Experimental Study of Inter-Language and Inter-Generational Intelligibility: Methodology and Case Studies of Ryukyuan Languages

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1 Turning Subjective Judgment to Objective Understanding

The literature of Ryukyuan languages has made various claims, including: "this language is not intelligible to that (neighboring) language/dialect," "fluent speakers are 60 years old or above," or "younger generations are Japanese monolingual or understand the local language but do not speak it" (Pellard & Shimoji 2010, Takubo 2013, among others). These statements

Japanese/Korean Linguistics 26.
Edited by .

are solely based on the researcher's or her/his consultant's subjective judgment. The reports on the inter-generational language transmission of the endangered languages (UNESCO Ad Hoc Research Group on Endangered Languages 2003) in Japan are also based on such a subjective judgment (Kibe et al. 2010, cf. Yamagiwa 1967).

The goal of this study is to establish a crosslinguistically valid and objective methodology for testing language intelligibility. Drawing on Yang et al's (2016) intelligibility test for Jejueo, we constructed a standardized test for language intelligibility. In this paper, we report our findings for crosslinguistic intelligibility targeting Okinoerabu-Ryukyuan, Miyako-Ryukyuan, Tsugaru-Japanese, and Standard-Japanese. We will also report the results of inter-generational intelligibility of Okinoerabu-Ryukyuan. Specifically we aim to answer the following questions:

(1) Questions concerning inter-language intelligibility
   a. Is language/dialect L_1 intelligible to speakers of another language/dialect L_2 and vice-versa? More specifically;
   b. Are Ryukyuan languages mutually intelligible?
   c. Do monolingual speakers of Standard Japanese understand Ryukyuan Languages or other mainland languages/dialects?
(2) Questions concerning inter-generational intelligibility
   a. Do younger generations understand the local language?
   b. If so, how young can they be?

From the viewpoint of intelligibility, we would conclude that languages L_1 and L_2 are different or independent languages if L_1 is not intelligible to L_2 and vice versa (Hockett 1985). We would also conclude that inter-generational transmission of language L ceased at generation G if the language community members of L from the generation G do not understand the language L.

2 Comprehension Tests

The comprehension tests we carried out start with a short narrative (approximately two minutes) spoken in the language we are examining. Participants first report the general level of understanding of the narrative (from 0% to 100%), then listen to twenty episode descriptions and answer comprehension questions.

The whole narrative and the episode descriptions are presented with sound only in the target language, while the questions are presented both with text and sound in Standard Japanese. We decided to use Standard Japanese, the language that all the participants understand, for questions in order to focus on the participants' ability to understand the episode

description, by eliminating the possiblity they understand the episode description but do not understand the question. The comprehension test is schematically shown in Figure 1.

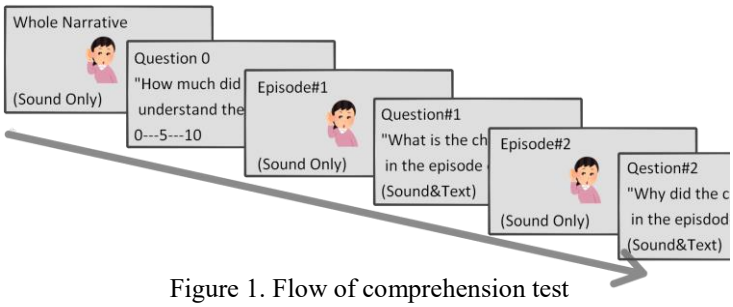

Figure 1. Flow of comprehension test

2.1 Preparation of the Comprehension Tests

In order to make the narrative and episode descriptions sound as natural as possible, we used two short movies (*Pear Story* (Chafe 1980) and an episode of *Pingu*[1]) and created the narrative with a fluent native speaker (the master narrator) describing the events of the episode. Both movies are free of speech and cultural cues that might help the participants of the experiment guess the contents of the episode without understanding the language completely.

We created a model of twenty descriptions corresponding to episodes in the movie using Standard Japanese in order to gurantee the consistency of the content across the languages we were testing. The model was used to guide the master narrator to avoid missing some episodes and not to describe irrelevant episodes.

We also prepared a comprehension question for each description within an episode. Since we are interested in the intelligibility of a language from a naturalistic, global point of view, the questions were not about mere vocabulary knowledge. They were also carefully constructed to avoid giving any clues for the description or for the whole story.

Half of the questions ask about information in the matrix clause (MATRIX type) and the other half about information in the embedded or subordinate clause(s) (EMBEDDED type). Below are examples of each type in four Japonic languages; 1 in Okinoerabu-Ryukyuan, 2 in Miyako-

[1]We used *Pingu Runs Away from Home* posted by Pingu Official YouTube Channel at youtu.be/iCag8yqPjTM (originally posted on Feb.14, 2011; last accessed on Mar.31, 2019) We found *Pingu* movies especially useful for the current purpose because the events that happen in the movie are very concrete as their intended audience is children.

Ryukyuan, 3 in Tsugaru-Japanese, and 4 in Standard Japanese. Note that the questions were presented in Standard Japanese, the language shared by the researchers and all speakers of these languages.

(3) Episode and Question MATRIX type (asking the matrix VP)

a. Episode description;

1.	aɕa=tu	ama=tu	iŋga=nu	kwaa=nu	jii	kaduɴ.
2.	zza=tu	mma=tu	bikidun	jarabigama=nu	jui=ju	faijui.
3.	tottɕa=do	kattɕa=do	odogo	warasɨ	baŋge+mama	kuttera.
4.	otoosan=to	okaasan=to	otoko=no	ko=ga	baŋgohan=o	tabeteiru.
	father=COM	mother=COM	male=GEN	child=NOM	dinner=ACC	be.eating

"Father, mother, and a boy are having a dinner."

b. Question; "What is/are the character(s) in the episode doing?"

c. Answer; "(They are) having dinner."

(4) Episode and Question EMBEDDED type (asking the reason clause)

a. Episode description;

1.	jinga=nu	kwaa=wa	waɕimitɕutantu	iʑiti	iʑan.
2.		ffaa	tsumudiutaiba	idii	hatai.
3.	odogo	warasɨ	ogodderahande	dehatte	itta.
4.	otoko=no	ko=wa	okotteitanode	dete	itta
	male=GEN	child=TOP	angry.PAST.because	get.out.SEQ	go.PAST

"The boy went out because he was angry."

b. Question; "Why did the character(s) in the episode do so?"

c. Answer; "Because (he was) angry."

2.2 Field Recording and Compiling the Sound Files into a Test

At each site, a fluent native speaker (the master narrator) watched the two movies and was asked to describe what occurred, guided by the twenty episode descriptions prepared in advance. We recorded twenty episode descriptions and compiled them into a narrative.[2]

We asked the master narrator whether the questions we prepared could be answered after listening to the episode descriptions. We allowed minor variations of the episode descriptions in different languages as long as they were sufficient to answer the comprehension questions.

The sound files obtained from the master narrator were placed in the skeleton of the comprehension tests in the form of a Microsoft PowerPoint file as illustrated in Figure 1 above.

[2]The master narrator was asked to assess the naturalness of the complied narrative and correct the parts that did not sound natural as a discourse.

3 Intelligibility Experiment

Following the creation of the comprehension tests, we recruited a group of fluent native speakers from each field site to take the comprehension test in their native language as a base line and another test in a different language in order to assess the inter-language intelligibility. We also recruited people from younger generations who are considered by speakers to be unable to speak the local language in order to assess the inter-generational language transmission. The ages of the participants may be found in Section 5.

Each participant participated in the intelligibility experiment individually, using a laptop computer and a dynamic speaker for a (semi-)[3] self-paced comprehension test. Participants were instructed to give an answer to each question in Standard Japanese. These answers were recorded by the experimenter. No feedback was given until the whole session is over.

(5) Experiment Procedure

1. Consent form and collection of participant's information, including their subjective attitudes towards the languages tested
2. Practice session in Standard Japanese to become familizalized with the task (a narrative, three pairs of an episode description, and a comprehension question)
3. Break
4. Comprehension test in the participant's local language
5. Break
6. Comprehension test in another language

4 Scoring

The oral answers were transcribed and coded into a score by the experimenter and another coder systematically following the scoring criteria (6). When the two coders gave different scores, they discussed until their scores converged.[4] The maximum score possible for a given participant on the comprehension test was twenty points. This was interpreted as her/his intelligibility score of the language used in the comprehension test.

(6) Scoring criteria (0/0.5/1 for each question)

a. 1 even if the elements in the question are omitted in the answer.
b. 0.5 if corresponding Japanese words (if any) are answered with different words.

[3] For elderly people, the experimenter pressed the space key to move on to the next slide.

[4] We did not employ completely naïve coders because the coders need to have knowledge of the language tested.

c. In [Obj V], 0.5 if Obj is missing, 0 if V is missing.
d. In [Obj Obj V], 0.5 if two elements are answered, 0 if only one element is answered.
e. 1 even if non-core arguments are missing.
f. 0.5 if unnecessary extra elements are added

5 Results

We ran the intelligibility experiments in Nishihara village on Miyako island (where Ikema-Miyako-Ryukyuan is spoken), Hyoo village and Kunzjai village in Okinoerabu island, and a supplementary experiment at two colleges in Tokyo. Below we report the results site by site.

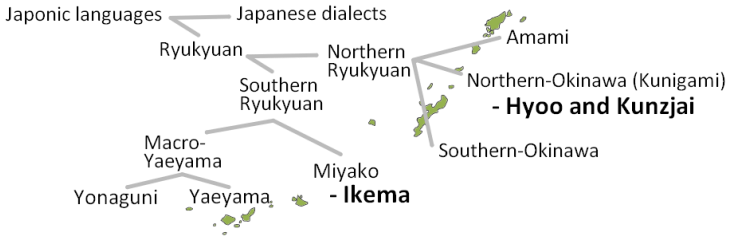

Figure 2. Japonic Languages

5.1 Inter-Language Intelligibility

5.1.1 Nishihara Village in Miyako Island

We tested Hyoo-Okinoerabu intelligibility to Ikema-Miyako fluent native speakers and found that Hyoo-Okinoerabu is not intelligible to Ikema-Miyako speakers as shown in Figure 3 ($p<0.001$).

(7) a. Participants;
10 fluent native speakers of Ikema-Miyako (age mean=69.67)
b. Comprehension tests in; Ikema-Miyako (Southern Ryukyuan)
Hyoo-Okinoerabu (Northern Ryukyuan)
c. Scores of the tests; Ikema-Miyako test: mean=19.3, SD=0.63
Hyoo-Okinoerabu test: mean=2.45, SD=2.54

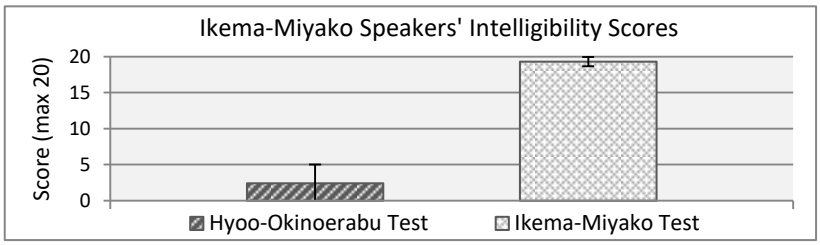

Figure 3. Ikema-Miyako speakers' intelligibility score

5.1.2 Hyoo Village in Okinoerabu Island

We also tested Ikema-Miyako intelligibility to fluent native speakers of Hyoo-Okinoerabu and found that Ikema-Miyako is not intelligible to Hyoo-Okinoerabu speakers as shown in Figure 4 ($p<0.001$).

(8) a. Participants;
11 fluent native speakers of Hyoo-Okinoerabu (age mean=73.10)
b. Comprehension tests in; Hyoo-Okinoerabu (Northern Ryukyuan)
Ikema-Miyako (Southern Ryukyuan)
c. Scores of the tests; Hyoo-Okinoerabu: mean=18.23, SD=1.79
Ikema-Miyako: mean=0.82, SD=0.64

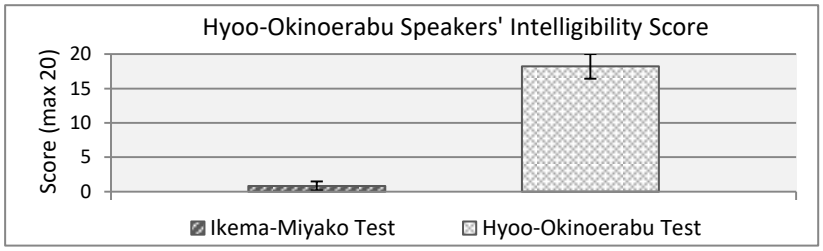

Figure 4. Hyoo-Okinoerabu speakers' intelligibility score

5.1.3 Supplementary Study in Tokyo

As a supplementary study, we also tested Tsugaru-Aomori-Japanese and Hyoo-Okinoerabu-Ryukyuan intelligibility to Standard Japanese monolingual speakers in Tokyo. In contrast to the tests carried out in Nishihara Village and Hyoo Village, all these participants took the comprehension tests in a classroom at the same time instead of individually. They also wrote down their answers instead of orally responding to the questions. See section 6 for discussion.

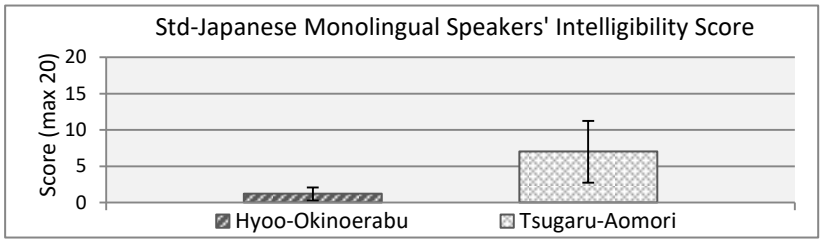

Figure 5. Standard Japanese monolingual speakers' intelligibility score

(9) a. Participants; 82 college students, born and raised in Tokyo area, both parents from Tokyo area
b. Comprehension tests in; Tsugaru-Aomori-Japanese

Hyoo-Okinoerabu-Ryukyuan

c. Scores of the tests; Tsugaru-Japanese: mean=7.00, SD=4.23
Hyoo-Ryukyuan: mean=1.20, SD=0.90

5.2 Inter-generational intelligibility

5.2.1 Hyoo village in Okinoerabu island

We tested the local language intelligibility to language community members around 40 years old in Hyoo village in Okinoerabu island. The villagers in general think that the participants in this age range do not speak or understand the local language. However, we found that the particpants' understanding of the local language did not significantly differ from that of the fluent native speakers (p=0.373).

(10) a. Participants;
10 young language community members, born and raised in Hyoo village (36-48 years old, age mean=42.18)
11 fluent native speakers of Hyoo-Okinoerabu (age mean=73.10)
b. Comprehension tests in; Hyoo-Okinoerabu(, Ikema-Miyako)
c. Scores of the generations; Young: mean=17.32, SD=2.78
Fluent NS: mean=18.23, SD=1.79

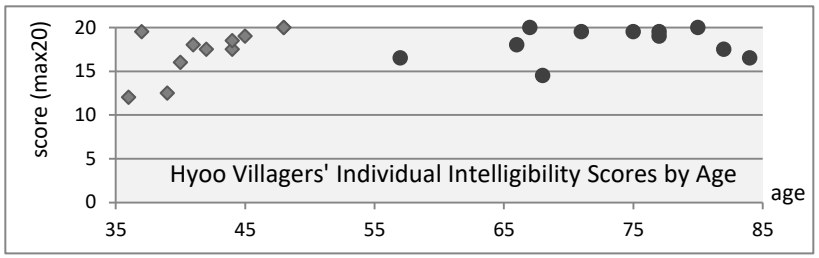

Figure 6. Intelligibility of the local language in Hyoo village by age

5.2.2 Kunzjai village in Okinoerabu island

We ran the same experiment in another village in Okinoerabu island, Kunjai, with language community members in their 40s. The result was essentially the same as in Hyoo village: participants in their 40s do not understand the local language significantly less than fluent native speakers (p=0.574).

(11) a. Participants;
10 young language community members, born and raised in Kunzjai village (40-49 years old, mean=46.30)
10 fluent native speakers of Kunzjai-Okinoerabu (age mean=68.09)
b. Comprehension tests in; Kunzjai-Okinoerabu(, Hyoo-Okinoerabu)

c. Scores of the generations; Young: mean=17.90, SD=2.02
Fluent NS: mean=17.41, SD=1.91

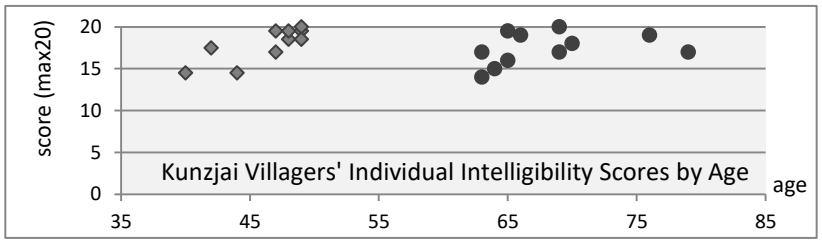

Figure 7. Intelligibility of the local language in Kunzjai village by age

6 Discussion and Concluding Remarks

6.1 Establishing a Method to Test Language Intelligibility

The fluent native speakers of three Ryukyuan languages scored nearly perfectly for their own language in our intelligibility experiment, while Japanese monolingual speakers scored close to zero. We have demonstrated that the comprehension tests we made suffice to test the intelligibility of Ryukyuan languages. In other words, the same comprehension tests can be used to test mutual intelligibility of other Ryukyuan languages and to test comprehension by different generations in a community[5].

6.2 Inter-language intelligibility

Subjective claims such as "this language is not intelligible to that language/dialect" were proven to be true for Ikema-Miyako (Southern Ryukyuan) and Hyoo-Okinoerabu (Northern Ryukyuan). In other words, they are not mutually intelligible. However, such claims have never been substantiated scientifically until now.

Under the assumption that if two linguistic variants are not mutually intelligible then they are different languages, Ikema-Miyako and Hyoo-Okinoerabu are different languages. This is true even though they share many cognates and must have split relatively recently (<1,000 years). The result of the comprehension test in Tsugaru-Aomori-Japanese suggests that Tsugaru-Japanese may not be intelligible to Standard Japanese monolingual speakers either. Under the same assumption, it may be more appropriate to consider them different languages, though we point out a potential 'intelligibility distance' is greater for Ikema-Ryukyuan than for Tsugaru-Japanese to Japanese monolingual speakers.

[5]Yokoyama & Kagomiya (to appear) confirmed the validity of our experiment with more participants in Kunjzai village.

The purpose of this paper is not to make a strong claim about a language variety's status as either a 'language' or a 'dialect'. However, the findings reported in this paper have implications for documentation of the linguistic variants in Japan. Given that almost all of the local languages in Japan are in danger of extinction, (their degree of) intelligibility to other well documented language varieties can be used as a criterion to guide the documentation works efficiently. We should also add that our results should not be taken to challenge the language communities' subjective attitude toward their own language and neighboring languages. Both objective measures and the subjective sentiment should be taken into account when we make our judgment for the imminence of endangerment.

6.3 Inter-Generational intelligibility

The other subjective claims we raised in the introduction can now be restated on objective grounds. At least in Hyoo and Kunjzai villages in Okinoerabu island, speakers in their 40s do not understand the local language significantly less than the fluent native speakers.[6] In other words they have linguistic knowledge of their local language and are therefore passive bilinguals of Japanese and their local language.

Yokoyama & Kagomiya (to appear) extended the current method to test inter-generational intelligibility with additional age groups in Kunzjai village in Okinoerabu island. Their intelligibility scores can distinguish between passive bilinguals and Japanese-monolinguals. This information is vital for a language revitalization project.

Concerning language revitalization, we have reported the results of the intelligibility experiments through newsletters (Yamada & Yokoyama 2017) and talks in the language communities (Takubo 2018, Yamada 2017, Yokoyama 2017) so that community members can gain an objective understanding of the situation of their local language, which has been described simply as 'in danger of extinction'. The community members, especially the passive bilinguals in Okinoerabu island, have been empowered by the findings that they have linguistic knowledge to understand their local language and there are now many people actively involved in different language revitalization projects (Yamada & Yokoyama 2018, 2019).

Acknowledgements

We would like to thank all the language community members who collaborated with us for this study. The following grants made this study

[6]We obtained the same result for people in their 50s at Nishihara village in Miyako.

possible: Toyota Foundation (D15-R-0637), JSPS Grant-in-Aid (17H02333, 16K16824, 17J04617), Hakuho Foundation, and NINJAL Institute-based Project "Endangered Languages and Dialects in Japan."

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