Analysis of Korean-to-English Machine Translation Systems' Treatment of Passives[*]

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This study explores how Korean-to-English machine translation (MT) systems (e.g., Google Translator, NAVER Papago) deal with Korean passive structures. Cross-linguistically, Korean and English passives show different ways to construct passive-voice sentences from active structure. English passives including with be+p.p. may have a 'by phrase' after the verb, which perform the agent of the action. However, Korean has three different passive structures and a rich repertoire of affixes, including case markers, which play critical roles in the production and comprehension of passives, complicating translation to English. Moreover, the grammatical constructions that express passive voice in Korean and English differ in terms of frequency in both written and spoken contexts. To explore production accuracy by two MTs, 213 Korean passive sentences were translated into English passives. This finding shows that current Korean-to-English MTs almost always produce translations that are correct in meaning when they generally translate Korean passives into English passives. They also translate Korean passives into English active voice constructions at significant rates.

Keywords: machine translation, passive, Korean-to-English, Google Translator, Naver Papago

1 Introduction

Machine translation (MT) systems have become highly accurate and reliable in recent years, although their output can still be problematic at times. The most popular MTs in Korea are Google Translator (hereafter, GT) and Naver Papago (hereafter, NP), which are freely available on the web and can be used through computers and cellphones (Kim, 2018; Kim, 2021; Park, 2017). NP offers translation between eleven languages, while GT offers translation of more than one hundred, including English and Korean.

Easily accessible and providing nearly instant results, MTs can be a useful tool in language teaching and learning, and can support foreign language

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learners' learning processes. For instance, EFL learners may use the translation systems to check the target-likeness of their sentence formation. When MTs are used in such ways, however, foreign language learners should know how confident they can be of the output.

Despite the increasing availability and apparent utility of MT systems in daily life, there are few studies on their use in language teaching and learning. Some previous works have reported a variety of errors, such as lexical errors and syntactic errors, in the web-based translation of Korean (Kim, 2018; Kim, 2021; Park, 2017). Kim (2021), for example, investigated how Korean RCs are translated into English RCs in GT and NP. The study's results suggest that MTs are not fully able to deal with the Korean case-marking system. To my knowledge, no study to date has focused on how MT systems translate Korean passives.

The present study speculates that the translation of Korean passives into English could reveal fundamental problems for Korean-to English MTs, and pinpoint the linguistic features that must be reflected in these systems if they are to function reliably. Not only do the structures of Korean passives differ from the structures of English passives, but Korean passives, which utilize particular verbal affixes, are of three different types: (i) lexical passives, (ii) phrasal passives, and (iii) adversity passives (Park, 2005). If crucial distinctions are not reflected in Korean-to-English MTs, the outcomes may be semantically inappropriate, which could be particularly problematic for self-learning students at any level. For MTs to be useful and reliable as foreign language-learning tools, it is important to understand whether and how they make linguistic errors. Therefore, this study tests how two representative Korean-to-English MTs, GT and NP, convert Korean passives into English passives. The remainder of this study is divided into three sections. Section 2 reviews the relevant literature, discussing the history of MT systems, introducing the two MTs used in this study, describing some of the problems that have been observed with MTs, explaining the linguistic difference between Korean and English passives, and presenting the research questions. Section 3 introduces the study's data sources and describes how the targeted structures were collected and processed. Section 4 describes the translation results, and discusses error types and issues in MTs based on the analyzed translation results. Section 5 concludes the paper.

2 Literature Review

2.1 Machine translation systems

As the "Fourth Industrial Revolution" continues, the internet has made the goal of learning a foreign language perhaps more approachable for more people than ever before. A few studies have focused on artificial intelligence–based

tools for the teaching and learning of English as a foreign language in Korea. They have suggested that internet- and machine-based translation engines can play an important role in the teaching and learning of foreign languages (Kim, 2017; Kim, 2018; Kim, 2021; Seo & Kyun, 2019). Among the various MTs available, the crucial strength of GT and NP is their high accuracy, which is based on their ability to rapidly accumulate huge amounts of data (Kim, 2021). The translation machines are able to learn languages themselves; thus, AI technology provides the information basis for using the language by allowing the machines to acquire the target language. When this process works as in Figure 1, communication between humans and machines becomes possible. While it is not like learner-teacher communication, for EFL learners who have few chances to communicate with other speakers of English, used suitably, AI-based machine translation can be an excellent learning tool.

In an ongoing project, the author is conducting research toward a proposal for a process of EFL learning with MTs. The tentative proposal is that such learning takes place in three steps, as in Figure 1. The EFL learners first formulate what they would like to express in English. In order to do this, they might use an MT to extract the (semantically) correct output. To check whether their intention and the output from the MT are in accordance, however, they must be able to comprehend the extracted results. That is, the learners must learn how to use MTs properly and then practice using them. Sufficient practice, meaning many, many trials of translation, leads to the next step, which is learning. "Learning" here refers to the formation of a habit of finding out the correctness/incorrectness of the MT outcomes. As the last step, the EFL learners produce the target language themselves, using it productively and creatively, whether they are aided by MTs or not. At this point, EFL learners will have mastered: (i) how to comprehend the data provided by the MTs (i.e., MT output); and (ii) how to manipulate that data.

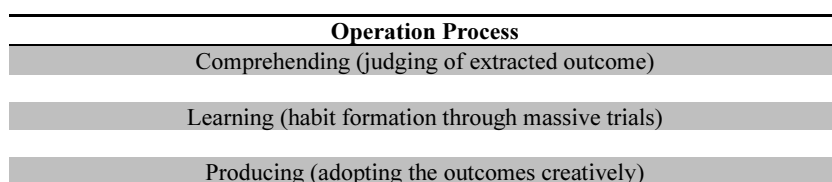| **Operation Process** |
| --- |
| Comprehending (judging of extracted outcome) |
| Learning (habit formation through massive trials) |
| Producing (adopting the outcomes creatively) |

Figure 1. A process of learning through machine translation

2.2 Google Translator and Naver Papago

While many translation machines now exist, GT was the first. In 2006, when it was first developed, only a small number of languages (e.g., English, Chinese, French) were available, but GT currently provides translation services for over one hundred languages (Kim, 2018). NP is one of the free MTs offered by one of the Korean corporations and it uses Artificial Neural Network (ANN) in

order to represent linguistic features of Korean language. Over time, both the naturalness and the accuracy of its output have increased, and this is possible because MTs can be improved through the process of deep-learning-based translation. GT has evolved dramatically because of the massive number of its users. In particular, GT's fundamental method is to create a corpus of data for each pair of two languages; the data can be analyzed by Statistical Machine Translation (SMT), which models the frequency of use of words-words, phrases-phrases, and picks the most frequent to provide as the results of its translation services. Because it is a corpus-based translation method, errors inevitably arise. To avoid this trouble, MTs need to have the capacity to grasp the characteristics of the target language (Park, 2017). Previous studies have argued that machine translation systems remain incomplete, and that the various errors they produce support the claim that human judgment is ultimately required.

While MTs continue to show improvement, they also reveal linguistic problems, such as outcomes that include syntactic errors and ambiguous sentences. In order to utilize MTs for effective foreign language learning and teaching, it is necessary to establish a framework for analyzing the accuracy of the translation results by assessing them on the basis of linguistic knowledge.

2.3 Syntactic and morphological errors in MTs: Korean to English

Previous studies have documented ungrammatical English sentences produced by GT translating from Korean. In the following three examples, the first translation was documented by Park (2017) as the translation offered by GT in 2017. The second translation is the current one offered by GT, and the third is NP's current translation (both in 2022).

(1) Na-nun   khameyla-ka   totwuk-mat-a-se   yehayngci-eyse
    I-Nom   camera-Nom   steal-Passive-and   travel-destination-Loc
    sacin-ul   hancang-to   ccikci-mos-hayess-ta
    picture-Acc one-CL   take-NOT-do-Decl

GT, 2017 (Park): I was stolen from the camera, so I could not take a picture of it on my trip.
GT, 2022: I didn't take a single picture of the trip because my camera was stolen.
NP, 2022: My camera was stolen and I couldn't take any pictures at my travel destination.

In example (1), the error in the 2017 translation happens because the MT does not recognize that the two nouns marked by nominative case markers (*-nun* and *-ka*) serve different functions, with *na-nun* (I-NOM) as the topic of the sentence, and *khameyla-ka* (camera-NOM) as the sentential subject of the

following passive verb. In contrast, GT's translation in 2022, which avoids the obvious errors of 2017, illustrates a frequently observed limitation of MTs; although the 2022 output is grammatical, it is not strictly accurate and does not reflect the detailed, specific linguistic elements of the Korean sentence.

In addition, the MTs make lexical errors, as in the 2017 translations in (2a-b) and (3a-b), which a human processor would not make.

(2a) Ku-uy   hayngtong-ulo inhay ku-ka   patun   pel-tul-un
  He-Poss behavior-with cause he-Nom receive-Pst punishment-PL-Top.
  cengtang-hata
  Justify-Pst

GT, 2017 (Park): The bees he receives due to his actions are legitimate.
GT, 2022: The punishments he received for his actions are just.
NP, 2022: The punishments he received for his actions are justified.

(2b) Ku-nun Pam-i   masiss-tako   sayngkak-hayss-ta
   He-Top chestnut-Nom delicious-Decl-and think-Pst-Decl

GT, 2017 (Park): He thought that night was delicious. (Park, 2017)
GT, 2022: He thought the chestnuts were delicious.
NP, 2022: He thought chestnuts were delicious.

Both (2a) and (2b) show mistranslations in which the 2017 MT makes the wrong choice between two homophones, despite the context and the obvious semantic mismatch. The fact that the translation of homophones based on the context and the speech situation failed also meant that the MT did not understand the context accurately. However, as the 2022 translations of (1) and (2a-b) show, these errors are now avoided by both GT and NP.

2.4 Korean and English passives

Example (3) shows how passive structures (3b) are derived from active (3a) structures in English.

(3a) English Active: The buses produce filthy fumes.
(3b) English Passive: Filthy fumes are produced _ by the buses.

In (3a), the grammatical subject (*buses*) has the agent role. In (3b), *buses* is no longer the grammatical subject, but retains the same thematic role. In formal syntax, the English passive tends to be considered a structure with NP movement: active and passive voices share a deep structure but are realized as different surface structures through transformation (Aarts, 2017). According to Baker (1996, p. 102), voice indicates the grammatical category, showing the

connection between the syntactic subject and its verb. All in all, the function of a passive structure is to defocus the agent of the event denoted by the verb. This is related to the pragmatic function of passives (Shibatani, 1985). Baker (1996) also discussed that the purpose of using English passives is to avoid 'specifying the agent' and to suggest the speaker's objectivity. Across languages, the way the link is established between the voices, or the manner in which the passive is derived, will differ according to typology (Lee, 2010). However, (4a-c) suggests a formula to form passives from actives.

The active-passive correspondence (Quirk et al., 1972, p.160)
(4a) John admired Mary. (NP1+active verb+NP2)
(4b) Mary was admired by John. (NP2+passive verb phrase+NP1)
(4c) Mary was admired.

According to Shibatani (1985), in (4b), *John* is the logical subject, and the syntactic subject *Mary* is the logical object, which means that English passives lose syntactic transitivity while retaining semantic transitivity (Aarts, 2017; Lee, 2010)

English passives are usually categorized into two kinds (e.g., Biber et al. 1999; Cowan, 2008): long passives, which have a 'by' phrase that includes the agent (e.g., 4b), and (ii) short passives, also called agentless passives, which do not have a 'by' phrase (e.g., 4c). According to Celce-Murcia and Larsen-Freeman (1999, p. 354), only 15–20% of English passives take the long form; similarly, Quirk et al. (1972) indicated that four out of five English passives are agentless.

Cowan (2008, p. 398) suggested several reasons to use agentless passives, listed in (5a-d), as well as a few situations in which long passives are preferred, given in (6a-d).

(5a) *The agent is unknown:*
       His car was stolen at the park.
(5b) *The speaker does not want to reveal the agent:*
       I was given his secret information.
(5c) *The agent is understood:*
       The mail was delivered to my front gate.
(5d) *The writer is more interested in the action being reported than in the agent:*
       The participants were given a five-dollar bill.

(6a) *The agent is important new information:*
       That search engine was developed by a young college student.
(6b) *The agent is a famous person:*
       This old soccer ball is signed by the great player Pele.

(6c) *The agent has caused harm or annoyance to the subject:*
      I was kept up all night by my screaming neighbors.

Some scholars consider passives to be of three kinds (e.g., Quirk et al., 1972): agent passives (7a), quasi-passives (7b), and non-agentive passives (7c).

(7a) Tom was interested in physics.
(7b) Physics interested Tom.
(7c) Tom seemed very interested in and keen on physics.

Just like agent passives, quasi-passives have their own active voice as shown in (7b). However, one clear distinction is that *interested* in (7c) is similar to an adjective because: (i) it is coordinated with the other adjective (*keen*) and (ii) the copula *be* verb can be replaced with a *seem*-type verb.

Example (8) shows a Korean active (8a) sentence and a passive (8b) version of it. As Korean has a case-marking system, the agent and patient are clear. Note that, in the passive, the agent is marked by the dative case marker *-eykey* (i.e., forming the counterpart of the English 'by'-phrase).

(8a) Korean Active:
    soneyn-i   soney-lul   anassta
    boy-Nom   girl-Acc   hug-Pst.
    'the boy hugged the girl'

(8b) Passive:
    soney-ka   soneyn-eykey   an-ki-ess-ta
    girl-Nom   boy-Dat   hug-passive-Pst.
    'the girl was hugged by the boy'

In addition, Korean has three varied ways to construct the passive voice, as displayed in Table 1.

Table 1. Three Types of Korean Passives (Tchoe, 2018)

Type of passive	Examples
Phrasal passives: add *-ci* to the verb root	Soney-ka kyeyhoy-i pakkwu-ess-ta p Girl-Nom plan-Acc change-Pst-Decl 'The girl change the plan' kyeyhoy-i soney-uyhay pakkwui-eci-ess-ta Plant-Nom Girl-Dat change-Pass-Pst-Decl 'The plan was changed by the girl.'
Lexical passives: add *-i*, *-hi*, *-li*, or *-ki* to the verb root	Soney-ka soneyn-ul capass-ta Girl-Nom boy-Acc hold-Pst-Decl 'The girl held the boy.' Soney-ka soneyn-eyuyhay cap-hi-ess-ta Girl-Nom boy-Dat hold-Pass-Pst-Decl

	'The girl was held by the boy.'
Adversity passives: In active voice, for the predicate, the noun and the verb *-hata* (do) are adjoined. For passive voice, the noun and the verb *-tanghata* appear and the agent is marked by *-eykey*.	Soney-ka soneyn-ul hayko-hayss-ta Girl-Nom boy-Acc fire-Pst-Decl 'The girl fired the boy.' Soney-ka soneyn-*eykey* hayko-tanghayss-ta Girl-Nom boy-Dat fire-Pass-Pst-Decl 'The girl was fired by the boy.'

Note: Nom (Nominative), Acc (Accusative), Dat (Dative) Pst (Past), Pass (Passive), Decl (Declarative)

Klaiman (1988) claimed that in Korean, unlike in English, the passive is difficult to derive from the active. Korean has some restrictions on the choice of the verb and its direct object in passive constructions. Hong (1992) pointed out that lexical passives let the logical subject lose agentivity while the logical object acquires agentivity, as shown in Table 1. However, the phrasal passives make no change at the semantic level; put differently, as Table 1 indicates, in the phrasal passive, the agent still has the role of agent.

Some previous studies have investigated the linguistic differences of passive structures in English and Korean (Lee, 2010; Kim et al., 2011). According to Kim et al. (2011), Korean passives can be compared with English passives in terms of coding system, agentivity, animacy, and lexicalization. Traditional works on translation between the two languages have conducted contrastive analysis, focusing on linguistic variations using translations of novels from English to Korean as data (Kim et al., 2011). They have shown that English passives are often translated into Korean active voice structures. In fact, passives are used much more frequently in English than in Korean, in both spoken and written discourse (Sohn, 2019; Byun, 2017).

In short, to derive passives from actives, English employs movement, while Korean employs affixes: passive particles on the verb and case markers on the nouns. Research has shown that non-comparable grammatical structures in their native and target languages pose a challenge to EFL learners (Byun, 2017). Hence, both the distinct characteristics of Korean passives and their infrequent use cause difficulties for Korean EFL learners. However, the construction of English passives is simpler, following a regular pattern.

2.5 Research questions

This study investigates the accuracy of two MTs, GT and NP, by examining their performance in translating target structures that clearly differ between Korean and English: passives. The study tested how the two MTs translated all three types of Korean passive structures (lexical, adversity, phrasal),

documented the frequency of syntactic errors in the translation results, and examined the cause of the errors.

This study addresses the following two research questions:

1.   Do two MTs (GT and NP) show accurate results in Korean-to-English translation of the three types of Korean passives?
2.   What kinds of errors do the two MTs make when they translate the three types of Korean passives into English?

3 The Study

This section describes how the data were collected, translated, and analyzed.

3.1 Target structures

The three types of Korean passive constructions are used for translation and analysis. A total of 213 passive sentences were extracted from academic research papers on Korean passives found in the Korean Citation Index as published papers within the last 20 years. Then, GT and NP were used to translate the sentences into English, and the results were categorized. Table 2 shows the breakdown of the entire dataset according to the three types of passive structures.

Table 2. Percentages of Three Types of Passives

Types of passives	Numbers	%
Lexical	98	46.00%
Phrasal	62	29.10%
Adversity	53	24.88%
Total	213	100%

Lexical passives are the most frequently discussed in the academic papers (46%); the phrasal and adversity passives are discussed much less frequently, at similar rates of 29.1% and 24.88%, respectively.

3.2 Procedure

The English results of the two MTs' translations of the Korean passives were analyzed to determine: (i) whether the product's meaning is accurate, and (ii) whether the product is a grammatically correct passive.

As various scholars (e.g., Ferreira & Dell, 2000; MacDonald, 2013; Kim, 2017) have pointed out, language users can choose among various alternative utterances to indicate the intended meaning. For this reason, human translations of a single utterance can vary widely. This study is interested in

whether MTs also produce various alternative translations, and if so, how the translations vary, and how semantically appropriate they are.

By the two translations, Korean passives were entered into an Excel sheet for coding and analysis. To establish reliability, the translations were analyzed by a researcher, and then rechecked by the author. The translations were analyzed twice, first for meaning and the grammaticality. In particular, all responses with passive voices shows the breakdown according to the three types of Korean passives: lexical, phrasal, and adversity passives.

For instance, an example from a research paper on Korean passives is shown in (9), followed by the two translations, one from GT and one from NP.

(9) Lexical passive:
    Totwu-i   kyengchal-eykey pwucap-hi-ess-ta
    thief-Nom Police-Dat (by)   catch-Pass-Pst-Decl
    GT: *The thief caught by the police
    NP: The thief was caught by the police.

All data were entered into an Excel sheet for coding and analysis. To ensure reliability, the translations were recorded by a native-English-speaking researcher, and then rechecked by the author. The translations were then analyzed twice, first for meaning and then for grammaticality/grammatical structure type. In the second analysis, errors were marked and recorded, and the error types were categorized.

For example, when the Korean passive in (10) was entered into GT and NP, both results were semantically accurate. However, the GT output was an active voice sentence, while the NP output was a passive voice sentence. Thus, while both sentences convey what the Korean sentence means, only the NP output reflects the fact that the original Korean was a passive structure.

(10) Lexical passive:
    Emma-eykey ai-ka   an-ki-ess-ta
    Mother-Dat   baby-Nom   hug-Pass-Pst-Decl
    GT: ?Mother held a child.
    NP: A child was hugged by the mother.

In contrast, when the Korean phrasal passive in (11) was entered into GT and NP, the GT translation, 'A prize was set for the guests' is semantically incorrect (it employs the meaning of *sang* 'prize', a partial homophone for *han-sang* 'full table to serve guests'). It is however, grammatical, but does not have the passive form, and therefore was categorized as 'non-passive'. Meanwhile, the NT translation is both semantically appropriate and a passive (although grammatically awkward).

(11) Phrasal passive:
    Sonnim-eykey   han-sang-i   chalie-ci-ess-ta

Guest-Dat   a table(with food)-Nom prepare-Pass-Pst-Decl
GT: * A prize was set for the guests.
NP: ?A table was served to the guests.

4 Results

The first analysis checked all translations for accurate meaning, and found that although NP outperformed GT, all three types of passives were translated with semantic accuracy at fairly high rates. Details are presented in Table 3.

Table 3. English Translations of Korean Passives: Rates of Semantically Accurate Translations Produced by The Two MTs

Type of Korean passive	GT	NP
Lexical	83.67% (82/98)	96.93% (95/98)
Phrasal	82.25% (51/62)	93.54% (58/62)
Adversity	96.22% (51/53)	98.11% (52/53)
Total	86.38% (184/213)	96.24% (205/213)

Table 4. English Translations of Korean Passives: Rates of Grammatically Accurate Passive Structures Produced by The Two MTs

Type of Korean passive	GT	NP
Lexical	60.20% (59/98)	65.30% (64/98)
Phrasal	58.06% (36/62)	62.90% (39/62)
Adversity	83.01% (44/53)	84.90% (45/53)
Total	65.25% (139/213)	69.48% (148/213)

Table 4 shows the rates at which the translations were passive structures. The remainder of this section focuses on the analysis of non-target output, in two main categories: (i) semantically appropriate forms that are, however, not passives; that is, active voice sentences with relatively target-like meanings; and (ii) semantically inappropriate forms, of three types: (a) non-passives that are correctly formed active sentences with incorrect meanings; (b) non-passives that are structures that are not full sentences (e.g., relative clauses), with correct or incorrect meanings; and (c) passives with incorrect meanings (e.g., with mistranslated lexical items). To better understand the types of errors made by MT systems in producing English passives based on Korean passives, the analysis is separated by type of Korean passive.

4.1 Lexical passives

Table 5. Percentage of Non-target Responses for Lexical Passives

	Semantically appropriate	Semantically inappropriate	
	Active voice	Non-passives	Wrong meaning

| GT | 22.44% (22/98) | 11.22% (11/98) | 5.10% (5/98) |
| NP | 31.63% (31/98) | 0% (0/98) | 3.06% (3/98) |

For the lexical passives, both MTs produced semantically appropriate forms that were not passives as the most frequent type of non-target output. In other words, they fairly frequently provided active voice structures with the same meaning as the Korean original, as shown in (12). Semantically inaccurate responses occurred much less frequently; in GT but not NP, some of these were also not passives. (12) presents an example. In English, the verbs *open* and *close* can be transitive or intransitive; both MTs' translations use them as intransitive verbs, and intransitive verbs cannot be made passive. Meanwhile, the Korean counterpart *yetat-ta* is transitive; hence, the addition of the passive morpheme *-hi* forms a passive with the implication that there is an unmentioned agent responsible for the acts of opening and closing. Hence, a more appropriate translation would be 'the door is opened and closed'.

(12) Chwuipmwu-i yetat-hin-ta
     Door-Nom open-close-Pass-Decl
     GT: door opens and closes
     NP: The door opens and closes

Next, the example in (13) shows two different translations. The NP output is semantically appropriate and grammatically correct, but not passive. The GT output is grammatically inappropriate, as it is a relative clause rather than a full sentence.

(13) menci-ka   palam-ey   nal-li-ess-ta
     Dust-Nom wind-By   blow-Pass-Pst-Decl
     GT: *dust blown in the wind
     NP: Dust blew in the wind

(14) shows another example, in which, again, NP produced a semantically appropriate and grammatically correct but non-passive sentence. This time, however, GT produced a grammatically correct active voice sentence with the incorrect meaning.

(14) Chelswu-eykey isanghan somwun-i   tul-li-ess-ta
     Chelswu-Dat   strange   rumor-Nom hear-Pass-Pst-Decl
     GT:* I heard strange rumors about Cheol-su
NP: Cheol-soo heard a strange rumor.

4.2 Phrasal passives

For phrasal passives, the same non-target categories appeared in the translations, with the addition of a single lexical error leading to a semantically

inappropriate sentence, which is the example in (12) in section 3.2. As this is very rare, it will not be further discussed.

Table 6. Percentage of Non-target Responses for Phrasal Passives

	Semantically appropriate	Semantically inappropriate		
	Active voice	Lexical error	Non-passives	Wrong meaning
GT	82.25% (51/62)	1.61% (1/62)	6.45% (4/62)	9.67% (6/62)
NP	30.64% (19/62)	0% (0/62)	6.45% (4/62)	0% (0/62)

For the phrasal passives, while both MTs sometimes provided semantically appropriate forms that were not target-like passives, GT did so at a much higher rate. (15) is an example.

(15) i sangcem-uy cwuin-i pakkwui-eci-ess-ta
     This store-Poss owner-Nom change-Pass-Pst-Decl
     GT: This store has changed owners
     NP: The owner of this store has changed

GT's output in (15) is due to the fact that in English, the verb 'change' can be used intransitively; therefore, these can be derived. However, in Korean, *pakkwu-ta* means to change in an active way but *pakkwui-eci-ess-ta* does 'was changed' in a passive way. This crosslinguistic distinction led to the difference in the examples extracted from the two MTs.

In (16), GT translated the Korean phrasal passive sentence as a fragment in the form of a relative clause, leading to a semantically inappropriate meaning.

(16) Kotwupepwun-uy   phankyel-i   taypepwen-eyse
     High court-Poss   decision-Nom Supreme Court-Loc
     twicip-eci-ess-ta
     overturn-Pass-Pst-Decl
     GT: *High Court decision overturned by Supreme Court (inanimate)
     NT: The High Court ruling was overturned by the Supreme Court

4.3 Adversity passives

The non-target translations of the adversity passives were all non-passives, some semantically appropriate and some semantically inappropriate; that is, there were no lexical errors or passives with the wrong meaning among these translations, as shown in Table 7.

Table 7. Percentage of Non-target Responses for Adversity Passives

	Semantically appropriate	Semantically inappropriate
Types of error	Active voice	Non-passives
GT	13.20% (7/53)	3.77% (2/53)
NP	15.09% (8/53)	0% (0/53)

(17) shows an example of GT's active voice output with a similar meaning as the passive, while NT's output is both semantically appropriate and passive.

(17) ku-nun wuli-eykey   conkyeng-pat-nun-ta
    He-Nom we-Dat   respect-Pass-Prog-Decl
    GT: he deserves our respect
    NP: He is respected by us

(18) is an example in which GT produced a non-passive form, which never occurred for phrasal passives in NP. Again, GT produced a relative clause rather than a full sentence.

(18) hohuphki-ka   phayel-toy-ess-ta
    Respiratory organ-Nom destruct-Pass-Pst-Decl
    GT: *ruptured respiratory tract (inanimate)
    NP: The respiratory system ruptured

5 Conclusion

The purpose of this study is to investigate how Korean passives are translated into English through two MTs, Google Translator and Naver Papago. All three types of Korean passives were translated using these MTs to determine their rates of semantic accuracy as well as the rates at which the translations were rendered in passive voice.

    First, both MTs translated the Korean passives into semantically appropriate English passives at fairly high overall rates: GT at 65.2% and NP at 69.40%. Broken down by type of Korean passive, the rates were as follows: for lexical passives, 60.20% for GT, 65.30% for NP; for phrasal passives, 58.06% for GT, 62.90% for NP, and for adversity passives, 83.01% for GT, 84.90% for NP.

    Second, even when they did not produce passives, the MTs mostly provided sentences with the proper meanings, albeit in active voice. If this output is included in acceptable translations, the rates are much higher: for lexical passives, 83.67% for GT, 96.93% for NP; for phrasal passives, 82.25% for GT, 93.54% for NP; and for adversity passives, 96.22% for GT, 98.11% for NP.

Third, however, they also produced some inappropriate translations. In particular, rather than providing a full sentence, they sometimes presented relative clauses constructed of the head noun with a modifying adjectival clause. In these cases, the translation of individual words is correct, so the meaning of the translation is related to the meaning of the original. Unaddressed in this study is the possible effect of animacy; Korean passives most commonly use an animate noun as a grammatical subject. However, the RC response errors are too few to analyze the effect of animacy on the head nouns (here, the grammatical subject in passives).

Fourth, the outcomes from the MTs are very much like the results of human language processing mechanisms. Previous work by Kim (2021) on using MTs to translate Korean relative clauses into English relative clauses observed that the MTs' patterns were quite similar to what human beings are likely to produce in a natural setting. Similarly, it is not uncommon for English-speaking adults and children to choose active voice rather than passive voice when both are available and appropriate. In fact, both L1 and L2 speakers have been documented as choosing active voice structures as an avoidance strategy; that is, avoiding the more complex structure in favor of the simpler structure.

In sum, Korean passives are translated by the most popular MTs with both grammatical and ungrammatical forms. In particular, it seems that MTs can successfully produce active voice translations of Korean passives. Compared to the findings of earlier work on MTs, this study found minimal translation problems related to Korean case markers. It can be concluded that the two MTs have stored a great deal of information on the three Korean passive structures, which has led to remarkably accurate results, while still allowing for variation between them. To further improve the reliability of translation data on Korean to English passives, however, it is important to notice that MTs' outcomes are not always perfect. In particular, the MTs sometimes produce active voice rather than passive voice, which may be due to differences in the (in)transitivity of the most frequent verbs for some meanings, such as *open* and *change*, in the two languages.

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