	throw-2FAM.PRES
বেলে	bæl-e	roll pastry-3.PRES	বেলো	bæl-o	roll pastry-2FAM.PRES
ধরে	d̪ʱɔr-e	hold-3.PRES	ধরো	d̪ʱɔr-o	hold-2FAM.PRES
পড়ে	pɔɽ-e	read-3.PRES	পড়ো	pɔɽ-o	read-2FAM.PRES
চলে	ʧɔl-e	walk-3.PRES	চলো	ʧɔl-o	walk-2FAM.PRES
করে	kɔr-e	do-3.PRES	করো	kɔr-o	do-2FAM.PRES
বলে	bɔl-e	say-3.PRES	বলো	bɔl-o	say-2FAM.PRES
শেখে	ʃekʰ-e	learn-3.PRES	শেখো	ʃekʰ-o	learn-2FAM.PRES
লেখে	lekʰ-e	write-3.PRES	লেখো	lekʰ-o	write-2FAM.PRES
ভাবে	bʱɑb-e	think-3.PRES	ভাবো	bʱɑb-o	think-2FAM.PRES
ভরে	bʱɔr-e	fill-3.PRES	ভরো	bʱɔr-o	fill-2FAM.PRES
বসে	bɔʃ-e	sit-3.PRES	বসো	bɔʃ-o	sit-2FAM.PRES
ছোঁড়ে	ʧʰõɽ-e	throw-3.PRES	ছোঁড়ো	ʧʰõɽ-o	throw-2FAM.PRES
থাকে	t̪ʰɑk-e	stay-3.PRES	থাকো	t̪ʰɑk-o	stay-2FAM.PRES
মোছে	moʧʰ-e	wipe-3.PRES	মোছো	moʧʰ-o	wipe-2FAM.PRES

Productivity and argument sharing in Hindi light verb constructions

Ashwini Vaidya, *IIT Delhi*
Eva Wittenberg, *University of California, San Diego*

Received AUGUST 2019; Revised NOVEMBER 2020

ABSTRACT

Light verb constructions (e.g. *give a sigh, take a walk*) are a linguistic puzzle, as they consist of two predicating elements in a monoclausal structure. In the theoretical literature, there has been much interest in the linguistic analysis of such constructions across a range of grammatical frameworks. One such proposal is event co-composition, where the argument structures of noun and light verb merge, resulting in a composite argument structure, which has been claimed to be the source of increased processing costs in English and German. In contrast to these languages, in Hindi a larger proportion of the predicates are light verb constructions. Hence, we may ask whether a Hindi speaker's experience with light verb constructions allows them to go through the same co-composition operation faster than a speaker of English. Our results show that Hindi speakers are adept at the process of using light verb constructions to 'verbalize' predicates, more so than speakers of Germanic languages. We argue that these data provide evidence for a case of specific linguistic experiences shaping cognition, cost disappears with practice.

1 Introduction

One fact that all languages have famously in common is the ability to convey any category of meaning – things, ideas, events, or states. But what varies widely across the globe is how exactly each language packages meaning into a syntactic structure. In this paper, we explore how the prevalence of such a packaging strategy will lead to different observable behaviors in the speakers of a language.

Our main concern is a predicational strategy where a verb such as *do, make*, or *give* combines with an event noun, such as *a jump* or *a call* to form a phrasal structure with a single meaning (*jumping, calling*). Such constructions are widespread and can be found in languages as diverse as Hindi, Persian, and English. They belong to the class of complex verb constructions; in this paper, we focus particularly on light verb constructions (Jespersen 1965).

Light verb constructions open up an interesting perspective on how we conceive of the interaction between the usage patterns, grammatical allowances, and grammatical possibility spaces within a particular language on the one hand, and the fundamentals of the human mind on the other hand: While cognitive mechanisms, concepts in the mind, and expressive needs do not vary significantly across the world, each language has its own grammatical preferences, combinatoric possibilities, and frequency biases. For instance, say you want to ask your child to hug you. In English, the language wide preferred way to encode an action concept like 'hug' is via a simple verb ('hug me'). However, you can also use a light verb construction ('give me a hug'). Crucially, the language-wide preference for simple verbs and the frequency of specific constructions can be independent: While overall, English has few complex predicates like ‘to give a hug’ (low language-wide systemic frequency), the ones that it has are highly frequent (high token frequency).

In other languages, the picture is different: In Hindi for instance, there is a language-wide preference to encode actions as complex verbs, thanks to a very productive light verb construction schema. In either language, comprehenders need to construct the path from a linguistic structure to an action concept, relying on the same mental architecture across languages.

Here, we ask whether language-wide preferences, not only token frequency, interact with this comprehension process: Light verb constructions have been analyzed as a general process of event *co-composition*, one example of constructions that compose predicative meaning from both an event noun as well as from a verb (Ahmed et al. 2012). Given that this predicational strategy is present across many languages and language families, but also given each language’s systemic preferences for one predicational strategy over the other, we can ask whether a speaker’s ample experience with light verb constructions allows her to go through the same cognitive event co-composition operation faster than a speaker of a language in which light verb constructions are less productive.[1]

Psycholinguistic research on the processing of light verb constructions has found evidence for a cost of co-composition (Piñango et al. 2006, Wittenberg et al. 2014, Wittenberg and Piñango 2011). However, the languages studied in these experiments (English and German) use light verb constructions overall relatively infrequently. In contrast, this paper asks whether the process of event co-composition is observable in Hindi, a language that uses complex verbs for nearly a quarter of its predicates. That is, if we take the nature of the cognitive process of event composition as identical across languages (and speakers’ minds), we would still expect the overall frequency and productivity of co-composition in Hindi, and cognitive constraints, such as working memory (Norcliffe et al. 2015) to interact with grammatical processes.

Our paper is organized as follows: We begin with a theoretical description of the event composition process. We then examine evidence for this process in the form of existing psycholinguistic studies, before turning to a discussion of the light verb construction in Hindi. Following this, we describe four experiments that compare how light verb constructions and their non-light counterparts are processed, using two different experimental techniques. We conclude with a summary and discussion of the results.

1.1 A model of co-composition

Many theoretical studies across grammatical frameworks have proposed analyses of light verb constructions, because they are challenging for the interaction of semantic and syntactic information in language (Sag et al. 2002, Culicover and Jackendoff 2005, Wittenberg 2016). Specifically, in most of the literature, the theoretical questions are related to the formal representation of compositionality: If a light verb and a noun together form a predicate, then how does the syntactic and semantic representation of both these elements result in the particular syntactic and semantic properties of the light verb construction?

Usually, a verb (for instance, *to describe*) denotes the meaning of an event (in that case, someone uttering something) and, its object or objects (for instance, *a dance*) will fill in argument slots: *describe a dance* denotes a recount of a dance. In light verb constructions (for instance, *do a dance*), the verb (*do*) does not supply the event type – we know that we are talking about a dancing event because the predicative meaning is supplied by the syntactic object (*a dance*).

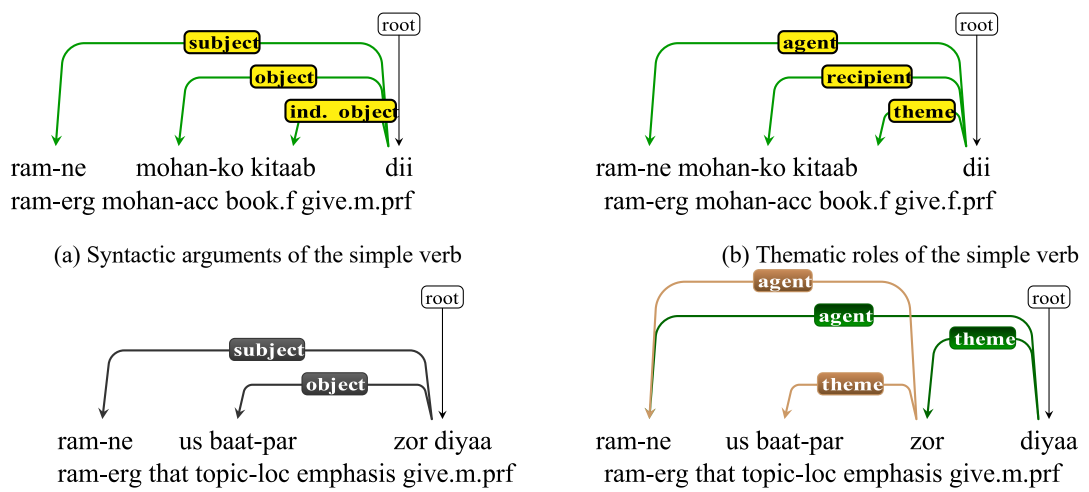
[1] Note that this is neither a Whorfian question – there is no claim that there are language-specific influences on perception – nor is it a question about token frequency of a particular construction. Rather, we ask how language-wide structural preferences interact with cognitive processes.

One account that effectively handles this problem argues that the argument structures, demanded by the lexical semantics of both noun and light verb, overlap with each other, and a 'shared', or 'composite' argument structure, emerges in the monoclausal light verb construction (Mohanan 1997, Alsina et al. 1997, Ahmed et al. 2012, Durie 1988, Piñango et al. 2006). For instance, the Hindi Ex. (1) consists of the ditransitive verb *give* 'de' with three arguments, *Raam*, *Mohan* and *kitaab* 'book'. In this case, three syntactic arguments, subject, indirect object and object, are mapped directly to the set of thematic roles for the verb, agent, recipient and theme (Figures (1a) and (1b)).

(1) *raam=ne* *mohan=ko* *kitab* **d-ii**
Ram.M.Sg=Erg Mohan.M.Sg=Dat book.F.Sg give-Perf.F.Sg
'Ram gave Mohan a book'

(2) *raam=ne* *us* *baat=par* **zor** **di-yaa**
Ram.M.Sg=Erg that topic=Loc pressure.M.Sg give-Perf.M.Sg
'Ram put emphasis on that topic'

On the other hand, Ex. (2) has the light verb *de*, which takes two syntactic arguments: *Ram* and *us baat* (Figure (1c)). These emerge only after the two sets of thematic roles from the noun and light verb are combined. Both noun and light verb contribute towards the argument structure of the sentence. The light verb *de* licenses the nominal predicate argument *zor* and the agent *Raam*. The noun *zor* also licenses the agent *Raam* and the theme *us baat par* (see Figure (1d)).



(a) Syntactic arguments of the simple verb

(b) Thematic roles of the simple verb

(c) Syntactic arguments of the light verb

(d) Composite thematic roles of noun and light verb

FIGURE 1: A simple verb with its syntactic arguments is shown in Figure (1a). The same simple verb maps the syntactic arguments to the semantic ones in (1b). The light verb has two surface syntactic arguments in (1c). But these emerge after two sets of thematic roles from noun and light verb combine in Figure (1d), resulting in a composite argument structure.

In language comprehension, the agent argument *Raam* must be identified as common to both predicates *zor* and *de*. This is sometimes described as the *argument identification step* (Davison 2005). In Davison's (2005) model, following argument identification, a semantic argument merger step will take place such that a composite, but monoclausal structure is formed. This interaction between the syntactic arguments on the surface and the two sets of semantic arguments is characteristic of light verb constructions, and it has been defined as event co-composition: a process where "two semantically predicative elements jointly determine the structure of a single syntactic clause" (Mohanan 1997, p. 432).

Light verb constructions have additional properties that are crucial to the event co-composition process. Across languages, light verbs consist of a small class of high-frequency, general-purpose verbs that are form-identical with their non-light counterpart, e.g. *make, do, give, take* etc., a fact that has led Butt (2010) to consider the light verb as a unique category that shares a lexical entry with its non-light form. That means that at one point during comprehension, the listener or reader needs to interpret the light verb as light rather than non-light, in order for the the event composition process to succeed. For example, in (1), we have the verb *de* 'give' in its non-light form, but in (2), it is part of a light verb construction.

An effect of this form-identity with full verbs is that when a comprehender resolves a verb as light, the predicating noun provides the eventive meaning, but the verb still supplies additional aspectual or agentive information about the event and its structure (Butt et al. 2008, Wittenberg et al. 2017). This also has implications for the structure and nature of the semantic arguments expressed in a light verb construction. For instance, while the non-light use of *give* (e.g *give an orange to someone*) has three semantic roles (Source, Theme, and Goal), the light use (e.g *give a kiss to someone*) has only two (Agent and Patient), with the predicating noun *kiss* fusing its agent role with *give*. These syntactic and semantic interactions with the predicating noun result in the structure of a complex predicate. In the next section, we review the results from the psycholinguistic literature that have shed light on how the process of light verb construction comprehension unfolds.

1.2 Measuring event co-composition

In light verb constructions, the challenge for comprehenders is to understand that the verb, usually the only projector of sentential argument roles, is sharing this power with the event nominal. This means that the event co-composition process lies at the interface between syntactic and lexicosemantic representation. During real-time interpretation of such constructions, how do comprehenders resolve the mismatch between the syntactic and semantic arguments in the clause?

The literature offers several psycholinguistic studies on light verb construction comprehension in English and German. These studies have focused on collecting behavioural and electro-physiological data at the point when the verb is read or heard (in Subject-Object-Verb or Object-Verb-Subject structures) or at the noun (in the case of Subject-Verb-Object structures), based on the theoretical prediction that the composite argument structure of noun and light verb must be 'resolved' after both verb and noun are processed, and the co-composition process would be observable as a behavioural or electro-physiological signal.

Briem et al. (2009) carried out three experiments to study how light verbs are processed in German. They contrasted light verbs like *geben* ("give") with non-light verbs like *erwarten* ("expect") either in contrast with a pseudo-word, by themselves, or within a sentential context. Briem et al. (2009)'s study used MEG in order to demonstrate that light verbs (e.g. *give*) when presented by themselves or in comparison with pseudo-words showed less cortical activity as compared to non-light verbs (e.g. *expect*). The authors interpreted this as a result of lexically underspecified features in the light verb. In the third experiment, when presented in a minimal sentential context using object verb-subject structure, a verb like *give* had to get resolved as either light or non-light depending upon the presence of the noun, e.g. *a kiss gives he* vs. *a book gives he*. Here, the pattern followed that of the previous two experiments; a non-light context *give a book* resulted in greater left-temporal activation as compared to light. Briem et al. (2009) interpreted these results as evidence for distinct brain processing areas for distinct categories of verbs. However, the authors did not measure activity *after* the verb, where subsequent behavioural studies have found differences between light and non-light conditions (for further discussion, see Wittenberg et al. 2014). We now turn to some of these experiments which report such later effects.

A handful of behavioural experiments have studied late reflections of computational costs associated with light verb construction processing, motivated by the mismatch between the syntactic argument structure and the semantic roles defined by the construction (see section 1.1). This mismatch was predicted to surface as computational cost *after* the construction has been comprehended.

Piñango et al. (2006) predicted to show a cost of processing light verb constructions at around 250-300ms after the offset of the construction. This prediction was based on studies that had shown that the (re-)assignment of semantic roles results in slower-developing effects that can be detected at a later point during sentence processing (Boland 1997, McElree and Griffith 1995). Based on this idea, Piñango et al. (2006) used an interference paradigm in the form of a cross-modal lexical decision task. Piñango et al. (2006) used three conditions for their study, where the light condition was contrasted with non-light condition, and a third condition ('heavy') containing the same noun, but paired with a non-light verb:

(light) Mr. Olsen <u>gave an order</u> last night to the produce guy.

(non-light) Mr. Olsen <u>gave an orange</u> last night to the produce guy.

('heavy') Mr. Olsen <u>typed an order</u> last night for the produce guy.

Participants listened to sentences containing one of the three conditions as shown above. At a point after the object (*order* or *orange*) was heard, participants had to make a lexical decision on a letter string that flashed on the screen. The reaction time to make a decision was taken as a reflection of the demand placed on working memory by the construction that was just heard: Slower reaction times would reflect higher computational cost.

Piñango et al. (2006) also manipulated the timing of the probe placement: Either the probe was placed immediately at the offset of the object, or 300ms after. In the former case, the non-light condition was significantly slower, an effect that Piñango et al. (2006) attributed to the higher frequency of the light verb construction. However, when the probes were placed 300ms after the noun was heard, this effect was numerically reversed (albeit with no statistically significant difference), and the light condition elicited significantly slower reaction times than the heavy condition. Piñango et al. (2006) concluded that the computational costs of argument sharing become apparent when measured later, i.e after the construction is 'disambiguated' as light.

Wittenberg and Piñango (2011) replicated this study in German. Like Piñango et al. (2006), they also used three conditions (light, non-light, and heavy), but since German can be verb-final (e.g., *a hug give*), the probe was placed either immediately or 300ms after the verb (not noun) was heard. The interference immediately after the verb resulted in no significant differences between the conditions. But again, when the probe was placed 300ms after the verb, listening to light verb constructions while making a lexical decision resulted in significantly slower reaction times than listening to either non-light or heavy constructions. This pattern of results was interpreted by Wittenberg and Piñango (2011) as further support for the hypothesis that the event co-composition process can be measured as a late, more gradually developing effect, after the lexical composition process has taken place.

However, the cost of co-composition could not be replicated in a self-paced reading study in German using the same stimuli (Wittenberg 2013). In this self-paced reading experiment, people read light and non-light constructions at similar speed, with only semantically anomalous constructions being processed slower. We return to the results of this experiment later in the paper.

Yet another study (Wittenberg et al. 2014) used Event-Related Potentials to understand the processing of light verb constructions. This study had three conditions: light (*give a kiss*) and non-light (*give a book*), like the interference-based paradigms, and then an anomalous condition, consisting of a non-felicitous noun-verb pairing (**give a conversation*). This was done mainly to distinguish the processing of complex, but plausible, constructions from implausible ones. The authors found evidence for a late, widely distributed, but frontally focused negativity after the onset of the light verb, compared to the non-light counterpart, and the anomalous condition showed a larger positive effect associated with semantic anomalies. Wittenberg et al. (2014) interpreted their results as reflecting a working memory cost caused by the process of event co-composition, particularly the linking of the two syntactic argument structures that surface in a single monoclausal structure.

In sum, the results of these studies generally point towards two broad themes: first, that the cost of event co-composition can be measured after the verb and noun combination has been processed, using both a cross-modal task and electro-physiological methodologies, but that the effect could not be detected in self-paced reading. Second, this cost appears to be a late effect, developing several hundred milliseconds after the light verb construction has been licensed. Its signature is distinct from semantically implausible constructions, but consistent with the processing of other types of complex events. Taken together, three out of four studies provide evidence for the cost of event co-composition in English and German.

1.3 Light verb constructions in Hindi

Light verb constructions are found across South Asian languages, including Hindi (Masica 1993). Seiss (2009) identifies the following properties that distinguish them from other types of verbal multiwords. First, they are always form-identical with the main or 'full' verbs in the language. Second, they are restricted in their combinatorial possibilities with the predicating noun, that is, every light verb can only combine with a certain kind of noun; and finally, they contribute subtle semantic information in the form of telicity and agentivity, among others (Hook 1974). In describing these constructions, we need to acknowledge terminological differences: in the South Asian linguistics literature, light verbs are sometimes subsumed under the term 'complex predicates'. While this term is arguably used more widely, we use the term *light verb construction*, because in Hindi 'complex predicates' may refer to noun and light verb combinations as well as verb and light verb, or even adjective and light verb combinations. Here, we use 'light verb constructions' to only refer to complex predicates consisting of a predicating noun and a light verb.

In a Hindi light verb construction, a verb combines with another pre-verbal noun, predicate, adjective, adverb, borrowed English verb, or noun (Ahmed et al. 2012). In this paper, we focus only on constructions with nouns, to keep comparability to previous studies. In the sentences below, the verb *de* 'give' is used as simple predicate in Ex. 3, but in Ex. (4), the verb *de* is light and combines with a predicating noun (both examples repeated from the previous section).

(3) raam=ne mohan=ko kitab d-ii
Ram.M.Sg=Erg Mohan.M.Sg=Dat book.F.Sg give-Perf.F.Sg
'Ram gave Mohan a book'

(4) raam=ne us baat=par **zor** **di-yaa**
Ram.M.Sg=Erg that topic=loc pressure.M.Sg give-Perf.M.Sg
'Ram put an emphasis on that topic'

In English, many light verb constructions have a denominal verb counterpart (e.g., *take a walk* can also be expressed by *walk*; (Tu and Roth 2011)). In Hindi as well, some light verbs (like *khoj kar* 'search do') will co-exist with their denominal verbs (*khojnaa* 'to search').

However, the distribution of Hindi light verb constructions differs from English and German because the vast majority of the light verb constructions in Hindi do not have an denominal verb counterpart. While both light and denominal verbs co-exist in English, the formation of denominal verbs in Hindi has ceased to be freely productive (Davison 2005).

Butt (2010) notes that Hindi light verb constructions act as a verbalizers in order to create new predicates and to incorporate borrowed items into the language (e.g. *email kar* 'email do; email'). Light verb constructions are highly productive and are sometimes described as "a preferred way of augmenting the creative potential of the language" (Kachru 2006) [93]. This is reflected in corpora: If English has approximately 7000 simplex verbs, Hindi has only 700 (Vaidya et al. 2013).[2]

1.4 Frequency and co-composition

In all of the experiments that were discussed in section 1.2, the cost of argument structure composition was interpreted as being due to the real-time processing of the light verb construction, because composite argument structures are built 'on the fly'.

An alternative view to this would be that light verb constructions are stored (in the manner of non-compositional idioms) in the lexicon. In order retrieve the right syntax-to-semantics mapping, native speakers would merely detect the construction as light, and retrieve the stored argument structure associated with a given construction. If light verb constructions were stored and retrieved as non-compositional units like this, instead of assembled incrementally and compositionally, what one would predict for real-time processing is that the higher the frequency of a given construction, the faster the recognition; reaction times for light verbs should therefore be faster.

Crucially, in all of the experimental results reported in section 1.2, the token frequency of any given light verb construction was higher than its non-light counterpart. For example, *make*, *have*, or *give* are more likely to occur with a light noun (forming a light verb construction) than with a non-light noun in English or German. That is, the collocational frequencies of light verb constructions such as *give someone a hug* are higher than the collocational frequencies of non-light constructions such as *give someone a book*.

Based on collocational frequency alone, then, one should expect speakers of English and German to be able to process light verb constructions with more ease than their non-light counterparts. However, the results of the psycholinguistic studies do not concord with this prediction (Piñango et al. 2006, Wittenberg and Piñango 2011). In fact, what we see is the reverse: reaction times are slower despite higher frequency. This pattern of results was interpreted as the cost of co-composition overriding any advantages of collocational frequency, when measured in reaction times at the verb. These results demonstrate that at least in languages like English and German, where the language-wide productivity of light verb constructions is relatively low, the higher collocational frequency of an individual light verb construction does not facilitate processing.

At the same time, as mentioned above, there is a great deal of cross-linguistic variation in how frequently light verb constructions are used. Using a corpus of 50 Wikipedia articles, Vincze et al. (2011) estimated that in English, about 9.5% of the predicates are expressed by light verb constructions. In Hindi, the proportion of light verb constructions is about 37% of roughly 37,600 predicates in the Hindi Treebank (Vaidya et al. 2013). Hindi is not an exception when it comes to language-wide frequency of complex predicates: In a language like Persian for instance, only about 115 simple verbs are commonly used, whereas almost all the rest are light verb constructions (Sadeghi 1993). These numbers highlight the differences in systemic frequency of the light verb construction across languages, and with it, the grammatical productivity of expressing a predicate with a complex verb in a given language.

Thus, in a language like Hindi, where language-wide frequency of the light verb construction is higher than English, we could expect to find that processing light verb structures results in a pattern

[2] Based on counts from English PropBank and Hindi PropBank, respectively.

similar to those found in English and German, i.e the overall token and language-wide frequencies do not facilitate processing when measured at the verb. Alternatively, we may also find that since the overall systemic productivity of the light verb construction results in greater exposure to the type of composite argument structures associated with this construction, this sensitivity towards previously seen argument structures makes them easier to process (Mitchell et al. 1995). If this is the case, then we would expect that the systemic productivity of light verb constructions in Hindi facilitates processing. Previous exposure to light verb constructions could imply that such argument structures are stored, or that Hindi native speakers are much more efficient at the process of event co-composition itself.

Some cross-linguistic studies support this idea. Structural preferences in different languages will correspond to the frequency with which they appear in those languages. For instance, preferences in relative clause attachment to the head noun in ambiguous sentences seem to differ cross-linguistically. While French and Spanish prefer 'higher' attachment, i.e. to a noun higher in the structure, English and Italian pattern 'lower' (Cuetos et al. 1996). These preferences may be tied to the frequency with which these structures appear across languages (although see Grillo and Costa (2014)'s paper which suggests that other factors may also be involved).

1.5 Frequency and predictability

Token frequency of a particular light verb is context-independent. In comparison, a word or lexical item's predictability depends upon its immediately preceding context, and the particular collocational frequency of a light verb and noun composition can play a role in facilitating its retrieval. Eye tracking studies have shown that the effects of frequency and predictability on reading are distinct and additive in nature (Kennedy et al. 2013). This implies that if a word is both low frequency and unpredictable, it will have greater cost than a word that is high frequency and predictable. There is evidence for the effect of both frequency and predictability on reading times, and Staub (2011) have also shown at these are distinct factors that do not necessarily interact with each other.

In the context of light verb constructions, it is close to impossible to control for the collocational frequency of a noun and light verb (it is almost always likely to be greater than the non-light). But we can control for the predictability of both light and non-light constructions, such that they are matched. This will help us tease apart the effect of familiarity or frequent exposure to event co-composition (as a result of language-wide frequency) vs. exposure to the individual noun-light verb combination in its token frequency. Crucially, if both light and non-light constructions are low in predictability, then any facilitation in processing can be attributed to systemic frequency, and not to the individual collocation.

1.6 Experimental Predictions

In the previous sections, we have elaborated on the theoretical motivation for event co-composition, the measurement of this phenomenon using behavioural and electrophysiological paradigms, and its relationship with frequency and predictability. With respect to the processing of Hindi light verb constructions, our experiments ask whether we can replicate the English and German data pattern in Hindi, a language that uses light verbs much more frequently as a predicational strategy than Germanic languages.

If comprehenders across the globe perform co-composition the same way, we should replicate the previous results, with light verb constructions taking longer to process than non-light constructions. However, if the systemic prevalence of light verb constructions in a language (and consequently a greater exposure to those constructions) influences the speed at which comprehenders perform cognitive operations such as co-composition, then we would expect light verb constructions in Hindi to be processed *faster* or equally fast as non-light constructions.

In order to account for the predictability of individual lexical collocations, we control for the predictability of light verb constructions and their non-light counterparts. If light verb constructions are processed faster than non-light constructions under this manipulation, we can conclude that any difference found in previous studies is not due to individual items' predictability, but to adeptness with complex verbs as a predicational strategy.

We test these predictions in four experiments, one of which is a self-paced reading study, and the remaining three use the cross-modal lexical decision task paradigm.

2 Experiments

In this section, we report four experiments on the comprehension of light verb constructions in Hindi, to understand whether the high frequency of complex predicates will lead to different processing patterns from English and German.

2.1 Experiment 1: Self-paced reading

Experiment 1 was designed to ask whether light verb constructions incur a processing cost, compared to their non-light counterparts, in a self-paced reading study. As Hindi is a verb-final language like German, the light verb will also appear at the end of the sentence. If we were to find results similar to those found in German, we would expect a difference in the processing of the light condition relative to the non-light condition in the verb region or right thereafter. In addition to both light and non-light conditions, we also include an anomalous control condition that combines a light verb with an incompatible noun (see Table 1), to distinguish effects that are due to semantic implausibility from those that could be a result of event co-composition. A similar control condition was used for German, both in a behavioural as well as in an ERP task (Wittenberg 2013, Wittenberg et al. 2014).

Context phrase:	*apne samay=ka prabandhan karnaa mushkil hai isiliye...* own.obl time=Gen management.M do.inf difficult be.Pres.sg therefore 'It is difficult to manage one's time, therefore ...'
Light/Non-Light/Anomalous	*adhyapak=ne vidyarthi=ko* **calender/bhaashan/*silsilaa** *diyaa ...* teacher=Erg student=Acc calendar/speech/*happening give.perf.3.M.Sg 'the teacher gave the student a calendar/speech/*happening ...'
Continuation	*aur kuch aasaan upaay bhi bataaye* and some simple solution.pl also tell.Pl '.. and gave (him) some useful suggestions'

TABLE 1: Example sentence showing all three conditions.

We predict that analogous to Wittenberg's (2013) results, the anomalous condition will trigger longer reaction times compared to light or non-light constructions, because of the semantic in-compatibility between noun and light verb in anomalous constructions. For light and non-light constructions, we predict that if the frequency of complex verbs as a predicational strategy influences speed of co-composition, then light verb constructions will be processed faster or equally fast as non-light constructions at the verb and thereafter. But if comprehenders across languages perform co-composition similarly, we would expect longer reading times for light verb constructions, compared to non-light constructions.

2.1.1 Method

Participants read sentences in a masked word-by-word self-paced reading paradigm. We used Ibex Farm for presentation (Drummond 2007). Participants were recruited using Amazon Mechanical Turk. We included a participant screening task that included a series of 8 puzzle questions. Participants were asked to choose between two Hindi sentences, where one was grammatical and the other contained an agreement error. This ensured that the participants were able to make basic grammaticality distinctions in Hindi. This test was introduced before the self-paced reading items were shown as a way to prevent non-Hindi speaking Turkers from participating.

The experiment was preceded by four practice items, followed by 15 experimental items in a Latin square design. We also included 20 fillers, half of which were semantically anomalous. Each experimental and filler item was followed by a comprehension question about the sentence, with two choices (Y/N).

2.1.2 Materials

Fifteen experimental sentences were created for three conditions: light, non-light and anomalous, all using the verb *de* 'give', which can appear both in light and non-light contexts. Each sentence consisted of a short context phrase, followed by the main sentence ending with the verb *diyaa* and a continuation. Table 1 shows an example sentence across three conditions: light, non-light, and anomalous. All the stimuli sentences were minimal pairs with either a non-light, light, or anomalous noun. In the example shown in Table 1, these are *calendar/speech/*happening* respectively, where the noun **happening* is semantically anomalous in combination with *diyaa*. A list of all experimental items used in this experiment is given in the appendix.

Frequency Norming. As mentioned in section 1.3, Hindi light verb constructions are highly productive. While it is impossible to control the productivity and frequency of a construction in a speaker's language system overall, we can control for individual frequency of a word. Thus, we matched the frequency of pre-verbal nouns across conditions.

To obtain frequency data, we used a corpus consisting of 17 million tokens from BBC Hindi (6.5 million) and the Hindi Wikipedia (10.5 million). This corpus was tokenized and tagged with parts of speech to calculate the frequencies of the nouns as well as the collocational frequencies of the noun and light verb (Reddy and Sharoff 2011). As expected, the collocational frequency of noun and verb was greater for light verb constructions (Mean: 13.62 pairs per million) than non-light constructions (Mean: 1.04 pairs per million); t=3.68, p =0.002 in a two-sample t-test. As expected, anomalous constructions were significantly lower in frequency (Mean: 0.027 words per million) as compared to non-light (t=2.19 p=0.04 in a two-sample t-test). Anomalous were also much lower compared to light verb constructions (t= 4.5, $p < 0.0001$ in a two-sample t-test) (Although the number for anomalous should have been zero, two anomalous nouns *pasand* 'like' and *ghoshanaa* 'declaration' had counts of 8 and 4 respectively, perhaps due to tagging errors in the corpus. However, the anomalous pairs are indeed semantically anomalous).

We were able to control the frequency of the preverbal noun across all three conditions. On average, nouns in the light condition appeared 91.3 times per million, in the non-light condition 92.9 times per million, and in the anomalous condition also 92.9 times per million tokens. There were no significant differences in noun frequency across light and non-light conditions using a two-sample t-test (t=-0.05, p=0.96) or anomalous and non-light conditions (t=-0.0004, p=1).

Acceptability Norming. We also conducted acceptability ratings across all three conditions with 16 native Hindi speakers, who were students of IIT Delhi (11 males, average age: 21.9). Participants were asked to rate sentences on a 7-point scale, ranging from 1-Unacceptable to 7-Acceptable. The average acceptability rating for the light sentences was similar to the non-light (6.22 light, SD=0.85; 5.64 non-light, SD=0.96), while the anomalous sentences had an average rating of 2.97 (SD=1.4). There was no significant difference between the acceptability ratings of light and non-light in a two-sample t-test (t = 1.74, p = 0.09). There were significant differences in the ratings between non-light and anomalous in a two-sample t-test (t=6.06, p<0.001), which is to be expected.

Cloze probabilities norming. 44 Hindi native speakers, who were students of IIT Delhi (24 males, average age: 22.5), provided sentence continuations for the verb in all three conditions, such as in 8, which had a missing sentence-final verb. The participants were requested to complete the sentence in the most natural way possible.

(8) *rohan=ki daadi=ne use promotion milne par badhaii ...*
rohan=Gen grandma=Erg him promotion get.Inf on congratulations ...
'On getting promoted Rohan's grandmother (gave) him congratulations'

The verb in the light verb condition was predicted 76% of the time, significantly more often than the verb in the non-light (49.88%) and the anomalous conditions (0.2%) A two-sample t-test showed significant differences in the light and non-light cloze predictions (t = 2.83, p = 0.008). For the light and anomalous cloze predictions as well, a two-sample t-test showed significant differences t=6.68 and p<0.00001. Anomalous and non-light also showed a significant difference in a two-sample t-test t= 3.83, p<0.0001. Thus, the verb in the light condition was highly predictable, compared to the other two conditions. This is similar to data from German (Wittenberg et al. 2014).

2.1.3 Participants

154 participants completed the experiment on Amazon Mechanical Turk. We selected only those participants who scored above 75% in the Hindi agreement puzzle questions (they had to get at least 6 out of the 8 questions correct). These participants on average had a score of 88% on the comprehension questions. This resulted in a total of 101 participants with a mean age of 33.5 years (21 females).

2.1.4 Results

We fit a linear mixed model to log-transformed reaction times with condition as fixed effect; the conditions were treatment-coded with the reference level as non-light, and items and participants were random intercepts (including random slopes for items and participants resulted in non-convergence). The t-values from the linear mixed model were approximated to p-values. The `pnorm` function in R was used to compute the probability density of the region above the obtained t-values. Since this is a two-tailed test, the obtained probability value is then multiplied by 2 to give us the approximated p-values. Table 2 gives an overview of the significance pattern for the regions following the noun.

The three conditions did not differ significantly in the regions preceding the noun. At the noun itself, we did not find a difference in reading times between conditions (see Table 3). Reading times at the verb indicate that the verb in the anomalous condition was read significantly slower than the verb in the non-light condition (t =4.34, p < 0.0001), but there was no significant difference at the verb between the light and the non-light conditions (t = 0.45, p = 0.65). The slowdown incurred by the anomalous condition also carried forward to the first postverbal region, where the difference between non-light and anomalous was still significant (t = 2.72, p = 0.006), but for the light vs. non-light conditions, there were no significant differences in reaction times after the verb was read. For t-values (and their approximated p-values) across all regions in the sentence, please refer to Table 4 in the Appendix. Table 5 in the Appendix also provides the mean reaction times (and SDs) across all regions in the sentence. Figure 2 shows the mean reaction times for the three conditions across all regions of interest in the sentence.

Region		**Noun**	**Verb**	**Post-verb-1**	**Post-verb-2**	**Sentence end**
Light vs. Non-light	t-value p-value	-0.76 0.44	0.45 0.65	-0.56 0.57	-0.92 0.35	-0.14 0.89
Anomalous vs. Non-light	t-value p-value	1.0 0.32	**4.35** **<0.001***	**2.73** **<0.01***	0.48 0.63	0.75 0.45

TABLE 2: T-values and p-values in the regions after the noun in Experiment 1. The critical region is at the verb. Significant effects in bold.

Region	**Noun**	**Verb**	**Post-verb-1**	**Post-verb-2**	**Sentence end**
Light	753.38	724.82	591.28	580.27	593.32
Non-Light	709.97	676.71	566.36	573.79	569.59
Anomalous	783.61	813.32	637.5	587.79	584.82

TABLE 3: Reading times for comparison between the three conditions for the regions following the noun until sentence end, in milliseconds. The critical region is at the verb, where the difference in the anomalous and non-light condition is significant.

2.1.4 Discussion of Experiment 1

This study compared reading times between light verb constructions, non-light constructions, and anomalous constructions. We did not find any differences in reading times between the light and non-light conditions, although the anomalous condition was read significantly slower than the other two at the verb, and in the region immediately following the verb.

This work is directly comparable to Wittenberg (2013)'s German self-paced reading study, which also included our three conditions (light, non-light, and anomalous), and showed a similar pattern of results as Experiment 1: a slower read anomalous condition and no detectable difference in reading times between light and non-light constructions.

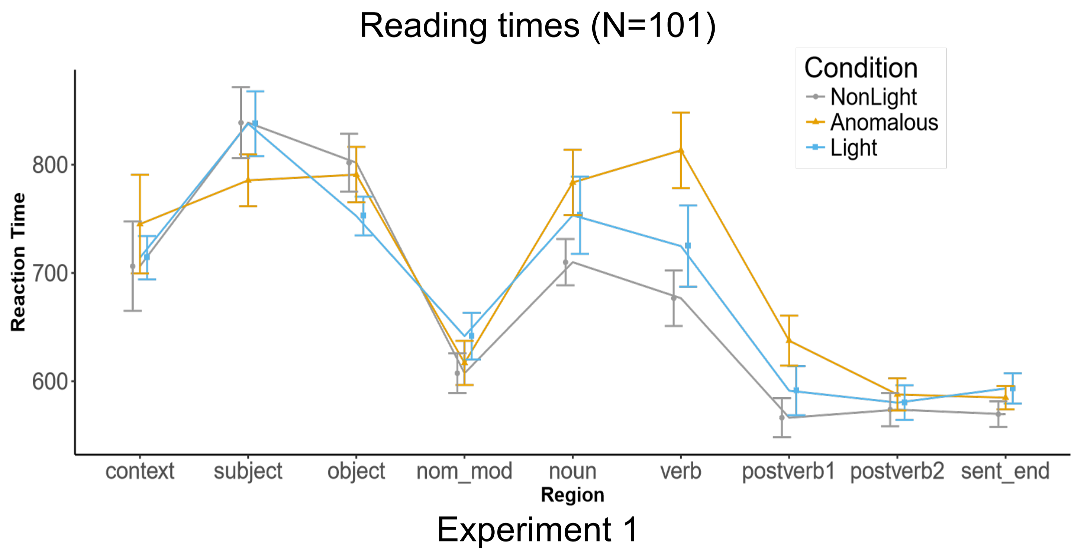


FIGURE 2: Mean reaction times for anomalous, light and non-light conditions for nine regions of interest in the sentence. The error bars show standard error. The critical region was at the verb, where the anomalous condition is significantly different from the non-light condition. Light and non-light are not significantly different at any region in the sentence. The error bars represent standard error.

Thus, our Experiment 1 serves as a conceptual replication of the study in German. At the same time, as discussed in Wittenberg (2013) as well, self-paced reading paradigms may not be able to detect more elusive semantic effects. While this method has been shown to reliably detect semantically or syntactically *implausible* constructions (Mitchell 2004), it may be less effective at capturing the plausible but subtle event co-composition processes in light verb constructions.

In section 1.2, we had reviewed the processing of light verb constructions in English and German using interference tasks, specifically the cross-modal lexical decision task (Piñango et al. 2006, Wittenberg and Piñango 2011). Such a paradigm was used to detect the effects of processing costs by placing an additional demand on working memory (e.g. Piñango et al. 2006, Kamienkowski et al. 2011). In an interference paradigm, a deliberate interference with working memory following the verb may slow down the processing of structures which are in fact semantically plausible and grammatical but posit an increased demand on working memory due to resolving the mismatch in syntax and semantics, like light verb constructions. In the experiments that follow, we use the cross-modal lexical decision task to test our predictions. Using the cross-modal decision task, we can manipulate the temporal placement of the probe in order to capture these effects.

2.2 Experiment 2

In the previous experiment, we found no reliable differences between reading the light and non-light constructions using a self-paced reading study. In this set of experiments, we decided to investigate the same questions using a different paradigm, particularly to understand whether an enhanced demand on working memory at the verb would capture any fine-grained differences between the conditions.

Hence, this experiment was also designed to ask when differences in processing between light and non-light would be apparent. Just like previous German and English studies (Wittenberg and Piñango 2011, Piñango et al. 2006), we placed the probe immediately after the verb (in this experiment) and 300ms after the verb (in Experiment 3), and measured reaction times to the lexical decision.

2.2.1 Method

Both experiments use a cross-modal lexical decision task paradigm. Participants heard sentences in a light, non-light or anomalous condition. In Experiment 2, a string unrelated to the sentence was visually presented immediately after the verb was heard; in Experiment 3, the probe was placed 300ms after verb offset. Participants had to decide whether the string was a word or a non-word (lexical decision). The sentences were pseudo-randomized in a Latin square design, and the same probe word was used in all three conditions.

Each participant also heard 25 filler sentences and was asked 20 comprehension questions on both the filler and experimental items. Out of the 25 filler sentences, 15 were semantically anomalous. Thus, each participant heard a total of 40 sentences, of which half were semantically anomalous.

After each sentence, there was a pause of 1500ms and then the next sentence was heard. Each experiment was preceded by a trial session where participants were familiarized with the task. The cross-modal lexical decision task was coded using a browser-based presentation software, jsPsych, version 5.0.3 (de Leeuw 2015), with a custom plugin for the cross-modal lexical decision task paradigm.

2.2.2 Materials

The sentence materials for this experiment were identical to the ones created for Experiment 1. Experimental and filler sentences were recorded by a female native Hindi speaker in randomized order during a single setting. After every ten sentences, the recording was paused to ensure that the tempo and volume was not inconsistent. All the sentences were then checked by another Hindi native speaker to ensure that there was no variation in the volume and tempo for each item. For each sentence, the offset up to the verb for each item and condition was noted. The sentence length for each item prior to the verb did not vary significantly across conditions. The mean length (in ms) of the sentences prior to the critical region of the verb (i.e. sentence prefixes) were 6380 ms for the light condition, 6293 ms for the non-light condition and 6391 ms for the anomalous condition.

In order to investigate if the prefix (i.e., the region before the light verb) was significantly different across the 3 conditions, we fit a linear regression model with the conditions as the independent variable and the length of the prefix (in ms) as the dependent variable. Treatment contrast coding was used with the non-light condition acting as the reference level. The result showed no significant difference between the baseline condition and the other conditions (Light p=0.8, t=0.24; Anomalous p=0.3, t=0.7).

Lexical Probes. For each experimental sentence, we created lexical probes that were semantically unrelated to the items. We recorded individual reaction times for the probe words in a separate lexical decision task. A total of 16 native speakers of Hindi (11 males, average age=22.31) participated and carried out a lexical decision task, where a string in the Hindi Devanagari script was flashed on the screen and participants had to decide whether it was a Hindi word or a non-Hindi word. A total of 102 words (48 words and 54 non-words) were presented to the speakers in a randomized order.

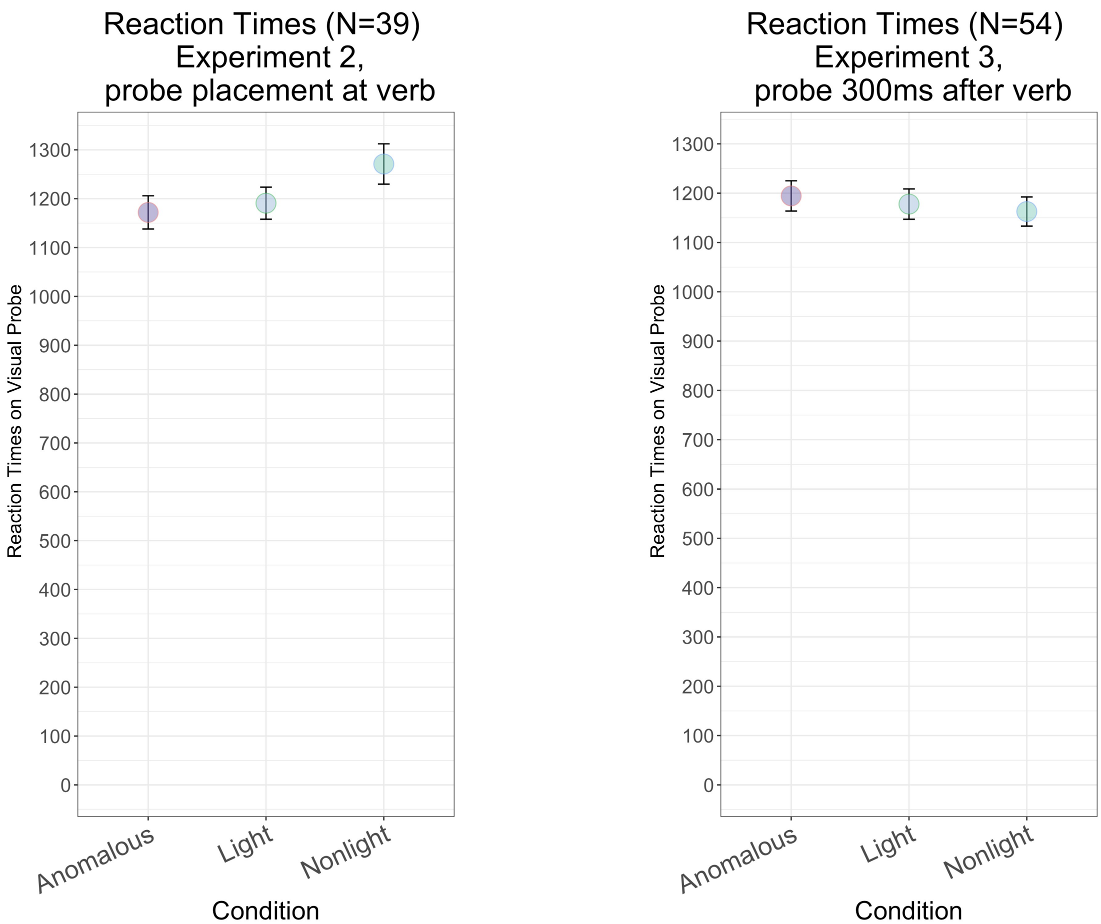
The probes were presented visually on a screen in Devanagari. Out of the 102 words we chose 15 words for the experimental sentences. In isolation, these words had a mean reaction time of 717.53 ms (SD= 33). A one-sample t-test showed that they did not differ significantly from each other (t=0, p=1). The same probe was used across all three conditions of a single item in the experiment. Each word was paired with one experimental item- the same across all conditions. As the items were presented in a Latin square, participants saw only one of the three conditions, and consequently each word probe was seen only once. We also chose 25 non-words that only appeared with the fillers. For non-words, the mean RT was 1020.87 ms (SD = 93).

2.2.3 Participants

83 native speakers of Hindi participated in Experiment 2, recruited through Amazon Mechanical Turk. 39 participants (mean age=30.5) were included as part of the analysis based on performance in comprehension questions (> 70%) and (> 60%) accuracy at the word-non-word task.

2.2.4 Results

We used a linear mixed effects model as before, using log reaction times with condition as fixed effect and item and subject as random intercepts. Light, Non-Light and Anomalous were treatment-coded with Non-Light as the reference level. Mean reaction times for the three conditions were 1,172 ms for the anomalous, 1,190.8 ms for the light, and 1,271 ms for the non-light condition as shown in Figure 3a. In line with results from English and German, there were no significant differences between light and non-light ($t = -1.53$, $p = 0.19$) or non-light and anomalous ($t = -1.53$, $p = 0.21$).



(a) Mean Reaction times for lexical decisions in Experiment 2 (Cross modal with probe immediately after the verb

(b) Mean Reaction Times for lexical decisions in Experiment 3 (Cross-modal with probe shown 300ms after the verb.

FIGURE 3: Results for Experiments 2 and 3.

2.3 Experiment 3

This experiment used the identical paradigm as Experiment 2, i.e., the cross modal lexical decision task, and the same set of materials as before. The only difference was that the lexical probe was shown 300 ms after the verb was heard (in contrast to Experiment 2, where it was shown immediately after the verb).

2.3.1 Participants

60 Hindi native speakers (36 male, average age=20.77), who were students at IIT Delhi, participated in the experiment. Out of these, four participants were excluded due to less than 70% accuracy on the word-non-word identification task, and two due to poor performance on comprehension questions. We were left with a total of 54 Hindi speakers.

2.3.2 Results

The mean reaction times for all three conditions are shown in Figure 3b (anomalous: 1,194.3 ms, light: 1,177.8 ms, and non-light: 1,162.7 ms). Again, light, non-light, and anomalous were treatment coded with non-light as the reference level in the analysis. The linear mixed model showed that there was no significant differences between the light and non-light condition (t = 0.28, p = 0.77), and also no difference between non-light and anomalous conditions (t =0.47, p =0.63).

2.4 Discussion of Experiments 2 and 3

Experiments 2 and 3 showed that when reaction times to a word probe were measured either immediately after the verb (Experiment 2), or 300ms after the verb (Experiment 3), there was no difference in reaction times to probes between the light and non-light conditions.

This lack of difference in reaction time between the light and the non-light condition fits with the experimental results of the self-paced reading study (Experiment 1), where there was no evidence for a difference in processing cost as measured by reading times between those two conditions. However, the lack of difference in reaction times to light versus non-light constructions differs from previous results using the same paradigm in English and German, where differences were found reliably with late probe placement (Piñango et al. 2006, Wittenberg and Piñango 2011), and is a useful point of cross-linguistic comparison.

Unlike in the self-paced reading task, the anomalous condition did not result in slower reaction times in either of the probe placements, although the set of items used across all three experiments was the same. The fact that the lexical decision task is not sensitive to the anomalous condition at odds with the results of Experiment 1. We have little doubt in the adequateness of our sentences, because Experiment 1 showed that the anomalous condition caused the expected slowdown. Instead, the lack of effect for anomalous sentences may be explained with reference to Wittenberg et al. (2014), which found a 'semantic P600' in response to anomalous constructions – a neural signature that has been described as reflecting a violation of overall propositional coherence, triggered by impossible, unparseable combinations (see (Kuperberg 2013, Kuperberg et al. 2020) for reviews). We would not expect such constructions that render event composition impossible to interfere with working memory later on; thus, a lack of slowdown in our working memory interference task is not completely surprising. We suggest studying this in the future.

Based on results from English and German, we trust the cross-modal decision task paradigm itself, and its sensitivity to semantically plausible but complex constructions. With this premise, the cross-linguistic differences between the light and non-light condition provide an important point of comparison for the construction in these languages (see section 3 for more discussion on this point), and we argue that taken together, the results of these three experiments imply that in Hindi, the event composition process does not result in a slowdown in reaction times at the light verb, unlike (Piñango et al. 2006, Wittenberg and Piñango 2011). This suggests that the event composition process does not seem to incur a cost for Hindi native speakers like it does for their German or English counterparts.

We also note that light verb constructions have a greater collocational frequency and greater predictability as compared to their non-light counterparts (see section 2.1.2). But we cannot be sure whether it was language-wide preference that facilitated processing, or whether the greater predictability of the individual light verb construction was more helpful, compared to previous work on German and English. In other words, it is possible that there may be context-dependent predictability effects which are reducing the computational cost of processing light verbs.

In Experiment 4 that follows, we control for the predictability of the light verb construction in order to tease apart both these frequency effects. We match the predictability between light and non-light constructions, operationalized through cloze probability. If we were to control the predictability of both light and non-light conditions, rather than keep them varied, we may be able to show more clearly the effects of event composition when measured at the verb. To avoid a floor effect in reaction times, we matched both conditions to be equally *low* in predictability.

2.5 Experiment 4

The aim of this experiment was to control both light and non-light conditions for token-based predictability, using the same paradigm as in Experiments 2 and 3, i.e. the cross-modal lexical decision task. Here, we can tease apart two factors that could have contributed to the null effects between light and non-light constructions in Experiments 1-3.

First, these results could have been due to Hindi native speakers' experience with the *language-wide systemic frequency* of the light verb construction in Hindi as a means to express predicates. If this is the case, we should find *faster* reaction times to light verbs when they are matched in cloze predictability: Hindi native speakers should be less surprised to hear a light verb construction than a non-light construction. However, if experience with the *individual construction* was driving reaction times, then we should find *slower* reaction times in the light condition, compared to non-light conditions, when cloze probabilities are matched. In this experiment, the anomalous sentences as control condition were omitted, focusing only on the comparison between the light and non-light constructions.

2.5.1 Method

This experiment also used a cross-modal lexical decision task paradigm. Participants heard sentences in either the light or non-light condition. A lexical probe was presented 300ms after the verb offset and participants had to decide whether the string was a word or a non-word. The sentences were randomized in a Latin square design and the same probe word was used in both conditions. Each participant also heard 15 (grammatical) filler sentences. The participants were asked 10 comprehension questions. Each participant heard a total of 30 sentences, half of which were experimental and half of which were fillers. In a manner similar to Experiment 2 and 3, there was a trial session that familiarized participants with the task. The presentation software used was also the same as Experiment 2 and 4 (jsPsych, version 5.0.3 (de Leeuw 2015)).

2.5.2 Materials

40 items were constructed, in the format described in Table 1, with a context sentence, a sentence containing either the light or non-light verb and a continuation. All items included the same light verb (*de* 'give'), as in Experiments 1-3.

A sentence completion task was used to calculate the cloze probabilities of the items. 16 native Hindi speakers (Mean age 33.06, female=12) were shown an incomplete sentence leading up to the light verb and were asked to complete it as naturally as possible. The items were presented using Ibex Farm (Drummond 2007). The responses were coded with respect to how often the light verb (*de* 'give') was predicted. Those items that were at chance (i.e. with a cloze probability of 50-60%) were not considered. 10 such items were removed. From the remaining 30 items, a subset of 15 low-cloze items were chosen. In the low-cloze group, both light and non-light conditions were almost equally predictable (light: 45% and non-light: 42%) with no significant difference between the two in a two-sample t-test (t=0.42, p=0.67). The remaining items were discarded.

The experimental items were recorded by a female native Hindi speaker in randomized order during a single setting. After every ten sentences, the recording was paused to ensure that the tempo and volume remained consistent. All sentences were then checked by another Hindi native speaker to ensure that there was no variation in the volume and tempo for each item. For each sentence, the offset up to the verb for each item and condition was noted. The sentence length for each item prior to the verb did not vary significantly across conditions (mean sentence length for light prior to the verb was 13333.33 ms and mean sentence length for non-light was 13226.27 ms. In order to investigate if the prefix (i.e., the region before the verb) was significantly different in the two conditions, we fit a linear regression model with the conditions as the independent variable and the length of the prefix (in ms) as the dependent variable. Treatment contrast coding was used with the non-light condition acting as the reference level. The result showed no significant difference between the baseline condition and the light condition p=0.89; t= 0.14.

2.5.3 Norming of sentences

The pre-verbal nouns in the light and non-light conditions were matched for frequency using a large corpus of 60 million tokens (Kilgarriff et al. 2010). The corpus was tokenized and tagged with parts of speech to calculate the noun frequencies and the collocational frequencies of noun and light verb.

The pre-verbal nouns were matched for frequency in the light and non-light conditions, with nouns in the light condition appearing 55.33 times per million and nouns in non-light appearing 58.88 times per million. A two-sample t-test showed no significant difference between the two conditions ($t=-0.18$, $p=0.8$).

As seen in Experiment 1, the mean collocational frequency of the predicating noun and light verb was greater than the non-predicating noun and verb, which is to be expected (Mean light: 16.83 per million words, Mean non-light: 2.09 per million words). Despite the higher collocational frequency of the light condition, note that light and non-light collocation were not significantly different in terms of predictability (see Section 2.5.2).

2.5.4 Lexical Probes

The lexical probes used in this task were identical to those used in Experiments 2 and 3. A list of all probes and items can be found in the Appendix.

2.5.5 Participants

120 native Hindi speakers (Mean age 31 years) participated in the experiment on Amazon Mechanical Turk, out of which 59 remained after filtering based on performance on comprehension questions (more than 70 % correct) and accuracy in the lexical decision task performance (more than 70 % correct).

2.5.6 Results

Reaction times to probes in the light condition were on average 63 ms *faster* than probes in the non-light condition (Mean light= 1265 ms, Mean non-light=1328 ms). This pattern is shown in Figure 4. As in the previous studies, we fit a linear mixed model predicting log reaction times from construction (light vs. non-light) as fixed effect, and item and subject as random intercepts. This model showed that the difference between reaction times to probes presented while hearing the light vs. non-light construction were significant ($t=-2.12$, $p=0.01$).

2.5.7 Discussion of Experiment 4

The results of Experiment 4 show that when the predictability of light and non-light construction is equally low, listening to light verb constructions incurred significantly faster reaction times while making a lexical decision to unrelated probes than listening to non-light constructions.
This effect should not be due to predictability or frequency of the individual constructions. The matched cloze probability ensured that the number of possible verbs that could appear after the noun was roughly the same for both conditions. Similarly, the nouns in both conditions were matched for frequency. After controlling for these factors (particularly, cloze for this experiment), we had predicted that the effect of the co-composition process would show up in the form of longer reaction times in the light condition, while the results show the opposite pattern.

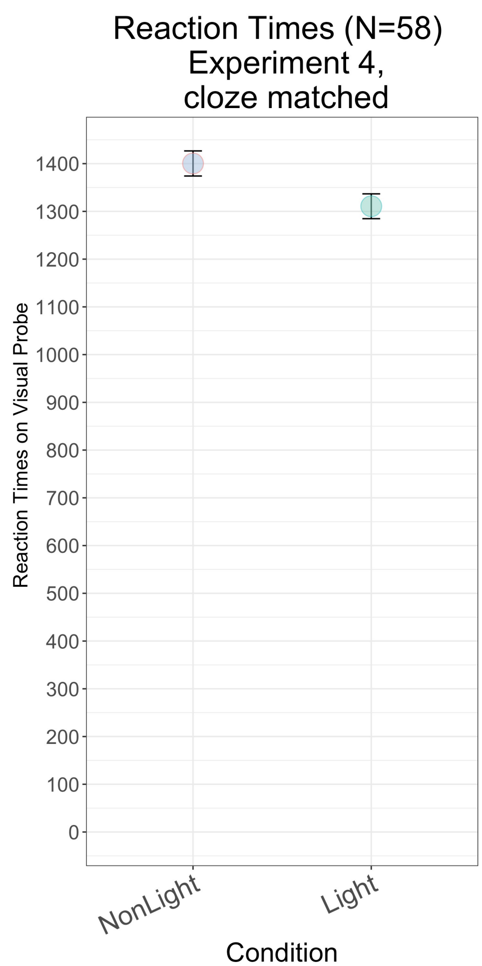


FIGURE 4: Mean reaction times for Experiment 4 (cross-modal lexical decision task with matched cloze probabilities).

We can interpret the results in two ways: First, the collocational frequency of the predicating noun and the light verb together resulted in faster reaction times at the verb, superseding any predictability effects for the individual constructions. Another way to interpret these results is the *language-wide productivity* of the construction in Hindi: Hindi native speakers develop a greater efficiency in co-composition, where the light verb construction is being composed faster due to greater practice with this predicational strategy in the language overall.

3 General Discussion

This paper explored how the systemic, language-wide frequency of a predicational strategy affects cognitive processing, using light verb constructions in Hindi as a test case. Experiment 1 used a self-paced reading paradigm, and while people slowed down reading anomalous constructions, there was no difference in reading speed between light and non-light constructions. Experiments 2 and 3 used a cross-modal lexical decision paradigm, which has been shown to be more sensitive to semantic composition processes. However, regardless of the timing of the lexical decision task, we failed to detect any difference in reaction times to probes presented while people listened to light vs non-light constructions. Experiment 4 used the same cross-modal task, where light and non-light constructions were controlled for predictability. Crucially, in this final study, light verb constructions led to *faster* reaction times than non-light constructions. Most of these data stand in contrast to German and English data, where longer reaction times and higher processing costs were found for light verb constructions (Piñango et al. 2006, Wittenberg and Piñango 2011, Wittenberg et al. 2014, but see Wittenberg, 2013).

These results show that for speakers of Hindi, where the language-wide systemic frequency of light verb constructions is greater than in English or German, the event co-composition process does not incur a measurable computational cost when measured at the verb, or in the region immediately following the verb. We interpret these findings to imply that the process of event co-composition is facilitated by a greater exposure to the composite argument structure of light verb constructions in the language.

Thus, we interpret these datasets as evidence for language-specific effects of the systematic prevalence of a predicational strategy on cognitive processing. In Hindi, a greater proportion of predicates are expressed using complex verb phrases; light verb constructions make up more than a quarter of predicates, more than double that of English or German. Thus, Hindi native speakers have significantly more experience in processing these constructions, and this practice effect overrides any cost of co-composition.

Crucially, this interpretation hinges on two assumptions: The first of these assumptions is that the English and German data are reliable. While we have not attempted a replication of those data, we hope to do so in future work, once in-person data collection is possible again. This plan is not rooted in mistrust, but scientific prudence: In the ten years that have gone by since these data were collected, statistical methods and conventions on sample size, for instance, have changed, and so may have usage patterns, with some constructions being now perhaps more or less frequent than they used to be.

Related to this point is a valid discussion on the reliability of the relatively rarely used interference paradigm, the parametrization of probe timings, and their explanatory power (see Wittenberg, 2013, for discussion). This evaluation of the paradigm is beyond the current discussion, but converging evidence from both dual tasks and Event-Related Potentials alleviates this concern (Piñango et al. 2006, Wittenberg et al. 2014, Wittenberg and Piñango 2011).

Importantly, the present results are decidedly not in line with earlier data, which brings us to the second assumption our interpretation hinges on: Namely, that in light verb construction, cocomposition is indeed the explanandum. However, within the co-composition assumption, several variations on the theme are conceivable, and there are also there are several broader theoretical alternatives to consider. We discuss these in turn.

3.1 Early vs. late co-composition

The model of event co-composition that has been discussed in this paper assumes that the eventive meaning of the noun is incomplete until the integration of the light verb. This means that co-composition is not complete until after the processing of the light verb. We can refer to this as 'late' co-composition. Another possibility is a noun-driven composition account, which would predict that the process will be initiated before the verb is comprehended.

This alternative model of event composition has the noun as the sole predicator in the light verb construction (Grimshaw and Mester 1988, Kearns 1988). According to such an account, the noun is the primary predicator, while the light verb is merely a theta-marker, supplying an agent role to the subject of the clause (e.g. *Mohan* in Figure 1).

From a processing point of view, this set of accounts would predict that the co-composition process will take place early, i.e. at the noun itself, rather than after the verb is encountered. Although the noun is not usually a predicating element, in the context of the light verb construction, its eventive meaning is strongly predictive of the entire predicate. We note that this account does not rule out co-composition as a phenomenon. Rather it implies that during the real-time processing of light verb constructions the noun is so strongly predictive of the light verb that there is a negligible cost when reaction times are measured at the verb.

Both models predict a process of co-composition, but in processing terms, the noun-driven composition account would predict the process to be initiated *earlier* than the event co-composition account, and the quality of co-composition would differ. The faster reaction times at the verb in Experiment 4 could indicate that event composition has already taken place at the noun. On the other hand, if the noun was the only predicating element, then we should have observed faster reaction times when cloze probabilities for the light condition were higher (as in Experiment 1-3). Hence our experiments do not strongly support either the late or early account and could be compatible with both. We hope to address the time-course of co-composition in future studies.

3.2 Alternatives to event co-composition

In this paper, we have adopted event co-composition as the model to explain the process of light verb construction interpretation, but there may be alternate mechanisms contributing to the data. In this section we review some of these explanations.

Aspectual implicatures. Wittenberg and Levy (2017) have shown that the conceptualization of event duration differs between a simple transitive verb (*A kissed B*) and a light verb construction (*A gave B a kiss*). In English, a computational cost for processing light verb constructions may be attributed to incorporating these aspectual implicatures such as telicity or volitionality during the co-composition process. In Hindi, one possibility is that these aspectual implicatures are missing in light verb constructions, which could result in a reduced computational cost when measured at the verb.

One reason for this would be the absence of denominal and light verb alternations in Hindi. Only a small group of nouns in Hindi have both denominal and light verb forms, whereas in English both forms will co-exist in the language (i.e., *a kiss* vs. *to kiss*). In Hindi, the light verb construction is often the only way to express a certain meaning; no simplex verb alternative exists. Hindi native speakers must be adept at the process of using the construction to 'verbalize' new predicates into the language. Consequently, the verb in Hindi provides much less semantic content to the light verb construction as compared to German and English.

We do not have psycholinguistic evidence for the availability of aspectual implicatures in Hindi light verb constructions, but we do know, from Hindi corpus studies, that predicating nouns in light verb constructions tend to form semantically coherent groups (Sulger and Vaidya 2014). For instance, it is possible to form a light verb construction as *give a sigh/grunt/cry* but not **take a sigh/grunt/cry*: A predicating noun, such as sound emission nouns, will combine with only certain types of verbs, and not others. This suggests that there may be lexical semantic properties of the light verb that control combinatorial possibilities. If light verbs in Hindi were simply verbalizers, such restrictions should not exist- indeed they would be compatible with any noun. We note that this is still indirect evidence, and more studies need to examine the availability of these implicatures.

Collocational frequencies. It would also be possible to interpret our results as the effects of frequency and productivity alone, rather than increased practice with the co-composition process. This would amount to treating light verb constructions as any other type of multiword expression with high collocational strength, like verbal idioms or compounds, where prediction is faster due to storage as a whole construction (also see discussion in Wittenberg 2016). However, this is not supported by the results of the low cloze experiment (Experiment 4) - there is potentially more than one light verb that can appear after the noun, and yet, reaction times are faster. Additionally, on the basis of collocational strength alone, we should have also found faster reaction times in Experiment 1, which we do not. This leaves us to conclude that the process of co-composition does not appear as a processing cost as it does for English or German. Rather, this cost disappears due to language specific differences in Hindi.

Alternative syntactic and semantic configurations. As discussed above, the composite argument structure of noun and light verb is distinct from that of other verbal predicates, in Hindi and other languages. Unlike canonical one-to-one mapping between syntactic and semantic argument structure, the light verb construction needs to combine thematic roles originating from both noun and light verb. It is possible, however, that this composite argument structure is an erroneous assumption (see for discussion e.g. He and Wittenberg 2020, Wittenberg 2016); rather, light verb constructions may simply have a number of semantic roles that correspond to its syntactic arguments, where the predicating noun fills a 'metaphorical' thematic role slot. Alternatively, the predicating noun need not fill a semantic role slot at all – it simply forms a single predicate together with the light verb, and the structure has two semantic roles corresponding with two syntactic arguments. In both these scenarios, there would be no reason to believe that a composite argument structure is derived as in Figure 1, and therefore we find no computational cost associated with processing the light verb construction.

However, there is experimental evidence for co-composition in light verb constructions (again, on English). In Wittenberg and Snedeker (2014), participants were trained to categorize pictures of events according to number of thematic roles, for instance, sleeping children into a one-role category; monkeys eating bananas would be a two-role event; and a child giving an apple to a teaching would be a three-role event. In the test phase, participants also had to sort sentences containing light verb constructions containing the verb *give* (e.g., *give a kiss/kick/hug…*), base verbs (e.g., *kiss/kick/hug…*), or non-light constructions (e.g., *give a flower/plate/ticket…*). The predictions were that if the thematic argument structure of light verb constructions is constructed following surface syntactic arguments, participants will categorize light verb constructions as three-role events. If they are understood as stored constructions to describe the same as base verbs, then they would be categorized as two-role events. Results showed that sentences with light verb constructions fell between the two categories – they were categorized differently from two-role events *and* differently from three-role events, suggesting that light verb constructions may be associated with two types of argument structure simultaneously.

In a followup to this study, Wittenberg et al. (2017) conducted an eye-tracking experiment. Here, participants *implicitly* learned to classify two- and three-role sentences, without being instructed about their valency properties. Participants were able to do this successfully for non-light and base verb sentences, but when light verb constructions were encountered, they again displayed an intermediate pattern, again between the two and three-role alternatives, indicating that native speakers need to resolve two sets of thematic roles coming from the noun and light verb respectively.

None of these studies alone can answer the question of how light verb constructions are learned, stored, comprehended, and produced. However, all of them together indicate that at least in English and German, light verb constructions behave differently from canonical constructions on several different levels; and the evidence suggests that the assembly of the argument structure plays a crucial role.

3.3 Pairwise comparisons.

Experiments 2 and 3 in our study yielded no differences between the light and non-light condition. We expected to find no differences in Experiment 2 (based on the English and German results), but we found a null effect in Experiment 3 as well. In order to explain it, we examined the experiment design for the previous experiments on light verb constructions.

Interestingly, the cross-modal lexical decision task for English did not find differences between light and non-light when measured 300ms after the verb (Piñango et al. 2006). Rather, they found a pairwise difference between the light and *heavy* condition, i.e. between *Mr. Olson gave an order last night to the produce guy* (light) and *Mr. Olson typed an order last night for the produce guy* (heavy). There was no difference between the light and non-light condition at 300ms after the verb. For German, on the other hand, the light condition did result in slower reaction times than both heavy (same noun) and non-light constructions 300ms after the verb.

This seems to suggest that there could be other types of pairwise comparisons that are possible, particularly grammatically plausible ones (such as the heavy condition) rather than the semantically implausible anomalous condition used in our experiments for Hindi. Perhaps future work can examine such comparisons in more detail.

4 Conclusion

We presented four studies on comprehending Hindi light verb constructions, compared to their non-light counterparts, and anomalous sentences. In summary, there appear to be considerable differences in the speed of co-composition carried out by Hindi speakers as compared to their English and German counterparts. Our results imply that Hindi native speakers are adept at the process of understanding light verb constructions as 'verbalizing' predicates, much more so than speakers of Germanic languages. One potential explanation of these data is that the process of argument sharing is not universal but limited to Germanic languages. However, the gist of the theoretical proposal seems to hold across languages and was originally developed for languages like Hindi and Urdu (Butt 2010). Thus, we argue that these data provide evidence for a case of specific linguistic experiences shaping cognition: cost disappears with practice.

Acknowledgments

We thank the audiences at SALA 2018 in Konstanz, Germany, and X-PPL 2019 in Zurich, Switzerland, for helpful comments and discussion, and gratefully acknowledge Sidharth Ranjan (IIT Delhi) for creating the custom JsPsych plugin for the presentation of the stimuli. Ashwini Vaidya was supported by the DST-CSRI (Dept of Science and Technology-Cognitive Science Research Initiative) post-doctoral fellowship at IIT Delhi (PDF-67/2015 from 2016-18).

References

Ahmed, Tafseer, Miriam Butt, Annette Hautli, and Sebastian Sulger. 2012. A reference dependency bank for analyzing complex predicates. In *Proceedings of the Eight International Conference on Language Resources and Evaluation (LREC'12)*.

http://www.lrec-conf.org/proceedings/lrec2012/pdf/474_Paper.pdf.

Alsina, Alex, Joan Bresnan, and Peter Sells. 1997. Complex Predicates: Structure and Theory. In *Complex Predicates*. CSLI Publications, Stanford. https://trove.nla.gov.au/version/17082409.

Boland, Julie E. 1997. The relationship between syntactic and semantic processes in sentence comprehension. *Language and Cognitive Processes* 12(4):423–484.

Briem, Daniela, Britta Balliel, Brigitte Rockstroh, Miriam Butt, Sabine Schulte im Walde, and Ramin Assadollahi. 2009. Distinct processing of function verb categories in the human brain. *Brain Research* 1249:173–180.

https://doi.org/10.1016/j.brainres.2008.10.027.

Butt, Miriam. 2010. The Light Verb Jungle: Still Hacking Away. In M. Amberber, M. Harvey, and B. Baker, eds., *Complex Predicates in Cross-Linguistic Perspective*, pages 48–78. Cambridge University Press. https: //doi.org/10.1017/CBO9780511712234.004.

Butt, Miriam, Tracy Holloway King, and Gillian Ramchand. 2008. Complex Predication: How Did the Child Pinch the Elephant? In L. Uyechi and L. Wee, eds., *Reality Exploration and Discovery: Pattern Interaction in Language and Life*. CSLI Publications, Stanford. http://ling.uni-konstanz.de/pages/home/butt/ main/papers/mo-final.pdf.

Cuetos, Fernando, Don C. Mitchell, and Martin M.B. Corley. 1996. Parsing in different languages. In M. Carreiras, J. Garcia-Albea, and N. Sabastian-Galles, eds., *Language Processing in Spanish*. Erlbaum. https://www.taylorfrancis.com/books/e/9780203773970/chapters/10.4324/9780203773970-11.

Culicover, Peter W and Ray Jackendoff. 2005. *Simpler syntax*. Oxford University Press. https://global.oup.com/academic/product/simpler-syntax-9780199271092?cc=us&lang=en&#.

Davison, Alice. 2005. Phrasal predicates: How N combines with V in Hindi/Urdu. In T. Bhattacharya, ed., *Yearbook of South Asian Languages and Linguistics*, pages 83–116. Mouton de Gruyter. http://www.uiowa.edu/~linguist/faculty/davison/phrasal.pdf.

de Leeuw, J. R. 2015. jsPsych: A javascript library for creating behavioral experiments in a web browser. *Behavior Research Methods* 47(1):1–12. https://doi.org/10.3758/s13428-014-0458-y.

Drummond, Alex. 2007. Ibex farm. https://spellout.net/ibexfarm/. accessed August 8, 2020.

Durie, Mark. 1988. Verb serialization and "verbal-prepositions" in oceanic languages. *Oceanic linguistics* 27(1):1. https://www.jstor.org/stable/3623147.

Grillo, Nino and Joäo Costa. 2014. A novel argument for the universality of parsing principles. *Cognition* 133(1):156 – 187. https://doi.org/10.1016/j.cognition.2014.05.019.

Grimshaw, Jane and Armin Mester. 1988. Light verbs and theta-marking. *Linguistic Inquiry* 9(2):205–232. https://www.jstor.org/stable/4178587.

He, Angela Xiaoxue and Eva Wittenberg. 2020. The acquisition of event nominals and light verb constructions. *Language and Linguistics Compass* 14(2): e12363.

https://onlinelibrary.wiley.com/doi/abs/ 10.1111/lnc3.12363.

Hook, Peter. 1974. *The Compound Verb in Hindi*. University of Michigan, Ann Arbor.

Jespersen, Otto. 1965. *A Modern English Grammar on Historical Principles, Part VI, Morphology*. George Allen and Unwin Ltd.

Kachru, Yamuna. 2006. *Hindi*. John Benjamins.

Kamienkowski, Juan E, Harold Pashler, Stanislas Dehaene, and Mariano Sigman. 2011. Effects of practice on task architecture: Combined evidence from interference experiments and random-walk models of decision making. *Cognition* 119(1):81–95. https://doi.org/10.1016/j.cognition.2010.12.010.

Kearns, Kate. 1988. Light verbs in English. Manuscript, MIT (revised 2002), http://citeseerx.ist.psu. edu/viewdoc/summary?doi=10.1.1.132.29.

Kennedy, A., J. Pynte, W.S. Murray, and S.A. Paul. 2013. Frequency and predictability effects in the dundee corpus: an eye movement analysis. *Quarterly Journal of Experimental Psychology* 66(3):601–618. https://doi.org/10.1080/17470218.2012.676054.

Kilgarriff, Adam, Siva Reddy, Jan Pomikálek, and Avinesh PVS. 2010. A Corpus Factory for Many Languages. In *Proceedings of the Seventh Conference on International Language Resources and Evaluation (LREC'10)*. http://www.lrec-conf.org/proceedings/lrec2010/pdf/79_Paper.pdf.

Kuperberg, Gina R. 2013. The proactive comprehender: What event-related potentials tell us about the dynamics of reading comprehension. *Unraveling the behavioral, neurobiological, and genetic components of reading comprehension* pages 176–192.

Kuperberg, Gina R, Trevor Brothers, and Edward W Wlotko. 2020. A tale of two positivities and the n400: Distinct neural signatures are evoked by confirmed and violated predictions at different levels of representation. *Journal of Cognitive Neuroscience* 32(1):12–35.

Masica, Colin. 1993. *The Indo Aryan Languages.* Cambridge University Press. https://www.cambridge.org/in/academic/subjects/languages-linguistics/other-languages-andlinguistics/indo-aryan-languages?format=PB&isbn=9780521299442.

McElree, Brian and Teresa Griffith. 1995. Syntactic and thematic processing in sentence comprehension: Evidence for a temporal dissociation. *Journal of Experimental Psychology: Learning, Memory, and Cognition* 21(1):134.

Mitchell, Don, Fernando Cuetos, Martin Corley, and Marc Brysbaert. 1995. Exposure-based models of human parsing: Evidence for the use of coarse-grained (nonlexical) statistical records. *Journal of Psycholinguistic Research* 24:469–488. https://link.springer.com/article/10.1007/BF02143162.

Mitchell, Don C. 2004. On-line methods in language processing: Introduction and historical review. In M. Carreiras and C. C. Jr., eds., *The on-line study of sentence comprehension: Eyetracking, ERPs and beyond*, pages 15–32. New York, NY: Psychology Press. https://www.taylorfrancis.com/books/9780203509050.

Mohanan, Tara. 1997. Multidimensionality of representation- NV complex predicates in Hindi. In A. Alsina, J. Bresnan, and P. Sells, eds., *Complex Predicates*. CSLI Publications, Stanford.

Norcliffe, Elisabeth, Alice C. Harris, and T. Florian Jaeger. 2015. Cross-linguistic psycholinguistics and its critical role in theory development: early beginnings and recent advances. *Language, Cognition and Neuroscience* 30(9):1009–1032. https://doi.org/10.1080/23273798.2015.1080373.

Piñango, Maria Mercedes, J. Mack, and Ray Jackendoff. 2006. Semantic combinatorial processes in argument structure: Evidence from light-verbs. In *Proceedings of Berkeley Linguistics Society 32nd Annual Meeting*. http://dx.doi.org/10.3765/bls.v32i1.3468.

Reddy, Siva and Serge Sharoff. 2011. Cross Language POS Taggers (and other Tools) for Indian Languages: An Experiment with Kannada using Telugu Resources. In *Proceedings of the Fifth International Workshop On Cross Lingual Information Access*, pages 11–19. Chiang Mai, Thailand: Asian Federation of Natural Language Processing. https://www.aclweb.org/anthology/W11-3603.

Sadeghi, Ali Ashraf. 1993. On denominative verbs in Persian. In *Farsi Language and the Language of Science*, pages 236–246. Tehran: University Press.

Sag, Ivan A., Timothy Baldwin, Francis Bond, Ann Copestake, and Dan Flickinger. 2002. Multiword Expressions: A Pain in the neck for NLP. In *Proceedings of the 3rd International Conference on Intelligent Text Processing and Computational Linguistics (CICLing'02)*, pages 1–15. https://link.springer.com/ chapter/10.1007/3-540-45715-1_1.

Seiss, Melanie. 2009. On the difference between auxiliaries, serial verbs and light verbs. In *Proceedings of the LFG09 Conference*. https://web.stanford.edu/group/cslipublications/cslipublications/LFG/14/papers/lfg09seiss.pdf.

Staub, Adrian. 2011. The effect of lexical predictability on distributions of eye fixation durations. *Psychonomic Bulletin and Review* 18(2):371–6. https://doi.org/10.3758/s13423-010-0046-9.

Sulger, Sebastian and Ashwini Vaidya. 2014. Towards Identifying Hindi/Urdu Noun Templates in Support of a Large-Scale LFG Grammar. In *Proceedings of the Fifth Workshop on South and Southeast Asian Natural Language Processing at COLING 2014*. https://www.aclweb.org/anthology/W14-5501.pdf.

Tu, Yuancheng and Dan Roth. 2011. Learning English Light Verb Constructions: Contextual or Statistical. In *Proceedings of the Workshop on Multiword Expressions (MWE 2011), 49th Annual Meeting of the Association for Computational Linguistics: Human Language Technologies (ACL-HLT 2011)*. https: //www.aclweb.org/anthology/W11-0807.

Vaidya, Ashwini, Martha Palmer, and Bhuvana Narasimhan. 2013. Semantic roles for nominal predicates: Building a lexical resource. In *Proceedings of the 9th Workshop on Multi-word Expressions, NAACL-13*. https://www.aclweb.org/anthology/W13-1018.

Vincze, Veronika, István Nagy T, and Gabór Berend. 2011. Detecting noun compounds and light verb constructions: a contrastive study. In *Proceedings of the Workshop on Multiword Expressions: from Parsing and Generation to the Real World (MWE 2011)*. https://www.aclweb.org/anthology/W11-0817/.

Wittenberg, Eva. 2013. Paradigmenspezifische effekte subtiler semantischer manipulationen. *Linguistische Berichte* 2013(235):293–308. https://buske.de/paradigmenspezifische-effekte-subtilersemantischer-manipulationen.html.

Wittenberg, Eva. 2016. *With light verb constructions from syntax to concepts*, vol. 7. Universitätsverlag Potsdam. https://publishup.uni-potsdam.de/opus4ubp/frontdoor/deliver/index/docId/8236/file/pcss07.pdf.

Wittenberg, Eva, Manizeh Khan, and Jesse Snedeker. 2017. Investigating thematic roles through implicit learning: Evidence from light verb constructions. *Frontiers in Psychology* 8:1089. https://www. frontiersin.org/article/10.3389/fpsyg.2017.01089.

Wittenberg, Eva and Roger Levy. 2017. If you want a quick kiss, make it count: How choice of syntactic construction affects event construal. *Journal of Memory and Language* 94:254 – 271. http://www. sciencedirect.com/science/article/pii/S0749596X16302480.

Wittenberg, Eva, Martin Paczynski, Heike Wiese, Ray Jackendoff, and Gina Kuperberg. 2014. The difference between "giving a rose" and "giving a kiss": Sustained neural activity to the light verb construction. *Journal of Memory and Language* 73:31–42. https://doi.org/10.1016/j.jml.2014.02.002.

Wittenberg, Eva and Maria Mercedes Piñango. 2011. Processing light verb constructions. *The Mental Lexicon* 6(3):393–413. http://dx.doi.org/10.1075/ml.6.3.03wit.

Wittenberg, Eva and Jesse Snedeker. 2014. It takes two to kiss, but does it take three to give a kiss? categorization based on thematic roles. *Language, Cognition and Neuroscience* 29(5):635–641. https: //doi.org/10.1080/01690965.2013.831918.

Appendix

Region		Context	Subject	Object	Nominal modifier	Noun	Verb	Post-verb-1	Post-verb-2	Sent end
Light vs. Non-light	*t-value* *p-value*	1.53 0.12	-0.10 0.91	-1.43 0.15	0.65 0.51	-0.76 0.44	0.45 0.65	-0.56 0.57	-0.92 0.35	-0.14 0.89
Anomalous vs. Non-light	*t-value* *p-value*	0.24 0.8	-1.28 0.19	-1.24 0.21	0.32 0.74	1.0 0.32	4.35 0.00001*	2.73 0.006	0.48 0.63	0.75 0.45

TABLE 4: Region-wise results for the entire sentence showing t-values (top row) and p-values (bottom row) in Experiment 1. The critical region is at the verb.

Region		Context	Subject	Object	Nominal modifier	Noun	Verb	Post-verb-1	Post-verb-2	Sent end
Light	*Mean RT*	714.12	837.92	752.61	641.66	753.38	724.82	591.28	580.27	593.32
	SD	904.04	874.07	539.24	574.82	802.61	842.96	509.89	360.2	718.02
Non-Light	*Mean RT*	706.26	838.85	801.85	607.39	709.97	676.71	566.36	573.79	569.59
	SD	1820.22	945.37	809.12	500.8	480.26	577.13	406.14	344.25	615.56
Anomalous	*Mean RT*	745.14	785.58	790.86	616.92	783.61	813.32	637.5	587.79	584.82
	SD	2047.39	678.09	767.12	562.57	677.58	784.26	533.13	325.04	564.32

TABLE 5: Region-wise Mean Reaction times and standard deviations for each condition in Experiment 1. The critical region is at the verb.

1 Items in Experiment 1,2 and 3

1. अपने समय का प्रबंधन करना मुश्किल है, इसीलिए अध्यापक ने विद्यार्थी को भाषण/कैलंडर/*सिलसिला दिया और कुछ आसान उपाय भी बताये It is difficult to manage one's time, hence the teacher gave the student a *speech/calendar/*happening* and mentioned a few tips. PROBE: गाय ; cow
2. अपनी भूल को कबूल करते हुए, लंडन के अधिकारी ने ब्रिटिश अम्बेसेडर को अपना इस्तीफा/पासपोर्ट/*अफ़सोस दिया लेकिन वे फिर भी नाराज़ थे While accepting his mistake, the officer in London gave the British ambassador his *resignation/passport/*regret* but he was still upset. PROBE: चाँद; moon
3. सम्मलेन के बाद प्रोफेसर बासु ने अपने विद्यार्थियों को भारत भ्रमण करने का वचन/नक्शा/*आज़ाद दिया और साथ में उनको किस्से सुनाये After the conference, Professor Basu gave his students a *promise/map/*freedom* and recounted a few anecdotes. PROBE: चोर; thief
4. दिवाली के दिन मीरा ने एक गरीब को बाजार में इशारा/पोशाक/*फायदा दिया और उसको अपने बगल में बैठाया On the day of Diwali Meera gave a poor man a *sign/clothing/*advantage* and made him sit beside her. PROBE:साँप; snake
5. मुंबई के स्टूडियो में, मशहूर गायक राध्येश्याम ने जय को एक मौका/एल्बम/*अपराध दिया और जय को बड़ी ख़ुशी हुई In the Mumbai studio the famous singer Radheshyam gave Jay a *chance/album/*offence* and Jay was very happy. PROBE: धूल; dust
6. इस फिल्म में भगवान ने करीना के सपने में उसे दर्शन/उपन्यास/*तापमान दिया लेकिन उठने के बाद वह सपना समझ नहीं पायी In this film, God gave an *audience/novel/*weather* to Kareena in her dream, but on waking up she could not understand the dream. PROBE: जाल; web
7. ऊपर से ऑर्डर आने के बाद सीनियर इंजीनियर ने अपने विभाग को ब्रिज बनाने का निर्देश/डिजाइन/*प्रकाशन दिया और मीडिया के लिए प्रेस कांफ्रेंस की योजना बनाई After getting an order from his superiors, the senior engineer gave his department an *order/design/*publication* and made arrangements for a press conference. PROBE: नाक; nose
8. वायरस के फैलने के बाद इस संस्था ने गरीब लोगों को अस्पताल के बाहर जानकारी/जगह/घोषणा दी और उनको बड़ी राहत मिली After the virus began to spread, this organization gave the poor people *information/space/*announcement* outside the hospital and they were very relieved. PROBE: तंबाकू; tobacco
9. उसे प्रमोशन मिलने पर दादी ने रोहन को बधाई/बाइक/*पसन्द दी और पूरे बिल्डिंग को दावत भी दी After he got his promotion, grandma gave Rohan *compliments/motorcycle/*liking* and threw a party for the whole building. PROBE: कुर्सी; chair
10. आज अख़बार में लिखा था कि उस क्रांतिकारी गुट ने ही लोगों को उत्तर/हथियार/*व्यवहार दिया और उसके बाद वे जंगल में वापस चले गए Today the newspapers reported that the revolutionary group gave an *answer/weapon/*behaviour* to the people and then they went back into the jungle. PROBE: रेत; sand
11. एक निश्चित समय पर रिपोर्टर ने बाहर खड़े हुए सहायक को संकेत/पत्र/*चर्चा दिया और उसके बाद उसे कुछ समझाने लगा At a particular time, the reporter gave a *signal/letter/*argument* to his aide standing outside and then began to explain something to him: PROBE: जूता; shoe
12. क्रिकेट की ट्रेनिंग के लिए बाबूजी ने रोहन को स्टेडियम में खेलने के लिए प्रोत्साहन/किराया/*तारीफ़ दिया और अगले महीने उसका खेल देखने का वादा भी किया In order to train for cricket, Babuji gave Rohan *encouragement/fare/*praise* and promised to come see him play next month. PROBE: कमल; lotus
13. आज के कार्यक्रम में प्रधानमंत्री ने नए अध्यक्ष को कृषि सेवा का उदहारण/विभाग/प्रयास दिया और कृषि पर इस सरकार का बहुत ज़ोर है In today's event, the prime minister gave the new officer a(n) *example/division/*effort* of the agriculture ministry as this area is important to him. PROBE: कपड़े; clothes
14. उस गाँव के छोटेसे मंदिर में पंडितजी ने अभय को आश्वासन/प्रसाद/आकलन दिया क्योंकि अभय अपनी परीक्षा के लिए काफी परेशान था In the small temple in the village the priest gave Abhay *reassurance/offerings/*assessment* because Abhay was worreid about his exams. PROBE: सड़क; street
15. उस ज़िले में लोक कलाकारों ने इस आंदोलन को अपना समर्थन/संगीत/*संबंध दिया और आंदोलन ने दो महीने से काफी तेज़ी पकड़ ली है In that district, the folk artists have given this campaign their *support/music/*connection* and the campaign has intensified in the last two months. PROBE: दाल; lentil

the papers about trees getting cut in the park and they gave the authorities a *bother/deadline* about the illegal nature of this work. PROBE: कुर्सी ; chair

8. परीक्षा के दिन शहर में तेज़ बारिश हुई, और देरी से आने वाले छात्रों के लिए कॉलेज ने विशेष रियायत देकर, उनको राहत/कक्षा दी जिससे वे परीक्षा पूरी कर पाये. On the day of exams, it rained heavily in the city and for the students who arrived late, the college made arrangements and gave them *assistance/(a) classroom* where they could complete their exams. PROBE: गाय; cow.
9. मेडिकल शोधकर्ताओं ने अपने शोध के जरिये एड्स जैसी गंभीर बीमारी के खिलाफ लड़ने के लिए एक नया सुझाव/हथियार दिया है जिससे मरीजों को बहुत फायदा हो सकता है. The discoveries made in medical science have given those suffering from serious diseases like AIDS a new *possibility/weapon* which will surely benefit them a great deal. PROBE: रेत; sand.
10. उस क्षेत्र के सभी जिलों में दंगा-फसाद के कारण लोग अपनी खेती बारी छोड़कर भाग गए लेकिन सरकार ने उन लोगों को न कोई सुरक्षा/भूमि दी न उन्हें मुआवज़ा मिला. In all the districts in this area people have left their homes and fields due to the riots but the government has neither given any *protection/land* to these people nor have they received any other compensation. PROBE: कमल;lotus.
11. मनु चाचा को स्कूल में पढ़ाना पसंद था, फिर भी उन्होंने नया व्यवसाय शुरू करने के लिए ज्योतिष बाबा को अपनी सहमति/कुंडली दी और अपना इस्तीफ़ा लिख दिया. Uncle Manu liked to teach in school but in order to start a new business, he gave the astrologer his *consent/horoscope* and wrote his resignation. PROBE: जूता; shoe.
12. हम घर के बाहर गाड़ी का इंतजार कर रहे थे तभी रामदासजी नजर आये और उन्होंने हमें निर्मल की शादी का न्यौता/तोहफा दिया जो एक बड़े लाल और पिले डिब्बे में रखा था. We were waiting outside the house for the car, when Ramdasji came into view and he gave us an *invitation/gift* for Nirmal's wedding which was kept in a large red and yellow box. PROBE: दाल; lentil.
13. स्पोर्ट्स मिनिस्ट्री की ऑर्डर मिलने के बाद टीम के कोच जोशी जी ने नए हॉकी टीम को आकार/कप दिया जिससे बहुत लोगों को प्रेरणा मिली है. After receiving the order from the Sports Ministry, the team coach Joshi gave the new hockey team a *shape/cup* which has given a lot of people hope. PROBE: सड़क; road.
14. दस साल के बाद इस महीने पहली बार पंचायत की भेट हुई, जिसमें ग्राम पंचायत के अलग-अलग कार्यों के लिए पंचायत प्रमुख ने एक करोड़ की पूंजी निवेश की सिफारिश/फाइल दी और आगे के काम की योजना बनाई. After 10 years, the village council met this month, where the council chief gave a *recommendation/file* for one crore rupees to take care of various activities and make a plan for the days ahead. PROBE: कपड़े; clothes.
15. कृषि विश्वविद्यालय से डिग्री प्राप्त करने के बाद ,महेशजी रामपुर गाँव गए और वहाँ उन्होंने जैविक खेती करने के लिए गाँववालों को बढावा/चैलेंज दिया और अपने चाचा की ज़मीन पर अपने आप प्रयोग करने लगे. After obtaining a degree from the agricultural university, Maheshji went to Rampur and gave the villagers *motivation/(a) challenge* to farm organically and began to experiment on his uncle's land himself. PROBE: नाक; nose.

2 Items in Experiment 4

1. कोचिंग क्लासेज बहुत पैसे लेते हैं, लेकिन कोचिंग वालों का यह फायदा है कि वे इस साल की परीक्षा में आनेवाले सवालों का अंदाजा/पेपर देते है, जिससे अच्छा अभ्यास हो सकता है. Coaching classes charge a lot of money, but one advantage of these classes is that they give a *hint/test* about the exam questions for this year and this results in better preparation. PROBE: चाँद ; moon
2. सुमन के परिवार वालों को किसी भी हालत में बेटा चाहिए था, और डिलीवरी के बाद अस्पताल कर्मचारियों ने बड़ी हिम्मत करके सुमन को सुरक्/बेटी षा दी और किसी को खबर नहीं की. Suman's family wanted a boy at any cost and after her delivery the hospital workers courageously gave Suman *protection/a girl* and made sure nobody found out. PROBE: साँप; snake.
3. सारंग गैलरी' में सुमन के कौशल्य को देखकर यूरोपियन आर्ट्स कौंसिल ने उसे बर्लिन आने का आमंत्रण/ऑप्शन दिया जहाँ वह अपनी कला को आगे बड़ा पायेगी. . After being impressed with Suman's work in the Sarang Gallery, the European Arts Council gave her an *invitation/option* to come to Berlin, where she could progress with her talent. PROBE: चोर ; thief
4. २१वी शताब्दी में भारत की सफलता को नजर में रखते हुए यू.न को भारतवासियों को एक नया दर्जा/स्वप्न देना है जिसका हमें अब एहसास हो रहा है. In the twenty-first century, keeping India's achievements in mind, the U.N. should give Indians a new *status/dream*, which we are only now beginning to realize. PROBE: धूल; dust.
5. पिछले कई सालों से भारत में इतिहास शोध की हालत देखते हुए, भारत सरकार की नयी योजना के द्वारा पैसों से इतिहासकारों को मान/आकर्षण दिया है और यह बात काफी अनपेक्षित है. Despite the sorry state of historical research in India over the last few years, the Indian government's new scheme of monetary rewards gave historians *recognition/inducement*, which was quite unexpected. PROBE: तंबाकू;tobacco.
6. उत्तराखंड के देहरादून शहर के पास 'वूडलैंड' स्कूल में सोनू के प्राध्यापक ने उसके माँ-बाप को छात्रवृत्ति के फॉर्म के लिए थोड़ी तकलीफ/फीस दी और उन्हें दो दिन के लिए वही रुकाकर रखा था. Near the city of Dehradun in Uttarakhand in Woodland school, Sonu's teacher gave his parents some *trouble/fees* and made them stay for a couple more days there. PROBE: जाल ; web.
7. इस इलाके के लोगों ने सभी अख़बारों में पार्क में पेड़ कटने के बारे में एक टिपण्णी लिखी और पार्क में हरियाली बचाने के लिए अधिकारीयों को जोर/वक्त दिया क्यूंकि यह अवैध रूप से हो रहा था. The people in this area wrote an article in