

Pausology and Listening Comprehension: Theory, Research, and Practice

Roger Griffiths

Nagoya University of Commerce and Business Administration

In this paper the investigation of temporal variables is presented as an example of the type of research on microprocesses which can be applied to actual language teaching. Such research is not derived from a strong theoretical network (which all the evidence suggests is unattainable) but it builds upon sound empirical work in L1 pausological studies and L2 input studies. A brief review of early L2 studies of temporal variables (mostly of NS-NNS speech rate) indicates them to be methodologically flawed to the extent that their findings must be discounted. A degree of optimism is, however, found in the improved quality of recent studies, which are reviewed in some detail. Particular attention is paid to studies which demonstrate that listening comprehension can be facilitated by the manipulation of temporal variables.

1. Introduction

In this paper I not only want to discuss the findings of a number of pausological investigations into listening comprehension, but also want to examine how they fit into the wider picture of research in applied linguistics. I would first like to make a number of observations on the status of theory generally in SLA before considering the status of theory on listening comprehension in particular. After that I will report on a number of studies which show that temporal variables can be modified to facilitate listening comprehension (throughout considered to be primarily comprehension of teacher-talk). Such research, minimal in theory, is then shown to have implications for practical application.

2. Theory, Research, and Practice in L2 Learning

Feyerabend (1970) has observed that:

The attempt to create knowledge needs guidance, it cannot start from nothing. More specifically it needs a theory, a point

of view that allows the researcher to separate the relevant from the irrelevant, and that tells him in what areas research will be most profitable. (p. 201)

Feyerabend is, however, specifically discussing the position of theory in the mature sciences where the proposition that "No information is collected in vacuo" (Medawar, 1984, p. 17) is commonly held (O'Hear, 1989, p. 89). This position is reflected in the following statement by Popper (1970):

A scientist engaged in a piece of research, say in physics, can attack his problem straight away. He can go at once to the heart of the matter: that is the heart of an organised structure. For the structure of scientific doctrines is already in existence; and with it a generally accepted problem situation. This is why he may leave it to others to fit his contribution into the framework of scientific knowledge. (p.51)

In terms of structures of knowledge in the mature sciences there is, as Popper puts it, "an edifice" (1970, p. 51). In the social sciences, however, even "well-shaped building stones are hard to come by" (Cronbach, 1987, p. 402), and there is no such edifice.

The major characteristic of a mature science has been conceptualized as it being governed by a single "paradigm," what Kuhn also calls a "disciplinary matrix" (1970a, p. 10). It is the lack of such a paradigm that most prevents the social sciences from qualifying as mature sciences. They are variously described, therefore, as "psuedosciences" (Feyerabend, 1970, p. 202), "spurious sciences" (Popper, 1970, p. 58), and "proto-science" (Kuhn, 1970b, p. 244). Adding to this list, Masterman (1970, p. 73) also identifies "non-paradigm science," which she describes as, "the state of affairs right at the beginning of the process of thinking about the state of the world, i.e., at the stage when there is no paradigm" (p. 73). She contrasts this with "multi-paradigm science", where she notes, "far from being no paradigm, there are on the contrary, too many" (p. 74).

Masterman considers the latter to reflect the overall situation in the psychological, social and information sciences, and she notes that at this stage, "discussion on fundamentals remains, and long-run progress (as opposed to local progress) fails to occur" (p. 74).

While it is easy enough, using the above criterion, to see that

applied linguistics does not qualify as a mature science, it is difficult to see where it fits into Masterman's conceptualization. Despite Brown's (1989, p. 169) recent baffling statement that one of the gratifying things about SLA research "is that it is research based on theory," it is doubtful that anything we have in SLA even qualifies as a "theory" (Gregg, 1984, p. 79), much less a paradigm. That, of course, would place the discipline in the first category. The total disagreement and seemingly endless debate over the legitimacy of fundamental assumptions and methods would indicate the second. It is, after all, not difficult to recognise something of our field in Feyerabend (1970, p. 202) and Kuhn's description of such endless debate: "The debates of 'pre-science' with their universal criticism and their universal proliferation of ideas are often directed as much to the members of other schools as...to nature."

The major problem at the stage in which "anything goes" (when no one paradigm marks the discipline) is that, as Krige puts it, "anything goes...means that, in practice, everything stays" (1980, p. 142). And much of what stays, does so despite incisive and relentless criticism, for example, that of Gregg (1984, 1986, 1988) and McLaughlin (1978, 1987) on Krashen's theory of SLA. Consideration of the contributions of others that have arrogated the name of "theory" in SLA, confirms this view (e.g., see Gregg, 1984, p. 96, on the theoretical contributions of Gattegno, Lozanov, and Curren). Ultimately, as O'Hear (1989) points out: "If a ruling theory does not fit the facts, someone in the end is going to blow the whistle if only because he will make his reputation by doing so" (p. 214). The facts are, however, seldom easily come by and not always scrupulously collected or reported (e.g., see Beretta on Krashen's reporting of empirical testing of Total Physical Response methods, 1986, p. 433).

It is clear, therefore, that none of what Ellis (1985, p. 248) generously calls a "plethora of theories" in SLA has resulted in anything like a common paradigm being adopted in research: no theoretical stance (for none of the so-called "theories" can be described as more than this) has, in fact, been a significant landmark in the progress of the discipline. However, research has gone on, with much of it being of the research-before-theory type (see Long, 1985a). While not wishing to espouse a naive inductivist position, it must be observed that much of the data gathered under

this strategy is clearly not “theory-laden.” The position is, in fact, much more akin to what O’Hear (1989) calls the “weak thesis” (p. 82) on this issue. This is perhaps worth quoting at length:

In considering the relationship between theory and observation in science, it is important to distinguish a weak thesis about the suffusing of observation by theory from a much stronger one. The weak thesis says that all observations are conditioned by presuppositions, assumptions regarding similarity and dissimilarity, directions of interest, and so... the fact that there are interests and schemes of classification behind any observation of the world does not amount to any elevated sense of theory. (pp. 82-83)

O’Hear also notes: “That all observation involves presuppositions and assumptions is undoubtedly true, but this does not imply that there is point in drawing distinctions between more and less theoretical levels of observation” (pp. 90-91). Because there is little agreement on the appropriateness of specific theories and because the theories we have are seldom explicit enough to indicate the direction of research programs, research in SLA conforms very much to O’Hear’s “weak thesis” on theory. Nor, to involve another dimension in the discussion, is there a strong relationship between explicit theory and practice in SLA. “Divorce” (Sinclair, 1989) does not seem to quite capture the quality of the relationship, as the two have never been closely attached (even the audiolingual approach bore only “a vague resemblance to an early version of Thorndikean association theory” [Carroll, 1966, p. 104]), but it is certainly the case that there is little intimacy. As Kasper (1988) recently wrote, “practitioners in the language teaching profession will be disappointed if they look for specific instructions on L2 teaching in the available literature...” (p. 5). But progress has been made, particularly in the area of input studies which have resulted in some practical applications. Long et al.’s (1984) work on “wait time” is an example of such intervention, although Long (1985a, 1985b) acknowledges that generally research on input is not derived from, nor has yet been incorporated into, current theories.

However, despite the absence of a unified theory, what research findings can do, as Lightbown (1985, p. 183) points out, is to

“answer some short-term questions about ‘what works.’” She continues, “Such short-term results are useful for getting teachers from day to day while they await the fulfillment of the great expectations of what might be called ‘basic’ or ‘non-applied’ (or even ‘pure’) research.” But getting from day to day is exactly what is required. This orientation is also congruent with Corder’s (1984, p. 58) view that “it is the task of the applied linguist to make practical use of whatever knowledge is available at the time.” In addition, the possibility of arriving at a total explanation must be extremely remote.

Cronbach (e.g., see 1975), is certainly of this view with regard to mainstream psychology, in which the quest for an overarching learning theory has been abandoned: in attempting to answer the question, “Should social science aspire to reduce behavior to laws?” (1975, p. 116), he looks back on the thirty years in which it has been attempted and laconically concludes, “I think most of us judge theoretical progress to have been disappointing” (p. 116). He further states: “The goal of our work...is not to amass generalizations atop which a theoretical tower can someday be erected.... The special task of the social scientist in each generation is to pin down the contemporary facts” (p. 126). To this one would only wish to add (even taking into account all the necessary caveats), “and use them.”

This certainly appears to be a realizable aspiration for the SLA researcher. It is a view which necessarily gives rise to the detailed investigations (described by Long et al. [1984, p. 3] as “research on microprocesses”) which are the hallmark of “normal science” (Kuhn, 1970a, p. 10) and which may have practical relevance and application. It is also the type of research referred to by Kasper (1988), who having noted that the large scale “methods” studies of the 60s and 70s failed largely as a result of failing to control the numerous variables involved, notes, “Recent classroom studies wisely examine more closely defined issues, e.g., features of teacher-talk...” (p. 5). Such an approach involves continuing to direct research resources towards the practice of one of the world’s great growth industries—classroom language teaching. Given, as Gregg (1988, p. 75) puts it, “the vast armies of unsuccessful L2 learners,” it is clear that it is not the outstanding quality of our product that

attracts consumers but a seemingly inexhaustible demand.

Without expecting nomothetic, or law-establishing, networks to emerge, it is assumed, however, that research should follow “the methods of the hard sciences” (Eysenck, 1986, p. 397). Eysenck’s view that psychology should consist of the “arduous work of providing actual proofs” (p. 397) is, in fact, central to the approach adopted in the research described here. There should, in short, be no room for choices over respective positions on academic issues in SLA to be made “on the grounds of personal preference, untrammelled by factual and general scientific consideration” (p. 397).

I see my own research on listening comprehension and pausology within this framework. However, before discussing pausological research, it is probably necessary to comment briefly on the current state of theory and research on comprehension generally and L2 listening comprehension in particular.

3. Comprehension: Theory and Research

According to Ehrlich (1982), the term comprehension refers to both the activity in which the subject is involved while processing information and to the product of this activity. The product may be analyzed as a mental structure or studies through the subject’s behavior observed in different tasks. (p. 157)

What, then, is the current state of knowledge regarding these two aspects of comprehension? Of the first, Garrod (1986, p. 226) states, “psychologists are a long way from producing any definitive statement of what occurs, in terms of processing, when we actually understand an utterance in natural discourse,” and, of the second, Foss (1988, p. 303), interpreting “product” in the sense of mental structure, observes that, “We know the input to the comprehension mechanism but their product is mysterious.” Such opinions appear to be representative of the area: neither the process nor the product is adequately understood, nor is there a generally accepted theory of comprehension in cognitive psychology.

Nor, it seems, is it widely expected that such a theory will emerge in the future. This is certainly the view of Kintsch and Kintsch (1984, p. 175), who consider, quite simply, “there can be no overall theory of comprehension,” and see their own work in terms

of understanding “the specific demands and operations involved in a particular cognitive task.” They conclude their review of the area with their opinion that:

the pursuit of a new, general theory of learning... is probably just a illusionary now as it was 50 years ago. Just as there can be no general, overall theory of comprehension...we are unlikely to be able to specify a general learning process. (p. 175)

SLA researchers cannot, therefore, look to L1 cognitive psychology for an overall theoretical framework of comprehension processes.

Specifically in terms of language comprehension, the situation is much the same: the general position is described by Harris and Coltheart (1986, p. 204), who note, “there is currently no overall theory of language comprehension.”

4. L2 Language Comprehension: Theory and Research

L2 models of listening comprehension have proved no more adequate than those in L1. Nagle and Sander’s (1986) attempt to produce “a theoretical model of listening comprehension” (p. 9), for example, merely results in meaningless baptism of processes inadequately understood.

The inadequacies of theory in this area are also long-standing and continuing. Carroll (1972, p. 2), for example, observed that the 1956-59 Educational Testing Service committee were not aided in their task of publishing “STEP Tests of Listening” by the lack of a theory of listening comprehension, which might have been expected to guide the program. More recently, Brown (1986, p. 286) has commented on the inadequacies of current formulations of L2 listening comprehension in terms of practical application: “We are still a long way from developing the sort of theory of comprehension processes which is going to be much help to teachers in the classroom.”

In short, no satisfactory theory of L2 listening comprehension exists at the present time. Current attempts at theoretical formulations do, however, tend to be heavily cognitive, and discussions as to the respective contributions of top-down and bottom-up processing appear to occupy the key area of disagreement (Buck, 1988, p. 19). Discussion of the relationship between these two hypothesized

skills centers upon whether language processing is only bottom-up or whether it is both top-down and bottom-up. For some the answer appears not to be in doubt. Certainly Chomsky (in his interview with Baars, in Baars, 1986, pp. 348-349) is in no doubt: "It is pretty obvious that when you and I understand each other we're bringing in all sorts of information that has nothing to do with language. I don't think we have to show that" (p. 348).

Chomsky's dismissal of the central issue in L2 attempts at comprehension theory is perhaps overly robust and unlikely to be widely accepted, but it indicates the inherent weakness of a model in which questions are not formulated in forms which can be answered empirically and are, consequently, subject to endless debate. It is argument over this sort of model which prompted Neisser (1976, p. 8) to criticize psychologists for "lavishing too much effort on hypothetical models of the mind and not enough on analyzing the environment."

Research directed towards application in our discipline has no alternative to analyzing the environment. Chaudron and Richards (1986, p. 122), for example, describe research on listening comprehension, in both L1 and L2, as "in its infancy." This certainly describes the state of research on the role of temporal variables in L2 listening comprehension: we are not in possession of even the most fundamental facts—even, for example, the basic relationship between speech rate and comprehension by L2 learners. In L2 pausology, the state of the art, has, in fact, until recently, involved very little science (however, broadly defined). L1 has fared rather better.

5. Pausology: Introductory Remarks

The temporal variables most often studied in psycholinguistics are speech rate (SR) and pause phenomena (PP). The latter comprise pause duration, distribution, and frequency. In addition, the distinction between silent pauses and filled pauses is consistently employed in the literature. Hesitation phenomena (HP) have increasingly been classified, "rightly or wrongly" (Grosjean, 1980, p. 39), as temporal variables and have often been included in pausological studies. They comprise not only filled pauses (such as *er*, *um*, and the schwa) but also repeats and false starts.

Investigation of such phenomena constitutes the empirical discipline of pausology, defined by O'Connell and Kowal (1980) as, "the behavioral investigation of temporal dimensions of human speech" (p. 8). Since the mid-fifties temporal variables in speech have been intensively investigated and a body of extremely specialized research findings has resulted. Goldman-Eisler is considered to be the pioneer of pausology, and the 1978 Kassel Workshop, designated in her honor, clarified the status of pausology as a component part of psycholinguistics (see Dechert & Raupach, 1980).

Goldman-Eisler's first pausological experiments were published in the early 1950s. Since then conventions of pausological measurement have gradually been established, and the importance of comparable methodologies has been emphasized (e.g., see Kowal et al., 1983, p. 390).

Pausological investigations have, however, been largely in L1 where researchers have typically investigated speech encoding. The role of temporal variables in speech decoding has, consequently, been relatively neglected. Nor has the general standard of research on decoding been comparable to the specialized encoding studies.

Decoding investigations have been carried out in a variety of contexts: in instructional systems technology the research focus has been on the deterioration in comprehension observed to occur at rapid SRs; in "baby talk" studies, SR in caretaker-infant interaction has been observed; while, in SLA, variations in rate in "foreigner talk" have been investigated.

6. The Relevance of Pausological Research to Language Comprehension

The frequency with which temporal variables are referred to in the SLA literature indicates a recognition of their importance (e.g., Hatch, 1983, p. 183; Klein, 1986, p. 45; Chaudron, 1988, p. 64). However, until recently research in this area had, almost without exception, been conducted as part of studies with wider concerns.

Yet the questions posed in pausological research are extremely relevant to language teaching and particularly important to listening comprehension. The speed of delivery, for example, when

addressing NNSs, is something that thousands of EFL teachers have to make decisions on during every lesson they teach, and HP in teacher-talk are a possible source of considerable incomprehension. These questions, and others concerning PP, represent ubiquitous issues: it cannot be wise to treat them as peripheral.

However, there has been, until recently, virtually no research basis on which, for example, recommendations of classroom SR could be made by teacher trainers. Nor has there been an adequate descriptive database from which it can be seen that modifications of SR and PP are actually used in teacher talk.

7. Early L2 Pausological Research

Despite Sabin et al.'s (1979, p. 54) assertion that "Efforts must... be begun on applications of pausological findings to language education," for many years (from approximately 1973-1989) the field of temporal variables has been treated as peripheral. Before 1989, in not a single article in the L2 literature had SR, PP, or HP been the sole focus of investigation, and only in one experimental study had SR been the prime focus of investigation.

A synopsis of this early work has been given by Chaudron (1985, 1988), who, despite noting that there has been very little consistent quantification of SR in the classroom (1985, p. 218), still draws a conclusion from the evidence: SR to beginner learners is about 100 wpm and SR to intermediate and advanced learners and NSs is about 30-40 wpm faster (1988, p. 69). But this is to give unmerited credence to extremely dubious data.

The studies of Henzl (1975, 1979), for example, are deficient in data collection, analysis, and interpretation. Hakansson's (1986) language classroom study is equally flawed, as is almost every study reporting on temporal variables before 1989. Moreover, differing instrumentation, methodologies, text genre, and languages mean that the studies are neither replicable nor comparable. (For detailed review see Griffith, forthcoming.)

Recently, however, published studies have begun to appear in the applied linguistics literature in which SR or PP are the major focus of investigations (Anderson-Hsieh & Koehler, 1989; Conrad, 1989; Tauroza & Allisson, in press). There has also been recent experimental work directly on SR and listening comprehension

(Griffiths, in press) and an impressive early L2 study (Grosjean, 1972) has come to light. I will begin by describing the recent pausological work, much of which has included research relevant to comprehension.

8. Recent L2 Pausological Research

A recently published study by Conrad (1989) focused largely on pausology: it should be seen as the first serious study of temporal variables in the SLA literature. Conrad used time-compressed speech in an experiment attempting to observe differences in aural processing strategies between NSs and NNSs of high and intermediate language proficiency. Twenty-nine NSs, 17 high-level NNSs and 11 medium-level NNSs were asked to immediately recall 5 time-compressed recordings of 16 English sentences. There were five trials for each sentence with each one being heard at 450, 320, 253, 216, and 196 wpm after which subjects were asked "to report everything and anything they thought they had heard" (p. 7).

Results showed that, whereas NSs had nearly full reports of all the sentence components by the second trial (320 wpm), NNSs of both "high" and "medium" levels of proficiency experienced considerable difficulty even with the slowest rate after the fifth hearing (at this stage the high-level group still failed to report accurately 28% of the sentence items, and the medium-level group failed to report 56%). These latter figures confirm the belief that, as with NSs, there is a level of SR at which NNSs of differing levels will experience rapid declines in comprehension. It appears from these figures that for high-level groups this may be around 200 wpm but for medium-level groups considerably less.

Another recent study (Anderson-Hsieh & Koehler, 1989) also describes the SR-comprehension relationship, but does so in relation to NSs listening to NNSs. In their investigation Anderson-Hsieh and Koehler hypothesize that, because SR studies of native speech have shown an increase in SR is associated with a decrease in comprehension, it is reasonable to expect the same relationship to be observed with nonnative speech. It is consequently investigated, as is the effect of foreign accent on comprehension.

The speakers for the study were three native speakers of Chinese of different levels of proficiency in English who between

them read six passages (310 to 475 syllables in length) reporting arcane information. A NS then read all six passages at almost exactly the same rates as the NNSs. The rates chosen were determined "empirically," that is, the slow rate was based on what the NS could read without sounding abnormally slow, and the fast rate was based on what the least proficient NNS was able to produce without sounding too rushed. This gave slow rates between 2.39 and 2.65 sps; regular rates between 3.25 and 3.49 sps; and fast rates from 4.22 to 4.58 sps. Comprehension was tested with six multiple-choice questions for each passage, various combinations of which were given to 224 NS American university students.

Results showed that scores on the passage delivered at the fast rates were significantly lower than for the regular rate for all speakers. All series of scores indicated least comprehension at the fast rate, and all but one showed greatest comprehension at the slowest rate. Significant differences in all cases were found between the fast and regular rates, and fast and slow rates, but not between the slow and regular rates.

In addition, findings from an investigation of perception of SR within the experiment (using a 5 point scale) indicated that Ss were aware of the rate differences which resulted in comprehension variability (there are somewhat mixed findings on this issue as will be indicated in the next section). Anderson-Hsieh and Koehler conclude, "the study has shown rather dramatically that speaking rate is an important factor in the comprehension of the nonnative speech investigated in this study" (p. 591). Their finding, therefore, mirrors that of Conrad's (1989) investigation which also showed L2 learners to have difficulty in understanding rapid NS speech.

Another recent study, but one which has focused on the occurrence of rate variability in different speech genres, is that of Tauroza and Allison (in press). However, their findings on SR norms could have been derived from the infinitely fuller information in the pausological literature and their recommendation that spm rather than wpm should be adopted was made by Goldman-Eisler in 1954 (p. 94). Nonetheless, the study is sounder than many previous ones in the area, and it adds to the accumulating body of knowledge on temporal variables which is now being assembled in L2 research and is now appearing in the SLA/applied linguistics

literature. It can justifiably be regarded amongst those recent contributions (in addition to Grosjean's study) which give the area a quality and an optimism which was previously lacking.

9. L2 Pausological Experimental Studies: Temporal Variables and Listening Comprehension

That optimism is not, however, derived from the first study described in this section (Kelch, 1985). To date this is still the only published study on the relationship between comprehension and SR in the SLA literature. However, it is flawed in so many respects that no convincing conclusions can be derived from it. A major, indeed a fatal, flaw in the experiment was introduced when Kelch inserted extended pauses into the experimental text (originally recorded at SRs of 191 wpm and 124 wpm) in order to accommodate his chosen testing method—dictation. If these 45 sec pauses are included in the SR calculations, the delivery rate of the passages falls rather dramatically to 4.2 wpm and 4.3 wpm respectively.

A further difficulty in interpreting the results arises due to Kelch employing two very different methods of scoring. He found that while the slower SR resulted in significantly greater comprehension when measured by an exact word method, it did not do so when measured by an equivalent meaning method: in fact, the reverse relationship was observed when comprehension was measured on the different methods, but this point is not so much as mentioned in the discussion of findings. Kelch's summary of his results is, therefore, both partial and misleading and the study fails to illuminate the SR/comprehension relationship.

However, a study which is never reported in the SLA literature, but which convincingly demonstrates that modification of temporal variables can facilitate L2 comprehension, is Grosjean's (1972) unpublished doctoral thesis, briefly reported in Lane, Grosjean, Le Bette and Lewin (1973). The paper appeared in *Linguistics* and was delivered at the 1971 International Congress of Applied Psychology, "Achievements and Prospects in the Applications of Psycholinguistics to the Teaching of Foreign Languages," in Liege, but since then seems to have got lost. As just noted, however, it is a study which is well worth reviving as it is still probably the most thorough investigation in the area to date.

The study was undertaken to “see whether...differences between...high and low values of the temporal properties made a difference to comprehension—and how much of a difference” (Lane et al., 1973, p. 17). Nineteen matched pairs of adult ESL students drawn from a population of 485, heard “high” and “low” versions of 6 texts modified in terms of articulation rate (SR minus pause time), number of pauses/length of run, and pause duration. “High” and “low” in this context were defined as about 1.5 standard deviations above and below mean rates; they were, therefore, only moderately high and low. For example, on the first text “high” articulation rate was 5.46 syllables per second (sps) and the “low” rate was 4.01 sps (Grosjean, 1972, p. 57).

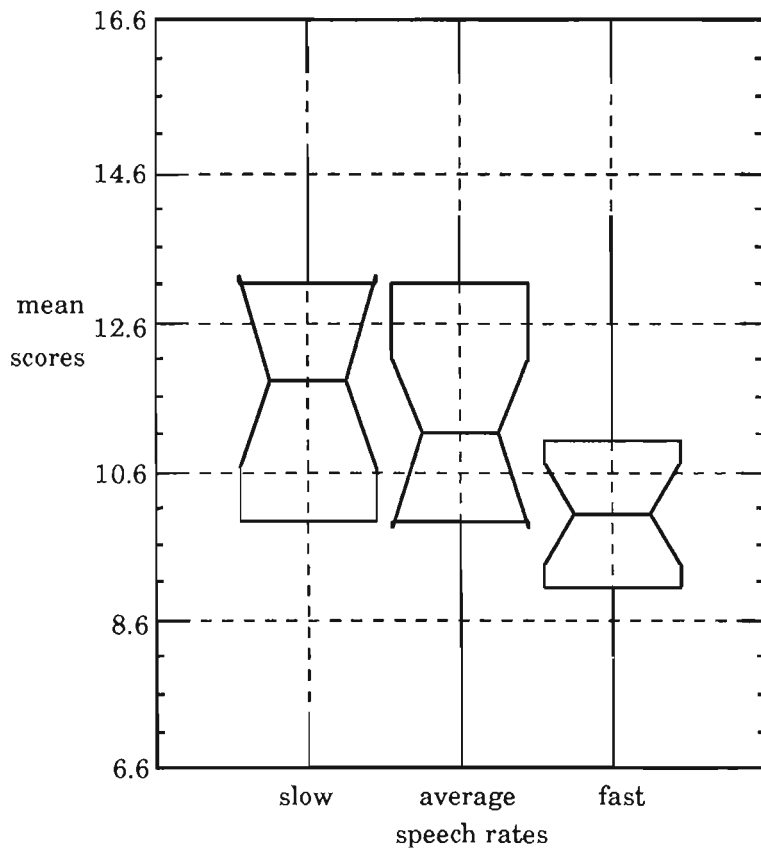
Comprehension was tested with six open-ended questions on each text. Lane et al. (1973) summarize the results in the following way: “In 5 of the 6 cases, changing from moderately high to moderately low values of a temporal variable led to moderate improvements in comprehension by non-native speakers” (p. 18). They conclude their comments on this experiment with an interesting summation of the three sets of findings:

If we simply add the effects on comprehension of the three temporal variables under study, comprehension stepped up an average of 24 per cent, but this figure depends too much on the passages used and does not take account of how the temporal variables covary normally and interact in their effects on comprehension; it is probably an underestimate of the impact of moderate changes in temporal properties on second-language comprehension. (p. 18)

Grosjean (personal communication, 6/27/89) acknowledges that summing the three sets of results may not be justified and that a different type of experimental design would be needed to investigate the combined effect of the three variables. However, even the individual results indicate the very important role played by temporal variables in facilitating comprehension. Moreover, were Lane et al.’s conclusion to be verified through replication, the implications for language teaching would be enormous: nowhere else has such a massive increase in comprehension been observed through moderately adjusting performance dimensions.

A recent investigation (Griffiths, in press) was undertaken to examine the effects of 3 SRs (200 wpm/3.8 sps; 150 wpm/2.85 sps; 100 wpm/1.9 sps) on the comprehension of three 350 to 400-word lexically and grammatically graded passages delivered to a group of 15 low-intermediate level NNSs. Repetition of the testing procedure with three texts and the use of a randomised complete block design were used to compensate for the small n and the lack of

Figure 1
 Notched Box-and-Whisker Plot of Mean Scores
 Obtained at Slow, Average and Fast Speech Rates



homogeneity amongst the subjects. The use of three texts also increased the statistical power of the experiment to acceptable levels. After several testing methods had been piloted, true-false questions were adopted to check comprehension. Two-way ANOVA indicated the observed difference in scores under the three SRs to be at the .0549 level, that is, narrowly missing the 5% level of significance. However, as this was a preliminary study conducted with a small *n*, further exploratory data analysis was undertaken (following Tukey, 1977). The notched box-and-whisker plot in Figure 1 shows not only how close the experiment came to giving a significant finding but, more importantly, shows where the difference lay within the three means.

As significant differences are indicated where notches do not overlap, it can be seen that scores obtained at the moderately fast rate and the slow rate are close to being significantly different, while the notches on the average rate box overlap both of the others. In summary, results showed that moderately fast speech rates resulted in a large reduction in comprehension, but that scores on passages delivered at slow rates did not differ markedly from those delivered at average rates.

It appears, therefore, that (in this particular context) speaking slowly did not greatly aid comprehension, but speaking moderately quickly reduced it. Should this tentative finding be replicated in future studies in different conditions, then the oft-repeated teacher-training direction to speak at normal rates (Hatch, 1983, p. 159) would, using simplified input, be empirically supported with low-intermediate students (but probably not for beginners). However, an investigation of subjective responses by both the NNS subjects and 14 NSs who also heard the recordings, showed frequent misperception of SR variation: if that is the case, consistent modification may not easily be achieved by teachers.

It should be stressed, however, that the complexity of the findings in this study and in those described above, as well as the caveats that have to accompany any conclusions that can be drawn from them, indicate the need for local studies and local applications rather than the ability of research to furnish wide-ranging recommendations with total confidence. Moreover, the value of this type of experimental research is only convincingly demonstrated when

the results are allied to those of descriptive studies (in this case of SR) conducted in the same setting.

For example, one such study (Griffiths, 1990), of the SR of 10 EFL teachers to university students of three different levels, revealed not only no significant difference between rates observed in a NS-NS baseline and rates to low-proficiency NNS learners, but also teachers talking to these students at rates of up to 4.5 sps. Even taking into account the standard caveats, it is highly unlikely that deliveries at such rates are adequately comprehended.

A related finding, from an investigation into the effect and occurrence in teacher-talk of hesitation phenomena (Griffiths, in preparation), does, however, reveal the apparently unconscious sensitivity of the above group of EFL teachers to, in particular, filled pauses. Firstly, the experimental part of the study confirmed, with low- and intermediate-proficiency NNSs, Voss's (1979) finding with advanced-level NNSs that hesitation phenomena were sources of perceptual error. A study of the occurrence of filled pauses (which caused most of the observed errors) in 30 EFL lessons showed them to be significantly less frequent ($t[9] = 5.446$, $p < .005$) than under comparable NS-NS baseline conditions. As it is extremely unlikely that any of the teachers in the experiment have ever given any conscious thought to the number of filled pauses in their speech to NSs or NNSs, this finding appears to show an unconscious modification of a particular temporal variable which is likely to facilitate comprehension of the input.

10. Summary and Conclusion

Each major category of temporal variable appears, therefore, to be capable of manipulation to facilitate NNS comprehension. If one of the major tasks of those involved in L2 teaching is simply to ensure comprehension, then these variables can be seen as amenable to manipulation. It now remains for researchers to specify more exactly how comprehension might be facilitated by manipulation of temporal variables, and to gauge how far these modifications are currently deployed in language classrooms.

However, a beginning has been made. Prior to 1989, MacLaughlin's conclusion that "We remain in a night in which all cows are black" (1980, p. 298) was the only one which could be drawn. Recent

developments require that that conclusion be changed. A number of recent investigations have not only been specifically of temporal variables but they have, to varying degrees, demonstrated the researchers' familiarity with pausological methodology. These studies have, consequently, produced more substantial findings. The study of temporal variables in an L2 context appears to be being granted the sort of prominence that it merits, and current research is doing justice to the importance of the problems being investigated.

To conclude, there is still no substantial theoretical underpinning to the research taking place and it seems unlikely that there is going to be one: as Cronbach (1982) notes generally for the social sciences: "Waiting for Newton is as pointless as waiting for Godot" (p. 61). However the detailed work which is taking place is beginning to "pin down the contemporary facts" (Cronbach, 1975, p. 126); they might then be used to inform practice. That is no mean aspiration.

This is a revised version of a paper presented at the JALT 15th Annual International Conference on Language Teaching/Learning, Okayama, Japan, November 4, 1989.

Roger Griffiths is Associate Professor of English at Nagoya University of Commerce and Business Administration. He is also a Chartered Psychologist and Associate Fellow of The British Psychological Society. He has a Ph.D. from Southampton University on the role of temporal variables in L2 learning.

References

- Anderson-Hsieh, J., & Koehler, K. (1989). The effect of foreign accent and speaking rate on native speaker comprehension. *Language Learning*, 38, 561-613.
- Baars, B. J. (1986). *The cognitive revolution in psychology*. New York: The Guilford Press.
- Beretta, A. (1986). Program-fair language teaching evaluation. *TESOL Quarterly*, 20, 431-444.
- Brown, G. (1986). Investigating listening comprehension in context. *Applied Linguistics*, 1, 284-301.

- Brown, G. (1989). Sitting on a rocket: An interview with Professor Gillian Brown. *ELT Journal*, 43, 167-172.
- Buck, G. (1988). Testing listening comprehension in Japanese University Entrance Examinations. *JALT Journal*, 10, 15-42.
- Carroll, J. B. (1966). The contributions of psychological theory and educational research to the teaching of foreign languages. In A. Valdman (Ed.), *Trends in language teaching* (pp. 93-106). New York: McGraw Hill.
- Carroll, J. B. (1972). Defining language comprehension: Some speculations. In J. B. Carroll & R. O. Freedle (Eds.), *Language comprehension and the acquisition of knowledge* (pp. 1-29). New York: John Wiley.
- Chaudron, C. (1985). Comprehension, comprehensibility, and learning in the second language classroom. *Studies in Second Language Acquisition*, 7, 216-232.
- Chaudron, C. (1988). *Second language classrooms: Research on teaching and learning*. Cambridge: Cambridge University Press.
- Chaudron, C., & Richards J. C. (1986). The effect of discourse markers on the comprehension of lectures. *Applied Linguistics*, 7, 113-127.
- Conrad, L. (1989). The effects of time-compressed speech on native and EFL listening comprehension. *Studies in Second Language Acquisition*, 11, 1-16.
- Corder, S. P. (1984). Review of S. D. Krashen "Second Language Acquisition and Second Language Learning" and "Principles and Practice in Second Language Acquisition." *Applied Linguistics*, 5, 56-58.
- Cronbach L. J. (1975). Beyond the two disciplines of scientific psychology. *American Psychologist*, 30, 116-127.
- Cronbach, L. J. (1982). Prudent aspirations for social inquiry. In W. M. Cruskal (Ed.), *The social sciences: Their nature and uses* (pp. 61-81). Chicago: Chicago University Press.
- Cronbach L. J. (1987). Social inquiry by and for earthlings. In *Evaluation Studies* (Vol. 12, pp. 400-424). Newbury Park: Sage.
- Dechert, D. W., & Raupach, M. (Eds.). (1980). *Temporal variables in speech: Studies in honour of Frieda Goldman-Eisler*. The Hague: Mouton.
- Ehrlich, M-F. (1982). An experimental study of the relationship between comprehension and memorization of a text. In J-F Le Ny & W. Kintsch (Eds.), *Language and comprehension* (pp. 157-168). Amsterdam: North Holland.
- Ellis, R. (1985). *Understanding second language acquisition*. Oxford: Oxford University Press.
- Eysenck, H. J. (1986). Consensus and controversy—Two types of science. In S. Modgil & C. Modgil (Eds.), *Hans Eysenck: Consensus and controversy* (pp. 375-398). Philadelphia, PA: The Falmer Press.
- Feyerabend, P. (1970). Consolations for the specialist. In I. Lakatos & A. Musgrave (Eds.), *Criticism and the growth of knowledge* (pp. 197-230). Cambridge: Cambridge University Press.
- Foss, D. J. (1988). Experimental psycholinguistics. *Annual Review of Psychology*, 39, 301-348.

- Garrod, S. (1986). Language comprehension in context: A psychological perspective. *Applied Linguistics*, 3, 226-238.
- Goldman-Eisler, F. (1954). On the variability of the speed of talking and on its relation to the length of utterances in conversation. *British Journal of Psychology*, 45, 94-107.
- Gregg, K. R. (1984). Krashen's Monitor and Occam's Razor. *Applied Linguistics*, 5, 79-100.
- Gregg, K. R. (1986) Review of "The input hypothesis: Issues and implications" by S. D. Krashen. *TESOL Quarterly*, 20, 116-122.
- Gregg, K.R. (1988). Epistemology without knowledge: Schwartz on Chomsky, Fodor and Krashen. *Second Language Research*, 4, 66-80.
- Griffiths, R. T. (1990, March). *Language classroom speech rates: Life in the fast lane*. Paper delivered at the 24th Annual TESOL Conference, San Francisco, CA.
- Griffiths, R. T. (in press). Speech rate and NNS comprehension: A preliminary study in time-benefit analysis. *Language Learning*, .
- Griffiths, R. T. (forthcoming). Pausology and SLA. *Applied Linguistics*.
- Griffiths, R. T. (in preparation). The paradox of comprehensible input: Hesitation phenomena in L2 teacher-talk.
- Grosjean, F. (1972). *Le rôle joué par trois variables temporelles dans la compréhension orale de l'anglais étudié comme seconde langue et perception de la vitesse de lecteurs et des auditeurs*. Doctoral dissertation. University of Paris V11.
- Grosjean, F. (1980). Temporal variables within and between languages. In H. W. Dechert & M. Raupach (Eds.), *Towards a cross linguistic assessment of speech production* (pp. 39-53). The Hague: Mouton.
- Håkansson, G. (1986). Quantitative aspects of teacher talk. In G. Kasper (Ed.), *Learning, teaching and communicating in the foreign language classroom* (pp. 83-98). Aarhus: Aarhus University Press.
- Harris, M., & Coltheart, M. (1986). *Language processing in children and adults: An introduction*. London: Routledge & Kegan Paul.
- Hatch, E. M. (1983). *Psycholinguistics: A second language perspective*. Rowley, MA: Newbury House.
- Henzl, V. M. (1975, August). *Speech of foreign language teachers: A sociolinguistic register*. Paper delivered at the 4th International Congress of AILA, Stuttgart.
- Henzl, V. M. (1979). Foreign talk in the classroom. *IRAL*, 17, 159-167.
- Kasper, G. (1988). Editor's Note. In G. Kasper (Ed.), *Classroom Research—AILA Review*, 5 (pp. 5-9). Amsterdam: Free University Press.
- Kelch, K. (1985). Modified input as an aid to comprehension. *Studies in Second Language Acquisition*, 7, 81-90.
- Kintsch, W., & Kintsch, E. (1984). Studies in test comprehension: Toward a model for learning from reading. In V. Sarris & A. Pardicci (Eds.), *Perspectives in psychological experimentation: Toward the year 2000* (pp. 165-176). Hillsdale, NJ: Lawrence Erlbaum .
- Klein, W. (1986). *Second language acquisition*. Cambridge: Cambridge University Press.
- Kowal, S. H., Wiese, R., & O'Connell, D. C. (1983). The use of time in storytelling.

- Language and Speech*, 26, 377-392.
- Krige, J. (1980). *Science, revolution and discontinuity*. Brighton: Harvester.
- Kuhn, T. S. (1970a). *The structure of scientific revolutions*. Second Edition. Chicago: University of Chicago Press.
- Kuhn, T. S. (1970b). Reflections on my critics. In I. Lakatos & A. Musgrave (Eds.), *Criticism and the growth of knowledge* (pp. 231-278). Cambridge: Cambridge University Press.
- Lane, H., Grosjean, F., Le Berre, J., & Lewin, E. (1973). Exploring some properties of foreign-language utterances that control their comprehension. *Linguistics*, 112, 15-22.
- Lightbown, P. M. (1985). Great expectations: Second language acquisition research and classroom teaching. *Applied Linguistics*, 6, 173-189.
- Long, M. H. (1985a). Input and second language acquisition theory. In S. M. Gass & C. G. Madden (Eds.), *Input in second language acquisition* (pp. 377-393). Rowley, MA: Newbury House.
- Long, M. H. (1985b, February). *Theory construction in second language acquisition*. Paper presented at the Second Language Research Forum, University of California, Los Angeles.
- Long, M. H., Brock, C., Crookes, G., Deicke, C., Potter, L., & Zhang, S. (1984). *The effect of teachers' questioning patterns and wait-time on pupil participation in public high school classes in Hawaii for students of limited proficiency*. Manoa, Hawaii: University of Hawaii at Manoa.
- McLaughlin, B. (1978). The monitor model: Some methodological considerations. *Language Learning*, 28, 309-332.
- McLaughlin, B. (1980). Towards a theory of speech processing: Some methodological problems. In D. W. Dechert & M. Raupach (Eds.), *Temporal variables in speech: Studies in honour of Frieda Goldman-Eisler* (pp. 291-298). The Hague: Mouton.
- McLaughlin, B. (1987). *Theories of second language learning*. London: Edward Arnold.
- Masterman, M. (1970). The nature of a paradigm. In I. Lakatos & A. Musgrave (Eds.), *Criticism and the growth of knowledge* (pp. 59-89). Cambridge: Cambridge University Press.
- Medawar, P. (1984). *The limits of science*. Oxford: Oxford University Press.
- Nagle, S. J., & Sanders, S. L. (1986). Comprehension theory and second language pedagogy. *TESOL Quarterly*, 20, 9-26.
- Neisser, U. (1976). *Cognition and reality*. San Francisco: Freeman.
- O'Connell, D. C., & Kowal, S. (1980). Prospectus for a science of pausology. In H. W. Dechert & M. Raupach (Eds.), *Temporal variables in speech: Studies in honour of Frieda Goldman-Eisler* (pp. 3-10). The Hague: Mouton.
- O'Hear, A. (1989). *Introduction to the philosophy of science*. Oxford: Clarendon Press.
- Popper, K. R. (1970). Normal science and its dangers. In I. Lakatos & A. Musgrave (Eds.), *Criticism and the growth of knowledge* (pp. 51-58). Cambridge: Cambridge University Press.
- Sabin, E. J., Clemmer, E. J., O'Connell, D. C., & Kowal, S. (1979). A pausological

- approach to speech development. In A. W. Siegman & S. Feldstein (Eds.), *Of speech and time* (pp. 35-55). Hillsdale, NJ: Lawrence Erlbaum.
- Sinclair, J. M. (1989, November). *The divorce of practice and theory*. Paper delivered at the 15th JALT Conference, Okayama, Japan.
- Tauroza, S., & Allison, D. (in press). Speech rates in British English. *Applied Linguistics*.
- Tukey, J. W. (1977). *Exploratory Data Analysis*. Reading, MA: Addison-Wesley.
- Voss, B. (1979). Hesitation phenomena as sources of perceptual errors for non-native speakers. *Language and Speech*, 22, 129-144.