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Verb extensions in English to Swahili machine translation[1]

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Abstract

Swahili forms new verbs from the base forms of verbs by attaching suffixes to the verb. Typical extended verb forms include applicative, causative, stative, reciprocal, and combintions of these. English does not use extended verbs, and it forms corresponding meanings using auxiliary verbs. Because word to word translation is not possible, we must find other solutions. The report discusses this problem and suggests alternative solutions.

Key Words: *verb derivation, machine translation*

1 Introduction

Bantu languages, including Swahili, have rich verb morphology. They express the subject, TAM, relative relations and object by means of prefixes. The verbs are also very productive in that the base form of the verb allows several extended forms with specific meanings. Because all this is missing in English, the translation requires careful procedure for producing correct result.

Typical extended verb forms include applicative, causative, stative, reciprocal, and combintions of these. English does not use extended verbs, and it forms corresponding meanings using auxiliary verbs. In none of these cases one-to-one translation is possible.

There are three basic possibilities to handle the translation of such constructions. One approach is to handle the combination of the auxiliary verb and the main verb as a MWE and to give it the extended gloss in Swahili. The second approach is to list also the extended forms as glosses of the main verb, and the appropriate form is then selected on the basis of the context. The third possibility is a more general one. In it, only a tag of the extended form is added to the reading of the main verb. With the help of this tag, the extended form of the verb will be formed.

The last alternative is more tempting than the two first ones, because the number of verbs is big and each would require individual treatment.

2 Extended forms of verbs in Swahili

Below is a description of the extended verb forms in Swahili. Examples show their English equivalents.

Applicative
Alinitendea kazi
He worked for me.

In applicative constructions, the idea is that something is done for somebody else or for the benefit of somebody or something. In English, this is marked by a preposition such as *for* or *to*. Therefore, the verb form is also called 'prepositional form'.

Causative
Nilimnyamazisha.
I made him to be quiet.

In causative, the verb expresses that the object is made to do something. In English, the auxiliary verb *make* or *cause* is used to express this idea.

Stative
Barabara hii inapitika.
This road is passable.

Stative expresses the idea that the subject is in a static position, or that something is possible to do or happen. In such constructions, English uses an adjective derived from the verb.

Reciprocative
Watoto wanapendana.
The children love each other.

Reciprocative expresses mutual action between two or more subjects. In English, the word combinations such as *each other* or *one another* are used.

Stative + reciprocative
Usuluhisho huu unawezekana.
This solution is possible.
Mlima ule unaonekana.
That mountain is visible.
Inaonekana kwamba leo itanyesha mvua.
It seems that today it will rain.
Chumvi itapatikana dukani leo.
Salt will be available in the shop today.

There are a few common verbs, which allow the combination of stative and reciprocative extensions. The main extension in these constructions is the stative, and the idea would be understood even without the reciprocal extension. The reciprocal extension adds an idea of generality.

2.1 Using MWE constructions

We look at the possibility of using MWE technology for handling the above cases.
In applicative, one could consider joining the verb and the preposition as a single structure and give it the applicative form of the base form of the verb. This would require that for each such verb a MWE should be constructed.

In the case of causative, the auxiliary verb *make* and the main verb should be isolated as a MWE, and the causative form of the base form of the main verb should be given. In the case above, the construction has also another MWE *be_quiet*, which is embedded into the longer MWE.

The stative would require, that the verb *be* and the adjective with the ending *-able* would form a MWE. Each case would require a separate rule.

The reciprocative form is quite easy to isolate, because the cluster *each other* is not ambiguous. However, there is little motivation for treating this case as a MWE.

In sum, the use of MWE technology would require a big number of rules, because a separate rule should be written for each case.

2.2 Including the extended forms into the gloss list of the verb

Another approach is to extend the gloss list of each verb, so that also the extended forms are included. Then selection is made on the basis of context. We will see how this method would suit to each extended form.

In applicative, the applicative gloss would be selected, if the preposition *for* or *to* would follow. Correspondingly, the preposition would be given the NOGLOSS interpretation.

In causative, from the list of the main verb glosses, the causative gloss would be selected. The auxiliary verb *make* would be given the NOGLOSS interpretation.

Stative is more problematic, because the *-able* type adjective should be interpreted as a stative verb. This can be done, but it is a bit counter-intuitive.

In reciprocative, the approach would work well. The reciprocal extension would be selected on the basis of context. The words *each* and *other* would be given the NOGLOSS interpretation.

In the combination of stative and reciprocative, the approach would be the same as with stative. For those few verbs, which use this combination, the gloss would be the combined gloss instead of the simple stative.

In sum, each of the forms can be implemented using this method, but it requires reworking the lemma list and extending it considerably. On the other hand, the number of selection rules would be small, especially if each extended form would also be provided with a unique tag.

2.3 Adding extension tags to main verbs

The third approach is more general than the two previous ones. Each verb would have only the base form gloss, and the extended forms would be constructed on the basis of extension tags, added to each main verb. The problem with this approach is that all verbs do not have the same extension process. Especially the variation between *ch* and *z* in causative is a problem.

Below we will test translation with all three methods. We will use examples in (1).

3 Translation with MWE constructions

The sentences to be translated are these:

(1)
(a) He worked for me.
(b) I made him to walk.
(c) This road is passable.
(d) The children love each other.
(e) This solution is possible.

When we analyze and disambiguate the text and isolate the MWEs, we get the reading as in (2).

(2)

```
(a)
"<He>"
      "he" { NOGLOSS } %SUBJ CAPINIT PRON PERS NOM SG3
"<worked>"
      "work" { fanyA kazi } HUM-V %+FMAINV V PAST >MW { fanyiA
kazi }
"<for>"
      "for" { kwa } %ADVL PREP
"<me>"
      "i" { -angu } %<P PRON PERS SG1
"<.>"
      "."
(b)
"<I>"
      "i" { NOGLOSS } %SUBJ PRON PERS NOM SG1 CAPINIT
"<made>"
      "make" { fanyA } SVO %+FMAINV V PAST
"<him>"
      "he" { NOGLOSS } %OBJ PRON PERS SG3
"<to>"
      "to" %INFMARK> INFMARK>
"<walk>"
      "walk" { tembeA } HUM-V %-FMAINV V INF
"<.>"
      "."
(c)
"<This>"
      "this" { h } %DN> CAPINIT DET DEM SG
"<road>"
      "road" { 9SG 10PL barabara } %SUBJ N SG NOM
"<is>"
      "be" { AUX } MONOSLB %+FMAINV V PRES SG3 >MW { pitikA }
```

```
"<passable>"
      "passable" { pitikA STAT } A-REL %PCOMPL-S A ABS INDEF
"<.>"
      "."
(d)
"<The>"
      "the" %DN> CAPINIT DET
"<children>"
      "child" { 1SG 2PL toto } %SUBJ N PL NOM DEF
"<love>"
      "love" { pendA } HUM-V SVO %+FMAINV V PRES >MW { pendanA }
"<each other>"
      "each other" { NOGLOSS } %OBJ PRON RECIPR
"<.>"
      "."
(e)
"<This>"
      "this" { h } %DN> CAPINIT DET DEM SG
"<solution>"
      "solution" { 5SG 6PL suluhisho } %SUBJ N SG NOM
"<is>"
      "be" { ni } MONOSLB %+FMAINV V PRES SG3 >MW { wezekanA ,
wezekA }
"<possible>"
      "possible" { -na-wezekana } A-REL %PCOMPL-S A ABS INDEF
"<.>"
      "."
```

We see that in each sentence, a new interpretation was added to the verb. Other members of the MWE are also pointed out, and their interpretation will be removed later. The members of the MWE will be collected together (3).

(3)

```
(a)
"<He>"
      "he" { NOGLOSS } %SUBJ ACR CAPINIT PRON PERS NOM SG3
"<worked_for>"
      "work_for" { fanyiA kazi } HUM-V %+FMAINV MW V PAST
"<me>"
      "i" { kwangu } %<P PRON PERS SG1
"<.>"
      "."
(b)
"<I>"
      "i" { NOGLOSS } %SUBJ ACR PRON PERS NOM SG1 CAPINIT
"<make_walk>"
      "make_walk" { tembezA } MONOSLB %-FMAINV MW V INF
"<him>"
      "he" { NOGLOSS } %OBJ ACR PRON PERS SG3
"<to>"
      "to" %INFMARK> INFMARK>
```

```
"<.>"
        "."
```

```
(c)
"<This>"
      "this" { h } %DN> CAPINIT DET DEM SG
"<road>"
      "road" { 9SG 10PL barabara } %SUBJ N SG NOM
"<is_passable>"
      "be_passable" { pitikA } MONOSLB %+FMAINV MW V PRES SG3
"<.>"
      "."
(d)
"<The>"
      "the" { The } %DN> CAPINIT DET
"<children>"
      "child" { 1SG 2PL toto } %SUBJ N PL NOM DEF
"<love_each_other>"
      "love-each_other" { pendanA } HUM-V SVO %+FMAINV MW V PRES
"<.>"
      "."
(e)
"<This>"
      "this" { h } %DN> CAPINIT DET DEM SG
"<solution>"
      "solution" { 5SG 6PL suluhisho } %SUBJ N SG NOM
"<is_possible>"
      "be_possible" { wezekanA } MONOSLB %+FMAINV MW V PRES SG3
"<.>"
      "."
```

Now the verb in each sentence has the extended gloss, as needed in each of them. We can continue with translation process by adding inflection tags (4).

(4)

```
(a)
"<He>"
      "he" { NOGLOSS } %SUBJ ACR CAPINIT PRON PERS NOM SG3
"<worked_for>"
      "work_for" { fanyiA kazi } HUM-V %+FMAINV MW V PAST TAM-li
SP-1 OP-SG1
"<me>"
      "i" { NOGLOSS } %<P PRON PERS SG1
"<.>"
      "."
(b)
"<I>"
      "i" { NOGLOSS } %SUBJ ACR PRON PERS NOM SG1 CAPINIT
"<make_walk>"
      "make_walk" { tembezA } MONOSLB %+FMAINV MW V PRES TAM-na
SP-SG1 OP-SG3
"<him>"
      "he" { NOGLOSS } %OBJ ACR PRON PERS SG3
```

```
"<to>"
      "to" %INFMARK> INFMARK>
"<.>"
      "."
(c)
"<This>"
      "this" { h } %DN> CAPINIT DET DEM SG DEM-9
"<road>"
      "road" { 9SG barabara } %SUBJ N SG NOM
"<is_passable>"
      "be_passable" { pitikA } MONOSLB %+FMAINV MW V PRES SG3 TAM-
na SP-9
"<.>"
      "."
(d)
"<children>"
      "child" { 2PL toto } %SUBJ N PL NOM DEF
"<love_each_other>"
      "love_each_other" { pendanA } HUM-V SVO %+FMAINV V PRES TAM-
na SP-2
"<.>"
      "."
(e)
"<This>"
      "this" { h } %DN> CAPINIT DET DEM SG DEM-5
"<solution>"
      "solution" { 5SG suluhisho } %SUBJ N SG NOM
"<is_possible>"
      "be_possible" { wezekanA } MONOSLB %+FMAINV MW V PRES SG3
TAM-na SP-5
"<.>"
      "."
```

In all cases above, the inflection tags were added correctly. The translation is in (5).

(5)
(a) Alinifanyia kazi.
(b) Nilimtembeza.
(c) Barabara hii inapitika.
(d) Watoto wanapendana.
(e) Suluhisho hili linawezekana.

4 Translation by adding extended verb glosses

In this solution, we add extended verb glosses to the verbs. When glosses are added, the analysis of test sentences is in (6).

(6)

```
(a)
"<He>"
      "he" { yeye , -ake , NOGLOSS } %SUBJ CAPINIT PRON PERS NOM
SG3
"<worked>"
      "work" { fanyA kazi , fanyiA kazi APPL , fanyianA kazi
APPL+REC } HUM-V %+FMAINV V PAST
"<for>"
      "for" { kwa , NOGLOSS } %ADVL PREP
"<me>"
      "i" { mimi , -angu , NOGLOSS } %<P PRON PERS SG1
"<.>"
      "."
(b)
"<I>"
      "i" { mimi , -angu , NOGLOSS } %SUBJ PRON PERS NOM SG1
CAPINIT
"<made>"
      "make" { fanyA , amili , fanzA , jengA , sanidi , undA } SVO
%+FMAINV V PAST
"<him>"
      "he" { yeye , -ake , NOGLOSS } %OBJ PRON PERS SG3
"<to>"
      "to" %INFMARK> INFMARK>
"<walk>"
      "walk" { tembeA , tembezA CAUS } HUM-V %-FMAINV V INF
"<.>"
      "."
(c)
"<This>"
      "this" { h } %DN> CAPINIT DET DEM SG
"<road>"
      "road" { 9SG 10PL barabara , 9SG 10PL njia } %SUBJ N SG NOM
"<is>"
      "be" { INFMARK+wA , ni , si , AUX , LOC } MONOSLB %+FMAINV V
PRES SG3
"<passable>"
      "passable" { -na-pitika , -enye kupitika , pitikA STAT } A-
REL %PCOMPL-S A ABS INDEF
"<.>"
      "."
(d)
"<The>"
      "the" %DN> CAPINIT DET
"<children>"
      "child" { 1SG 2PL toto , 1SG 2PL ana , 9SG 10PL akilimali }
%SUBJ N PL NOM DEF
"<love>"
      "love" { pendA , pendanA REC , abudu , hibu } HUM-V SVO
%+FMAINV V PRES
```

```
"<each other>"
      "each other" { NOGLOSS } %OBJ PRON RECIPR
"<.>"
      "."
(e)
"<This>"
      "this" { h } %DN> CAPINIT DET DEM SG
"<solution>"
      "solution" { 5SG 6PL suluhisho , 5SG 6PL fumbuzi , 5SG 6PL
tatuzo } %SUBJ N SG NOM
"<is>"
      "be" { INFMARK+wA , ni , si , AUX , LOC } MONOSLB %+FMAINV V
PRES SG3
"<possible>"
      "possible" { -na-wezekana , wezekanA STAT+REC } A-REL
%PCOMPL-S A ABS INDEF
"<.>"
      "."
```

After semantic disambiguation we can see how well the rules were able to select the correct glosses (7).

(7)

```
(a)
"<He>"
      "he" { NOGLOSS } %SUBJ CAPINIT PRON PERS NOM SG3
"<worked>"
      "work" { fanyiA kazi APPL } HUM-V %+FMAINV V PAST
"<for>"
      "for" { NOGLOSS } %ADVL PREP
"<me>"
      "i" { NOGLOSS } %<P PRON PERS SG1
"<.>"
      "."
(b)
"<I>"
      "i" { NOGLOSS } %SUBJ PRON PERS NOM SG1 CAPINIT
"<made>"
      "make" { fanyA } SVO %+FMAINV V PAST
"<him>"
      "he" { NOGLOSS } %OBJ PRON PERS SG3
"<to>"
      "to" %INFMARK> INFMARK>
"<walk>"
      "walk" { tembezA CAUS } HUM-V %-FMAINV V INF
"<.>"
      "."
(c)
"<This>"
      "this" { h } %DN> CAPINIT DET DEM SG
"<road>"
```

```
      "road" { 9SG barabara } %SUBJ N SG NOM
"<is>"
      "be" { AUX } MONOSLB %+FMAINV V PRES SG3
"<passable>"
      "passable" { pitikA STAT } A-REL %PCOMPL-S A ABS INDEF
"<.>"
      "."
(d)
"<The>"
      "the" %DN> CAPINIT DET
"<children>"
      "child" { 2PL toto } %SUBJ N PL NOM DEF
"<love>"
      "love" { pendanA REC } HUM-V SVO %+FMAINV V PRES
"<each other>"
      "each other" { NOGLOSS } %OBJ PRON RECIPR
"<.>"
      "."
(e)
"<This>"
      "this" { h } %DN> CAPINIT DET DEM SG
"<solution>"
      "solution" { 5SG suluhisho } %SUBJ N SG NOM
"<is>"
      "be" { AUX } MONOSLB %+FMAINV V PRES SG3
"<possible>"
      "possible" { wezekana STAT+REC } A-REL %PCOMPL-S A ABS INDEF
"<.>"
      "."
```

In all cases above, the correct verb gloss was selected. Adding the correct inflection tags might be more problematic. We will see this in (8).

(8)

```
(a)
"<He>"
      "he" { NOGLOSS } %SUBJ ACR CAPINIT PRON PERS NOM SG3
"<worked>"
      "work" { fanyiA kazi APPL } HUM-V %+FMAINV V PAST TAM-li SP-
1 OP-SG1
"<for>"
      "for" { NOGLOSS } %ADVL ACR PREP
"<me>"
      "i" { NOGLOSS } %<P ACR PRON PERS SG1
"<.>"
      "."
(b)
"<I>"
      "i" { NOGLOSS } %SUBJ ACR PRON PERS NOM SG1 CAPINIT
"<made>"
      "make" { fanyA } SVO %+FMAINV V PAST TAM-li SP-SG1 OP-SG3
```

```
"<him>"
      "he" { NOGLOSS } %OBJ ACR PRON PERS SG3
"<to>"
      "to" %INFMARK> INFMARK>
"<walk>"
      "walk" { tembezA CAUS } HUM-V %-FMAINV V INF
"<.>"
      "."
(c)
"<This>"
      "this" { h } %DN> CAPINIT DET DEM SG DEM-9
"<road>"
      "road" { 9SG barabara } %SUBJ N SG NOM
"<is>"
      "be" { AUX } MONOSLB %+FMAINV V PRES SG3 SP-9
"<passable>"
      "passable" { pitikA STAT } A-REL %PCOMPL-S A ABS INDEF A-2
A-9
"<.>"
      "."
(d)
"<children>"
      "child" { 2PL toto } %SUBJ N PL NOM DEF
"<love>"
      "love" { pendanA REC } HUM-V SVO %+FMAINV V PRES TAM-na SP-2
REC
"<each other>"
      "each other" { NOGLOSS } %OBJ PRON RECIPR
"<.>"
      "."
(e)
"<This>"
      "this" { h } %DN> CAPINIT DET DEM SG DEM-5
"<solution>"
      "solution" { 5SG suluhisho } %SUBJ N SG NOM
"<is>"
      "be" { ni } MONOSLB %+FMAINV V PRES SG3 SP-5 SP-5 SP-5
"<possible>"
      "possible" { wezekana STAT+REC } A-REL %PCOMPL-S A ABS INDEF
A-5
"<.>"
      "."
```

In some cases in (8), the inflection tags are correct, but in others they are attached to the wrong word. The rule system for adding tags correctly should be fundementally reworked.

5 Translation by converting the base form of the verb gloss using tags

The third approach tries to figure out a more general method for producing needed extended forms. In this approach, the verb has only the base form, and each derivation tag would convert the verb into desired form (9).

(9)

```
(a)
"<He>"
      "he" { yeye , -ake , NOGLOSS } %SUBJ CAPINIT PRON PERS NOM
SG3
"<worked>"
      "work" { fanyA kazi } HUM-V %+FMAINV V PAST
"<for>"
      "for" { kwa , NOGLOSS } %ADVL PREP
"<me>"
      "i" { mimi , -angu , NOGLOSS } %<P PRON PERS SG1
"<.>"
      "."
(b)
"<I>"
      "i" { mimi , -angu , NOGLOSS } %SUBJ PRON PERS NOM SG1
CAPINIT
"<made>"
      "make" { fanyA } SVO %+FMAINV V PAST
"<him>"
      "he" { yeye , -ake , NOGLOSS } %OBJ PRON PERS SG3
"<to>"
      "to" %INFMARK> INFMARK>
"<walk>"
      "walk" { tembeA } HUM-V %-FMAINV V INF
"<.>"
      "."
(c)
"<This>"
      "this" { h } %DN> CAPINIT DET DEM SG
"<road>"
      "road" { 9SG 10PL barabara , 9SG 10PL njia } %SUBJ N SG NOM
"<is>"
      "be" { INFMARK+wA , ni , si , AUX , LOC } MONOSLB %+FMAINV V
PRES SG3
"<passable>"
      "passable" { pitikA STAT } A-REL %PCOMPL-S A ABS INDEF
"<.>"
      "."
(d)
"<The>"
      "the" %DN> CAPINIT DET
"<children>"
```

```
      "child" { 1SG 2PL toto , 1SG 2PL ana , 9SG 10PL akilimali }
%SUBJ N PL NOM DEF
"<love>"
      "love" { pendA } HUM-V SVO %+FMAINV V PRES
"<each other>"
      "each other" { NOGLOSS } %OBJ PRON RECIPR
"<.>"
      "."
(e)
"<This>"
      "this" { h } %DN> CAPINIT DET DEM SG
"<solution>"
      "solution" { 5SG 6PL suluhisho , 5SG 6PL fumbuzi , 5SG 6PL
tatuzo } %SUBJ N SG NOM
"<is>"
      "be" { INFMARK+wA , ni , si , AUX , LOC } MONOSLB %+FMAINV V
PRES SG3
"<possible>"
      "possible" { wezA V } A-REL %PCOMPL-S A ABS INDEF
"<.>"
      "."
```

The sentences will be semantically disambiguated, and then inflection tags and derivation tags will be added (10).

(10)

```
(a)
"<He>"
      "he" { NOGLOSS } %SUBJ ACR CAPINIT PRON PERS NOM SG3
"<worked>"
      "work" { fanyA kazi } HUM-V %+FMAINV V PAST TAM-li SP-1 OP-
SG1 APPL
"<for>"
      "for" { NOGLOSS } %ADVL ACR PREP
"<me>"
      "i" { NOGLOSS } %<P ACR PRON PERS SG1
"<.>"
      "."
(b)
"<I>"
      "i" { NOGLOSS } %SUBJ ACR PRON PERS NOM SG1 CAPINIT
"<made>"
      "make" { NOGLOSS } SVO %+FMAINV V PAST
"<him>"
      "he" { NOGLOSS } %OBJ ACR PRON PERS SG3
"<to>"
      "to" %INFMARK> INFMARK>
"<walk>"
      "walk" { tembeA } HUM-V %-FMAINV V INF INFMARK CAUS SP-SG1
TAM-li OP-SG3
"<.>"
```

```
      "."
(c)
"<This>"
      "this" { h } %DN> CAPINIT DET DEM SG DEM-9
"<road>"
      "road" { 9SG barabara } %SUBJ N SG NOM
"<is>"
      "be" { AUX } MONOSLB %+FMAINV V PRES SG3 SP-9
"<passable>"
      "passable" { pitikA STAT } A-REL %PCOMPL-S A ABS INDEF TAM-
na SP-9
"<.>"
      "."
(d)
"<children>"
      "child" { 2PL toto } %SUBJ N PL NOM DEF
"<love>"
      "love" { pendA } HUM-V SVO %+FMAINV V PRES TAM-na SP-2 REC
REC
"<each other>"
      "each other" { NOGLOSS } %OBJ PRON RECIPR
"<.>"
      "."
(e)
"<This>"
      "this" { h } %DN> CAPINIT DET DEM SG DEM-5
"<solution>"
      "solution" { 5SG suluhisho } %SUBJ N SG NOM
"<is>"
      "be" { AUX } MONOSLB %+FMAINV V PRES SG3 SP-5
"<possible>"
      "possible" { wezA V } A-REL %PCOMPL-S A ABS INDEF SP-5 A-5
STAT+REC
"<.>"
      "."
```

We see above that the inflection and derivation tags are in correct places. Even if the words are originally adjectives, they are now interpreted as verbs and verb tags are attached to them.

Next we attach the tags to verb stems in appropriata places (11).

(11)

```
(a)
"<He>"
      "he" { NOGLOSS } %SUBJ ACR CAPINIT PRON PERS NOM SG3
"<worked>"
      "work" { SP-1+TAM-li+OP-SG1+fany+I+A kazi } HUM-V %+FMAINV V
PAST
"<for>"
      "for" { NOGLOSS } %ADVL ACR PREP
```

```
"<me>"
      "i" { NOGLOSS } %<P ACR PRON PERS SG1
"<.>"
      "."
(b)
"<I>"
      "i" { NOGLOSS } %SUBJ ACR PRON PERS NOM SG1 CAPINIT
"<made>"
      "make" { NOGLOSS } SVO %+FMAINV V PAST
"<him>"
      "he" { NOGLOSS } %OBJ ACR PRON PERS SG3
"<to>"
      "to" %INFMARK> INFMARK>
"<walk>"
      "walk" { SP-SG1+TAM-li+OP-SG3+tembe+Ish+A } HUM-V %-FMAINV V
INF
"<.>"
      "."
(c)
"<This>"
      "this" { h+DEM-9 } %DN> CAPINIT DET DEM SG
"<road>"
      "road" { 9SG barabara } %SUBJ N SG NOM
"<is>"
      "be" { SP-9+AUX } MONOSLB %+FMAINV V PRES SG3
"<passable>"
      "passable" { SP-9+TAM-na+pitikA STAT } A-REL %PCOMPL-S A ABS
INDEF
"<.>"
      "."
(d)
"<children>"
      "child" { 2PL toto } %SUBJ N PL NOM DEF
"<love>"
      "love" { SP-2+TAM-na+pend+an+A } HUM-V SVO %+FMAINV V PRES
REC
"<each other>"
      "each other" { NOGLOSS } %OBJ PRON RECIPR
"<.>"
      "."
(e)
"<This>"
      "this" { h+DEM-5 } %DN> CAPINIT DET DEM SG
"<solution>"
      "solution" { 5SG suluhisho } %SUBJ N SG NOM
"<is>"
      "be" { SP-5+AUX } MONOSLB %+FMAINV V PRES SG3
"<possible>"
      "possible" { SP-5+TAM-na+wez+ek+an+A V } A-REL %PCOMPL-S A
ABS INDEF
"<.>"
```

" . "

In (b) above, the causative suffix *Ish* is not correct. It should be *z*. It is difficult to formulate a general rule for this variation, because the correct form cannot be derived reliably from the morphophonological context.

The final translation is in (12).

(12)
(a) Alinifanyia kazi.
(b) Nilimtembeza.
(c) Barabara hii inapitika.
(d) Watoto wanapendana.
(e) Suluhisho hili linawezekana.

6 Conclusion

In this report we have tested three methods of handling verb extensions in English to Swahili machine translation. All methods are possible to implement, but the third method is most promising, because it allows more generalisation than the other two methods. However, the risks of mistakes are bigger, especially in case of causative forms, due to lack of reliable rules.