Investigating the Interaction of Visual Input, Working Memory, and Listening Comprehension

Kerry Pusey and Karen Lenz

Northern Arizona University

Abstract

This study investigated the effect of visual input on second language (L2) listening comprehension within the context of an intensive English program at a North American university. The interaction between visual input and working memory (WM) on listening comprehension was also investigated, with the aim of clarifying what role visual input, together with WM, plays in tests of L2 listening. This study compared two groups of upper-intermediate students. All participants took a WM test and then were divided into two groups in order to take a listening comprehension test under two treatment conditions: one with video texts and one with audio-only texts. Results from participants' test scores were analyzed and revealed that the presence of visual input had a significant negative effect on listening comprehension. However, working memory had no significant effect on listening comprehension and there was no interaction between working memory and the presence or absence of visual input. Results may have implications for test developers, teachers, curriculum developers, and L2 students.

Keywords: listening, assessment, video, working memory

Investigating the Interaction of Visual Input, Working Memory, and Listening Comprehension

Background

Research investigating the effect of visual input on second language (L2) listening comprehension has been hotly debated, as investigations in this area have yielded mixed results. While some studies have found that the use of video in listening assessment has a positive impact on listening comprehension (e.g., Wagner, 2010), others have found either no relationship (e.g., Londe, 2009), or a negative relationship (e.g., Ockey, 2007). One possible moderating variable is working memory (WM). It has been argued that WM is crucial in learning an L2, contributing to vocabulary acquisition and sentence comprehension (Szmalec, Brysbaert, & Duyck, 2012). Therefore, if WM contributes to other aspects of language learning, it may affect learners' listening comprehension as well. However, the interaction of WM and visual input during listening comprehension tasks has not, to the researchers' knowledge, been studied.

Research Questions

RQ 1: Does the presence of visual input affect listening comprehension among university-level L2 learners?

RQ 2: Does working memory affect listening comprehension?

RQ 3: Is there an interaction between working memory and the presence of visual input on listening comprehension?

Methods

Participants consisted of 24 first language (L1) Arabic and Chinese adult students. Two sections of Level 4 students participated in this study. Listening comprehension was operationalized as participants' ability to respond correctly to a series of multiple-choice main

idea and detail questions on the Sociology Listening Test (SLT), an academic listening comprehension test. The presence of visual input was operationalized as the use of video texts during the SLT. The absence of visual input was operationalized as the use of audio-only texts on the SLT. WM was operationalized as the extent to which one can correctly repeat a series of numbers that are presented in increasingly numerous sets, as represented by scores on a digit span task (DST) and subsequent placement into low, middle, or high WM groups (WMGs).

This study employed the SLT under two treatment conditions: one that used video texts, and one that used audio-only texts. The SLT scores of the two groups were compared and conclusions were drawn regarding the effect of the presence of visual input (i.e., the videos texts) on listening comprehension. The DST was used to categorize participants into low, middle, and high WMGs based on the percentiles in which students scored. Additional comparisons were made between SLT scores and WM scores in order to determine if WM had an effect on listening comprehension and if there was an interaction between WM and the presence of visual input on listening comprehension. For all comparisons, an alpha level was set at .05.

Results

Research Question 1 investigated whether or not there were any differences in students' SLT scores when a video text was used as opposed to an audio-only text. Results of the Mann-Whitney U test are presented in Table 1. Because the observed value of -2.39 exceeds the critical value of ±1.96, the null hypothesis that there is no difference in listening comprehension scores between students who received video input during the test and students who received audio input was rejected. Effect size was calculated using eta^2 and was found to have a value of .25, indicating a low/moderate degree of practical significance.

Table 1

Difference in Listening Comprehension Scores Between Video and Audio Groups

Group	n	Mean rank	z
Video	14	9.64	
			-2.39*
Audio	10	16.50	

Note. Mann-Whitney U, $z_{critical} = 1.96$; *$p < .05$; $eta^2 = .25$.

Research Question 2 investigated whether or not there were any differences in scores on the SLT among students with varying levels of WM. Results of the Kruskal-Wallis test indicated no statistically significant differences among WMGs.

Research Question 3 investigated whether or not there was an interaction between students' digit span scores and the use of video vs. audio texts on the SLT. As can be seen in Figure 1, WMGs (low, middle, and high) are plotted on the x-axis; listening comprehension scores are plotted on the y-axis, and the body of the figure contains the two visual input groups. It was concluded that there was no clear interaction between the two independent variables.

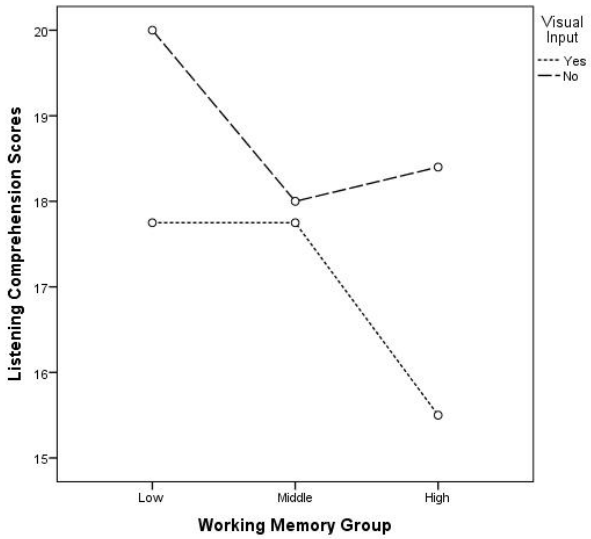

Figure 1. Interaction between WM and visual input.

Relevance to PIE and Second Language Learning

The results of the current study have theoretical and practical implications for L2 listening assessment and the construct definition of academic listening in an L2. In theoretical terms, this study has further problematized the construct of L2 listening in academic contexts, aligning with previous studies, such as that of Ockey (2007), which have indicated a negative effect of visual input on listening comprehension. In practical terms, this may imply that L2 listening assessment that lacks a visual component does not necessarily hinder student performance; rather, visual input may in fact be detrimental to certain students (for example, those with high WM, though this claim is extremely tentative and merits further investigation).

Future studies could investigate whether scores on different types of listening test tasks (e.g., short-answer, note-taking) are affected by visual input. A qualitative component to future studies is also recommended. In particular, a mixed methods (Johnson & Onwuegbuzie, 2004) design may help clarify how students engage with visual input during testing situations and other TLU domains related to academic listening (e.g., lectures, groups discussions, labs). Qualitative analysis could also indicate the possibility of an interaction between other variables (e.g., anxiety, learning styles), which could then be investigated quantitatively.

It is hoped that the findings of this study have contributed to the growing body of research on L2 listening assessment. The researchers also hope to have provided some impetus for further research within this particular area of applied linguistics.

References

Johnson, R. B., & Onwuegbuzie, A. (2004). Mixed methods research: A research paradigm whose time has come. *Educational Researcher, 33*(7), 14-26.

Londe, Z. C. (2009). The effects of video media in English as a second language listening comprehension tests. *Issues in Applied Linguistics, 17*, 41-50.

Ockey, G. J. (2007). Construct implications of including still image or video in computer-based listening tests. *Language Testing, 24*(4), 517-537.

Szmalec, A., Brysbaert, M., & Duyck, W. (2012). Working memory and second language processing. In J. Altarriba & L. Isurin (Eds.), *Memory, language, and bilingualism: Theoretical and applied approaches* (pp. 74-94). New York, NY: Cambridge University Press.

Wagner, E. (2010). The effect of the use of video texts on ESL listening test-taker performance. *Language Testing, 27*(4), 493-513.