

Scalarity and state-changes in Mandarin (and other languages)

Jean-Pierre Koenig and Lian-Cheng Chief^{*}

One of the goals of lexical semantics is to delineate the space of possible meanings, how it varies across language, and to compare that space with what we know of conceptual space. Vendler (1967), Dowty (1979), Carter (1976), Bach (1986), Talmy (2000), among others, have argued that the space of verb meanings can be divided into four quadrants. Verbs can describe states, processes, changes of state, or causal events. Individual verb meanings, then, differ in the constraints they impose on the base predicates (states and processes) and their arguments. Individual verbs can, of course, be quite idiosyncratic in the constraints they impose on (induced) states and participants. Thus, the French verb *limoger* is defined in the *Trésor de la langue française* as in (1a). Its idiosyncrasy, though, does not prevent its meaning from being analyzed as composed of the same building blocks as other verb meanings, as shown, very informally, in (1b). (We use, for mere expository purposes, some standard lexical decomposition representational scheme. “*Military*” is a stand-in for another conjunct (or possibly, a presupposition) constraining the argument of *relieved-of-command*. Nothing substantial hinges on these expository conveniences.)

- (1) a. *limoger* ‘to relieve a high-ranking military officer of his/her command’
 b. CAUSE(x, BECOME(*relieved-of-command* (“*military*”)))

Similarly, the French verb *chambrier*, whose definition in (2a) seems equally idiosyncratic, can be equally aptly (and equally informally) schematized along the lines of (2b).

- (2) a. *chambrier* ‘to keep a bottle of wine in a warm room so that it can slowly be brought to room temperature’
 b. CAUSE(x, BECOME(*at-room-temperature* (“*wine*”)))

Such idiosyncratic variation in verb meaning does little to further elucidate the space of possible verb meanings, aside, possibly, from shedding light on its informational boundaries. This paper investigates more systematic differences within and across languages between verb meanings. In particular, we discuss differences in the kinds of induced changes of states languages may have verbs for. What varies across verb meanings within and across languages in our study are the kinds of caused or induced changes of state, not the end states or processes by themselves. Verb meanings

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can vary in the kinds of states, processes, and the arguments they lexicalize; but they can also vary in the properties of induced changes of state they lexicalize, even though they may not vary in the meaning of the stems denoting base states or processes.

1 The incompleteness effect

Sentences like (3)-(10) are semantically felicitous in a variety of South- and East-Asian languages, among which, at least, Hindi (see (3)-(5) and Singh (1998)), Tamil (Paramasivam (1977), Thai (see (6) and Koenig and Muansuwan (2000)), and Mandarin (see (7)-(10) and Smith (1997)).

- (3) *chaar auraton=ko mAAraa gayaa par keval do mArii*
 4 women=DAT kill go-PERFV but only 2 died
 ‘Four women were killed but only two of them died./He wanted to kill four people but only two died.’
- (4) *us=ne ek cup chai pii par purii nahii pii*
 Pron.3.Sg=ERG one cup tea drink but all NEG drink
 ‘He drank a cup of tea, but he did not drink all of it.’
- (5) *us=ne do murgiyaa pakaayii par vo taiiyaar nahii hai*
 Pron.3.Sg=ERG two chicken cook but Pron.3.Pl ready NEG be
 ‘He cooked two chickens but they are not ready yet.’
- (6) *Surii t`εεŋ klɔn bɔt nii k^hũn tɛɛjaŋ māj sɛd*
 Surii compose poem CL this SEMI-PERFV but still not finish
 ‘Surii composed this poem, but has not finished it yet.’
- (7) *Xu Mei he Sun Mazi ba Lao Luo sha le mei sha-si^{Google}*
 Xu Mei and Sun Mazi BA Lao Luo kill PERF not kill-die
 ‘Xu Mei and Sun Mazi killed Lao Luo but didn’t make him die. (lit.)’
- (8) *PinWei qingji zhixia jiu ba JiaHui gei sha le, mei xiangdao Jiahui mei*
 PinWei nervous under then BA JiaHui give kill LE, not think Jiahui not
si, buguo que hunmibuxing lo^{Google}
 die, but coma Sent.Ptr.
 Pinwei killed Jiahui under stress; he didn’t expect that Jiahui didn’t die, but she was in a coma ...’ (Intended Reading)
- (9) *wo (...) gai le xin fangzi, fangzi hai mei gai-wan^{Google}*
 I (...) build PERF new house, house still not build-finish
 ‘I build a new house, but it is not finished.’
- (10) *Tuoersitai-de Zhanzheng yu Heping wo bu xihuan, du le ji ci*
 Tolstoy’s War and Peace I not like, read PERF several time
dou mei du-wan^{Google}
 all not read.finish
 ‘I don’t like Tolstoy’s War and Peace, I read it several times, but never finished reading it.’

The phenomenon sentences (4)-(10) illustrate can be described as follows. Sentences whose English translations typically denote induced changes of state can felicitously apply to situations where the change of state seems to not have occurred. In other words, it is as if, in those languages, there are described killings in which no death occurred, repairs in which nothing gets fixed, persuasions in which nobody was persuaded ... We call this phenomenon the *Incompleteness Effect* (in short, the IE), meaning that the described killings, repairs, or persuasions need not be completed. For reasons of space, we concentrate mostly on Mandarin in this paper and only provide suggestive data from Hindi and Thai.

Although a killing may not strictly have occurred for sentences such as (7) to felicitously apply,¹ the patient must have been affected in some way, as the following examples from Mandarin illustrate. The change also typically needs to be significant enough. A scratch would not satisfy the semantic requirement that Lisi be affected in (12). In fact, *shā* can only be used when the agent used a weapon of some sort (hands included) to attempt to kill the patient and manages to at least significantly injure him/her. (Since the need for a significant change to have occurred might be a Gricean effect and what constitutes a significant change varies with individual verbs, we do not discuss it further in this paper.)

- (11) #Jintian zaoshang chi le yi ge hanbao, buguo wo lian yi kou ye
 Today morning eat PERF one CL hamburger, but I even one bit also
 mei chi
 not eat
 'I ate a hamburger this morning, but I didn't even have one bite.'
- (12) #Ta sha le Lisi, danshi Lisi mei shou bandian shang
 He kill PERF Lisi, but Lisi not receive little.bit injury
 'He killed Lisi, but Lisi was not even hurt a little bit.'

The fact that many induced state change stems in several languages display the IE effect suggests that it is unlikely to be due to just a stem or two being wrongly glossed. (13) lists some Mandarin verb stems which display the IE when inserted in a syntactic frame of the kind illustrated in sentences (7)-(10). (Note that the English translations of some verbs in (13) may also lead to the IE, a point we return to briefly at the end of the paper.)

- (13) *jiǎn* 'to cut with scissors', *xiū* 'to repair', *quàn* 'to persuade', *shā* 'to kill', *guān* 'to close', *niàn* 'to read', *chī* 'to eat', *hōng* 'to dry (clothes)', *xǐ* 'to wash', *zhǔ* 'to cook', *dú* 'read', *xiě* 'write', *bèi* 'to recite (memorize)', *chàng* 'to sing', *xiàzài* 'to download', *jiāo* 'to teach', *gài* 'to build', *zhì* 'to cure', *guān* 'to close', *zhuā* 'to catch', *diǎn* 'to light up', ...

The IE and the existence of incomplete languages raises two questions. (i) What is the source of the Incompleteness Effect? (ii) Is there a way of capturing what is com-

¹Examples such as (7) and (8) are felicitous for this paper's second author and we found dozens of attested sentences on Google in which the patient's death is explicitly denied in a subsequent clause. But, some native speakers reject our attested examples (7) and (8). We do not know at present if dialectal differences or other factors are the source of this apparent discrepancy.

mon to the meaning of corresponding stems that differ in “completeness” in two languages (e.g., Mandarin and English)? The first question is an exercise in (Fregean) sentential semantics and is the topic of section 2. The second question is an exercise in comparative semantics and is the topic of section 3.

2 The source of the incompleteness effect

Frege (1884) wrote the following dictum:

‘Only in the context of sentences do words have meaning.’ (Frege, 1884)
 (‘nach der Bedeutung der Wörter muß im Satzzusammenhange, nicht in ihrer Vereinzelnung gefragt werden’)

Pelletier (2001) names this principle the *Context Principle* and discusses its various interpretations. For our purposes, the relevant interpretation is methodological. If the Context Principle is correct, what we observe, as semanticists, once pragmatic enrichments are removed from an utterance’s interpretation, are the semantic values of sentences or propositions. The meaning of words and morphemes are the result of theorizing (we have only indirect access to them). We can see the effect of Frege’s Context Principle in Zucchi’s (1999) indirect access problem, i.e. that we only have indirect access to the meaning of bare sentences that serve as input to tense and aspect markers. More generally, we only have indirect access to the meaning of *all* sub-sentential natural language expressions.

The methodological consequences of the Context Principle are particularly stark when trying to explain the IE. To see why, consider the schematic representation of the meaning of the relevant sentences in (14), where *Operator’* stands in for the relevant aspect (or tense) operators. The semantic expression in (14) contains expressions that belong to three semantic types: entities, relations, and, property/relation modifiers (assuming with de Swart (1998) that aspect operators are event description modifiers). If we make the assumption that the semantic content of sentences such as (7) can be schematized, informally as in (15), there can be three sources of the IE: the meaning of the aspect (or tense) operators, the meaning of NPs that denote arguments, and the meaning of the verbal stems. Much work in the last thirty years has demonstrated that all these components of a sentence’s meaning can affect its Aktionsarten and telicity. In other words, Mandarin (and Hindi, Tamil, and Thai) can differ from English and English-like languages in the kinds of meaning that are associated with a subset of their verbal stems that describe induced changes of state; they can differ in the kinds of meaning their perfective-like aspect operators encode; or they can differ in the meaning of some of their NPs. It is a testimony to the methodological correctness of Frege’s Context Principle that all three hypotheses have been proposed.

(14) Operator’ (Verb’(e, argument’₁, ... argument’_n))

(15) -le’(sha’(e, Xu Mei, Lao Luo))

2.1 Three possible sources of the IE

Soh and Kuo (2005) proposes the following hypothesis to account for the IE in Mandarin.

Hypothesis 1 (The Quinian hypothesis, Soh and Kuo, 2001). *The source of the IE is the denotation of one or more of the stems' arguments.*

Simply put, their hypothesis is that the denotation of (some) theme/patient NPs in Mandarin differs from the denotation of corresponding theme/patient NPs in English; their denotation is paraphraseable as *a non-necessarily proper part of NP* where *NP* is the denotation of the corresponding NP in English. Thus, sentence (16) from Tai (1984) would be better translated as (17), according to this hypothesis. Soh and Kuo's hypothesis is reminiscent of Quine's (1960, 1969) argument to the effect that the reference of terms is not determined by the truth or falsity of sentences they appear in. Hence, the mnemonic name for this hypothesis. Note that English sentences whose patient NPs' denotation is similar to the purported denotation of *yi-feng xin* 'a letter' in sentence (16) display the same entailment failure, as (18) demonstrates. The difference in entailments between Mandarin and English is thus ascribed, according to the Quinian hypothesis, to differences in the denotation of some NPs.

- (16) Wo zuotian xie-le yi-feng xin, keshi mei xie-wan.
I yesterday write.PERF one.CL letter, but not write.finish
'I wrote a letter yesterday, but I didn't finish it.'
- (17) 'I wrote (a non-necessarily proper) part of a letter yesterday, but I didn't finish it.'
- (18) Schubert composed *part of* the Unfinished Symphony \neq The Unfinished Symphony has been (completely) composed.

Smith (1997) proposes that the meaning of Mandarin *-le* is not that of ordinary perfect(ive) markers. Its denotation is paraphraseable as *stopping* (in contrast to *finishing*). Thus, sentence (16), according to this hypothesis, would be more appropriately translated in English as (19) (*modulo* the conversational implicature that the main clause of the English translation conveys (that the letter was not finished), which Mandarin *-le* does not convey).

- (19) 'I stopped writing a letter yesterday and didn't finish it.'

If generalized, Smith's proposal amounts to the following hypothesis.

Hypothesis 2 (Aspectual Hypothesis, Smith, 1997). *The source of the IE lies in the meaning of aspect operators.*

English sentences that use aspectual verbs (in the sense of ter Meulen (1995)) that are close paraphrases of the putative meaning of Mandarin perfective operators display the same entailment failure characteristic of Mandarin, as (20) shows. This suggests that Smith's Aspectual Hypothesis, which adjusts the meaning of aspect operators across these two languages *can*, in principle, correctly model the difference between English and Mandarin.

- (20) Schubert *stopped* composing the Unfinished Symphony ≠ The Unfinished Symphony has been (completely) composed.

Finally, a number of researchers have assumed that the source of the IE lies in the meaning of verb stems (see Singh (1998) for Hindi, Koenig and Muansuwan (2000) for Thai, Talmy (2000) and Lin (2004) for Mandarin, and Zucchi (1999) for Russian, assuming that the Russian data are comparable to the data we discuss in this paper). In other words, rather than hypothesizing that it is the reference of terms or meaning of NPs, or the meaning of aspect operators that varies between these languages, these researchers hypothesize that it is the denotation of verbal stems that need adjustments. Because this last hypothesis claims that it is the denotation of members of major lexical categories that can vary between languages, we mnemonically label it *ps(eudo)-Quinian*, despite the fact that Quine himself, in contrast to Davidson (1967), would not have assumed that verbs denote. English paraphrases of the meaning of induced change of state stems in incomplete languages will vary somewhat with individual proposals, but for many of them, the relevant stems in Mandarin (or Hindi, Tamil, and Thai) mean something like *performed part of an activity (e.g., reading) that would induce a state-change*. According to Talmy (2000), the verb *wash* in English is an incomplete stem and does not license an entailment that the patient is clean, as indicated in (21) (Talmy's judgments). It means something like act on the dishes with the intent of making them clean. Talmy's analysis of *wash* is similar to the analysis of incomplete stems in Koenig and Muansuwan or Zucchi.

Hypothesis 3 (ps-Quinian Hypothesis, Talmy 2000, Koenig and Muansuwan, 2000, Lin 2004). *The source of the IE is the meaning of the verb stems themselves.*

- (21) I *washed* the dishes ≠ The dishes are clean.

2.2 Which hypothesis is correct?

The IE is not restricted to non-bounded complements: As alluded to above, a methodological consequence of Frege's principle is that all three hypotheses are *a priori* possible. How are we, then, to decide between these hypotheses? The short answer is that the Quinian Hypothesis under-estimates and the Aspectual hypothesis over-estimates the set of sentence types that lead to the IE. One predicts that some sentences that lead to the IE should not and the other that some sentences that do not lead to the IE should. We address both kinds of problems in turn.

Soh and Kuo (2005) is an often-cited example of the Quinian hypothesis. Soh and Kuo make two claims. First, they suggest that the IE in Mandarin only applies to sentences whose main verbs are a subset of verbs of creation and destruction and does not apply to sentences whose verbs are not verbs of creation or destruction. Second, they suggest that the IE only arises when the proto-patient NP (to use Dowty's (1991) phrase) does not include a numeral (what they call a *demonstrative object*). We address their second claim first. The intuition behind Soh and Kuo's proposal is that Determiner Phrases (DPs) that include numerals are bounded([+bounded] in their analysis) whereas DPs that include demonstratives or indefinites are not necessarily bounded ([±bounded] in their analysis). Thus, they contrast the unacceptability of sentence (22a) and the felicity of sentence (22b). Soh and Kuo's argument is thus that finishing,

in contrast to stopping, requires an event description to be telic and that the boundedness of its direct object is a necessary condition for sentences including verbs of creation/destruction to be telic. Since only DPs containing demonstratives are not necessarily bounded, the event description that is the argument of *wan* in sentence (22a) (i.e., the event description expressed by the sentence minus *wan*) is telic, thus explaining the infelicity of the overall sentence.

- (22) a. #Ta chi-le liang-ge dangao, keshi mei chi-wan
 he eat-LE two-CL cake, but not eat-finish
 'He ate two cakes, but he did not finish them.'
- b. Ta chi-le na-ge dangao, keshi mei chi-wan
 he eat-LE that-CL cake, but not eat-finish
 'He ate that cake, but he did not finish it.'

The attested sentence (23) contradicts Soh and Kuo's judgment on sentence (22a) and shows that the presence of numerals in object NPs does not necessarily block the IE. In fact, other DP complements that are traditionally assumed to be bounded do not block the IE, in particular proper names, as the attested sentence (7) shows.

- (23) wo (...) chi le liang chuan dakao, dan mei chi-wan^{Google}
 I (...) eat PERF two CL kabob, but not eat-finish
 'I ate two kabobs, but didn't finish eating them. (lit.)'

The IE in other languages is similarly not restricted to sentences that include a subset of non-numeral direct objects, as sentences (24)-(25) from Thai and Hindi, respectively, show. Sentence (26) additionally shows that the IE can arise in Hindi, even when the direct object is a proper name (similar facts hold in Thai).

- (24) Piti kin súp sǒŋ chaam
 Piti eat soup two bowl
 'Piti ate two bowls of soup.'
- (25) us=ne do kitaab-ēē padii par puur-ii nahii padii
 pron.3.Sg=Erg 2 book-FPl read but completely-F neg read
 He read two book but did not read it completely (read parts of both).
- (26) us=ne Ramayan padh-ii par puur-ii nahii padh-ii
 pron.3.Sg=Erg Ramayan.F read-F.Sg but completely-F neg read-F.Sg
 He read the Ramayan but did not read it completely.

In summary, attested examples from Mandarin (and similar, constructed examples from Hindi and Thai) show that that the IE does not seem to be due to properties of Mandarin (or Hindi or Thai) DPs. To be sure, for event completeness to arise and the use of *wan* 'finish' to be felicitous, the DPs filling the verb's proto-patient argument position must be bounded (quantized) and the sentence must be in the perfective aspect, as expected and known since at least Verkuyl (1993). But, the IE effect is not due to the fact more DPs are not bounded (quantized) in Mandarin, Hindi, or Thai than in English.

The IE is restricted to a subset of verbal stems: We saw that Soh and Kuo's first constraint on the IE pertains to the boundedness of the proto-patient DP. Soh and Kuo's second constraint pertains to the event type denoted by the main verb. They claim that only certain verbs of creation and destruction lead to the IE, for example *hua* 'draw', *xie* 'write', *kan* 'read', or *chi* 'eat', but not others, for example *zuo* 'bake' or *zao* 'build', as sentence (27) exemplifies (their judgement).

- (27) #Ta zao-le yi-jian fangzi, keshi mei zao-hao
 he build-PERF one-CL house but not build-finish
 'He built a house, but did not finish it.'

The following attested example suggests that Soh and Kuo's claim is incorrect. Sentences whose main verb is *gai* 'build' (a more natural verb when the patient is a building) can display the IE.

- (28) yushi you gai le yi tao xin fang, keshi fangzi mei gai-wan, tian
 so again build PERF one CL new house, but house not build-finish, sky
 jiu leng le, wufa shigong^{Baidu attested}
 jiu cold le, unable construct
 'So they built a new house, but the house was not finished, the weather became cold, and it could not be under construction.'

Sentence (28) shows that Soh and Kuo's claim is too restrictive. But, there *are* constraints on the verbal stems that can appear in sentences that license the IE, although not the ones Soh and Kuo propose. A critical observation on which this paper focuses is that only a subset of verbal stems license the IE. This observation invalidates both the strictly Quinian hypothesis and Smith's Aspectual Hypothesis. Smith (1991) proposes that Mandarin *-le* indicates that an event was stopped, not necessarily finished. Leaving aside the issue of verbs of creation and destruction, both Soh and Kuo's Quinian and Smith's Aspectual hypotheses predict that the IE will arise no matter which (dyadic) state-change stem is used as a main verb, since they locate the source of the IE in either differences in the boundedness of DPs or the meaning of the aspect marker *-le*. This prediction is incorrect. Sentence (29) shows that not all non-creation verbs can license the IE. Table 1 lists some Mandarin verbal stems that license the IE (those in column *I*) and some that do not (those in column *C*). Table 2 does the same for Thai.²

- (29) #ta tou le yi zhang piao, keshi mei tou-wan
 he cast PERF one CL ballot, but not cast-finish
 'He cast a ballot, but didn't finish voting. (lit.)'

In summary, the IE does not depend on the proto-patient DP being non-bounded (non-quantized) (*contra* Soh and Kuo). But the IE depends on the main verb stem. That is, not all induced changes of state stems lead to the IE in Mandarin, Thai, or Hindi. This state-of-affairs is exactly what the ps-Quinian hypothesis predicts, as it assumes the meaning of state-change stems is the source of the IE. We conclude that the ps-Quinian hypothesis is correct: *Some* state-change stems do not mean in languages like Mandarin what their English glosses suggest they mean.

²We leave a fuller discussion of Hindi to another venue, as the facts seem more complex in Hindi than in Mandarin or Thai.

Group I	Group C
<i>jiǎn</i> ‘to cut’, <i>xiū</i> ‘to repair’, <i>quàn</i> ‘to persuade’, <i>shā</i> ‘to kill’, <i>guān</i> ‘to close’, <i>niàn</i> ‘to read’, <i>chī</i> ‘to eat’ <i>hōng</i> ‘to dry (clothes)’, <i>xǐ</i> ‘to wash’, <i>zhǔ</i> ‘to cook’	<i>zhuǎn</i> ‘to turn’, <i>zhà</i> ‘to deep fry’, <i>yān</i> ‘to pickle’, <i>kǎo</i> ‘to bake’, <i>fù</i> ‘to pay’, <i>jìn</i> ‘to soak/immerse in liquid’

Table 1: Some incomplete and complete stems in Mandarin

Group I	Group C
<i>ʔàan</i> ‘read’, <i>khâa</i> ‘kill’, <i>kin</i> ‘eat’, <i>khïan</i> ‘write’, <i>tàd</i> ‘cut’, <i>pəəd</i> ‘open’, <i>sôm</i> ‘repair’	<i>càaj</i> ‘pay’, <i>câaŋ</i> ‘hire’, <i>cèεk</i> ‘distribute’, <i>lûaktâŋ</i> ‘vote’

Table 2: Some incomplete and complete stems in Thai

3 Defining the class of incomplete stems

In the previous section, we showed that the ps-Quinian hypothesis is correct. The source of the IE lies in the meaning of induced change-of-state stems in languages like Mandarin. A crucial piece of evidence in favor of this hypothesis is that only a subset of induced changes of state stems leads to the IE. This raises two sets of questions. First, which state-change stems lead to the IE and does the class of stems that lead to the IE form a natural semantic class? Second, what do these stems mean, if not a “true” induced state-change and what is the relation between the meaning of corresponding stems in pairs of languages like English and Mandarin? We answer these questions in turn.

3.1 Previous proposals

In this section, we review previous proposals regarding the meaning of incomplete stems in Mandarin or other languages displaying the IE. As we will see, none of them are entirely satisfactory. Talmy (2000) proposes that some verbs are *implied-fulfillment verbs* and that, for those, the occurrence of a result state is only implicated, not entailed. Talmy cites, for example the English verb *wash* as such a verb.³ The meaning of *wash* for Talmy can be paraphrased as in (30).

³Native speakers we polled seem to vary on the correctness of Talmy’s claim. This issue is irrelevant to our point.

- (30) *wash (the shirt)*: an activity whose intent is to get the shirt cleaned, but whether the shirt ends up clean or not is only implied.

Mandarin, then, for Talmy, is a language that includes many more implied fulfillment stems than English. In particular, many of the standard English induced changes of state stems are implied fulfillment stems in Mandarin (and, similarly, for incomplete stems in Hindi or Thai). Talmy's analysis must be improved upon, as it seems to mostly describe the issue, namely that some induced change of state stems which one would expect to entail the occurrence of a particular result state (given the correct arguments and aspect marking) merely implicate it. It does not say much about what incomplete stems actually mean.⁴ Nor does it characterize the set of stems that are incomplete.

Lin (2004) suggests that Mandarin has only states and activity stems. Lin's proposal ignores the set of induced change of state stems that do not license the IE (Lin calls accomplishments what we call, to avoid confusion, induced change of state stems). Furthermore, his proposal does not recognize that Mandarin incomplete stems describe induced changes of state and that, crucially, a minimal change of state has to have occurred, as sentences (11) and (12) show (again, similar facts hold of Hindi, see Singh (1998), or Thai). Finally, Lin does not propose an analysis of what incomplete stems mean in Mandarin or whether there is a common semantic core to incomplete stems.

Zucchi (1999) proposes that Russian stems denote predicates that are true of both complete and incomplete events. Because of the complexity of Slavic lexical aspect, we do not commit ourselves to whether or not Russian (or other Slavic languages) is on a par with Mandarin (and other languages we cited). But, Zucchi's characterization of Russian stems can be applied to incomplete stems in incomplete languages. According to Zucchi's proposal, the meaning of the VP *read Moby Dick* in Russian should be glossed as in (31). As previous proposals, Zucchi does not recognize that the IE only arises with some induced changes of state stems, let alone characterize semantically the set of induced changes of state stems that are incomplete stems. Furthermore, since stem meanings in Zucchi's analysis do not include information as to what would constitute completion of the event, Zucchi is forced to have event-type specific principles (a writing principle; a building principle, ...) that ensures that when the described event *is* complete, there is an object that is completely affected in the right way (see the *The Building Principle*, p.189).

- (31) *read (Moby Dick)*: applies to all events where part or whole of *Moby Dick* is read.

Finally, Koenig and Muansuwan (2000) propose that state-change stems in Thai include an operator that says that a (non-necessarily proper) part of the relevant event-type occurred. Informally, the stem $\text{t}^{\text{e}}\text{e}\text{n}$ in Thai is analyzed as meaning something like the progressive form of the word *composed* in English, as indicated informally in (32).

- (32) *write (Surii, "a poem")* \simeq *be writing (Surii, "a poem")*

⁴Entailments or implicatures of change of state are, of course, a property of sentences which depends on several factors, including, as mentioned in the text, the boundedness of the arguments or the verb or the sentence's aspect markers, see Verkuyl (1993) and others. For ease of exposition, we talk of stems entailing or implicating, when we mean to refer to stems in sentences with the appropriate arguments and aspect markers.

In contrast to Zucchi's analysis of Russian incomplete stems, Koenig and Muansuwan have a *single* operator rather than a list of event-type specific rules. Their analysis, like Zucchi, also makes a specific proposal as to the meaning of incomplete stems. But, Koenig and Muansuwan's proposal makes monomorphemic incomplete stems semantically more complex than complete stems and includes an imperfective marker, something theoretically unusual. Moreover, like all previous proposals, their proposal does not recognize that only a subset of induced change of state stems license the IE nor, of course, do they characterize the set of stems that do so.

In brief, all extant proposals are unsatisfactory. They either do not say much about the meaning of incomplete stems, in particular how their meaning differs from that of their corresponding complete counterparts in English or other languages (Lin and Talmy) or the meaning they assign to these stems is unsatisfactory (Zucchi and Koenig and Muansuwan). More importantly, in the context of this section, they do not answer two critical questions: (1) How can the class of incomplete stems be defined in Mandarin (or Hindi or Thai)? (2) Do incomplete stems belong to a natural semantic class?

3.2 The Scalar Hypothesis

The basic insight underlying our hypothesis is that only stems that denote event-types that include a change of property that is a matter of degree can be incomplete stems. To illustrate with some of the incomplete stems we have mentioned, killing involves seriously lowering the degree of somebody's health. Similarly, reading involves going through more or less of some printed material and cooking involves changing more or less the chemical structure of vegetables or meat so that it conforms to some cultural norm. We state our hypothesis, which we dub the *Scalar Hypothesis* as follows.

Hypothesis 4 (Scalar Hypothesis). *Incomplete stems denote induced changes of state whose result state is a property that can be a matter of degree.*

To make precise the Scalar Hypothesis, we need to first provide a few definitions, which borrow much, sometimes liberally, from Cresswell (1976), Hay et al. (1999), Kennedy and McNally 2005, and others.

Definition 1. *A gradable property is a relation between an entity and a degree d that obeys the following entailment pattern: For all eventualities e , entities o , and degrees d , if e is such that the property holds of o to degree d , it also holds of o to non-zero degrees d' inferior to d .*

Thus, if your health is extremely bad (as it has to be when you are dead), it is very bad. If you have read the entire *Moby Dick*, you have read the first chapter. If you have baked a cake, you have half-baked it (modulo Gricean implicatures). A more formal definition is provided below.

Definition 1. *A gradable property is a relation between an entity and a degree on a scale (defined, for now, simply as a pair of a dimension and an ordered set of degrees) that obeys the following entailment pattern $\forall e, o, 0 < d' < d, (C(e, o, d) \models C(e, o, d'))$*

Definition 2. *A normative gradable property is a pair consisting of a gradable property and a designated degree.*

The difference between non-normative gradable properties and normative gradable properties corresponds to the difference between open and closed scales in Kennedy and McNally (2005) and is easily illustrated by comparing the English verbs *learn* and *damage*. In its use illustrated in sentence (33), *learn* implies the existence of a boundary that counts as enough learning: When Joe knows the entire alphabet to a satisfactory degree, he can be said to have learnt it. In contrast, there is no clear boundary for *damage*, as used in sentence (34). More precisely, once a little damage has been done, one can go on and damage ever more to an indeterminate degree.

(33) Joe learnt the alphabet.

(34) Joe damaged the car.

Two kinds of designated degrees or thresholds must be distinguished (*contra* Caudal and Nicolas (2005)). In most cases, the designated degree is the maximum degree on the scale. For example, for *kill*, the threshold is the minimum of health or maximum of injury, for *read* or *eat*, the threshold is the destruction or otherwise affectedness of the *whole* patient (to the extent that the intellectual content of the book changes state by being known). In these cases, one cannot conceive of a higher degree on the relevant scale. But, in some cases, the designated degree is a cultural/individual norm and it is not hard to think of higher degrees on the relevant scale. Consider for example the verb *cook*. What counts as cooked varies with foods, cultures, and individuals and one can, unfortunately, think of many degrees of overcookedness!

Equipped with these definitions, we can now more precisely semantically characterize, informally for now, incomplete stems and the difference between English and Mandarin near translation equivalents.

Hypothesis 4 (Revised). *Only those stems that denote induced normative gradable changes can lead to the IE.*

Definition 3 (Informally). *Induced normative gradable changes are those changes that (i) are the result of an activity and (ii) whose resulting state is equivalent to a gradable normative property such that (iii) the proto-patient argument's degree on the relevant scale at the event's final time interval is greater than at the event's initial time interval.*

This last definition is fairly similar to ideas developed in previous work, in particular that of Kennedy and McNally (2005) or Beavers (2008). The only part where it differs is in the qualification *equivalent to a gradable normative property*. We will return to this qualification in the next section after we discuss in detail different kinds of induced normative gradable changes. We restate Definition 4 as follow to introduce terminology that will ease our exposition of the various kinds of gradable changes. Henceforth, whenever we use *A* and *C*, we will mean the activity and gradable change entailed to occur, respectively, by an induced normative gradable change.

Definition 3 (More formally). *A predicate P describes an induced normative gradable change if and only if whenever it holds of an event e , (i) an activity A holds during an initial subinterval of the temporal trace of e ($\tau(e)$) and a normative gradable property*

C holds during a final subinterval of $\tau(e)$, (ii) the occurrence of *A* causes *C* to hold, and (iii) $d > d'$ (d' is the degree at the initial subinterval of $\tau(e)$ and d the degree at the final subinterval of $\tau(e)$).

3.3 Different kinds of scalarity

A lot of recent work in lexical semantics has stressed the relevance of scalar semantics to the event structure encoded in verbs (see Beavers (2008), Filip and Rothstein (2006), Hay et al. (1999), and Wechsler (2005), among others). Most of this research has stressed the relevance of the nature of the change (binary or gradable) to the temporal contour of the events (durativity or punctuality of the change of state; the underpinnings of the notion of incremental theme; constraints on resultatives). In all of this work, a crucial distinction is made between binary changes (a change in non-gradable properties) and multi-valued or gradable change (a change in gradable properties), between *dead* and *clean*. But, to account for incomplete stems, we must define a more general notion of induced gradable changes that includes *shā* ‘kill’ in Mandarin or *khâa* ‘kill’ in Thai, but not words like *tou* ‘cast (a vote)’ in Mandarin or *càaj* ‘pay’ in Thai. Including words such as *shā* in the set of induced gradable changes of state requires a distinct definition of multi-valued changes than assumed in previous work. Our definitions must therefore generalize somewhat the notion of gradable change so as to capture the common semantic core of incomplete stems. The overall classification of changes we assume is represented in Figure 1.

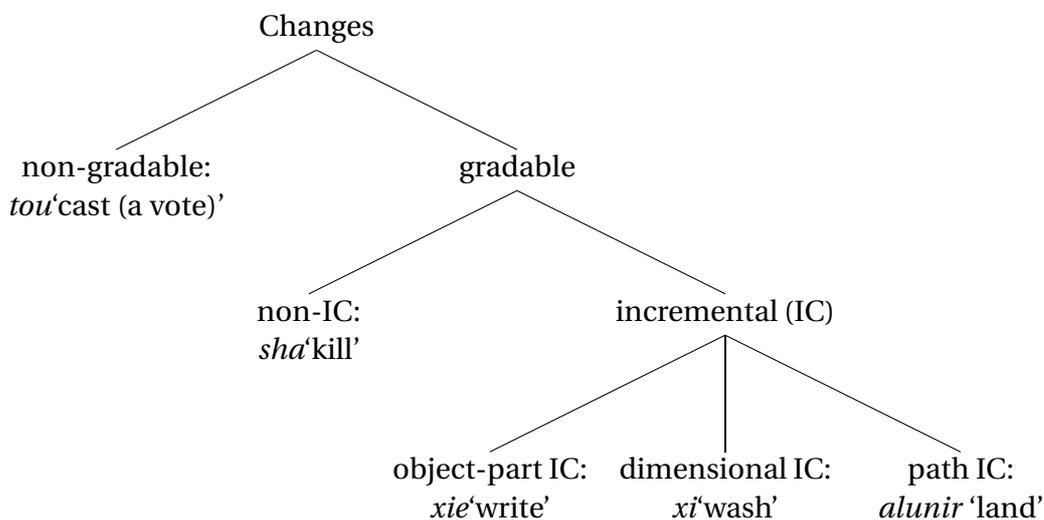


Figure 1: A classification of (dyadic) state-change stems

The basic insight underlying our analysis of the distinction between stems such as Mandarin *shā* ‘kill’ and stems such as Mandarin *xie* ‘write’ is that normative gradable changes can differ in their temporal contour. As Krifka (1989) has argued, for some changes, there is a correspondence between the change in degree on the scale and the event’s progress: The more you read, the larger the portion of the manuscript that is read; the more you cook the food, the less raw/more cooked it is. For others, there is no such correspondence, although the change can be still be analyzed as a non-binary change in the degree to which an entity bears a certain property. It is not the case that

the more preparations one makes for killing a turkey, the worse the health of the bird is. Similarly, it is not the case that the more time you spend repairing your computer, the better it works. We call such changes *non-incremental* (non-IC) as the degree of change does not incrementally follow the temporal progression of the event. In other words, we distinguish between induced changes whose resulting property is (or is equivalent to) a gradable property that changes over the course of the event and induced changes for which, additionally, one can define a correspondence (a homomorphism) between the degrees on the scale underlying the gradable property and the event parts. We provide a definition of incremental changes of state below. Non-incremental changes of state are simply those normative gradable changes that are non incremental.

Definition 4. *An induced gradable normative change is incremental if and only if for any two of its subparts e and e' of that event such that $e \sqsubseteq e'$, $d \leq d'$ where d and d' are the degrees to which the gradable property C holds at the final subinterval of the temporal traces of e and e' , respectively.*

Finally, we need to make some distinctions between incremental themes on the basis of the nature of the scale involved. In the case of *read*, the relevant scale involves parts of the object (one can paraphrase the scale as *portion x of manuscript y is read*). In the case of *cook*, the relevant scale is a more traditional kind of scale, the kind which underlies the meaning of gradable adjectives in those languages which have gradable adjectives (e.g., *raw*). In the case of French *alunir* 'land on the moon', the scale is the path of motion. We define these distinct incremental changes below. (There is no need to provide a definition of dimensional gradable changes, as in this case, the degrees involved are part of the definition of the property. That is, being tall, sharp, and so forth requires reference to degrees, see Cresswell (1976), among others.) These three kinds of incremental change involve three distinct homomorphisms between the event part-whole structure and the degree of change, depending on whether degrees of change involve the affected object's part-whole structure, the distance traversed by the theme since the event's inception, or the degree to which the affected object bears a dimensional property (such as being tall, long, or hot).

Definition 5. *An induced incremental gradable change of state is object-oriented if and only if the degrees of the property C whose change is induced by the activity A are parts of the patient (in other words, the degrees on the scale are the parts of the patient).*

Definition 6. *An induced incremental gradable change of state is path-oriented if and only if the degrees of the property C whose change is induced by the activity A are distances from the location of the theme at the initial subinterval of the activity included in A .*

Having distinguished among various kinds of induced normative gradable changes, let us return to our qualification in Definition 3 that the resulting state need not be a normative gradable property, but merely *be equivalent to one* (where equivalence may be defined as truth of the two alternative descriptions of the event in the same set of possible worlds or a suitably restricted subset of possible worlds). In the case of changes in induced dimensional gradable properties (e.g., for verbs such as *sharpen* or *lengthen*), there is no doubt that the resulting state is a gradable property, i.e. a relation between an entity and a degree. But, the issue is more difficult in other cases.

Consider, for example, object-oriented gradable changes and verbs such as *eat*. Analyzing the change as an incremental object-oriented change, as we did, amounts to saying that the change involved is paraphraseable as *the patient is consumed to degree d* where the degrees involved are the portion of the patient consumed. While any event of eating can be so analyzed, we do not wish to commit ourselves that this is *the* proper semantic analysis of events of eating. That is, speakers may not always analyze events of eating in this manner. For our purposes, it is sufficient that they can do so.

The issue is even more difficult with non-incremental induced gradable changes. Consider our parade *shā* 'kill' Mandarin example. Our analysis amounts to saying that this stem describes events in which a patient is caused to be hurt or otherwise injured to a degree that is not null, but may be less than death. Two questions arise. First, are all events we would characterize as true killings categorizable as events of induced injury that have reached the normative degree (death)? And if yes, is that the way English *kill* should be characterized? To answer *No* to the first question means we believe there are possible worlds in which an animate entity is killed, but is not caused to be injured to the normative degree. We must confess that we have a hard time having firm judgments on the matter or even being sure that there is a fact of the matter about this kind of issue. We find answering the second issue also hard. It is well-known since at least McCawley (1973) that English *kill* allows a so-called internal reading of degree modifiers such as *almost* in a way that *buy* does not (see the contrast between (35) and (36)).

(35) That almost killed Bill.

(36) #I almost bought the car.

The availability of an internal reading (i.e., an interpretation in which what is almost the case is that Bill has reached the maximum on the injury scale), suggests that induced changes of state, even in English, *may* be gradable, and contrast with non-gradable change of state verbs such as *buy*.

Additionally, *kill* can be modified by scalar modifiers like *half* in a way *buy* cannot. For example, a Google search of the string *he half killed* returned 1,100 examples, including (37) and (38). A similar search for the string *he half bought* returned 4 examples. In three of them, *buy* is used metaphorically to mean 'be convinced', which is a gradable property; in the fourth, it is used non-literally and ironically. The behavior of scalar modifiers provides some additional evidence that induced death can be categorized as a degree on a scale in a way that purchases cannot. But, the fact that it can be so categorized does not mean it needs to be so categorized and sentences such as (35) or (37)-(38) can only be considered suggestive evidence at best.⁵

⁵J. Bonhemeyer (p.c.) suggested to us an alternative analysis according to which *shā* in Mandarin is incremental, in contradistinction to its English counterpart. In other words, the difference between English and Mandarin (or other IE) languages, at least for this class of verbs, is that the change is conceived as incremental in Mandarin, whereas it is not so conceived in English (as Bonhemeyer (2005) claims). The difference between this view and the analysis we propose is partly terminological. We mean by *incremental* that the meaning of the sentence entails a non-trivial homomorphism between degrees of change and the denoted events parts (what Krifka (1998) calls strict incrementality). Bonhemeyer's view relies on the seemingly weaker notion of incrementality expressed in Dowty (1991) (although, Dowty's text may be interpreted differently), namely that such an homomorphism is *possible* (i.e., is true in at least some possible worlds). And, it is clear that our non-strictly incremental analysis of *shā* often means

- (37) ‘Then he half killed me,— kicked and trampled on me, as he’s done many a time’ *Nevermore*, Rolf Boldrewood, 1892.
- (38) ‘One punch and he half killed the guy with it. Broken nose, 2 teeth broken, and he was out cold for a good half minute.’
<http://forum.canucks.com/lofiversion/index.php/t174493.html>

3.4 Comparing languages

We have now answered the question of *which stems* in Mandarin (and Hindi or Thai) lead to the IE: Only stems that denote induced normative induced gradable changes, including, maybe somewhat surprisingly, induced normative induced non-incremental gradable changes. We have also defined normative gradable changes as well as distinguished various kinds of induced normative gradable changes. We must now answer the question of *why* those stems lead to the IE or why those stems lead to the IE in these languages, but not other languages like English. Otherwise put, what is it about the meaning of stems that denote induced normative gradable changes in these languages that explains the IE? The following is our answer.

Hypothesis 5. *In languages like Mandarin, sentences with main verbs that describe induced normative gradable changes entail that a normative gradable change occurred with degree $d_0 < d \leq d_N$. In languages like English, telic sentences with corresponding main verbs entail that a normative gradable change occurred with degree $d = d_N$*

that it is also weakly incremental, at least in possible worlds that obey our physiological laws. Remember that for all sentences that denote induced gradable changes of state (including sentences containing non-strictly incremental verbs such as *shā*), a change d such that $d_0 < d \leq d_N$ must have occurred. Now, consider the minimal non-null degree of change sufficient to warrant the utterance of a sentence with a verb like *shā* and let’s call this degree d_m . For any event e that involves a degree of injury d_N , a sentence with *shā* can truthfully apply to any subpart of e that entails a degree of change at least equal to d_m . Assuming that killings at least take time, there will be subparts of e where the degree of change is between d_m and d_N . So, in most circumstances our analysis will entail weak incrementality. But not as a matter of necessity. One can imagine a word *ps-shā* that means just what Mandarin *shā* means, but additionally requires the change to be non-weakly incremental, i.e. there can be preparations to the “killing”, but once a change occurs, it is instantaneous so there is no proper subpart of e where a degree of change between d_m and d_N has occurred. Of course, the way the world works means it is quite unlikely gradable changes *must* be instantaneous (the only case where non-strictly incremental gradable change categories do not coincide with weakly incremental gradable change categories). One possible case is the use of the expression *Beam me up, Scottie!* in Star Trek where one can define degrees of change (an order of locations), but where the change, once the “magical” button is pressed, is instantaneous (so that there cannot be a possible world where there is a homomorphism between proper parts of the events and degree changes). Our intuitions are shaky on the true meaning of that expression (after all, it is a Star Trek world we are talking about), but it is interesting to note that such non-weakly incremental gradable change categories seem restricted to sci-fi worlds. Aside from our desire not to build in the definition of gradable change a constraint that seems to us to be a matter of physics and physiology, our analysis was motivated by our desire to explain the differences between Mandarin (or Hindi and Thai) and languages like English. Sentences such as (35) or (37) suggest that English may conceptualize killings as gradable. If this is the case, the only way to distinguish between *shā* and *kill* would then be to say that *shā* denotes a weakly incremental gradable change, and *kill* simply a gradable, but not weakly incremental change. We are not sure what that would mean. Clearly, to the extent *kill* denotes a gradable induced change of state, it will be weakly incremental for the reason *shā* is: Among worlds we can conceive of, the induced gradable change *kill*’s denotation is equivalent to can occur in time-steps and a homomorphism can then be defined in these worlds between subevents and degrees of change.

We illustrate this difference in meaning between corresponding stems in Mandarin and English by discussing entailment patterns in incomplete languages. We use English as a metalanguage to state the entailment pattern for ease of understanding. The basic entailment patterns for incomplete stems is exemplified in (39).

- (39) a. Pat has killed Dodo \models Dodo's health has been affected by Pat's activity.
 b. Pat has read *Moby Dick* \models *Moby Dick* has been partially read.
 c. Pat has cooked a roast \models The roast is not entirely raw.

As the entailment patterns in (39) indicate, incomplete stems *do* entail that a change occurred. The proto-patient must have been affected in some way, i.e. it must have undergone some change of state, as the unfelicity of (40) (repeated from (12)) demonstrates. But, it is only *implicated* that Dodo is dead, *Moby Dick* is finished, or the roast is ready to serve.

- (40) #Ta sha le Lisi, danshi Lisi mei shou bandian shang
 he kill PERF Lisi, but Lisi not receive little.bit injury
 'He killed Lisi, but Lisi was not even hurt a little bit.'

The fact that incomplete stems entail the proto-patient *did* undergo some change of state means that these stems do not simply denote actions performed on an entity. In other words, *shā* 'kill' or *khâa* 'kill' do not simply mean 'be engaged in the activity that would result in a killing', as there must be some negative effect on the proto-patient's health for these words to be used. The fact that sentences including these words (with bounded arguments and non-imperfective aspect) implicates (sometimes strongly) that the proto-patient died suggests that they do not denote mere activities, as Lin (2004) suggests. Nor are they equivalent to verbs such as English *hurt*, as *shā* or *khâa* evoke in some manner the maximal degree of injury, as we mentioned in section 1. Our analysis of the meaning of incomplete stems models both of these observations by saying that there must be a non-null degree *d* of injury/health that has changed, but that that degree may but need not be equal to the norm (the maximal degree of injury in the case of events of killing).

In other words, the difference between Mandarin and English does not reduce to the fact that some predicates that describe quantized changes in English (in Hay et al. (1999) or Beavers' (2007) sense) have translations that describe non-quantized changes in Mandarin. A verbs such as *shā* 'kill' can only describe events in which an agent (significantly) affects the patient (in the sense that the patient undergoes that some change of state) and intends that change of state to be death, even though the injury might actually not be that severe for the event to be felicitously described by *shā*. Translating *shā* as either *hit* or *injure*, as it has sometimes been suggested to us, would, therefore, be inadequate. The degree of affectedness entailed by *hit* is less than the one entailed by *shā*. The verb *injure* does not describe a quantized change or even the intention of carrying out a quantized change (any injury level is large enough for an event to be described by the verb *injure*), whereas the meaning of Mandarin *shā* makes reference to the norm on the relevant scale (death, here). Our use of the notion of a normative degree in Definition 3 and Hypothesis 5 allows us to distinguish between true degree achievements in Mandarin and the kind of induced non-incremental, gradable

changes that *shā* describes, i.e. the kind of induced changes that make reference to a normative or maximal value on the relevant scale.

Our claim is that membership in the class of normative gradable changes is a necessary condition for the IE in languages like Mandarin. Is it a sufficient condition? If yes, we can redefine non-gradable changes as *binary* scalar changes (à la Beavers (2008) or Caudal and Nicolas (2005)). That non-gradable/binary scalar stems do not lead to the IE, reanalyzed as binary scalar stems then, would be an immediate consequence of Hypothesis 5, revised as in the following.

Hypothesis 5 (Alternative). *In languages like Mandarin, sentences with main verbs that describe induced changes of state entail that a scalar change occurred with degree $d_0 < d \leq d_N$. In languages like English, corresponding sentences entail that a scalar change occurred with degree $d = d_N$*

A binary scalar change analysis of *buy* amounts to saying that events of buying involve an induced change of ownership of an object that goes from 0 to 1. According to our alternative formulation of Hypothesis 5, all induced changes of state stems in incomplete languages entail that the proto-patient state changed to degree $0 < d \leq d_N$. If there are only two degrees (0 and 1), as in the case of verbs such as Mandarin *fū* 'to pay', then $d = d_N$.

Until now, we have tacitly assumed that most, if not all, stems describing induced gradable changes in languages like Mandarin were incomplete stems. It is certainly true that the overwhelming majority of stems that describe induced gradable changes we tested (over a hundred), are indeed incomplete stems and lead to the IE. Whether all of them are is not easy to determine. Consider the following Mandarin and Thai stems, which are not incomplete, although they seem to be describing induced gradable changes of state.

- (41) *zhuǎn* 'turn (a knob)'
- (42) *zhà* 'deep fry', *yān* 'pickle': both mean 'immersing into a particular kind of liquid'
- (43) *jiā yóu* 'pump gas': completion entailed when the amount is a direct object
- (44) *won* 'circle' in Thai is not an incomplete stem

Explaining why *zhuǎn* 'turn (a knob)' is not an incomplete stem is relatively easy: Any amount of turning counts as turning a knob, and therefore, Hypothesis 5 *does* predict that sentences that include this stem do not lead to the IE. In other words, *zhuǎn* is a weak induced change of state stem. Stems in (42) are also weak induced change of state stems, we believe, despite what their translation would suggest. Both *zhà* 'deep fry', *yān* 'pickle' mean to immerse in a liquid (boiling oil and some kind of brine, respectively). The fact that the proto-patient was affected and that the action's goal is to cook or otherwise prepare the food is an implicature that is not part of the stems' meanings. Whether all potential counterexamples can be so easily disposed of is unclear.⁶

⁶There might also be differences between Hindi and Mandarin and Thai. Despite the attested example in (3), Hindi speakers we asked find sentences such as i. *unfelicitous*. This suggests that only stems denoting induced incremental gradable changes of state might be in the set of incomplete stems in Hindi, or at least that stems denoting induced non-incremental gradable changes might only lead to

Reciprocally, languages like English may include incomplete stems. They may have a few words that leave unspecified whether the result state's property is maximal or not. Such is the case for *wash*, according to Talmy (2000) or French *chambrier*. Leaving aside the case of English *wash*, on which our consultants disagreed, the felicity of sentence (45), for example, suggests that even in languages like French, some normative induced gradable change of state stems are incomplete.

- (45) Marc a chambré le vin, mais le vin n' est pas encore
 Marc have.PRES warm'.PPT the wine, but the wine NEG be.PRES NEG yet
 Chambré.
 warm.PPT
 '%Marc has brought the wine to room temperature, but the wine is not yet at
 room temperature.'

In fact, Kratzer (2004) has claimed that many more verbs in English are what we would call incomplete stems (although her analysis of the phenomenon differs from ours). It includes, for example, verbs such as *cook*, *read*, *clean*, *wash*, and many others. Whether all of these stems or others Kratzer cites are indeed incomplete is not clear to us, because of the difficulty of factoring out the possible confounding effect of coercion. If Kratzer is correct, the difference between languages like English and Mandarin with respect to incomplete stems might not be as significant as it might seem. The main difference would be that in Mandarin, but not English, induced non-incremental gradable change of state stems (e.g., *shā* 'kill') are incomplete.

4 Conclusion

What we have called the Incompleteness Effect has been noted for a long time. In this paper, we argued that the source of the effect is in the meaning of stems that denote induced changes of state. We call such stems *incomplete stems*. Taking stock of recent work on the relationship between scalarity and change, we then suggested that incomplete stems denote induced gradable changes and provided a semantic characterization of these stems. We showed that the difference between incomplete and complete stems is whether the stem requires the degree of induced change to have reached the norm on the relevant scale or merely be non-null (or "significant") and be semantically vague whether or not the degree of change reached the norm.

There is a wider moral in our analysis of incomplete stems, if it is correct. We mentioned at the beginning of our paper how it is common practice to divide the space of verbal meaning into four quadrants (states, processes, changes, and induced changes). It is tempting to think that the more complex meanings can be derived from base categories, state and activities, through the application of two or three operator constants,

the IE in very restricted contexts. We leave further discussion of this issue to another venue.

- i. #Rama=ne Sarah=ko maaraa par vo nahii marii
 Rama=ERG Sarah=DAT kill.MASC but pron NEG die.FEM
 #Rama killed Sarah but she didn't die.

following the lead of Dowty (1979). The contrast between incomplete and complete stems within a language and between near translation equivalents across languages suggests there can be semantic differences not reducible to differences in base categories. There can be differences in *how much* of a change toward a normative end-state (death, health, or persuasion) is entailed to have occurred, without a difference in the end-state themselves. In other words, there can be “molecular” differences in word meaning that are not reducible to differences in “atomic” meanings.

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Jean-Pierre Koenig
University at Buffalo
jpkoenig@buffalo.edu