Auditory Discrimination of Content and Function Words: A Pilot Study

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Abstract

This is a report on a pilot study concerning Japanese university students' ability to discern content and function words. Given the high working memory capacity required for non-automated content word acquisition, it seems natural that function words with their hyper-frequency in the English lexicon would be automated more readily than the far less frequent content words; yet that is not how second language acquisition occurs. In this study I examined what students were hearing and to what frequency they were discerning function words versus content words, and within content words' parts of speech what were students hearing.

Keywords: function words, content words, listening comprehension

John Field (2008) asked the question, bricks or mortar? He was of course referring to which parts of lexical input, the *closed* or *open* class of word categories that make a language's lexical units, do second language listeners rely on during the process of input comprehension. In native English, content words, the *open class* that carries lexical meaning, "receive some stress according to basic phonological-lexical rules of the language, the prominent word will receive even greater stress, usually indicated by lengthening the vowel sound" (Rost, 2011, p. 55) while the nonnative listeners (NNL) of English receive no such markers when dealing with function words, or the *closed class* (e.g. of auxiliary verbs, conjunctions, determiners, prepositions, pronouns, and quantifiers).

In Field's study examining how listeners handle function words versus content words, he asked: What are students hearing when they listen to "authentic"

English examples in the learning environment and how does it affect their listening comprehension? Given the relatively limited number of function words in English, roughly 300, it is reasonable to expect that nonnative listeners can notice and process them more efficiently than the vast number of possible content words. However, Field suggested that the opposite is true; function words are identified significantly less accurately than content words by second language listeners, even amongst higher proficiency learners (p. 426). Taking Field's study as a model, I have attempted a pilot-replication study to examine to what degree Japanese nonnative listeners of English in their first year, second semester of university English studies are able to process content and function words accurately and efficiently over a multiple-playback of a prerecorded presentation related to a topic covered in their English course.

Literature Review

Field (2008) observed that quite a few studies have been conducted outside of the field of second language acquisition on the difference between how content words and function words are processed (p. 412). One strand of inquiry has been in the field of psycholinguistics examining why higher frequency content words reduce access time for speakers, but relatively high frequency function words do not share that advantage. A study conducted by Segalowitz and Lane (2000) showed for the first time that lexical access to function words is actually faster than for content words, perhaps due to the extremely high frequency of such words in a first language. As noted by Field (p. 412), Segalowitz and Lane argued that two distinct processing areas are not needed, due to function word hyper-frequency, yet quite a few researchers have concluded that content and function words are separately processed in different parts of the brain. In addition to those listed by Field, Mohr et al. (1994) showed tachistoscopically that cortical processing differs for function words, which appeared to be processed in the right

hemisphere of the brain; content word recognition was absent in the right hemisphere instead initializing in the left, the hemisphere usually associated with language.

One could imagine that processing and hearing might very well be two different things. If a NNL is unable to hear the unstressed or lightly stressed function words over the strongly stressed content words, all the processing speed or automatization in the world is unlikely to do them any good. As Cutler and Clifton (2000) wrote, "(f)or a spoken message to be understood … the perceiver must find and recognize … discrete parts" despite the fact that "they are uttered in a continuous stream, and coarticulation and other phonological assimilations may cross word boundaries" (p. 130). NNL would face additional disadvantages if coming from a *syllable-timed* language such as Japanese and attempting to parse the *stress-timed* language of English; How much processing capacity would be left to attend non-stressed words?

Field (2008) noted the importance of content words in relation to working memory capacity, as opposed to function words that are not central to meaning, and the likelihood that function words are "awarded less attention by the listener at the time they are being heard" (p. 415). Researchers such as Martin and Ellis (2012) looked at the role of working memory, divided into two really a working memory and phonological short-term memory, in listening comprehension as (a) temporary storage site(s), allowing lexical and grammatical retrieval of recently heard input. If function words are processed separately, as Mohr et al. (1994) suggested, then would working memory be further stressed as it tries to access and process from both sides of the brain? Surely the most efficient processing feature would be to "award less attention" to the less meaningful of the two categories to facilitate comprehension. Vandergrift and Baker (2015) discussed the role and limited capacity of the central executive in listening research, particularly how it controls "the flow of information between the components and other cognitive

processes" and maintains focus and inhibits "distracting information, behaviors crucial to listening success" (p. 396). This suggest that in the grand scheme of listeners' needs, the central executive would act as a cut-off valve, limiting the flow of non-essential information (function words) in favor of essential information (content words) needed for comprehension.

Two questions are addressed in this study: How do Japanese university students of varying proficiency levels process content and function words in a paused transcription listening activity? What difficulty, if any, do various forms of lexical inflections and contractions pose?

Method

1)　Participants

Nine Japanese learners of English were selected from two intact classes in the second semester of the academic year. Both classes were categorized as lower level, based on students pre-semester TOEFL-ITP paper-based test scores as administered every semester to English students as an exit mechanism from the English language program. Student TOEFL-ITP scores for lower level class placement are between 400 and 440. A score of 500 or higher is considered a passing score and to pass English courses at this university a student must achieve the predetermined TOEFL-ITP mark to continue with major courses. Roughly 90% of students pass within their first year of English courses, but the second semester students often are less motivated and more test-anxious than in the first semester.

The nine participants (2 males and 7 females) were all in their late teens and were selected from a total population of 33 students, all of whom were taught by the researcher. The NNLs were divided into three proficiency groups (low, medium, and high) based on in-class performances, student-instructor one-on-one practice speaking tests and my evaluation of various in-class listening

performances over the course of the semester. Eight of the students were typical Japanese students of English, having studied since junior high and attended cram schools for passing English exams to enter university. One participant, designated H3, had studied abroad for a single semester as a junior high school student. She displayed advanced pronunciation skills, more proficient speaking skills, and for the most part better listening comprehension. The justification for including her over another student was in previous fill-in-the-gap listening activities she did not seem to be at an advantage over other students, so I felt that while her speaking skills were more advanced than other students in the class, her listening comprehension was on par with the higher level students but not beyond the class ceiling.

2)   **Material: Paused Transcription**

As this was a replication pilot study of Field's (2008) research, a similar method of testing was used. Given the limitations of short-term memory when using longer listening tasks, is to "pause at specific points during the input phase of the activity – either by pausing the audio or video or by stopping the narration if the teacher is proving the input directly" (Rost, 2011, pp. 198-199). Like Field's paused transcription (pp. 418-419), this study's paused transcription targeted short sections of five words to limit overloading working memory. Eleven short pauses were inserted into the recording in an attempt to allow participants to hear a text "naturally," but then transcribe what they last heard accessing the independent verbatim information stored separately from general text content as proposed by Schönpflug (2008).

3)   **Material**

The recording (see Appendices A and B for the script and a breakdown of the targeted five-word chunks of transcription, respectively) was based on a text

associated with the class textbook chapter topic of space exploration, modified to eliminate words of over three-syllables and provide a slightly more balanced number of content words (27) that students had studied and function words (28). The vocabulary used in the text was within the participants' range of vocabulary, as all lexical items were introduced in previous class sessions or assignments. I also attempted to include a reasonable mix of content words from the four main parts of speech to a limited degree of success. Adding a mixture of suffixed and prefixed words to the text was more difficult, and only resulted in six of the former and two of the latter (both of which used the prefix *un* – which students should be familiar with). The recording was made using an Olympus handheld Voice-Trek VN-702PC recorder which has served in the past as a reliable voice-recorder that produces a clear sound. The recording was transferred to a laptop for classroom use.

Most studies that measures speaking speed do so in the number of syllables per second (SPM), number of runs, and average length of run (see Baker-Smemoe, Dewey, Brown, & Martinsen, 2014; Iwashita, Brown, McNamara, & O'Hagan, 2008; Kormos & Trebits, 2012) or a combination of those factors, but this can be a somewhat unwieldy and time consuming process. For this study, the simpler, albeit less accurate, words per minute (WPM) was used instead. A study (Ryan, 2000) on English native speaking children and mothers found that adult women have a speech rate of around 276 WPM, or 331 SPM, which is much higher than most text recordings the students are used to hearing in class. The original recording, before modification, had a speech rate of 116 WPM. This is a much lower rate of speech than usually reported in native English speaker speech. "Faster delivery of speech is assumed to cause more listening difficulty, because it affords a shorter period of time to process the incoming information" (Brunfaut & Revesz, 2015). According to McBride (2011) speed of speech is often related to overloading of a listener's working memory. Studies such as Griffith's (1990)

looking at temporal variables for Japanese speakers, have noted that slower rates of speech often allow NNLs to comprehend more of what they are hearing. I reached a compromise for this study, deciding to record and analyze my own words per minute used during the course of several class sessions, a rate of around 135 WPM. A rate of 133 WPM was used in this study. Presumably the students are familiar not only with my voice (accent), but also my rate of speech, perhaps helping to reduce some of the cognitive overload during the transcription process.

4)　Procedure

Participants were administered the paused transcription listening activity in their normal classrooms and class time. They were told that they would hear a recording of a presentation on the effects of space on human health, that the recording would have 11 pauses, and they were to write the last four or five words they had heard. A comprehension check of the instructions was preplanned into the beginning of the activity to ensure that students understood the directions.

The recording was played using a laptop connected to surround-sound speakers embedded in the classroom. The level of the speaker audio quality was moderate at best as the room acoustics were not intended for language classes, as it is a science building with high ceilings and many pipes and conduits which somewhat distort sound. Students were informed that they would hear the recording three times and that each time they were to use a different colored writing instrument, to be provided to them, for each playback. Pencils with no erasers were passed out for the first paused text transcription playing, the pencils were collected and students were given a red pen for the second playing of the recording, the pens were collected and finally students were provided black pens prior to the third playback of the recording. The recording was paused at the predetermined sections of the text, the number corresponding to the section to be transcribed was called out, a twenty second pause was provided, and then the

recording was resumed. This was repeated for each of the 11 sections to be transcribed and the entirety of the recording was played three time; once for each color writing instrument to be used for transcription. Using different colored writing instruments was intended to make it easier to determine what aspects of the transcription participants were able to hear from each instance of playback of the recording a suggestion made by the researcher's project advisor D. Beglar (personal communication, November, 2015). After the last playback of the recording students were given the recording script and asked to check their answers, but not change what they wrote, and on the back of the worksheet they were to write their thoughts on why they might have missed particular words.

5)　Results and Discussion

　　Participants' handwritten responses were collected and coded word by word, with phonetically approximate spellings to the target items accepted as correct. Unlike Field's study (2008), lexical words that were incorrectly inflected were treated as incorrect answers as part of the aim of this study was to determine if stems pose a problem to NNLs' listening comprehension.

　　I was unable to obtain a copy of the function word list as used in Field's study, instead relying upon a list of closed words as provided by the online academic publishing company Sequence Publishing. Contractions such as *can't, it's, and there's* were counted as one item and coded according to the non-contraction status as either a content word or function word, as the contracted auxiliary verb or verb would presumably be masked and more difficult to discern for NNLs. This meant that five contractions were counted as a single unit function words and one contraction as a single unit content word.

　　Correct answers were recorded for each instance of the text playback, but the third transcription sequence using the black pen was eliminated from analysis as several students were found correcting their last transcription using the script

provided at the end of the third playback of the recording.

　　The number of words accurately transcribed for each participant by word type (content vs. functors) is shown in Table 1. The grouping of students into low, medium, and high categories did not always work. Participant L3 could very well switch places with participant M1, but this could also be a function of the groups being less defined than perhaps they otherwise might be if separated into just a high and low grouping.

Table 1

Correct Content and Function Word Transcription from First and Second Recording Playback

	Content 1st	Content 2nd	Function 1st	Function 2nd
L1	8	10	12	14
L2	11	15	8	14
L3	17	20	18	22
M1	15	18	16	17
M2	16	16	12	16
M3	19	21	20	24
H1	21	24	22	23
H2	21	23	21	21
H3	13	19	18	23

(by Author)

　　Participant H3, the student who had studied for a semester abroad during junior high school, scored remarkably low during the first playing of the recording when looking at content words. She did not answer any questions concerning why she had such troubles, but in examining her transcriptions it appeared that she attempted to transcribe entire sentences *before* the paused segment, perhaps overloading her working memory. Other than those two outliers in grouping, the other participants fell within suitable groups. All of the participants, aside from H2, increased the number of correct function words transcribed between the first

time listening to the recording and the second, in several cases getting a higher number of function words versus content words correct. Most of the comments concerning missed items were of the variety that the speed of the recording was too fast. Which begs the question, what would these scores look like if a normal rate of speech had been used?

Table 2 below examines the frequency of correct answers in terms of parts of speech, function contractions, and suffixes. Nouns and verbs seemed to have the highest frequency of correct answers, with adjectives and adverbs still eliciting a fairly high frequency of correct transcriptions. This is likely due to the exaggerated stress that such parts of speech receive from the teacher talk style of speaking that is now part of the researcher's normal speech patterns. Three of the students (L1, L2, and M1) had difficulties with the function-contractions of *can't* and *it's*, oftentimes participants that missed these items would write can or it but completely miss the contracted *t* or *s*. In the case of suffixes, four of the five students had problems with *–ly*, *-ed*, plural *–s*, or *–er* inflections. The base word was in many cases written correctly, just missing the suffix.

Table 2

Parts of Speech, Function Contractions, and Suffixes Frequency Chart

	Verb	Noun	Adjective	Adverbs	Function-Contraction	Suffixes
L1	.33	.55	.50	.44	.00	.33
L2	.50	.66	.75	.33	.40	.17
L3	.83	.88	.50	.56	.80	1.0
M1	.66	.89	.75	.22	.40	.50
M2	.50	.56	.50	.56	.60	.33
M3	.83	.89	.75	.56	1.0	.83
H1	1.0	.89	.75	.78	.80	1.0
H2	1.0	.78	.75	.67	1.0	.83
H3	.66	.67	1.0	.67	1.0	.83

(by Author)

The most difficult item, in terms of suffixes, was the *–ly* ending on the word *physical*. This might have also been more difficult for students though as it was followed directly by the prefixed word *unhealthy*, which only one student (H3) transcribed correctly. Participant H3, despite her lower scores in general, was the only student to get both prefixed words transcribed correctly (only one other student manage to transcribe the prefixed word *unlike*, otherwise prefixed words had a 0% frequency rate which is why they were excluded from Table 2) and was the only student to also correctly transcribe the contraction *there's* correctly. In class, participant H3's use of contractions is much more frequent and accurate than her fellow students, so perhaps this familiarity has engendered some automaticity in terms of listening comprehension.

Looking at the descriptive statistics for the participants as groups (see Table 3), a somewhat startling trend appears to emerge. The lowest group of students maintains the highest standard deviations among the three groups, but from the first playing of the recorded text to the second, they also make some of the largest gains in terms of function transcription improvement, though admittedly from the lowest mean and with participant L3 as an outlier. Aside from the medium group actually regressing a bit in terms of correctly transcribed content words, all the groups make gains from one listening of the recording to the next. The high group started very nearly at the highest rate of correct functors transcribed at 78%, but only increased a percentage point during the second playback: whereas the lowest group went from 53% to 59%, a seemingly respectable increase of 6%. It is difficult to tell whether or not this was significant without delving further into a statistical analysis.

Table 3

Mean and Standard Deviation for Correct Content and Function Word Transcription from First and Second Recording Playback

	Content 1st M (SD)	Content 2nd M (SD)	Function 1st M (SD)	Function 2nd M (SD)
Low Group	12.00 (3.74)	12.67 (4.11)	15.00 (4.08)	16.67 (3.77)
Medium Group	16.67 (1.70)	16.00 (3.27)	18.33 (2.05)	19.00 (3.56)
High Group	18.33 (3.77)	20.33 (1.70)	22.00 (2.16)	22.33 (0.94)

(by Author)

Conclusion

Unlike Field's (2008) significant findings that English content words are identified significantly more accurately than function words by L2 listeners, the results of this study are inconclusive for many possible reasons which will be laid out in the limitations section of this paper. While statistically significant findings cannot be attributed to this study, we can infer from what is hinted at by the data in this study: In the case of the nine Japanese university participants in this study it seems reasonable to state that contractions, prefixed and suffixed words are items of some difficulty for the average student in terms of listening comprehension. Furthermore, as did Field's study, it would appear that in the case of parts of speech, NNLs rely more on the heavily stressed and meaning-bearing vocabulary items found in verbs and nouns more than they do in extraneous meaning-bearing lexis such as adjectives and adverbs.

The limitations of this pilot replication study are many. The most glaring would be the lack of statistical analysis beyond the use of descriptive statistics of frequency, means and standard deviations. Future post-pilot administrations of this study will also require more participants as nine students are not enough for statistically significant results. In future iterations of this study a series of *t*-tests measuring the significance of the differences between function and content word

recognition would have been appropriate at the very least.

In addition to the problem of a lack of statistical analysis, some more practical issues of a technical nature arose that would need to be addressed for the next post-pilot stage of this study. I was not confident in the quality of the sound as quite a bit of echo effect was encountered during the playing of the recording. In the future, having the class conducted in a listening lab with individual headphones for each student with the recording controlled by the researcher might eliminate the variable of poor listening conditions.

In terms of the recording itself and the activity used as a whole, there were several problems with time. The administering of listening portion of study required three playbacks of the recording, which all told took forty minutes of class time for a recording that was only three minutes and thirty-five seconds long. In addition, the pauses during the recording were set at twenty seconds, which was likely ten seconds too long as students appeared to have time to go back and check what they wrote from previous segments. In the beta version of this study, shorter pauses and perhaps playing the recording only twice would suffice to collect data relevant.

Finally, due to budget constraints, pencils, red pens, and black pens were used in the course of this study. I believe that more color differentiation would help make coding participant transcriptions much easier, as in some cases a magnifying glass had to be employed to make sure that what was being observed was pencil graphite instead of ink in the case of the black pen marks. In addition, if only two colors are needed for transcribing due to one less playback of the recording, then the third color can be employed by participants to write comments and check their work versus the script provided at the end of the activity.

What is noticed and how it is noticed by second language learners in their L2 is a critical aspect of language acquisition and one that needs to be examined in greater detail. While flawed, this pilot replication study does hold promise of more

significant contributions in the future for the field of SLA if the inadequacies and mistakes of this first attempt can be corrected. It is likely that a future attempt, and hopefully more successful attempt, will help to validate Field's (2008) findings and continue to improve the way we instruct learners in listening strategies.

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Appendix A

Content and Function Words Listening Script

Hi, everyone. I'm Dr. Carter. I'm a medical doctor, and I work for the space program. First, thank you for inviting me to your class today. <u>I always enjoy talking to</u> (1) students about space exploration. I also brought a video about life in space, and you'll see that in a few minutes.

First, you probably want to know why a doctor works for the space program. Well, astronauts, or people who work in <u>space, can't be physically unhealthy</u> (2). They must have good physical health. Seven years ago, I spent a month on the International Space Station. It was an amazing time in my life, <u>and I learned a lot</u> (3) about staying healthy in space.

The most important thing to know is that space is not a good place for human beings to live. <u>It's much too cold for</u> (4) us, and there's no atmosphere, so there's no air to breathe. And here on Earth, the atmosphere pushes down on us all the time. That air pressure, the atmosphere pushing down on us, is very important to us. With no air and no air pressure, <u>a person can't even live</u> (5) for 10 minutes!

Fortunately, astronauts have spacesuits. Spacesuits protect the body, <u>and they also provide air</u> (6) and air pressure. In the video, you'll see an astronaut *outside* the space station. That's called a "space walk," and astronauts can do space walks thanks to their spacesuits. In contrast, they can wear everyday clothes *inside* the space station. There are gasses such as nitrogen and oxygen inside, <u>so it's pretty much like</u> (7) the air on Earth.

In the video, we'll see the astronauts doing everyday things such as eating and sleeping. Astronauts on the space station eat <u>five small meals every day</u> (8). Most of the food is frozen or canned, so it lasts longer than fresh food, but it might not taste quite as good. When it's time to sleep, you'll see that it's light outside the station. In fact, <u>unlike on Earth the sun</u> (9) rises and sets several times in 24 hours, so many astronauts don't get enough sleep. For some of them, it's helpful to cover

the windows. That way, it appears to be nighttime, <u>and it's easier to sleep</u> (10).

The last thing I'll talk about is "zero gravity." In the video, the astronauts almost appear to be flying inside the space station. That's because the station is moving very fast, so really, the astronauts are always falling. <u>It feels like there's no</u> (11) gravity because their bodies don't need to work very hard. Astronauts can become thin and weak, so they need to exercise for two or three hours every day to stay strong and healthy. All right! Your teacher is going to turn off the lights, and we're going to watch the video. I hope you like it.

Appendix B

1) I / always / enjoy / talking / to　- function / adverb / verb / noun / function

2) space / can't / be / physically / unhealthy -　noun / function / verb / adverb / adjective

3) and / I /　learned / a / lot – function / function / function / verb / function / function

4) It's / much / too / cold / for – function / function / adverb / adjective / function

5) a / person / can't / even / live – function / noun / function / adverb / verb

6) and / they / also / provide / air – function / function / adverb / function / function

7) so / it's / pretty / much / like – function / function / adverb / function / function

8) five / small / meals / every / day – adjective / adjective / noun / function / noun

9) unlike / on / Earth / the / sun – function / function / noun / function / noun

10) and / it's / easier / to / sleep – function / function / adverb / function / noun

11) It / feels / like / there's / no – function / verb / function / adverb / function

Content words = 27, Function words = 28

Verbs = 6, Nouns = 9, Adjectives = 4, Adverbs = 8

Contractions counted as Function words = 5

Contractions counted as Content words = 1

Prefixes = 2

Suffixes = 6