Where Did the Metacognitive Train Leave the Rails? Putting the Train Back on the Track

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***Abstract*—For the past several decades, the fuzzy field of listening research has focused on strategy research; specifically, the investigation of which strategies proficient language learners use and how best to teach those strategies to L2 learners of lesser proficiency. L2 listening strategy research has broadly developed a three-part strategy classification whereby strategies are distinguished by their metacognitive, cognitive, and social-affective characteristics. The predominant assumption is that the use of metacognitive strategies is correlated with higher listening proficiency, ie., listeners of higher proficiency use a larger number of metacognitive strategies and use them more effectively. This assumption has proven to be difficult to detect and less robust across at larger scales and self-reports of strategy use. The present study reports results of a large scale listening strategy survey which suggests that perhaps a new listening strategy classification, drawn from insights gleaned from neurolinguistic research into brain functioning, be adopted in order to best understand, research, and teach listening strategies.**

***Index Terms*—Listening strategies, strategy survey, metacognitive, neurolinguistics.**

I. Introduction

Research into L2 listening strategies, following in the footsteps of the research into L1 and L2 reading strategies that occurred in the 1970s and 1980s, has started to gain momentum in the past decade [1], [2, p.154]. Studies from across languages demonstrate a correlation between the types of listening strategies used and L2 proficiency, with the strength of the correlation seeming to depend on the listening input and learner-specific variables [2, pp. 163-166]-[5]. L2 listening strategy research has also followed reading strategy research in the general acceptance of a tripartite taxonomy [6]. Specifically, the listening strategies discussed in the research are commonly categorized according to the strategy's metacognitive, cognitive, and affective or social functioning. This listening strategy taxonomy has also guided the interpretation of most empirical research into the listening process and also guided the way most teachers view listening strategy instruction [7],[8]. However, this metacognitive-cognitive- social/affective taxonomy has not proven to be as clear or as decisive as some may have hoped in language instruction and language learning, as empirical observations fail to show a strong delineation between categories and even how to precisely distinguish a skill, process, or strategy remains confused [2, p. 168], [5], [7]-[9]. The findings presented here may indicate that it is time to reconceptualize learning strategies to better fit the empirical data as well as nest the reconceptualization within the confines of solid findings from neurolinguistic research.

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II. Background

One of the largest deficits in SLA research into listening comprehension is a firm connection with neurolinguistics. Although functional magnetic resonance imaging (MRI) has been in place for more than a decade and numerous psycholinguistics studies dealing with basic aspects of hearing have been reported, there has been little connection of this strain of research with listening strategies or listening comprehension more generally [11]. This gap in the research seems like watching the approach of a great wave: we know it is coming but we cannot be sure how our own boat will manage. As a result, the remainder of this section will refer to an older understanding of brain functioning, with a sharp acknowledgement that the current neurolinguistic research tools may quickly displace prior theory.

The main distinction between hearing and listening is the attention the receiver pays to the input: we can "hear" sounds in that pressure waves displace our tympanic membranes, but this does not mean that the electrical impulse that reaches our brain in hearing is fully analyzed and processed in terms of "listening" [10, p. 8]. Listening is hearing with attention. Listening is the act of making sense of the sounds we hear: decoding them, interpreting them, and synthesizing them with prior knowledge. Hearing can occur unconsciously but listening cannot. The distinction between listening and hearing is fully dependent on another construct: attention.

Attention has been defined as a process of arousal, orientation, and focus [10, pp. 12-14]. The apparent circularity in this definition of "attention", as well as the natural ambiguity and imprecision in all previous attempts to analytically deconstruct the phenomenon, has caused many writers who do not specialize in the subject to revert to a more intuitive construction [22]. The study of attention is vital to any understanding of process of listening comprehension. Understanding how the brain processes acoustic input while simultaneously receiving and accounting for new acoustic input is fundamental to any discussion of listening strategies [12].

The reason for turning our attention to the subject of attention is that the brain is of limited capacity. No matter how large or nearly infinite we may believe the brain's capacity is, it is not, and any input processing activity the brain engages in is one of a constant shift of attention,

between sources of input and internal thought, creating a picture of ever-shifting points of focus [10, p.15],[12],[13]. Listening strategies must therefore be conceptualized within this larger framework. One does not simply use a metacognitive strategy without it affecting (positive or negatively) another aspect of cognition. All learning strategies exact some cost on mental processing capacity [2, p. 156] [14, p. 72]. Likewise, some processes which are normally beneficial can become detrimental under different circumstances [1]. For example, top-down processes can be over-relied upon by less linguistically proficient L2 learners, degrading their comprehension such as by the imposition of culturally inappropriate schemata [2, p.166], [5].

This study is part of a larger investigation of the listening process. One incidental question which arose during that larger project was whether the classification of listening strategies was appropriately delineated along the lines of metacognitive, cognitive, and social-affective for analytical and interpretative purposes. As we report here, against our initial hypothesis which was based on an abundance of listening research literature [1], [4]-[6], this strategy taxonomy was not readily identifiable in our data set, leading us to look for an alternative explanation.

III. Methods

A. Participants

As part of the larger research project from which this study derives, a listening strategy questionnaire survey containing 43 items on a 5-point Likert scale was administered to 575 Taiwanese college students during the 2010-2011 and 2011-2012 school years. 96.3% of the 554 surveys collected were from either freshman or sophomore students, with 283 males and 292 females participating.

B. Instruments

The questionnaire was a modified version of Liu's [15] survey. The survey was conducted in the respondents' L1 (Chinese). The survey questions themselves closely mirrored survey questions from other listening studies [1], [7], [9], [16]. Each survey question was classified *a priori* as a metacognitive, cognitive, or social/affective listening strategy. According to Chamot [17, p. 15], metacognitive strategies "are executive processes associated with the regulation and management of learning"; cognitive strategies are processes "used during the execution of a task to facilitate comprehension or production"; and social-affective strategies are processes to engage with the speaker or peers to enhance comprehension or processes to regulate one's emotions (eg., lower anxiety, stay motivated). All statistics were computed in SPSS 19.

IV. Results

First, Little's "missing completely at random" (MCAR) test was used to determine whether the missing values were randomly distributed, which they were. Next, the survey data set was checked for internal consistency and Cronbach's alpha was found to be 0.954 (43 items). The internal consistency of each subscale was also calculated and found to be 0.893 (15 items) for metacognitive strategies, 0.913 (19 items) for cognitive strategies, and 0.836 (9 items).

Principal component analysis (PCA) was then performed on the 43 item survey (n = 575). The Kaiser-Meyer-Olkin index was calculated to be 0.949 indicating that the data set is suitable for PCA [18]. PCA revealed 9 factors with eigenvalues greater than 1.0 explaining 62.5% of the variance. After varimax rotation, 9 factors still remained with eigenvalues greater than 1.0, but, after sorting the components and excluding coefficients less 0.3 [18], a clearer pattern emerged with very few items overlapping multiple factors. The 9th factor contained only one item and, given its weak explanatory power, will be disregarded from this report. The 8 factors remaining were inspected for synthesis and interpretation.

TABLE I: Survey Items for Factors with Divergent Item Categorization (Sorted Largest to Smallest Loadings)

Factor	Item [a] [b]
1	(M) I listen to key words for listening comprehension.
	(M) I continue to listen to other parts when I have difficulty.
	(C) I use known words to guess the meaning of unknown words.
	(SA) I try to be happy with what I can understand.
	(C) I relate the heard sound of words to unknown words.
	(M) I decide in advance what to listen to in general.
	(M) I pay attention to discourse marker words.
2	(C) I guess by means of the speaker's tone of voice.
	(M) I listen to tone of voice or how speakers refer to each other.
	(C) I guess the meaning of speakers from paralinguistic clues.
	(C) I use background sounds and relationships between speakers to guess the meaning of speakers.
	(M) I pay attention to the stress when listening to English.
	(C) I use information in the beginning to predict.
	(M) I ignore distracters and focus my attention on main ideas.
	(C) I try to understand by identifying the dialogue type.
3	(SA) I ask speakers to repeat to get another chance to understand.
	(M) I paraphrase the sentence to confirm my understanding.
	(SA) I ask speaker to explain the difficult words or phrases.
	(SA) I ask speakers to spell or explain the difficult words.
	(C) I use knowledge gained from academic situations to assist me in interpreting listening texts.
	(C) I use world knowledge to help me understand.
	(C) I use prior personal experience to interpret meaning.
6	(C) I make up a story line to help my understanding.
	(M) I try to get in the frame of mind to understand English
	(C) I use mental pictures to assist my comprehension.

[a] Classification is indicated in parenthesis (M = metacognitive; C = cognitive; SA = social-affective).

[b] Some items have been paraphrased due to formatting requirements.

Unexpectedly, the items in the 3 most explanatory factors (factors 1, 2, and 3), accounting for 28.1% of the variance

after rotation, were not categorically similar, ie., all items within the factor could not be categorized as solely metacognitive, cognitive, or social-affective. Factor 6, accounting for 6.9% of the variance after rotation, also showed divergent items. The items in factors 4-5 and 7-8, accounting for 24.0% of the variance, did conform to conventional metacognitive, cognitive, and social-affective categorization. The items from factors 1, 2, 3, and 6 are listed in Table I above. Factor 4 contained 5 items from what would normally be considered metacognitive strategies such as checking for understanding and self-monitoring; factor 5 contained 5 items of what would normally be considered social-affective strategies such as cooperating with classmates or anxiety reduction. Factor 7 contained two items which would normally be considered cognitive, specifically, translation and L1 transfer. Factor 8 contained 5 items of what would also be considered cognitive strategies, for example, uttering a word to recall its meaning or using a dictionary to look up unknown words.

Because communalities between items were high, PCA was preferred. However, other factor analysis methods that only consider shared variance, specifically maximum likelihood and principal axis factoring, were used to determine if the results found through PCA were consistent. Maximum likelihood and principal axis factoring both failed to reveal any recognizable reported strategy use pattern, even after varimax rotation. The results of these methods found factors with a mix of cognitive, metacognitive, and social-affective items, similar to the results of PCA, and explained 53% of the total variance.

V. Discussion

This study reports on research conducted as part of a larger investigation into the listening process. From the start, it was expected to find a general cohesiveness between the items in this study's listening strategy survey according to their classification as metacognitive, cognitive, or social-affective, as such a result has been commonly found in most listening studies and is not controversial [1],[3],[6]. However, the PCA of the listening strategy survey failed to reveal a clear pattern according to Chamot's [17, p.15] classification in that categorically different listening strategies seemed to be coalescing within factors.

Turning to the results reported in Table 1, we can see that there seems to be little to unify or explain the cohesion between the survey items listed in factors 1, 2, 3, and 6. The factors in Table 1 are comprised of diverse survey items. This outcome was surprising as, even though we did not expect to find a data set free of statistical noise, we were not prepared to find such a muddied picture as to reported listening strategy use [9, p. 144].

There are three broad possibilities to explain the PCA results reported here. First, the data collected in the listening strategy survey may not be reliable. This outcome would be explained by a poorly designed survey instrument, highly abnormal respondents (in that they were different from respondents of other reported listening strategy surveys), or random item responses (ie., respondents did not make a good faith attempt to answer the survey items). This first explanation is improbable for several reasons. The survey items were similar to ones that had been used in numerous studies before, including in the L1 used in this study (Chinese) [1][3][6][15]. Furthermore, the survey respondents of this study, Taiwanese freshman and sophomore college students, were not unusual or outside the range of respondents normally used for listening strategy research and the large number of respondents (575) reduces the likelihood that the survey data is random [18]. Little's MCAR and Cronbach's internal reliability statistics also fail to suggest that the problem lies in the data itself.

The second possibility to explain why PCA produced factors that failed to fit the conventional interpretation is that the statistical analysis was flawed. This explanation is also improbable. Other factor analysis methods were also used to investigate the data set, and these methods failed to ameliorate the initial results of the PCA, ie., showing divergent item types within the most predictive factors. Because of high communalities between items, these factor analysis methods were not focused on in this report, but their outcomes nonetheless reaffirm the PCA results.

The third possible explanation for the results reported here is that the system used to classify the listening strategy items contained in the survey is not a good taxonomy for interpreting the listening strategies used by the students in this study. Since the introduction of the metacognitive, cognitive, and social-affective framework for listening strategies, researchers have been attempting to show how higher proficiency or more successful L2 learners use more metacognitive strategies—both a larger number of metacognitive strategies and a greater frequency of use [1],[2, p. 153]. However, this framework has not always been easily identifiable in empirical data [3],[6]. For example, the interplay between the level of difficulty of the texts and the L2 proficiency of the learners is a critical variable that affects which listening strategy will be used [1],[10, p. 154]. In other words, the tool must fit the task: for simple input, simple strategies are sufficient. Even language learners who normally report using a large range of listening strategies, including metacognitive and top-down processing, will revert to bottom-up processing strategies when the text is not challenging. This interaction phenomenon, between the text and listener, has only recently begun to be the subject of attention and the final word on the matter has yet to be written [5].

An alternative explanation for the divergent listening strategies found in the factors in this study is that L2 learners are not guided by an unseen "metacognitive, cognitive, social/affective" taxonomy when employing or deciding to employ various listening strategies; instead, learners organically discover language strategies or transfer strategies from other areas of learning and they use these strategies according to unconscious rules guided by cognitive demand and mental processing capability. This explanation, turning away from the rigid imposition of the tripartite taxonomy, would make sense since the literature in this area makes clear that the theory came before the empirical observations [2, p.160]. As sound as the theory may appear, it must bend to the observations, and not the converse. Our proposed interpretation of listening strategies is based on

neurolinguistics, where the "mental energy" required to employ a particular listening strategy will control how frequently and in which situations it is employed. If a particular listening activity was relatively easy, listeners will resort to low mental energy strategies such as direct interpretation, making higher-order and presumably higher energy strategies unnecessary. In this respect, it would be mentally wasteful to elaborate, infer, or check for understanding if the input was simple and immediately comprehensible through direct translation.

Our alternative explanation for the PCA results reported here appears to also explain several studies that failed to find a strong link between the metacognitive strategies used by listeners and the listeners' L2 proficiency [4],[7],[19]. These studies report that higher proficiency L2 learners do not always employ metacognitive strategies in a way that would explain their language success: in fact, lower proficiency L2 learners may still use metacognitive strategies, although their lower proficiency means that their effectiveness in employing the strategy is reduced. Our proposed interpretation would suggest that lower proficiency learners would in fact use more top-down and more higher order metacognitive strategies, such as inference and relying on background knowledge, for texts which would be below the level of more proficient learners.

Many of those studies finding inconclusive links between metacognition and proficiency level were comparing L2 learners' reported strategy use and the learners' actual strategy use: it is highly likely that more advanced learners have had some strategy training and were more primed to respond to the survey in a way that fit the established metacognitive-cognitive-social-affective strategy taxonomy [4]. In practice, these higher proficiency learners oftentimes fail to demonstrate strategy use patterns that are convincingly different from other learners. In studies finding a clear strategy use pattern, the degree to which survey respondents may have been influenced by prior education experiences is wholly unmeasurable. On the other hand, this implies that the respondents to the listening strategy survey in this study may have had relatively less strategy instruction, something which is possible but has yet to be quantitatively verified through empirical comparisons of the way teachers practice across cultures [8]. The English education in Taiwan has embraced strategy training as a paradigm but the degree to which this acceptance has transformed classroom practices is uncertain [20]. The degree to which students were truly familiar with and understood the items and strategies being described is an open question that has yet to be standardized across the strategy research literature.

The alternative explanation offered here is not intended to overturn the metacognitive apple cart. We do not dispute that strategies can be classified as metacognitive, cognitive, or social-affective in principle. Instead, the alternative explanation has two functions: i) to sound the call for more extensive neurolinguistic research into the brain functions underlying specific listening strategies, and learning strategies more generally; and ii) to raise the question of whether simply "pushing" metacognitive strategies on L2 learners in the EFL context, in deference to cognitive or other "lower-order" strategies, is optimal.

Starting with the first point, the whole field of listening strategies is wholly dependent on future research into the functioning of the brain under certain conditions and in conducting certain tasks. We must know if certain strategies are rarely used because the L2 learners attempting to use them are not yet at a certain proficiency level or whether the strategy itself is too mentally taxing and inefficient. For listening instruction, it is critical that we know how a learner's memory potential affects his or her choice of strategy used and the rate of strategy use success. It is possible that working memory limitations can cap or hinder effective strategy use [2, p. 158]. For example, Taguchi [21] found that working memory was not correlated with listening comprehension response time, but it is not clear what role listening strategies played in this experiment. L2 learners may use metacognitive strategies more frequently and more effectively not because they are "aware" of metacognitive strategies, but because their mental engines are better trained and developed to handle them. From this perspective, learners are not "taught" learning strategies, but they evolve naturally over the course of a learner's development [22]. After all, learning strategies have only been the focus of educational research for the past 30 years, raising the question of how countless prior generations "learned" without any strategy instruction [6]. Thus, strategy instruction may not be simply a matter of priming the metacognitive pump, but upgrading the horsepower in the mental engine.

This leads to the second reason behind our alternative explanation for the PCA results reported here. The problem with much of strategy instruction today is that, even if the memory capabilities of the individual learner is neutral in effective strategy implementation, there is little differentiation between metacognitive strategies in instructional practice [2, p. 161],[5]. All strategies are not created equal and teachers should not give equal floor time to all metacognitive strategies. Many studies have tried to identify the "key" or "critical" metacognitive strategies but the results across the board have not been consistent or impressive [4], [5], [7], [19]. Because of this, a reassessment of the strategy taxonomy is in order. Ideally, strategies should be grouped from the learner's perspective, taking into account the learner's L2 proficiency, the genre, time constraints, and the learner's L1 and cultural background, for example. The painful truth is that many instrumental L2 learners come to survive in the L2 not by crafty or efficient strategy use but by the brute force of translation or memorization [8]. Higher proficiency L2 learners will also make use of brute force translation, but only when possible, ie., the input is not complex relative to their proficiency [2, p. 166]. A model of strategy use that accounts for potential mental energies could possibly explain this phenomenon.

Lastly, to be explicit and return to the results reported in Table 1, a new model of listening strategy use should explain the reason why the items failed to load the factors in any predictable fashion. If, as we suggest neurolinguistics has yet to make its presence felt in this subject, then perhaps that new model would account for the mental processing involved in each particular listening strategy. It may be that Factor 1 represents the mental processes with the highest mental

potential energy, ie., requiring the most mental work to complete. This guess is supported by the fact that factors 7 and 8, relatively weak in explanatory power, contained the items often associated with low proficiency learners and also appear to be the strategies requiring the least amount of mental energy. This raises the question as to whether these low proficiency learners are not just being unskilled but are actually making excessive use of listening strategies with a lower mental energy demand.

VI. Conclusion

The research reported here found that the study's listening strategy survey failed to follow the metacognitive, cognitive, and social-affective listening strategy classification predominant in most current L2 listening research. The underlying relationship between the items in the survey could not be readily determined with the existing conceptualization of L2 listening strategies. As a result, this report highlighted the need for further work into the area of neurolinguistics and SLA, calling for a new focus on how listening strategies run up against the brain's natural limitations and the strategy use choices L2 learners make, explicitly or implicitly, when comprehending a text.

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