# NEGATIVE POLARITY ITEMS IN MALAY:
## AN EXHAUSTIFICATION ACCOUNT*

DEBORAH J.M. WONG
*University of California, Los Angeles*

## 1 Introduction

This paper is concerned with the interpretation of Malay negative polarity items (NPI)[1] in conjunction with sentential negation. I present data that show these items contributing either an existential or a universal interpretation depending on the NPI's position relative to negation. I propose an analysis that involves an exhaustification process to account for the data, which reduces the NPI to just the existential interpretation while allowing the universal interpretation to be derived.

## 2 Malay Data and the Puzzle

In many languages of the world, NPIs are built with *wh*-words, which numerous researchers have argued have no quantificational force of their own. Malay is one such language, in which NPIs are composed of a reduplicated *wh*-word combined with the particle *pun* which, on its own, has the meaning of *'also/even'*[2].

[1]I use the term NPI for these items as they appear in environments (direct and indirect negation, adversative predicates, protasis of a conditional clause *etc.*) that license NPIs. However, as shown in the data, these items also appear in environments not usually associated with NPIs. This choice of terminology is not intended to make any theoretical or empirical claims about the behavior of these expressions.

[2]The morphological forms of Malay NPIs differ in context. The reduplication of the *wh*-word is not always necessary but preferred by my consultants. For this paper, I will only discuss the reduplicated *wh*-word + particle form.

(1)  Morphological Form of Malay NPIs

| anything | apa-apa pun | *what-what* pun |
|---|---|---|
| anyone | siapa-siapa pun | *who-who* pun |
| anytime | bila-bila pun | *when-when* pun |
| anywhere | mana-mana pun | *where-where* pun |

NPIs have been argued to be interpreted as a narrow scope existential with respect to its licensor (see Ladusaw 1979, Carlson 1980 for English, Lahiri 1998 for Hindi, Cheng 1994 for Chinese). However, recent work by Kim and Sells (2007) for Korean and Shimoyama (2008) for Japanese suggests that some NPIs have to be interpreted as a universal quantifier which outscopes negation. The Malay data that I present in this paper has sentential negation as the licensor to the NPI. From a semantic point of view, it is difficult to distinguish between a universal and an existential interpretation for NPIs when they interact with sentential negation because sentential negation denotes a function that satisfies the De Morgan's equivalence below (see Zwarts 1998 and Gajewski 2007 for more details).

(2)  a.  $\neg(P \vee Q) \Leftrightarrow \neg P \wedge \neg Q$

b.  John did not eat an apple or an orange $\Leftrightarrow$ John did not eat an apple and John did not eat an orange

The equivalence between a disjunction in the scope of negation and a conjunction that outscopes negation is the same as the equivalence between an existential in the scope of negation and a universal scoping above negation. This is known as an anti-additive function.

(3)  a.  $\neg\exists x.P(x) \Leftrightarrow \forall x.\neg P(x)$

b.  It is not the case that someone came $\Leftrightarrow$ Everybody did not come

Thus, NPIs can have either existential or universal interpretation, as long as they are in the correct scope configuration with negation. In the subsection below, I establish the scopal facts for Malay before presenting the NPI data.

## 2.1  Scope of Negation and the Interpretation of NPIs

Malay has a predominantly Subject-Verb-Object word order and negation appears between the subject and verb. In (4), when *satu orang* 'one person' is placed in subject position, negation is not able to scope over the subject.

(4)  Satu orang  tak  datang.
     one  person NEG come
     'One person didn't come.'

Reading:

  i.  It is the case that one person did not come
  ii.  *It is not the case that one person came

When *satu orang* is placed in object position, the only reading that is obtained is the one where negation takes wide scope.

(5) Ali tak   nampak satu orang  di sini.
    Ali NEG saw     one  person at here
    'Ali did not see one person here.'

> Reading:

>   i.   It is not the case that Ali saw one person here
>   ii.  *There is one person such that Ali did not see him

In Malay, the scope of quantification corresponds to the surface position of quantificational elements. Thus, we can establish the interpretation of the NPIs given the position that they appear in a sentence. Malay NPIs can appear in object position, syntactically below negation. As the example in (5) indicates, objects cannot scope over negation, which allows us to conclude that the NPI in (6) is an existential quantifier that is scoping below negation.

(6) Ali tak   beli apa-apa    pun.
    Ali NEG buy what-what PRT
    'There does not exist an $x$, such that Ali buys $x$.' (Ali did not buy anything.)

Malay NPIs can also appear in subject position, syntactically above negation. Given (4), in which negation is shown to not be able to scope over subjects, we can conclude that the NPI subject in (7) is a universal quantifier that is scoping over the negation.

(7) Siapa-siapa pun tak   datang.
    who-who    PRT NEG come
    'For all $x$, $x$ did not come.' (Nobody came.)

From (6) and (7), a preliminary observation can be made: As objects, these expressions receive an existential interpretation, while as subjects, they receive a universal interpretation. The fact that Malay NPIs have both existential as well as universal interpretations (depending on whether it is a subject or an object) is slightly unusual. The real puzzle, however, arises from a third position where these expressions are allowed to occur.

## 2.2   The Puzzle

As objects, Malay NPIs can also appear syntactically above negation and the meaning of the example in (8) is synonymous with the meaning in (6).

(8) Ali apa-apa    pun tak   beli.
    Ali what-what PRT NEG buy
    'Ali did not buy anything.'

I assume that the surface order of (8) is a result of the movement of the NPI into the position between subject and negation[3]. So far, this word order has only been found for NPIs in Malay. Using the scope of negation with the *satu orang* 'one person' test from the previous section results in ungrammaticality as seen in (9).

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[3]I do not know what type of movement this is nor what position the NPI has moved to. This is an unusual word order pattern for Malay given that it is a strict SVO language and that SOV order is generally not found in the Malayo-Polynesian language family.

(9)  *Ali satu orang  tak    nampak di sini.
      Ali one  person NEG see        at here

Given that (6) and (7) leads one to suspect different interpretations of NPIs in certain positions, one may ask the following question:

(10)  Does the movement of the NPI affect the interpretation in (8) since it is an object that originated from a position below negation?

There are two possible solutions to the question in (10):

(11)  a. **Solution 1:** The NPI in (8) is interpreted as an existential quantifier below negation despite surface order.  The sentence in (8) is a result of a semantically vacuous movement.
      b. **Solution 2:** The NPI in (8) is interpreted as a universal quantifier, just like the NPI subject in (7). The movement affects the interpretation of the NPI.

In section 3, I show that solution 2 is correct. When the NPI moves to a position above negation, it has a universal interpretation. Since the movement of the NPI is not semantically vacuous and it is the movement that allows the NPI to take higher scope above negation, this leads to the second question:

(12)  Given that the NPI starts below negation, how does it get the universal interpretation?

In section 4, I argue that the universal quantification is not inherent to the NPI but derived from existential quantification.  The universal interpretation arises due to the existence of an exhaustification operator.

## 3   Diagnosing the Quantifier: Non-anti-additive Contexts

As shown in (9), the 'one person' test does not work for the SOV word order, hence another test is needed to conclusively show that the NPI in (8) is a universal quantifier.  I appeal to the use of non-anti-additive contexts. Shimoyama (2008) creates non-anti-additive contexts for Japanese NPI *dare-mo* to show that it takes wide scope above negation hence it has to be interpreted as a universal quantifier to maintain the correct truth conditions. Using this test in a similar fashion to Shimoyama, I show that Malay NPI objects that appear syntactically above negation have a universal interpretation while the ones that appear below negation have an existential interpretation.

A non-anti-additive context is constructed by conjoining an additional quantificational element with sentential negation. The combination of a quantificational element $Q$ and sentential negation $\neg$ creates non-anti-additive functions $Q\neg$ and $\neg Q$. These functions do not validate the equivalence of the anti-additive function as $Q\neg\exists \neq \forall Q\neg$ and $\neg Q\exists \neq \forall\neg Q$. An example of a non-anti-additive expressions of the form $Q\neg$ is 'rarely' which Ladusaw (1979) argues to be composed of 'usually' + 'not'. To illustrate the working of this test, I discuss Ladusaw's example using 'rarely' to argue that NPI *any* cannot be a wide scoping universal quantifier.

(13)  The IRS rarely audits anyone.

Interpretation:

i. USUALLY ¬∃$x$[*Person*($x$)∧ IRS audits $x$]
It is usually not true that there is someone whom the IRS audits.
(= The IRS almost always audits no one.)

ii. ∀$x$[[*Person*($x$)] → USUALLY ¬ [IRS audits $x$]]
*Everyone is such that it is usually not the case that the IRS audits him.

In (13), 'USUALLY ¬∃', where the *any* has an existential interpretation, gives the correct meaning while '∀ USUALLY ¬' does not. 'Rarely' needs to embed an existential interpretation because it is atomic and cannot be decomposed. Hence, a representation using universal quantification is predicted to be impossible as that would require ∀ or *anyone* to be interspersed between USUALLY and ¬. The unavailability of the second meaning in (13) led Ladusaw to conclude that *any* must have an existential interpretation. The following argument presented for Malay is in a similar vein but the results point to different conclusions.

For Malay, I use the quantificational adverb *biasanya* 'usually' to create a non-anti-additive environment. The judgments involved are not the most straightforward due to the three scope bearing elements. To help with judgments, the following scenario is constructed.

(14) **Scenario**: Ali attends a lot of events. Since there are so many people on the list that he has to greet, the same individual is greeted only occasionally. However, Ali still greets people rather frequently.

In this scenario, only the universal over negation reading of the NPI is true while the existential under negation reading is false. Thus, if the non-anti-additive sentence can be uttered under the scenario then the NPI has a universal intepretation. Given the scenario, consultants are asked whether the sentence in (15) can be asserted.

(15) Ali siapa-siapa pun  biasanya tak    sambut.
Ali who-who   PRT usually   NEG greet

Interpretation:

∀$x$[[*Person*($x$)] → USUALLY ¬ [Ali greets $x$]]
Everyone is such that it is usually not the case that Ali greets him.

The sentence in (15) is found to be available under the given scenario which constitutes evidence that the NPI is interpreted as a universal quantifier. The same test is applied to NPI subjects, yielding the same result.

(16) Siapa-siapa pun  biasanya tak    mengambil bahagian dalam pertandingan nyayian.
who-who    PRT usually   NEG tak        part      in      competition singing
'Nobody usually takes part in singing competitions.'

Interpretation:

Everyone is such that it is usually the case that he or she did not participate in singing competitions.

Using non-anti-additive contexts again, this time with the adverb *sering* 'often' which is of the form ¬$Q$, NPI objects below negation are shown conclusively to be interpreted as an existential.

The scenario used in this case is the same as the one in (14). The reason why there cannot be a scenario where the existential below negation interpretation is true while universal over negation interpretation is false is because the existential under negation interpretation always entails the wide scope universal interpretation[4]. However, the universal over negation interpretation does not entail the existential under negation interpretation. Thus, if the sentence cannot be uttered under this scenario then the NPIs have to be interpreted as existential. Given the same scenario in (14), consultants are asked whether the sentence in (17) can be asserted.

(17)   Ali tak    sering sambut siapa-siapa pun.
       Ali NEG often   greet    who-who   PRT
       'Ali does not often greet anyone.'

       Interpretation:
       $\neg$ OFTEN $\exists x[Person(x)\wedge$ Ali greets $x]$
       It is not often true that there is someone whom Ali greets.
       (= Ali greets no one most of the time.)

The sentence in (17) is found to be unavailable under the given scenario, constituting evidence for an existential interpretation for the Malay NPIs under the scope of negation. The non-anti-additive contexts have conclusively shown that the movement that takes the NPI from the lower object position to the position above negation is not semantically vacuous. If the NPI had stayed below negation, it would not have received the universal interpretation. The next step is to answer the question in (12). In the next section, I propose the mechanisms to derive the interpretation of the NPIs.

# 4   Proposal: An Exhaustification Analysis

Given the mutually exclusive relationship between the universal interpretation and the existential interpretation, there are two possible strategies for analyzing the Malay NPIs. The first approach would be to analyze them in two distinct systems, one for the universal interpretation and the other for the existential interpretation. However, this approach would run into trouble with explaining NPI objects because the same object appears in different environments with different interpretations. The second approach, which I will be taking, assumes one inherent interpretation for the NPIs while deriving the other interpretation. This allows the two interpretations of Malay NPIs to be accounted for in one system.

Theoretically, universal quantification can be put in terms of conjunction, and existential quantification, disjunction (see Keenan and Faltz 1985, Keenan and Stavi 1986 for a fully formal version of standard logic extended to universal and existential quantification). Conjunction and universal quantification are greatest lower bound operators, differing in that conjunction only takes finitely many arguments while universal quantification is monadic second order taking a set of any cardinality as argument. Similarly, disjunction and existential quantification are least upper bound operators and differs the same way as universal quantification and conjunction. Hence, for our purposes, $\forall$ and $\exists$ can be replaced by a conjunction or disjunction of propositions involving

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[4]For example, if it is not often the case that there exist someone such that Ali greets him, then everyone is such that it is not the case that Ali often greets him.

constants. In the literature, it has been argued that 'or' can sometimes contribute to a sentence meaning that appears conjunctive. For example, Higginbotham (1991) considers the following example of 'or' being interpreted as a conjunction.

(18)   John can play chess or checkers (so he will play whichever you please)

> <u>Inferences:</u>
>
> i.   John can play chess
> ii.  John can play checkers

For cases like (18), Fox (2007) argues that disjunction can be grammatically strengthened to conjunction through an exhaustification process. To account for the two interpretations of Malay NPIs, I propose an analysis where these expressions, which are inherently existential, go through a grammatical strengthening operation to obtain the universal interpretation. The grammatical strengthening operator, *Exh* (Fox, 2007) is used to obtain the desired result. *Exh* is formally defined in the next section. After that, I discuss the semantics of *wh*-word + *pun* and the alternatives it introduces.

## 4.1   Strengthening Mechanism: *Exh*

Exhaustification is an operation for grammatical strengthening which has been proposed in the literature for explaining phenomena such as scalar implicatures, free choice inferences and polarity sensitivity (Chierchia 2006, 2013, Fox 2007). *Exh* is a covert counterpart of *only* which takes two arguments: a proposition (the prejacent) and a set of alternatives (alternatives to the prejacent) and returns the prejacent conjoined with the negation of all alternatives that are non-weaker than the prejacent. In order to avoid contradiction, *Exh* is defined using the notion of Innocent Excludability (IE). IE forces *Exh* to only negate proper subsets of non-weaker alternatives and not all of the alternatives. According to Fox (2007), *Exh* is a syntactic operator which applies to a set of alternatives and can be applied recursively. The formal definition of *Exh* with IE is as follows:

**Definition 1** Exhaustivity Operator with Innocent Excludability (IE)
   i.   $p$ is a proposition and $ALT(p) = \{ \, q|q$ is an alternative to $p \, \}$
   ii.  $[\![Exh]\!] \, (p) = p \wedge \forall q (q \in IE(p) \rightarrow \neg q)$ (IE is defined below)

**Definition 2** Innocent Excludability (IE)
   i.   Exclusion
        $EXCL(p) = \{ \, A \subseteq ALT(p) : A \neq \emptyset$ and $\{ \, \neg q : q \in A \, \} \cup \{ \, p\}$ is consistent $\}$
   ii.  Maximum Exclusion
        $EXCL_{max}(p) = \{ \, A \subseteq ALT(p) : A$ is a maximal set in $EXCL \, (p) \, \}$
   iii. Innocent Exclusion
        $IE(p) = \bigcap EXCL_{max}(p)$

Informally, *Exh* defines sets of negated strengthened meanings based on the alternatives to the prejacent. These sets then get intersected with the prejacent which in turn yields a stronger meaning of the prejacent. *EXCL* is function that takes the prejacent as argument and returns a set of negatable alternatives which shall be refered to as 'excludable' propositions since they can

be excluded without contradicting the prejacent. $EXCL_{max}$ returns the maximal sets in $EXCL$ and IE returns the intersection of all the maximal sets of excludable propositions. Thus, contradiction is avoided as the proposition that occurs in every one of the sets of excludable proposition is innocently excluded.

Using these definitions, I illustrate an application of *Exh* on inclusive disjunction to obtain exclusive disjunction. *Exh* is a syntactic operator and was used in Fox (2007) to derive the exclusivity implicature of the English disjunctive utterance *P or Q* such as in (19).

(19)   John talked to Sue or Mary.

  Implicature:

   i. John talked to Sue
   ii. John talked to Mary

I am using $p$ for 'John talked to Sue' and $q$ for 'John talked to Mary'. Following Sauerland's (2004) proposal, the set of alternatives[5] to $p \vee q$ is as follows:

(20)   $ALT(p \vee q) = \{p, q, p \vee q, p \wedge q\}$

Applying *Exh* to $ALT(p \vee q)$ gives the following set of sets of excludable propositions.

(21)   $EXCL(p \vee q) = \{p, q, p \wedge q, \{p, p \wedge q\}, \{q, p \wedge q\}\}$

The set of maximal elements of *EXCL* is as follows:

(22)   $EXCL_{max}(p \vee q) = \{\{p, p \wedge q\}, \{q, p \wedge q\}\}$

Once $EXCL_{max}(p \vee q)$ is calculated, the set of IE propositions can be derived by intersecting all the sets in $EXCL_{max}(p \vee q)$:

(23)   $IE(p \vee q) = \bigcap\{\{p, p \wedge q\}, \{q, p \wedge q\}\}$
      $= \{p \wedge q\}$

According to Definition 1, the proposition $(p \wedge q)$ is innocently excluded, thus is negated and combined with the prejacent. We end up excluding the proposition 'John talked to Sue and John talked to Mary' which leaves us with the strengthened exclusive *'or'* interpretation for (19).

## 4.2   Semantics of *Wh*-word + *Pun*

Since the lexical entries for Malay NPIs are composed of a reduplicated *wh*-word with the particle *pun*, I argue that they should be treated as a unit and as indefinites. In the literature, there are at least three approaches as to how indefinites should be treated. In the first approach, indefinites are represented as variables, as in Heim 1982. The second is the alternative semantics approach developed in Kratzer and Shimoyama 2002. In this approach, *wh*-words such as Japanese *dare* (who), denotes sets of individuals which are expanded via pointwise functional application until it meets some operators ($\exists, \forall, \neg$) that can quantify over the set. In the third approach, indefinites

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[5]The alternatives are constructed based on the algorithm in Katzir (2008) and Fox and Katzir (2011).

are argued to be inherently existentially quantified items. This existential quantificational view of indefinites is proposed in Karttunen 1977 for wh-words and used by Chierchia (2010) in his analysis of the entire polarity system.

Among the three approaches listed, I take the third approach. The main reason for this choice is that *wh*-words can be directly interpreted as existential quantifiers without the need of any extra operators. In the variable and alternative semantics approach, *wh*-words denote a basic meaning, either a variable or a set of alternatives, and can only obtain their quantificational force through some subsequent operator. Thus, I argue that Malay NPIs has the semantics of an existential which is capable of undergoing the exhaustification mechanism to obtain a universal interpretation.

(24)   $\llbracket wh\text{-word} + pun \rrbracket(p) = \exists x(p(x))$
       (for any $p$ of type $\langle e, t \rangle$)

This is similar to Bar-Lev and Margulis' (2013) analysis of Hebrew *kol* which they argue to be inherently an existential quantifier but can be strengthened to a universal quantifier.

## 4.2.1   Alternatives of Malay NPIs

Scalar items such as universal and existential quantification form a scale of entailment relations where universal quantification is the logically stronger member (Horn, 1972). Thus, an alternative of existential quantification includes the universal quantification which is the scalar alternative. Denoting existential quantification in terms of disjunction, where $\exists x(p(x)) = p(x_1) \vee p(x_2) \vee \ldots \vee p(x_n)$[6], I adopt the proposal in Sauerland 2004 where the set of alternatives available for an English disjunctive statement like *p or q* includes the individual disjuncts *p*, *q* as well as the scalar alternative *p and q*. Hence, the set of alternatives for existential quantification such as *some* in English would be $\{p, q, p \vee q, p \wedge q\}$.

Following Chierchia's (2013) analysis of polarity items, I argue that *wh*-word + *pun* introduces a set of alternatives. Given that I have assumed that *wh*-word + *pun* has the semantics of an existential, the set of alternatives should be the same as English disjunction. However, a crucial claim that I am making for this proposal is that the scalar alternative $(p \wedge q)$ is not included in this set of alternatives for *wh*-word + *pun*. Thus, the set of alternatives for the *wh*-word + *pun* is $\{p, q, p \vee q\}$.

The reason for keeping the scalar alternative out of the set of alternatives is to save it from being negated by the exhaustification operator. The exclusion of the scalar alternative from the set of alternatives of disjunction is not an outlandish claim and has been proposed in the literature for child acquisition (Singh et al., 2016), Hebrew *kol* (Bar-Lev and Margulis, 2013) and disjunction in Warlpiri (Bowler, 2014).

Singh et al. (2016) found that children reject sentences in (27a) if the statement in (27b) is false, which is evidence that children are interpreting the 'or' as a conjunction.

(25)   a.  The monkey is holding a flower or a book.
       b.  The monkey is holding a flower and a book.

The same exhaustification process with a limited set of alternatives is used to account for this pattern in child acquisition. Singh et al. (2016) claims that this limited set of alternatives is due

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[6]I am only considering two-element models for this paper, $p(x_1) \vee p(x_2) = p \vee q$.

to the inability of children to access the lexicon and include the scalar alternative when generating alternatives to $(p \vee q)$. I suspect that the lack of the scalar alternative for *wh*-word + *pun* is due to the lexical items available to Malay speakers. Since *wh*-words are inherently indefinites, the scalar alternative is not included in the set of alternatives.

## 4.3   Application of *Exh* on Malay NPIs

According to Fox (2007), *Exh* is optional in the syntax. For the examples in this paper, I assume that *Exh* is always present within the syntax and is located on the left edge of the tree. Thus the tree structure for (26) is in (27):

(26)   Ali siapa-siapa pun  tak    nampak.
       Ali who-who    PRT NEG see
       'For every *x*, it is not that case that Ali sees *x*.'

(27)
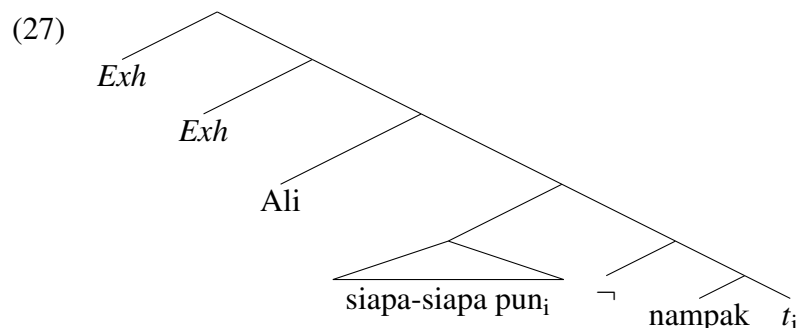


    The word order of (26) is derived from movement of *siapa-siapa pun*. I take *siapa-siapa pun* to be merged below negation initially and then undergo some kind of movement above negation. I will be illustrating a simplified derivation with a toy model of two items. The full derivation can be found in the appendix. The derivation for (26) is as follows:

(28)   a.  *Exh Exh* Ali who-who PRT $\neg$ see

     b.  $D = \{$person 1, person 2$\}$

     c.  $p = see(\text{Ali})(x_1)$
        $q = see(\text{Ali})(x_2)$

     d.  $[\![$Ali who-who PRT $\neg$see$]\!] = \exists x[\neg see(\text{Ali})(x)] = \neg see(\text{Ali})(x_1) \vee \neg see(\text{Ali})(x_2)$
        $= \neg p \vee \neg q$

     e.  $ALT([\![$Ali wh-wh PRT $\neg$see$]\!]) = \{\neg p, \neg q, \neg p \vee \neg q\}$

     f.  $Exh([\![$Ali wh-wh PRT $\neg$see$]\!]) = \neg p \vee \neg q$

     g.  $ALT(Exh([\![$Ali wh-wh PRT $\neg$see$]\!])) = \{\neg p \wedge q, \neg q \wedge p, \neg p \vee \neg q\}$

     h.  $Exh(Exh([\![$Ali wh-wh PRT $\neg$see$]\!])) = \neg p \wedge \neg q = \neg see(\text{Ali})(x_1) \wedge \neg see(\text{Ali})(x_2)$
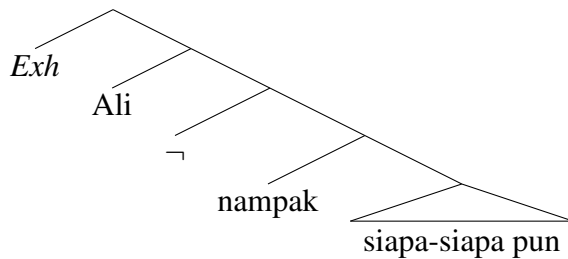        $= \forall x[\neg see(\text{Ali})(x)]$

    The semantics of (26) is given in (28d) where the existential quantifier scopes over negation. Excluding the scalar alternative gives the set of alternatives of (26) in (28e). Applying *Exh* the first time does not change anything as no alternative is excludable. However, the set of alternatives of

the exhaustified proposition is different[7] as seen in (28g). Applying *Exh* the second time to the alternatives in (28g) yields the strengthened meaning $\neg p \wedge \neg q$.

Next, I show the derivation of NPIs that scope below negation as no movement of the NPI has occurred. In this derivation, *wh*-word + *pun* retains its existential interpretation and any number of operation of *Exh* does not change this interpretation. The derivation is shown in (29).

(29)  Ali tak  nampak siapa-siapa pun.
      Ali NEG see    who-who   PRT
      'It is not that case that there is an *x* such that Ali sees *x*.'

(30)  *Exh* Ali ¬ nampak siapa-siapa PRT



(31)  a.  *Exh* Ali ¬ see who-who PRT
      b.  $D = \{\text{person 1, person 2}\}$
      c.  $p = see(\text{Ali})(x_1)$
          $q = see(\text{Ali})(x_2)$
      d.  $[\![\text{Ali} \neg \text{see who-who PRT}]\!] = \neg\exists x[see(\text{Ali})(x)] = \neg\,(see(\text{Ali})(x_1) \vee see(\text{Ali})(x_2))$
          $= \neg(p \vee q)$
      e.  $ALT([\![\text{Ali} \neg \text{see } who - who \; PRT]\!]) = \{\neg p, \neg q, \neg(p \vee q)\}$
      f.  $Exh([\![\text{Ali} \neg \text{see } who - who \; PRT]\!]) = \neg(p \vee q) = \neg\exists x[see(\text{Ali})(x)]$

Applying *Exh* repeatedly in this case yields the same result because the high scoping negation blocks the strengthening.

(32)  a.  $ALT\;(Exh[\![\text{Ali} \neg \text{see } who - who \; PRT]\!]) = \{\neg p \wedge q, \neg q \wedge p, \neg(p \vee q)\}$
      b.  $Exh(Exh[\![\text{Ali} \neg \text{see } who - who \; PRT]\!]) = \neg(p \vee q) = \neg\exists x[see(\text{Ali})(x)]$

## 4.4  Discussion

Though this paper concerns only Malay data, I believe that the analysis can be extended to other languages that share similar features. One of those languages is Malagasy, which is also in the Austronesian family. In Malagasy, NPIs are also built with a reduplicated *wh*-word and reduplicated particle. In this case, the particle used is *na* which also serves as disjunction in the language. Furthermore, NPIs can be found in topicalized position and appear above their licensor which is similar to Malay. The data below is from Paul 2005.

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[7]See Katzir (2008) for the algorithm to compute exhaustified alternatives.

(33) Na saka inona na saka inona dia   tsy     mihaza alika.
     or cat  what  or cat   what TOP NEG hunt     dog
     'No cat hunts dogs.'

This opens the question of whether this analysis can be extended to languages such as English which is of a different language family. English *any* functions both as an NPI that has an existential interpretation as well as a free choice item that has a universal interpretation. Thus, extending this strengthening analysis to *any* is not a completely outlandish claim. However, a main premise for this analysis to work is that the scalar alternative (universal quantification) is not included in the set of alternatives. For Malay, this premise is supported by the composition of its lexical items. *Wh*-words have traditionally been regarded as some kind of indefinite and having NPIs composed of *wh*-words supports the idea that they have an inherently existential interpretation that lacks the scalar alternative in the set of alternatives. At this point, there is no reason to speculate that English *any* also lacks the scalar alternative in its set of alternatives. Thus, it would be difficult to motivate this analysis for *any*.

# 5   Conclusion

Malay NPIs are found to have an existential interpretation when they occur below negation and a universal interpretation when they occur above negation. In this paper, I have provided evidence of the two interpretations in their respective position through non-anti-additive contexts. I argue that they are inherently existential and the universal interpretation is derived through a strengthening mechanism.

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# Appendix: Full Derivation of (26)

First we apply *ALT* to the proposition $(p \vee q)$.

(34)  Applying *ALT* to $(p \vee q)$:
$$\overline{ALT(p \vee q) = \{p, q, p \vee q\}}$$

Then we apply *Exh* to the alternatives of $(p \vee q)$ :

(35)
$$EXCL(p \vee q) = \{\{p\}, \{q\}\}$$
$$EXCL_{max}(p \vee q) = \{\{p\}, \{q\}\}$$

$$IE(p \vee q) = \bigcap \{\{p\}, \{q\}\}$$
$$= \emptyset$$

$$Exh(p \vee q) = (p \vee q)$$

We apply *ALT* to the exhaustified alternatives of $(p \lor q)$.

(36)   Apply *ALT* to *Exh*$(p \lor q)$:

$$ALT(Exh(p \lor q)) = \{Exh(p), Exh(q), Exh(p \lor q)\}$$

The calculation of the values of *Exh*$(p)$ and *Exh*$(q)$ are given below:

(37)   a.   Value of *Exh*$(p)$:

$$EXCL(Exh(p) = \{\{q\}\}$$
$$EXCL_{max}(Exh(p) = \{\{q\}\}$$

$$IE(p) = \bigcap\{\{q\}\}$$
$$= \{q\}$$

$$Exh(p) = \{p \land \neg q\}$$

b.   Value of *Exh*$(q)$:

$$EXCL(Exh(q) = \{\{p\}\}$$
$$EXCL_{max}(Exh(q) = \{\{p\}\}$$

$$IE(q) = \bigcap\{\{p\}\}$$
$$= \{p\}$$

$$Exh(q) = \{q \land \neg p\}$$

The alternatives for *Exh*$(p \lor q)$ is given below.

(38)                     $$ALT(Exh(p \lor q)) = \{Exh(p), Exh(q), Exh(p \lor q)\}$$
$$= \{p \land \neg q, q \land \neg p, p \lor q\}$$

*Exh* applies a second time on this new set of alternatives and the derivation is as follows:

(39)          $$EXCL(Exh(p \lor q)) = \{\{p \land \neg q\}, \{q \land \neg p\}, \{p \land \neg q, q \land \neg p\}\}$$
$$EXCL_{max}(Exh(p \lor q)) = \{\{p \land \neg q, q \land \neg p\}\}$$
$$IE(Exh(p \lor q)) = \bigcap\{\{p \land \neg q, q \land \neg p\}\}$$
$$= \{p \land \neg q, q \land \neg p\}$$

$$Exh(Exh(p \lor q)) = (p \lor q) \land \neg(p \land \neg q) \land \neg(q \land \neg p)$$
$$= (p \lor q) \land (p \rightarrow q) \land (q \rightarrow p)$$
$$= (p \lor q) \land (p \leftrightarrow q)$$
$$= p \land q$$