Faster, normal or slower?: the effects of speech rates on high-intermediate ESL learners' listening comprehension of academic lectures

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Faster, normal or slower?
---The effects of speech rates on high-intermediate ESL learners' listening comprehension of academic lectures

by

Fushun Le

A thesis submitted to the graduate faculty
in partial fulfillment of the requirements for the degree of

MASTER OF ARTS

Major: Teaching English as a Second Language/Applied Linguistics

Program of Study Committee:
John Levis (Major Professor)
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Ames, Iowa
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This is to certify that the master's thesis of

Fushun Le

has met the thesis requirements of Iowa State University

Signatures have been redacted for privacy
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>LIST OF TABLES</td>
<td>IV</td>
</tr>
<tr>
<td>LIST OF FIGURES</td>
<td>V</td>
</tr>
<tr>
<td>ABSTRACT</td>
<td>VI</td>
</tr>
<tr>
<td>CHAPTER 1: INTRODUCTION</td>
<td>1</td>
</tr>
<tr>
<td>CHAPTER 2: LITERATURE REVIEW</td>
<td>8</td>
</tr>
<tr>
<td>CHAPTER 3: METHOD</td>
<td>16</td>
</tr>
<tr>
<td>CHAPTER 4: RESULTS</td>
<td>23</td>
</tr>
<tr>
<td>CHAPTER 5: DISCUSSION</td>
<td>30</td>
</tr>
<tr>
<td>CHAPTER 6: CONCLUSION</td>
<td>41</td>
</tr>
<tr>
<td>REFERENCES</td>
<td>47</td>
</tr>
<tr>
<td>APPENDIX A. SCRIPTS OF THREE ACADEMIC LECTURES</td>
<td>52</td>
</tr>
<tr>
<td>APPENDIX B. SURVEY OF TOPICAL KNOWLEDGE</td>
<td>62</td>
</tr>
<tr>
<td>APPENDIX C. WORD LIST</td>
<td>63</td>
</tr>
<tr>
<td>APPENDIX D. WEBSITES FOR LECTURES AND A SAMPLE SCREENSHOT</td>
<td>66</td>
</tr>
<tr>
<td>APPENDIX E. TEST QUESTIONS</td>
<td>67</td>
</tr>
<tr>
<td>APPENDIX F. SUBJECTS’ RAW TEST SCORES</td>
<td>73</td>
</tr>
<tr>
<td>ACKNOWLEDGEMENTS</td>
<td>74</td>
</tr>
</tbody>
</table>
LIST OF TABLES

Table 1 Lectures and SRs 20
Table 2 Experimental design 21
Table 3 Mean scores and standard deviations on the three lectures and on the combined lectures 23
Table 4 Three-way analysis of variance for scores related to groups, lectures and SRs 24
Table 5 Differences of least squares means across lectures 25
Table 6 Effect of SRs on test scores in lectures 1 and 3 25
Table 7 Means and standard deviations on combined lectures 1 and 3 26
Table 8 Level of significance of mean differences between SRs of combined lectures 1 and 3 27
Table 9 Subjects’ perception of lecture SRs 27
Table 10 Subjects’ perception of and reasons for lecture difficulty 28
LIST OF FIGURES

Figure 1  Comparison of mean scores on combined lectures 1 and 3  26
ABSTRACT

The purpose of this study is to 1) identify whether three speech rates (SR) (normal, faster and slower) have different effects on high-intermediate ESL learners’ listening comprehension of academic lectures, and if so, to determine which SR is the most beneficial to the learners’ comprehension; and 2) to identify learners’ perception of SRs and reasons for lecture incomprehensibility. Eleven international students were asked to listen to three long academic lectures on unfamiliar topics and answer multiple choice comprehension questions, which was followed by a brief survey of their perception of the SR appropriateness and lecture difficulty. The original SRs of the lectures, 157 wpm/3.40 sps, 168 wpm/3.34 sps and 173 wpm/3.33 sps, were set as the normal SRs, which were compressed and expanded with sound editing software by 15% into the faster SRs (181 wpm/3.91 sps, 193 wpm/3.84 sps and 199 wpm/3.83 sps) and the slower SRs (134 wpm/2.89 sps, 143 wpm/2.83 sps and 147 wpm/2.83 sps). Comprehension scores revealed no significant differences in the mean scores obtained at these SRs, which tentatively suggests that neither an ideal SR nor a “threshold” SR exists within the SR range between 134 wpm/2.89 sps and 199 wpm/3.83 sps. At a close-to-significant level, the higher scores obtained at the slower SR, a rate preferred by the subjects, were taken to suggest that the most facilitative SR is likely to be lower than 134 wpm/2.89 sps. Topical and lexical unfamiliarity and SR were reported by the subjects as the major factors affecting lecture comprehension. The non-significant findings were interpreted as being attributed to the low modification rate, the small n and the low reliability of the comprehension questions. Despite its inconclusive results, the study offers both theoretical and practical implications. It highlights the importance of SR in L2 listening comprehension.
research, where spoken materials rich in acoustic features are recommended to be used as input. Besides informing L2 teachers of important factors that affect listening comprehension, it also raises lecturers’ awareness of slowing down for L2 learners.
CHAPTER 1: INTRODUCTION

1. Speech rate in L2: Frequently reported but little researched

The significant role of speech rate (SR) on listening comprehension has long been mirrored in native-speaker (NS)/nonnative speaker (NNS)-NNS communication practice and second language (L2) classroom research. It is commonplace to hear requests to slow down when an oral message fails, e.g., “Sorry, but could you speak more slowly?” “Say that again, please?” “Pardon me?” and “What’s that?” Based on the diagnostic needs assessments returned by my 50 non-native listening students at Iowa State University (ISU) over the past two years, the leading perceived cause of incomprehensibility is a fast SR: 75% of the students reported that they failed to understand English because the person spoke too fast. In another study into lecture comprehension problems and strategies, Cantonese speakers unanimously rated “speed of delivery as the greatest obstacle to understanding” (Flowerdew, n.d., p. 17). International students who listened to audio-taped lectures in McKnight’s (2004) study also frequently referred to the lecturer’s SR as causing comprehension difficulties even when the SR was within normal range. This seems to point to the undesirability of a fast SR, which may impair listening comprehension, and the benefit of a slow SR, which may facilitate comprehension. While the former has been widely documented, the latter is still inconclusive, supported by some studies and not by others. A slower SR, “albeit theoretically logical and intuitively appealing, has not found uniform empirical support” (Zhao, 1997, p. 49). More importantly, despite the growing body of literature on listening comprehension, there has been a paucity of research into the effects of SR on NNS lecture comprehension
since Griffiths (1990b). The present study is an experimental investigation into this issue, which is important for English as a foreign/second language (EFL/ESL) research and pedagogy of listening comprehension.

2. Definitions of listening comprehension and SR

2.1 Listening comprehension

Despite the gradually increasing amount of empirical research into L2 listening comprehension, the definition of listening comprehension has been mostly assumed or vaguely specified. It is usually clear how comprehension was measured but not what exactly was being measured. This could lead to the problem of measuring general language proficiency/comprehension ability instead of listening comprehension. For example, contrived short sentences were used in Conrad’s (1989) study, where comprehension was narrowly defined as recall of individual words and structures. A question that is worth asking is: Does such recall necessarily mean that the message conveyed in a sentence is genuinely interpreted? It is not impossible that such an instrument was able to measure the recall of lexical and syntactic form alone without measuring listening comprehension.

According to Buck (2001) “listening comprehension is a process, a very complex process, and if we want to measure it, we must first understand how that process works. An understanding of what we are trying to measure is the starting point of test constructions” (p. 1). Buck (2001) outlined the textual aspects that are unique to listening and that should be included in the input to test-takers. These features include but are not limited to physical features like pause units (short 2-3 second bursts of speech), hesitations, intonation, stress, variable speeds, background sounds, and linguistic features like colloquial vocabulary and
expressions, false starts and frequent use of ellipsis. If these features are absent from the stimulus, then the test results could be confounded.

In order to comprehend spoken input, perceivers have to go through some processes of interpretation, which include top-down, bottom-up and interactive processing (McKnight, 1993). Research has shown that NSs, who are armed with prior cultural knowledge, usually rely on top-down processing, while NNSs, who may lack the same schemata, are more likely to draw on bottom-up processing (McKnight, 1993; Conrad, 1989). In the case of SR research, bottom-up processing may be preferable because the less background knowledge that the subjects have about the input, the more clearly the effect of SR can be revealed. Whatever process is used, however, it seems a listener has to go through the “selective process of attending to, hearing, understanding and remembering aural symbols” (Barker, 1971, p. 17) by using complex skills like predicting with verbal and visual cues, selecting relevant data, combining significant elements into chunks for processing and interpreting the discourse to gain knowledge about the topic and content of the input, the role, status, purpose and attitude of the speaker.

Attending lectures is an important listening experience required by college education. As part of the higher learning process and one of the prerequisites of further learning, lecture comprehension “requires both language ability and skills in evaluating information (deciding what is important and needs to be noted), organizing information (seeing how ideas relate to each other), and predicting information (anticipating the content and direction of a lecture)” (Lebauer, 2000, p. v). Powers (1986), after surveying 144 American faculty members, found the following skills rated as most important for academic listening:

1) identifying major themes or ideas
2) identifying relationships among major ideas
3) identifying the topic of a lecture
4) retaining information through note-taking
5) retrieving information from notes
6) inferring relationships between information
7) comprehending key vocabulary
8) following the spoken mode of lectures
9) identifying supporting ideas and examples (Powers, 1986, pp. 10-11)

Although this list is not comprehensive enough to include particular L2 lecture comprehension skills such as the “ability to identify the role of discourse markers in signaling structure of a lecture (e.g., conjunctions, adverbs, gambits, routines)” (Richards, 1983, p. 229), it is evident that note-taking skills are considered an important part of academic listening ability. Research shows that test-takers who take notes tend to score higher in listening tests than those who do not (Douglas & Hegelheimer, 2005; Lai, Wood, & Considine, 2000), although Rost (1990) points out that there is no direct correlation between quantity or quality of notes and level of understanding.

What has been summarized only represents some of the interpretations of listening comprehension, a complex process that is still far from being understood.

2.2 Speech rate

Unlike listening comprehension, SR has been defined in a much more clear-cut manner. It is considered one of the important temporal variables for pedagogy. It can be defined as “a combination of articulation rate and pause time, usually expressed in syllables per second”
That is, SR is “measured by total number of syllables/total time and reported in syllables per second [sps]. Words per minute [wpm] are considered far too inexact to be used in the specialist literature” (Griffiths, 1991b, p. 345) because they “vary considerably among speech categories (i.e., radio broadcast, lectures, interviews, conversations)” (Rubin, 1994, p. 200). However, “as wpm is readily understood, it appears reasonable to continue to use it alongside other measures, when reporting L2 research” (Griffiths, 1990b, p. 316). It seems not only reasonable but necessary to report both wpm and sps because two excerpts, be they conversations or lectures, that have the same number of words usually come with a different number of syllables. That is, although they may have the same wpm rate, they differ in sps and vice versa. Even when both wpm and sps are used, it is not unproblematic. As Vanderplank (1993) points out, wpm/sps may not be able to grade the difficulty of spoken passages accurately because it ignores the role of stress and rhythmic patterning. In spite of that, they are still the most widely used among both L1 and L2 researchers.

SRs vary with genres, speakers and contexts, among other factors. It is noted in Robb, Maclagan, and Chen (2004) that adult speakers’ SR is approximately 3.67 sps (converted from 220 syllables per minute) in American English, 3.95 sps in Australian English, 4.38 sps in British English and 4.67 sps in New Zealand English. While the rate for spontaneous speech tasks in American English is 3.67 sps, the rate for reading tasks is 4.33 sps. For many one-hour lectures, however, in Bain, Basson and Wald’s (2003) analysis, the SRs have varied between 100 and 200 wpm. If SR can vary in a single language to this extent, it can be imagined how much it can vary in different languages. As Rubin (1994) summarized, “…different languages have different ‘normal’ rates and the rates defined in studies using
English can not be applied exactly to studies of other languages...normal rates vary among text types and that the range of what is considered normal may vary from language to language” (Rubin, 1994, p. 200). With this in mind, it is not surprising to find that 160, 153 and 155 wpm were set as the normal/average/medium SRs in Rader (1991), 170 wpm and 200 wpm in Blau (1990), 150 wpm/2.85 sps and 188 wpm/3.75 sps in Griffiths (1990a; 1992), 150 wpm in Robinson, Sterling, Skinner and Robinson (1997) and 194 wpm in Zhao (1997).

3. Objectives of the study

The objectives of the study are

- to identify whether three SRs (normal, faster and slower) have different effects on high-intermediate ESL learners’ listening comprehension of academic lectures, and if so, to determine which SR is the most beneficial to their comprehension;

- to identify learners’ perception of SRs and reasons for listening difficulties with academic lectures.

In order to explore the effects of different SRs, the original rate of three semi-authentic academic lectures was set as the normal rate (157 wpm/3.40 sps, 168 wpm/3.34 sps and 173 wpm/3.33 sps), which was modified by 15% to a faster rate (181 wpm/3.91 sps, 193 wpm/3.84 sps and 199 wpm/3.83 sps) and to a slower rate (134 wpm/2.89 sps, 143 wpm/2.83 sps and 147 wpm/2.83 sps).

4. Organization of the study

Chapter 2 reviews previous literature on the importance of SR and its effect on NS and NNS listening comprehension. Information about the subjects, materials, experimental design
and data analysis used in the study will be covered in Chapter 3. The results of the study will be presented in Chapter 4, which will be followed by discussion in Chapter 5. The theoretical and pedagogical implications and limitations of the study as well as my recommendations for further research will be summarized in the last chapter.
1. The importance of SR in L2 teaching and research

SR is of direct relevance to English language teaching methodology and L2 research. In Griffiths’ (1991b) words, “in both L2 and NS-NNS content classrooms, speed of delivery... is something teachers have to make decisions on during every lesson of their lives” (p. 347). EFL/ESL teachers should be aware of which SR is optimal for students’ listening comprehension, which is critical to their language acquisition and content learning. Recent empirical evidence suggests that the issue of SR adjustment should not be taken for granted but should receive serious attention and be incorporated into teacher training. Although foreigner talk and input studies indicate that “SR to NNSs is slower than that normally employed in NS-NS interaction... and ... that it becomes increasingly slow in discourse with NNSs of lower proficiency levels” (Griffiths & Beretta, 1991, p. 6), Griffiths and Beretta (1991) found no significant modifications to/reduction of SR in six professors’ 18 lecture deliveries to the NS and NNS groups, nor to the high- and low proficiency NNS groups. Similar results were observed in Griffiths (1991a) where 10 EFL university teachers’ rate adjustment was examined: “SR did not significantly differ over time, between proficiency levels of NNSs, or in utterances between NS-NNSs and NS-NSs” (p. 193).

Findings on SR can inform not only teacher talk but also listening comprehension materials development. It may be argued that with the advancement of computer technology, there is no point in doing such research because students can control the SR of materials using the speed-play feature available in plug-ins like Windows Media Player 10. This,
however, is a case of computer-assisted language learning, which is an ideal and trend that is still far from the status quo of many L2 learning situations around the world. Most teachers and learners actually still do and will have to teach in traditional classrooms relying on audio-taped materials. Furthermore, the current version of the software offers three SRs (fast, normal and slow) only, and even if further digital learning can provide any possible SRs, it is still necessary to know which SR is suited to which group of learners. This again may give rise to another argument, i.e., seeking an appropriate SR for a group of learners means denying individual learner characteristics and thus is pointless. Individual and group characteristics, however, do not always form a dichotomy. It is difficult to see how individual differences can be respected and how classes can be taught without acknowledging and attending to group characteristics, the general needs that a specific group or level of students have in common and the basis for scaffolding and collaborative learning. While every student may have a comfortable SR and “i+1” SR, there can always be an SR that is more appropriate for the beginner level than for higher levels, for instance. Moreover, the process of finding group SRs actually contributes to the search for SRs suitable for individuals and vice versa. Still another misconception is that the lack of a uniform normal SR renders cross-study comparison impossible and thus makes SR research that does not use a consistent and objective reference rate meaningless. This fear is unnecessary because non-uniformity is not unique to SR research; all research is context-dependent. In fact, it seems neither possible nor necessary to have a fixed norm for SR because it is the specificity of speech genres, speakers and listeners that ineluctably determines what a normal SR is. An SR, be it fast or slow, is always relative to the normal SR and the compression/expansion rate that are set in a particular situation or study. Therefore, the concept of SR is relative instead of absolute by
nature. This, however, does not stand in the way of examining and conducting investigations that seek to explore the effect of SR on listening comprehension.

2. Evidence against fast SRs

In spite of the apparent discrepancy among the normal SRs used, there is tremendous evidence against a facilitative effect for fast SRs, even in NS comprehension. Reviewing early studies, Robinson, Sterling, Skinner, and Robinson (1997) note that “research has consistently shown that listening comprehension suffers as speaking rate increases” (p. 260). “The disadvantages found at fast rates are [also] convincingly documented in compressed speech studies where speech recorded at normal rates (in the region of 150-175 [wpm]) is accelerated through the use of speech compressors (which electronically remove portions of sound and pauses but which do not result in distortion until extremely high rates are attempted)” (Griffiths, 1991b, p. 348). Griffiths (1991b) cited three studies to support the negative role of high rates (275-325 wpm). Along the same lines, Beatty, Behnke and Froelich (1980) summarized the results of several early studies and suggested that comprehension suffered significant losses when presentation rate exceeded approximately 275-280 wpm. They also reported that a significant reduction in comprehension resulted from accelerated presentation rates, a result that was predicted by an earlier study (Behnke & Beatty, 1977, as cited in Beatty, Behnke, & Froelich, 1980) that claimed to employ more sensitive measures of comprehension. Investigating the effect of both accented speech and SRs, Anderson-Hsieh and Koehler (1988) found that increasing the SRs of three Chinese speakers by an average of 30% led to significant decreases in NS listening comprehension. Therefore, although fast rates may have such merits as increasing persuasiveness in radio or
TV commercials, saving presentation time and storage space as well as serving to improve slow readers’ reading speed and aid the blind (Beatty, Behnke, & Froelich, 1980; Robinson, Sterling, Skinner, & Robinson, 1997), they do not seem to facilitate NS listening comprehension, let alone NNS listening comprehension.

3. Conflicting findings on slowed SRs

In contrast, the suggestion that a slowed SR facilitates listening comprehension is widely documented in both early and more recent literature. According to Griffiths’ (1991b) review of selected studies, Hatch (1979; 1983) identifies slow SR as one of the major facets of foreigner talk likely to enhance comprehension for learners, pointing out that “slowing of rate means clearer articulation, fewer reduced vowels, less consonant cluster simplification, more fully released final stops, and stronger voicing of voiced consonants in final position ... [as well as] longer pauses between major constituents” (1983, p. 159); Ellis (1985) also quotes slowing down speech as an input modification in foreigner talk; Dudley-Evans and Johns (1981) identify slow tempo as correlating strongly with lecture comprehension; Kelch (1985) found from his study of delivery in a dictation test to intermediate-level students that the slower SR resulted in significantly greater comprehension when measured by an exact word method although not when measured by an equivalent meaning method; Henzl (1979) observed a general tendency to slow down for NNSs and for beginning learners in a study into foreign language teachers’ speech modification; Hakansson (1986) concluded from her study that teachers adjusted their rate of speech to the proficiency level of the students. The last two studies have also been reviewed by Chaudron (1988), who considers L2 teacher speech modifications, e.g., alterations in phonology and rate of speech, likely to contribute to
students' comprehension and learning. After discovering that both higher comprehension and higher perceived value of the information were achieved at the slower lecture rate by NS undergraduates, Robinson, Sterling, Skinner, and Robinson (1997) remarked that “the answer to the question, ‘How fast should I speak?’ is a resounding, ‘As fast as the slowest lecturers (about 100 wpm)!’” In the same year, Zhao (1997), who allowed his subjects to control the SRs of individual sentences and short passages, found that NNSs’ comprehension increased when they mechanically slowed the rate of stimuli themselves. Not only did the slowed rates actually improved comprehension, but they were preferred by the respondents, 79% of whom reported that slower SR helped their listening comprehension.

This positive effect of slower SRs, however, is contradicted by some other research. Smith’s (1980) study of the effect of “Slowed Speech” on listening comprehension of French revealed that slowed French inhibited the development of listening comprehension skills. Derwing’s (1990) investigation into the relationship between rate adjustment and NS-NNS communicative success in retelling a film showed that NSs who did not adjust their SR communicated more successfully with NNSs than speakers who increased pause time significantly. Blau (1990) found no significant improvement in Polish or Puerto Rican learners’ listening comprehension when a faster SR (170 wpm) was mechanically reduced to a slower SR (145 wpm) although the rate reduction did benefit learners at the lowest proficiency alone. Rader’s (1991) study in a Spanish as L2 context indicated that the speech expansion of three Spanish texts did not facilitate the listening comprehension of third-quarter university Spanish students. Bowels and Healy’s (2000) three experiments which examined the relationship between SR and beginning learners' foreign word identification in sentences suggested that slowing speech may not be necessary for beginning foreign
language instruction. Derwing and Munro (2001) concluded from the findings of their study of NNSs’ SR preference that “the frequent admonition that people should speak more slowly than usual to L2 speakers may be of limited or possibly no value” (p. 334). Exploring NSs’ preference for L2 SR, Munro and Derwing (1998) found that although English NS listeners may prefer to hear accented speech presented slower than that of NSs, further reduction of L2 SRs did not improve NS-rated accentedness or comprehensibility. Their later study (Munro & Derwing, 2001) indicated that the estimated optimal rate for foreign-accented utterances “was somewhat faster than the rates typically used by the nonnative speakers” (p. 459).

Interestingly, Griffiths’ (1990b) findings on the effects of SR on NNS listening comprehension only partially supported the claim that a slowed SR facilitates listening comprehension. He had 15 “lower-to-intermediate” Japanese learners of English listen to three semi-scientific texts at three rates: moderately fast (about 200 wpm), average (about 150 wpm), and slow (about 100 wpm). The subjects were asked to answer fifteen true-false questions after each passage. Each of the 15 subjects had a chance to listen to the three passages at all three rates. Although he found that the moderately fast SR reduced comprehension, he also found that the slow rate of delivery did not increase comprehension significantly, as compared to speech delivered at a normal rate. In a similar study (Griffiths, 1992) with elementary-to-intermediate level subjects listening to stories, he found that slowed rates of delivery (approximately 127 wpm/2.5 sps) resulted in better comprehension scores than fast (approximately 250 wpm/5 sps) and average (approximately 188 wpm/2.75 sps) rates although average rates did not lead to better results than fast rates.

The two studies combined seem to indicate that for semi-scientific texts and stories (351-454 words in length), an SR beyond 188 wpm reduced low-to-intermediate L2 learners’
listening comprehension, while an SR between 100-150 wpm did not lead to significant
differences in comprehension. Then is this range of rates ideal for this group of NNSs? If so,
what are the ideal rates for higher-level learners? Although it is necessary “to indicate to
specific groups, on specific texts (a) how much, and at what rates, comprehension decreases
as SR rises; (b) if there is a lower SR limit at which reduced comprehension is also observed”
(Griffiths, 1992, p. 385), little further research has been conducted. It is also worth noting
that in both studies, the aural input was texts selected from SRA Mark 2 Reading Laboratory
2a Power Builder materials; they were passages designed for NS readers instead of spoken
input with the special features mentioned earlier. It seems the only speech feature available
was the pauses at clause boundaries and intra-clausal positions. It is clear that other than that,
the texts were not adapted for listening purpose and so such measures of listening
comprehension could be questionable, considering the important differences in the linguistic
features between written and spoken language. Another issue is text difficulty: statistical
analyses showed that there were significant differences between two of the texts used, “texts
2 and 3” (Griffiths, 1990b, p. 330), although they appeared “to be approximately equivalent
and … within the subjects’ proficiency level” (p. 331). The last issue which could have
diminished the validity of the findings is that comprehension was measured by means of
true/false questions, which could have been affected by guesswork. Griffiths pointed out that
this question type was chosen over multiple choice questions because the reading involved in
the former was not excessive, but there seems to be no evidence that it entails less reading
and is a superior instrument.

This review shows that while the negative role of a fast SR has been well established,
the facilitative role of a slowed SR is controversial. There is also little research that seeks to
identify optimal SRs for different proficiency levels. It is part of the purpose of this present pilot study to find out a facilitative rate for high-intermediate ESL learners listening to academic lectures.
CHAPTER 3: METHOD

1. Research questions

Although a fast SR has generally been shown to diminish comprehension in compressed-speech research and, a slow SR may be accompanied by improved comprehension, there is no consistent empirical evidence to support such a linear relationship in L2 listening comprehension and thus no solid theoretical foundation to formulate hypotheses. So the research questions that correspond to the purpose of the study are

1) Is there a significant difference between high-intermediate ESL learners’ comprehension of academic lectures delivered at faster, normal and slower SRs? If so, is the slower SR the most beneficial for the learners’ listening comprehension?

2) Is the learners’ perception of the SRs consistent with the actual SRs?

3) Is SR a major cause of incomprehensibility of academic lectures?

2. Subjects

The subjects were 11 international students (4 female, 7 male) from Korea (6), China (4) and Lebanon (1). Their ages ranged from 18 to 37. They had studied English for an average of eight years and had been in the US for at least two months. Although they majored in different areas: computer science (2), agronomy (2), horticulture (1), business (1), marketing (1), finance (1), design (1), transportation engineering (1) and open option (1), they were all enrolled in the spring 2006 E99 L at ISU. E99 L is a one-semester non-credit course offered to improve NNSs’ academic listening and note-taking strategies. All but one subject tested into the course after taking the ISU English placement test (EPT) and the E99
L diagnostic test (DT), which determined that their listening skills needed support. The EPT is administered before a semester starts to waive or place newly admitted international students into English classes. The DT is administered at the beginning of a semester. If students fail the EPT but pass the DT, they will still be waived from E99 L. Otherwise they will have to take the course. Therefore, although the subjects had passed either the TOEFL or IELTS and their English proficiency in some aspects may have been at an advanced level, their listening proficiency could best be described as high-intermediate. The subject who arrived late and missed both the EPT and DT was at the same level based on a full-semester class observation, which also showed that all the subjects had normal hearing ability and were familiar with using the computer for online listening practice.

3. Materials and measurement

Three academic lectures (APPENDIX A) were selected from the E99 L textbook---Learn to Listen, Listen to Learn: Academic Listening and Note-Taking (Lebauer, 2000), which is a textbook designed to teach high-intermediate to advanced ESL learners “how to listen to a lecture and take notes: how to recognize lecture organization, use lecture cues and conventions that indicate organization and emphasis, recognize redundancy, and predict information” (p. v). The materials provided claim to replicate the discourse style and function of academic lectures, where the language has features that are unique to spoken language, especially to lectures, e.g., hesitations, false starts, ellipsis, frequent use of gap-fillers, tangents and repetition, i.e., “high degree of paraphrase and redundancy … and the use of cues to introduce topics, signal organization, and conclude lectures” (p. v). The Flesch Reading Ease scores of the lecture scripts are approximately 78, 86 and 86, which means that
they are easier to read than average documents, which score 60-70. Although the readability of the scripts may not be able to predict the comprehensibility of the lectures, these scores show that the three lectures are roughly of the same syntactic level of difficulty.

In order to control for topic familiarity and lexical knowledge, a 0-10 level scale (APPENDIX B) and a word list were used two weeks before the experiment. Thirteen lecture topics were presented to the subjects who were asked to rate their own familiarity level with 0 representing the lowest level and 10, the highest level of familiarity. The three lectures that scored the lowest were considered the least familiar to the subjects and thus were selected for the experiment.

The subjects were also presented with a list of possible new vocabulary items from which they identified those that were truly unknown to them. If a word was unknown to 36% of the subjects, it was entered with a context-based definition into the word list (APPENDIX C) that was handed out to the subjects, who were told that these were the new words that would appear in their later listening practice and that they were supposed to learn by heart.

The three lectures, which were pre-recorded by three different NSs of standard American English (one female and two male) on audio tapes, were digitized with TechSmith Morae Recorder into audio files with little loss of sound quality but with a small amount of background noise (page turning, door opening and elevator signals), which added to the authenticity of the lectures. One of the reasons why the three semi-authentic lectures designed for learning purpose were used instead of authentic lectures is that the amount of noise in the latter is usually too high for research. Another reason is that the three lectures fit better into the students' note-taking curriculum at this point; authentic materials may not always be ideal. As Griffiths (1990a) notes, "evidence from temporal variable research leads
to the recommendation that authentic materials should be approached gradually rather than
be instantly confronted... after all, being thrown in at the deep-end is widely considered to be
more likely to result in sinking rather than swimming” (p. 60).

The SRs of the original recorded lectures were 157 wpm/3.40 sps, 168 wpm/3.34 sps
and 173 wpm/3.33 sps, which were considered the normal SRs in this study. These normal
SRs were compressed and expanded by 15% with the sound editing software Goldwave
V5.08 without causing unnaturalness in the speech. The lectures with modified SRs were
also aurally inspected to ensure that no other audible distortions had occurred as a result of
the rate manipulations. The increment/modification rate of 15% was adopted because the
lectures were not only on unfamiliar topics but also of greater lengths compared with
listening materials used in other SR studies. It was speculated that with such complexity of
the information to be processed, even a small change in SR may affect listening
comprehension. Another reason is that the SRs of most books on tapes seem to be slowed by
approximately 15% to facilitate NNS comprehension. The lecture topics, lengths and rates
were presented in Table 1. The lectures were uploaded onto a server so that they could be
delivered online to the subjects in a computer laboratory. The websites and a sample
screenshot were given in APPENDIX D. None of the URLs were revealed to the subjects
until they were ready to start listening for the experiment.
Table 1 Lectures and SRs

<table>
<thead>
<tr>
<th>Lecture</th>
<th>Topic and Speaker</th>
<th>Word Length</th>
<th>Syllables</th>
<th>Speech Rates</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Faster (85%)</td>
</tr>
<tr>
<td>1</td>
<td>Pheromones Female</td>
<td>1,574</td>
<td>2,047</td>
<td>181 wpm/ 3.91 sps TL= 8’43&quot;</td>
</tr>
<tr>
<td>2</td>
<td>Robodoc Male</td>
<td>2,441</td>
<td>2,908</td>
<td>193 pm/ 3.84 sps TL=12’38&quot;</td>
</tr>
<tr>
<td>3</td>
<td>Hall’s classification of cultures Male</td>
<td>3,104</td>
<td>3,583</td>
<td>199 wpm/ 3.83 sps TL= 15’35&quot;</td>
</tr>
</tbody>
</table>

Note. TL = time length

A total of 30 multiple choice questions (10/lecture, APPENDIX E) was used to measure the subjects’ listening comprehension. The question types were consistent across lectures. They all elicited the subjects’ interpretation of the lecture goal/major idea, organizational plan/lecture structure and supporting details, which included supporting ideas and examples, relationships between information, key vocabulary and the lecturer’s attitude. After the questions were constructed partly based on the questions available in the textbook, five NSs in the English department at ISU, one professor and four graduate students, were consulted to examine the questions for clarity, consistency and inferrability. Any item that could be confusing or inferred without listening to the lectures was either eliminated or revised. A post-experiment survey was also conducted to elicit the subjects’ perception of the SRs and reasons for the incomprehensibility of the lectures. The questions were both presented in a booklet and posted on the lecture webpages.
4. Experimental design

The subjects, whose listening proficiency level was estimated to be high-intermediate, were divided into three groups at random. Before the experiment, they had been practicing academic listening and note-taking skills for half a semester, both online and offline, as part of their coursework for E99 L, which met for 30 minutes twice a week. During the experiment, they listened to all three lectures and all three rates in three different sessions in a computer laboratory. They were allowed to listen to the lectures no more than once. In each session, the lecture was the same for all groups but three different rates were used. For example, in session 1, all three groups listened to lecture 1, but group 1 listened to the faster rate, group 2, the normal rate and group 3, the slower rate (See Table 2). This within-group design was adopted instead of a between-group design because although the subjects were at the same listening proficiency level, their background knowledge and other language skills may have varied. If a between-group design was used, it would be more difficult to tell whether the differences in comprehension are attributable to the rate differences or to the groups' inherent differences.

<table>
<thead>
<tr>
<th>Total n=11</th>
<th>Group 1 (n=4)</th>
<th>Group 2 (n=3)</th>
<th>Group 3 (n=4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Session 1</td>
<td>Lecture 1 - faster</td>
<td>Lecture 1 - normal</td>
<td>Lecture 1 - slower</td>
</tr>
<tr>
<td>Session 2</td>
<td>Lecture 2 - normal</td>
<td>Lecture 2 - slower</td>
<td>Lecture 2 - faster</td>
</tr>
<tr>
<td>Session 3</td>
<td>Lecture 3 - slower</td>
<td>Lecture 3 - faster</td>
<td>Lecture 3 - normal</td>
</tr>
</tbody>
</table>

At the beginning of each session, the subjects were instructed to put on their headphones and access the website where a specific lecture was located. They were not informed of the
difference in SRs among groups and sessions because they would be asked for their perception of the SRs after listening to the lectures and finishing the comprehension questions. Neither were they allowed to read the questions before listening to the lectures. Then they received the question booklet and two note sheets and started listening to the lecture and taking notes. They were allowed to take up to 50 minutes to answer the questions based on their notes. All subjects finished within the time limit.

5. Data analysis

Repeated measures ANOVA and paired-samples t-tests with Tukey-Kramer (T-K) adjustment performed in SAS (Statistical Analysis System) were used for data analysis. Results from returned post-experiment surveys were also tabulated.
CHAPTER 4: RESULTS

Based on the subjects' raw scores (APPENDIX F) obtained from the multiple choice questions, mean scores on each lecture and over the three lectures were calculated and are listed in Table 3 along with the standard deviations. The data demonstrate an interesting but confusing pattern: both the highest (bold) and lowest (underlined) mean scores occurred at different rates for different lectures: the highest score fell on the faster SR in Lecture 1, the normal SR in lecture 2 and the slower SR in lecture 3; the lowest mean score happened to the faster SR in lecture 2 and the normal SR in lectures 1 and 3. The means of the three combined lectures, however, show that the slower SR produced the highest score, while the normal, not the faster, SR led to the lowest score.

Table 3  Mean scores and standard deviations on the three lectures and on the combined lectures

<table>
<thead>
<tr>
<th></th>
<th>Mean (Maximum score = 10)</th>
<th>Standard Deviation (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Faster</td>
<td>Normal</td>
</tr>
<tr>
<td>Lecture 1</td>
<td>7.00</td>
<td>4.33</td>
</tr>
<tr>
<td>Lecture 2</td>
<td>3.75</td>
<td>5.25</td>
</tr>
<tr>
<td>Lecture 3</td>
<td>6.00</td>
<td>5.75</td>
</tr>
<tr>
<td>Combined Lectures</td>
<td>5.55</td>
<td>5.18</td>
</tr>
</tbody>
</table>

An analysis of variance with repeated measures model was performed to discover whether significant differences exist between the mean scores across the groups, the lectures and the SRs. The purpose of comparing test scores across groups and lectures is to clarify the initial interesting findings in the mean scores, to minimize the effects of differences in groups and lectures and to maximize the effects of SRs on listening comprehension.
Therefore, besides the previous steps of a within-group design, random group division and lecture topic screening, the statistical analysis itself is also a step to control for confounding factors. The results of the analysis together with relevant F test and $p$ values are given in Table 4, which presents no evidence that there are differences in mean scores between groups ($p = 0.4756$) or rates ($p = 0.3920$). There is, however, convincing evidence that the mean scores between lectures are different ($p < 0.0001$).

<table>
<thead>
<tr>
<th>Effect</th>
<th>Num DF</th>
<th>Den DF</th>
<th>F Value</th>
<th>Pr &gt; F</th>
<th>Alpha</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group</td>
<td>2</td>
<td>8</td>
<td>0.82</td>
<td>0.4756</td>
<td>0.05</td>
</tr>
<tr>
<td>Lecture</td>
<td>2</td>
<td>18</td>
<td>25.81</td>
<td>&lt;.0001</td>
<td>0.05</td>
</tr>
<tr>
<td>SR</td>
<td>2</td>
<td>18</td>
<td>0.99</td>
<td>0.3920</td>
<td>0.05</td>
</tr>
</tbody>
</table>

The insignificant finding on the group effect confirmed the homogeneity of the subjects and justified the use of randomization. The significant differences in the mean scores between lectures could come from the difference in the lectures themselves. So if there is one lecture that is sharply different from the other two, the test results in that one lecture could affect the mean scores between SRs. Therefore, a t-test with T-K adjustment for multiple comparisons was run to identify which lecture is different. The test result is shown in Table 5, which indicates that the mean score in lecture 2 is significantly different from that in both lecture 1 ($p = 0.0004$) and lecture 3 ($p = 0.0005$), while there is no significant differences between the mean scores in lectures 1 and 3. Therefore, the test scores from these two lectures were submitted to further analysis of the effect of SRs.
With the elimination of the test scores on lecture 2, another t-test with T-K adjustment was performed on the scores obtained in lectures 1 and 3 to see if the three SRs have different effects on the scores. The result of this analysis, as can be seen in Table 6, reveals a borderline level of significance \((p = 0.065; F\text{-test})\) for the mean scores across the three SRs. Such a result is consistent with Griffiths' (1990b) initial data analysis, which evidenced "differences narrowly missing the 5% level of significance" (p. 327). In consideration of the similarities between the present study and Griffiths' (1990b), which were both pilot studies that had a small number of subjects \((n = 11\) and 16\)), further analysis was conducted to identify exactly where significant differences within pairs of the three SRs are likely to exist. After all, "[w]e cannot afford to pour costly data down the drain whenever effects present in the sample 'fail to reach significance'" (Cronbach, as cited in Griffiths, 1990b). Data that reveal near-significant effects may be worthy of a closer examination.

**Table 6  Effect of SRs on test scores in lectures 1 and 3**

<table>
<thead>
<tr>
<th>Effect</th>
<th>Num DF</th>
<th>Den DF</th>
<th>F Value</th>
<th>Pr &gt; F</th>
<th>Alpha</th>
</tr>
</thead>
<tbody>
<tr>
<td>SR</td>
<td>2</td>
<td>9</td>
<td>3.89</td>
<td>0.065</td>
<td>0.05</td>
</tr>
</tbody>
</table>

The means and standard deviations on the combined lectures 1 and 3 are given in Table 7. A clearer picture of how much the mean scores of the three SRs differ is presented in Figure 1, which again shows that the lowest score was not obtained at the faster rate but at the normal rate. The highest mean score was still obtained at the slower rate, which is congruent
with many previous findings. Therefore, the biggest gap is found between the slower SR and the normal SR. Is this difference significant? What about the difference in means between the faster rate and the normal rate?

Table 7  Means and standard deviations on combined lectures 1 and 3

<table>
<thead>
<tr>
<th></th>
<th>Means</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Faster</td>
<td>6.57</td>
<td>1.51</td>
</tr>
<tr>
<td>Normal</td>
<td>5.14</td>
<td>1.95</td>
</tr>
<tr>
<td>Slower</td>
<td>7.00</td>
<td>1.91</td>
</tr>
</tbody>
</table>

Figure 1  Comparison of mean scores on combined lectures 1 and 3

Pairwise comparisons were made by using T-K adjustment for multiple comparisons. Table 8 shows that even between the two extremes, the slower and the normal rate in this case, the difference narrowly missed the 5% level ($p = 0.0570$). So no differences were found between the three SRs, although the results suggest that the slower SR proved to play the most facilitative role in the subjects’ listening comprehension. Is this role consistent with the subjects’ perception; i.e., do they prefer this slower rate to the other rates?
The answers to the above question can be found in Table 9, which indicates that none of the subjects thought any of the SRs was slow and that 27% of them considered the lecture delivery, even at the normal and slower rates, to be fast. This perception seems to reflect their preference for the slower rate. The fact that the majority of them (73%) thought that all the SRs were appropriate may demonstrate their marginal ability in detecting SR differences, since few of their assessments matched the actual SRs, which may lend further evidence to Griffiths’ (1990b) speculation: “subjective awareness of SR was rarely accurately perceived” (p. 331) by NNSs.

Table 8  Level of significance of mean differences between SRs of combined lectures 1 and 3

| Pair                  | Estimate | Standard Error | DF | t Value | Pr > |t| | Adjustment       | Adj P | Alpha |
|-----------------------|----------|----------------|----|---------|-------|---| |                 |       |       |
| faster - normal       | 1.4540   | 0.7277         | 9  | 2.00    | 0.0768|   | | Tukey-Kramer     | 0.1683| 0.05  |
| faster - slower       | -0.2400  | 0.6645         | 9  | -0.36   | 0.7263|   | | 0.9311           | 0.05  |
| normal - slower       | -1.6941  | 0.6255         | 9  | -2.71   | 0.0241|   | | Kramer           | 0.0570| 0.05  |

Table 9  Subjects’ perception of lecture SRs

<table>
<thead>
<tr>
<th>Actual SR</th>
<th>Faster</th>
<th>Normal</th>
<th>Slower</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perceived SRs</td>
<td>fast</td>
<td>appropriate</td>
<td>slow</td>
</tr>
<tr>
<td>No. of Ss Total: 33</td>
<td>3</td>
<td>5</td>
<td>0</td>
</tr>
</tbody>
</table>

Lecture SRs Perceived by Percentage of Ss

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Fast</td>
<td>27%</td>
<td>Appropriate</td>
<td>73%</td>
</tr>
</tbody>
</table>

As most of the subjects appeared to be in favor of the slower SR, how many of them attributed lecture difficulty to SR? Was a fast SR the leading cause of incomprehensibility as was found in the E99 diagnostic needs assessment?
Table 10 presents the subjects' perceived lecture difficulty and causes of incomprehensibility. It can be seen that most of the subjects considered the lectures difficult to understand and that topic familiarity, vocabulary and SR stood out as the major sources of lecture difficulty. The leading cause in this case, however, was topic familiarity rather than SR. While this confirms the appropriateness of the selected lectures for this SR study, it also points to the fact that despite the importance of SR in listening comprehension, there are other factors that are equally or even more important and that may interact with SR to influence comprehension. Some factors, however, were reported by only one subject. These factors included the subjects' listening and test-taking strategies, preference for listening materials and environment as well as physical and psychological conditions. As regards the information in Table 10, it should be pointed out that some subjects gave more than one reason for lecture difficulty and that although some considered the lectures appropriate, they still complained about the SRs, lexical difficulty or topic unfamiliarity.

Table 10  Subjects’ perception of and reasons for lecture difficulty

<table>
<thead>
<tr>
<th>Difficulty Level</th>
<th>No. of Ss (Total: 33)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Difficult/Not easy</td>
<td>20</td>
</tr>
<tr>
<td>Appropriate/Not difficult</td>
<td>13</td>
</tr>
<tr>
<td>Sources of Lecture Difficulty</td>
<td></td>
</tr>
<tr>
<td>Fast SR</td>
<td>4</td>
</tr>
<tr>
<td>Unfamiliar Topic</td>
<td>10</td>
</tr>
<tr>
<td>Unknown words</td>
<td>9</td>
</tr>
<tr>
<td>Failure to catch main ideas</td>
<td>2</td>
</tr>
<tr>
<td>Failure to catch details</td>
<td>2</td>
</tr>
<tr>
<td>Failure to find answers to questions</td>
<td>1</td>
</tr>
<tr>
<td>Having to explain reasons for the answers</td>
<td>1</td>
</tr>
<tr>
<td>Lecture too long</td>
<td>1</td>
</tr>
<tr>
<td>Lack of video</td>
<td>1</td>
</tr>
<tr>
<td>Other sounds besides lecturers’ voice</td>
<td>1</td>
</tr>
<tr>
<td>Uncomfortable headphone</td>
<td>1</td>
</tr>
<tr>
<td>Taking a mid-term exam right before listening</td>
<td>1</td>
</tr>
</tbody>
</table>
Based on the above analysis, the answers to the research questions can be summarized as follows:

1) No significant differences were found between high-intermediate ESL learners’ mean scores of academic lectures delivered at all three rates although the slower rate yielded the highest score;

2) Although the learners had difficulty forming an accurate idea of the actual SRs, they appeared to prefer the slower SR;

3) SR was only one of the major causes of incomprehensibility of academic lectures; other factors included lack of knowledge of lecture topics, vocabulary and listening strategies.
CHAPTER 5: DISCUSSION

The first research question asks whether there is a significant difference between high-intermediate ESL learners’ comprehension of academic lectures delivered at faster, normal, and slower SRs and if so, whether the slower SR is the most beneficial for the learners’ listening comprehension. The result, despite its tentative nature, suggests that lecture SRs ranging from 134 wpm/2.89 sps to 199 wpm/3.83 sps yield approximately the same degree of comprehension among high-intermediate ESL learners, since no significant differences were found between the scores obtained within this SR range. This may be explained by the narrow SR range determined by the low modification rate. The SR range used in the study does not exceed the rate at which most lectures are presented, which is 100-200 wpm (Bain, Basson, & Wald, 2003). It seems “the threshold rate’ (the rate at which comprehension begins to decrease rapidly” (Rubin, 1994, p. 200), even for L2 learners, lies beyond these regular lecture rates, and if a lecture rate does not reach that point, no significant differences will be observed. This is an echo of many early L1 presentation rate studies reported by Beatty, Behnke and Froelich (1980): no significant comprehension differences were found among groups listening to news casts recorded at 125, 150, 175, 200, 225 and 250 wpm in Nelson (1948), nor among groups listening to stories presented at rates ranging from 125 wpm to 200 wpm in Harwood (1948), nor among subjects listening to material presented at 141, 201 and 282 wpm in Fairbanks, Guttman and Miron (1957), nor among those listening to selections at rates within 125-250 wpm except for the significant reduced comprehension obtained at rates beyond 250 wpm (Foulke, 1962), nor among those listening to normal and
accelerated technical and literary stimulus material (Foulke, 1968). In these studies, the modification rate was at least 20%. In Griffiths’ two studies where the rates were modified by over 30%, no differences were found either between the moderately fast and normal rates (Griffiths, 1992) or between the normal and moderately slow rate (Griffiths, 1990b). Even in Rader (1991) where the modification rates of three Spanish broadcast narratives were 35% and 50%, the differences detected did not reach statistical significance. All these rates were higher than the 15% adopted in the present study. Such a low modification rate might be the very reason for the non-significance in the differences. Since the input types were different, it is unwarranted to deduce that even when a normal lecture rate is compressed by 50%, no significant difference will result. Therefore, it is necessary to use more than three lecture SRs with a higher increment in follow-up studies, but this entails more lectures and more time, which was not available in the present action research situation.

It was assumed that for L2 learners who listen to long and difficult academic lectures, even a slight change in SRs may affect their comprehension. This, however, was not justified by the result. Important factors that influence comprehension include background knowledge and SR. If the familiarity level of the former is high, listeners are likely to achieve comprehension by using top-down processing irrespective of the SRs. If the input contains unfamiliar terms and knowledge, perceivers may be forced to undertake the bottom-up process of decoding discrete language constituents and combining them into chunks for interpretation, which becomes more demanding with a large amount of information to be processed within a highly limited time. In this situation, the presentation rate should be critical, even a moderately adjusted SR can make a difference. Compared with the input used in recent studies, the lectures used in this study seemed to be more difficult and much longer.
Whereas passages or lectures used in Zhao (1997), Robinson, Sterling, Skinner, and Robinson (1997), Griffiths (1990b; 1992), and Anderson-Hsieh and Koehler (1988) were about 400 words, the lectures used in this study were 2373 words/2846 syllables on average. While the topics of the input used in the last two studies were about “arcane information” (Anderson-Hsieh & Koehler, p. 579) or “considered highly unlikely that the subjects would be familiar [with]” (Griffiths, 1990b, p. 321), little information regarding topical and lexical familiarity was specified in the previous two studies. It seems that significant effects of SRs are not observable until a certain increment is reached even when the processing load is increased through background knowledge and input size.

A more possible explanation of the insignificance may be the small sample size and the effect of background knowledge. Not only were there merely 11 subjects, but they were an intact group. When t-tests with T-K adjustment are used, correlation between measurements is assumed; i.e., subjects’ performance in one lecture and/or at one rate is correlated with that in another lecture and/or at another rate. However, not only were the three lectures used on different topics, the first on insect behavior, the second on computer technology and the last on classification of cultures, but the subjects majored in different areas. Thus, although the lectures were on topics least familiar to the subjects, some still had more topical knowledge than others. Those who majored in business or marketing may know more about lecture 3 (about cultural classification) than those who majored in computer science, for instance, and thus may have scored higher without being affected by SRs. A subject who majored in agronomy or horticulture may have performed well in lecture 1 (about pheromones) even at the fast SR but she/he may not have done so in the other two lectures even at slower SRs. This obviously violates that assumption that if a subject who has the same listening ability
performs well in/at one lecture/SR, she/he would perform well in/at another lecture/SR.

Equally problematic was lexical knowledge. A word list was distributed to the subjects for individual preparation; they were asked to study the new words which would appear in the lectures. In spite of that, some subjects may have prepared for the vocabulary while others may have not. This may have offset the effect of SRs on listening comprehension. Teaching the words beforehand would be helpful but their success of retaining them and interpreting them in contexts would still differ due to their inherent language aptitude. A large sample size, however, would be more able to minimize the effects of such differences and to clarify the current result. Considering the close to significant level (p=0.057) mean difference found between one of the SR pairs, it is probable that significant differences will be shown with an expanded number of similar subjects and lectures.

The most serious cause of the non-significant differences found, however, may be the inconsistency of the comprehension questions used. Since the questions were not piloted and adjusted until the reliability coefficient reached an acceptable level, there is every reason to question the accuracy of the test scores. Little attempt was made to control for the internal reliability of the questions used in recent L2 SR studies except for Griffiths' (1990b; 1992) where the reliability coefficient calculated in a K-20 test was about 0.80. The K-21 estimate based on the subjects' scores in the present study, however, turned out to be merely 0.34, which may also explain the higher score obtained at the faster rate as opposed to those obtained at the normal rate, although the difference was not significant. Highly reliable ready-made lectures and questions like those in TOEFL would not have been a better choice for this group, who had passed TOEFL and may have been familiar with the topics.
Although "the threshold rate" was not found, the slower SR seemed both the most beneficial to and favored by high-intermediate L2 learners. Although at a non-significant level, the test scores yielded by the slower rate were higher than those by the normal and faster rates. This is consistent with previous pro-slow-rate findings, throwing more doubt on studies that question the benefit of slowing down for L2 learners, especially in the case of academic lecture delivery. Research shows that students’ listening rate is around 150–175 wpm (Carver, 1982, as cited in Robinson, Sterling, Skinner, & Robinson, 1997), while they can take notes only at lecture rates up to 135 wpm (Ladas, 1980, as cited in Robinson, Sterling, Skinner, & Robinson, 1997). The farther a rate goes beyond that, the more challenge a lecture poses for the students, not to mention a lecture on an unfamiliar topic, because of the greater “amount of processing required of the incoming data in a very short space of time” (Flowerdew, n.d., p. 17). On the contrary, the slower the speed, the more time students have to process information and take notes, although the limit to slowness for L2 learners is yet to be identified. When explaining why the lecture was appropriate, one of the subjects commented that she could follow the speed and had more time to write down the notes. If “[a] normal speed of delivery requires a great deal of work in a very restricted time” (Griffiths, 1990a, p. 56) for NSs, who can take notes only at rates lower than 135 wpm, it is easy to see why NNSs prefer and perform better at a slower rate, which induces less stress and thus lowers their affective filter. Even the slowest rate used in the study, 134 wpm/2.89 sps, was at the top end of the rate for note-taking, and no strictly significant differences were found when SR rose up to 199 wpm/3.83 sps. This might suggest that better comprehension exists at lower rates. Again, it is necessary to move the slower SRs further down and the faster rate further up in future studies to see if significant differences will result.
It is often thought that reducing SR by shortening both syllables and pauses is only one way to slow down for L2 learners and that other methods include increasing pauses and hesitation, using redundancy like repetition, paraphrase, synonyms and modified sentences and inserting comprehension checks. It should be noted, however, that these are separate acoustic variables of relevance to the young field of L2 listening comprehension. Their facilitative role to comprehension is as inconclusive as that of a slower SR due to such factors as subjects' language proficiency. The temporal variable that has the most similar function as SRs, the pause phenomenon, is a case in point. Rubin (1994) has reviewed several studies into this variable:

Jacobs et al., who explored the effect of longer than normal pauses at clause and sentence boundaries on comprehension of expository lectures read aloud at both slow and normal speeds, found that pauses related significantly to comprehension for more advanced students, but not for less advanced students. This result was taken to suggest that students may need to be at a certain ability level in order to benefit from the processing time that pauses afford and also that input with overly long pauses can bore learners. Blau conducted two studies into pauses. In the first one, the effect of speed and blank pauses on comprehension was compared. At most language proficiency levels Blau found that blank pauses facilitated listening comprehension more than speed. In a second study, she found that blank pauses did not help comprehension while filled pauses did. Blau speculates that this difference in findings may relate to different conversational norms among NSs, since the subjects in the first study were Puerto Rican and Polish and those in the second were Japanese. (p. 201)
Another example reviewed by Rubin (1994) is the hesitation phenomena:

Dunkel, who worked with both low and high listening proficient groups and used taped versions of a lecture, found that use of hesitation phenomena gave students time to take a greater quantity of notes. Voss, who studied repeats, false starts, filled pauses, and unfilled pauses in spontaneous speech, however, found that all types of hesitation phenomena cause perceptual problems and thus comprehension errors for NNSs. Voss suggests that NSs are usually not bothered by hesitation phenomena since they possess strategies to recognize and process such phenomena while focusing on meaning. NNSs get stuck in bottom-up processing of phonetic utterances that do not affect meaning, while NSs discard these utterances in favor of tope-down processing. (p. 201)

As for redundancy, Rubin (1994) concludes from his review that both proficiency levels and redundancy types affect its function of enhancing comprehension. All these variables have the potential to facilitate L2 listening comprehension. If one or more were added to the three lectures used, significant differences may appear but at the same time, more ambiguity could result to obscure the effect of SRs. Therefore, it is of interest to explore interactions between these variables but probably not when they are investigated individually.

Deriving from both the non-significant finding, the possible benefit of the slower rate and the low comprehension rate, reflected by the mean score of around 5.5 (out of 10), it may be concluded that the ideal or optimal rate for high-intermediate learners does not exist between 134 wpm/2.89 sps and 199 wpm/3.83 sps but tends to be found below that range. It is also worth pointing out that although an SR lower than 134 wpm/2.89 sps may contribute to maximum immediate comprehension, it is yet to be investigated in longitudinal studies whether such a rate will promote or hinder the development of listening comprehension.
The second research question asks whether the learners' perception of the SRs is consistent with the actual SRs. The answer to the question is negative; L2 learners' ability to perceive SRs seems to be marginal, which might be due to input characteristics and learners' intrinsic variations. As discussed above, the modification rate of the SRs could have been too small for the subjects to detect. Additionally, although it may be exaggerated to say that there are no two naturally identical SRs in this world, it is true that people usually speak at different rates. It is also true that different L1 backgrounds, L2 proficiency levels, prior knowledge, and speech categories can lead to different perceptions of SRs. For example, while a learner from a faster-rate L1 background may consider the faster rate to be normal, a learner from a slower-rate background may consider it fast. The same lecture delivered by a female voice can be perceived faster because of the higher pitch than by a male voice although such an effect seemed to be absent in the present study. As Zhao (1997) notes, whether a speed is fast or slow is the result of the interaction between the pausological quality of the speech and listener-internal factors. He suggests that the effect of SR may be more clearly revealed by observing how learners manipulate SR, which is an invaluable perspective.

However, although Zhao (1997) points out that "a reference speed can be found from either external or internal sources" (p. 61), he argues that the reference speed is inside the learner rather than in the input, assuming that the speed selected by a learner is the ideal speed for her/him. "It is, therefore, extremely important to realize that one cannot expect to reliably examine the influence of speed without letting the listener control the speed. In other words, in order to better understand how speech rate is related to listening comprehension, researchers should consider students as unique individuals, who operate with different
perceptions and internal reference” (Zhao, 1997, p. 62). This can be mistakenly taken to suggest that unless a consistent “objective reference” (p. 61) speed is set and used by SR research, the incomparability of results will render such research “meaningless” and therefore, research that does not give control of SRs to individual learners is disrespecting individual characteristics and futile. As was addressed earlier in this thesis, not only does such a plausible notion overemphasize the internal reference, ignoring the external reference speed, but it denies group characteristics while accentuating listener characteristics, especially personal perception. It is important to note that a learner’s self-determined ideal SR applies mostly to the realm of perception and not necessarily to actual performance, because a learner who listens to a lecture at a rate that she/he considers appropriate does not necessarily comprehend better than a learner who listens to a lecture that she/he considers fast. In fact, some subjects who considered the SR fast scored higher than those who considered the rate appropriate in this study.

Different from Rader’s (1991) speculated reasons for the non-significant improved comprehension found at the slower rates in her study, the answer that Zhao (1997) proposed, based on the formula: self-perceived ideal rate = actual ideal rate, was that “the speeds used did not match each individual’s internal ‘reference’” (p. 61). Such an interesting interpretation, be it applicable to Rader’s (1991) study or not, may not apply to the present study, where the slower SRs matched most of the subjects’ “internal reference speed” and yet resulted in no significant improvement in comprehension. This may point to the problem of equalizing learners’ perceived ideal rate with their actual ideal rate. Whereas individual differences are apparent, both L1 and L2 SR research (Foulke, 1962; Beatty, Behnke, & Froelich, 1980; Robinson, Sterling, Skinner, & Robinson, 1997; Anderson-Hsieh & Koehler,
1988; Hatch, 1979, 1983; Dudley-Evans and Johns, 1981; Griffiths, 1990b; 1992) shows that there exists a speed or speed range for a certain category of aural input that impairs or facilitates comprehension, regardless of the learners' perception. It remains to be explored how personal perception of SRs is derived, differs from actual SRs and interacts with spoken input to affect listening comprehension.

The last research question asks whether SR is a major cause of incomprehensibility of academic lectures. Although SR was identified to be one of the major factors that caused lecture difficulty, contrary to expectation, topical and lexical familiarity instead of SR appears to be the leading factor. This, on the one hand, should not be surprising considering the nature of the input required by the study and the aforementioned low modification rate; the topical and lexical demand seemed to be more salient than the SR-induced processing load. Moreover, it has previous support. Rader (1991) referred to background knowledge and text difficulty as the first two factors that contributed to the insignificant effect of slowing down speeds. On the other hand, as also mentioned above, personal perception can be plausible. It is not known whether a factor is factually a leading one when it is most frequently reported. All that is known is that there is more than one factor that affects comprehension. Rubin (1994) summarized five major factors that affect listening comprehension as follows:

1) text characteristics (variation in a listening passage/text or associated visual support)
2) interlocutor characteristics (variation in the speaker’s personal characteristics)
3) task characteristics (variation in the purpose for listening and associated response)
4) listener characteristics (variation in the listener’s personal characteristics)
5) process characteristics (variation in the listener’s cognitive activities and in the nature of
interaction between the speaker and listener). (Rubin, 1994, p. 199)

Rost (2002) also listed some factors that influence listening test performance:

1. **Nature of the input**: dialect, speech rate, length, background, propositional density, amount of redundancy.

2. **Nature of the assessment task**: use of visual context, amount of context given, clarity of instructions, availability of question preview, type of thinking processes involved.

3. **Individual listener factors**: memory, interest, background knowledge, motivation.

(p. 174)

When SR is set as the independent variable to be investigated, all other factors should be controlled to the maximum extent although it is also of importance to explore the interactions between various factors.
CHAPTER 6: CONCLUSION

1. Theoretical implications

Although the tentative results should be taken with caution, the study has contributed to the body of pausological research by zeroing in on the effects of SRs on L2 academic lecture comprehension. It was intended to seek an ideal SR and to identify a “threshold” SR for high-intermediate ESL learners although both rates are yet to be found. The experiment has identified a lecture range that leads to no significant comprehension differences for this group of learners, which suggests that the lecture rate range and modification rate to be used for future studies should be expanded. It has provided some modest support for the possible benefit of using a slower rate for high-intermediate learners listening to academic lectures. Furthermore, it has raised questions about the reliability of using learner-perceived ideal SRs as optimal SRs. Theories of learner-centered instruction has highlighted the importance of respecting learner needs, but learner needs are not an equivalent of learner opinions. Although higher-level learners may have less difficulty understanding which SR is suitable for them, lower-level learners may confuse a comfortable SR for a truly facilitative SR.

More importantly, the study has emphasized the importance of using input that bears features unique to spoken language, which has been overlooked in L2 SR research that relied on texts designed mostly for reading purposes. Not only did recent SR studies focus on different issues but they used individual sentences or recorded texts that possess few acoustic features. Bowles and Healy (2000) considered the effects of SRs on foreign word identification accuracy of ultimate beginners who were trained on Spanish sentences. Zhao
(1997) concentrated upon learners’ SR modification behavior by using sentences or short passages taken from a TOEFL test. Robinson, Sterling, Skinner, and Robinson (1997) used short passages taken from college freshman level Timed Readings to investigate the effects of SRs on NS lecture comprehension. Anderson-Hsieh and Koehler (1988) used reading texts recorded at different rates to investigate the effect of foreign accent and SR on NS comprehension. Although McKnight (2004) and Schmidt-Rinehart (1994) used academic lectures or near-authentic speech, the former investigated general learning by listening and note-taking and the latter, the effects of topic familiarity. Griffiths (1990b; 1992) investigated the same issue but worked with low-to-intermediate learners who listened to texts selected from reading materials.

2. Pedagogical implications

Since the range of SRs (134wpm/2.89 sps-199 wpm/3.83 sps) explored in the study yielded a relatively low level of listening comprehension, ESL teachers and lecturers might as well heed the Robinson, Sterling, Skinner, and Robinson’s recommendation that they should speak as fast as the slowest lecturers (about 100 wpm) to high-intermediate L2 learners. SR appears to be one of the major sources of reduced lecture comprehension although topical and lexical difficulty may have been the leading cause in this particular study. Furthermore, learners may be able to control speakers’ SRs to a certain extent in a conversational discourse or web-based listening practice, but not as much in a lecture context where two-way interactions usually do not occur until the question part or after class. Therefore, if a lecturer does not want the information conveyed to go in a student’s one ear and out the other, it is critical for her/him to be aware of and remember which SR to use
while addressing NNS students. Although students usually have sufficient topical knowledge and visual aids to help interpret lectures within their own major field of study, the characteristics that NNSs do not share with NSs require particular SR considerations. It is the same with L2 listening material development. Since the study shows that even semi-authentic lectures with controlled SRs posed much difficulty for high-intermediate learners, it should not be presumed that the more authentic the lectures are, the more beneficial they will be to students. Although the normal lecture SR for NSs can be set as a goal, it may not be wise to impose it immediately on NNSs without transitions, because it can lead to both comprehension decline and negative learner perception, which may further affect their listening comprehension. As SR is only one of the major factors that affect listening comprehension, it is indispensable to identify which factor(s) can be modified to what extent to promote learners’ listening comprehension. It may further facilitate high-intermediate learners’ lecture comprehension by preparing them for adequate background knowledge through pre-teaching key vocabulary items, especially technical terms, and explaining topical information. Such knowledge seems a must in academic lectures designed for ESL learners.

3. Limitations of the study

Despite endeavoring to control for confounding effects, there are a few aspects that may have affected the present findings. Besides the issues of a small $n$, differences in background knowledge and the reliability of the comprehension questions, which were discussed earlier, the test was administered during mid-term exam weeks and so some subjects had to take exams for other classes before or after the test. This led to differences in physical and psychological conditions which affected their performance: those who had just
finished an exam may have been exhausted while those who had one coming may have rushed through the listening task. In addition, although multiple choice questions are a commonly used measure in language testing, they involve not only a 25% chance of conjecture but also a certain amount of reading since the questions and the options were presented in the written mode. Some subjects who had passed the EPT reading section may have outperformed those who had not. So if the questions and options had been provided in the spoken mode at a rate that corresponded to the lecture rate, the effect of SRs could have been magnified.

4. Suggestions for further research

The non-significant differences found in the mean scores obtained from the lecture SRs of approximately 134 wpm/2.89 sps-199 wpm/3.83 sps seem to suggest that within this SR range, high-intermediate ESL learners' comprehension will neither fall dramatically nor increase to an optimal level, despite the slight benefit found at the slower rate. Although learners may not have accurate perception of SRs, they seem to prefer a slower SR. The major factors that cause lecture incomprehensibility include topical and lexical familiarity and SRs.

These findings, combined with the methodological issues observed in the study, indicate a need for further research in this little explored area. First, more carefully controlled experiments should be followed to clarify the present results by using more reliable comprehension questions and more SRs with a higher increment as well as a larger sample. The failure to identify the two SRs that are critical to high-intermediate ESL learners' lecture comprehension could have been attributed to the smallness of the pilot study: a small
reliability coefficient, a small number of SRs with a small increment and a small number of subjects. All these should be avoided in follow-up studies.

Second, it would be more reliable to use materials rich in spoken language features as aural input. It has been assumed that anything read aloud is equivalent to spoken language, which may be why L2 SR research has been frequently "bookish", using written language in the form of sentences and passages as input. This could be a confounding factor. When there is no evidence that spoken and written language, which possesses widely different discourse features, have the same effect on listening comprehension, it might be advisable to use spoken materials, whether they are natural or fabricated speech. It is also commonplace to think that the more authentic the materials are, the more clearly the effect of a variable under investigation will be revealed. Authentic materials are attractive and should be encouraged but when proficiency levels are taken into account, such an idea becomes an ideal. For lower-level L2 learners, highly authentic materials may actually conceal the effect of a variable. For example, if ultimate beginners are asked to listen to an authentic conversation at the normal speed, it is not impossible for all of them to get a maximum score of 0. Therefore, as long as the input contains adequate acoustic features, even pseudo-authentic materials that fit the research purpose can be justified.

Third, further research is yet to be conducted using different speech genres on different L2 listening proficiency levels from different perspectives, a suggestion first made by Griffiths more than a decade ago. There has been research using beginners, intermediate and advanced learners listening to different types of input, mostly recorded reading materials. It would be both convenient and worthwhile to replicate those studies using spoken materials, especially academic lectures, and a more tightly controlled procedure. An alternative is to
explore the effect of SR from a different perspective, e.g., by observing learner behavior and perception (Zhao, 1997) and by examining how SR interacts with other acoustic variables and discourse features as well as other factors to influence NNSs’ listening comprehension. Much as learner perception deserves respect, it remains to be explored how it is related to actual listening performance. Investigations into the relationship between SR and other factors like process characteristics may throw light on not only the phenomenon of SR but also the nature of L2 listening comprehension.

Finally, longitudinal studies into the effect of SR on the development of comprehension skills are much desired to further unravel the complexity of the relationship between SR and L2 listening comprehension. “The potential impact of such study is great with ramifications for every recorded language program” (Smith, 1980, p. 9). However, Smith seems to be the only researcher that has investigated this issue. He found an inhibitory effect of slowed French on learner achievement of listening skills after having second semester college level French learners listen to presentations slowed by 20% and 10% for two-thirds of the language course. Does this negative effect apply to English or other languages? In immediate comprehension, the effect of slowed SRs is inconclusive. It would be of great interest to examine its long-term effect. Also of great value is to find out whether a fast SR, which has been convincingly shown to reduce immediate comprehension, will foster or impede listening skills development.
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Lecture 1: Pheromones

OK as we discussed earlier when we were looking at the studies of ants... bees... etc... animals obviously communicate with each other... and yet we know that they don't communicate with words as humans do... and one way they communicate is by emitting a chemical substance... which sends signals to other members of the species... and this substance is called a pheromone [on board].... OK... what is a pheromone?... and I'm going to give you a regular scientific definition of that... a pheromone is... a chemical substance... released by an organism... into the environment... to evoke a response... from the members of the same species... let me repeat that... it's a chemical substance... released by an organism... into the environment... to evoke a response from the other members of the same species... and these chemicals may be detected by either the sense of smell or taste... and as I'll talk about later on... you'll see that these pheromones are widely used within the animal kingdom... in a variety of species ranging from one-celled animals all the way to higher primates... a group which includes monkeys, apes, and man... and the special characteristics of pheromones... and that I'll talk about again later... are that one... they're highly sensitive... an animal can release one microgram of a pheromone and get a response and one microgram as you probably know if you've done scientific experiments is extremely extremely small... and the other special characteristic is that it's highly specific... each species responds only to its own species' pheromones... and these pheromones have no effect on members of other species... so if a pheromone is released by a bee... it will have an effect on other bees and not on other species... OK I'm going to divide this talk up according to the different classifications that scientists have given pheromones... and primarily they divided pheromones into two types... primer pheromones... P-R-I-M-E-R... and releaser pheromones... now the primer pheromones cause physiological changes in the organism... and affect its development and later behavior... now as an example of that and we talked about it... the queen bee... gives off a primer pheromone and this primer pheromone prevents the reproductive development of female worker bees... so it allows the queen bee to be the sole reproducer in the hive... OK so... her primer pheromone changes... causes physiological changes... in the other females... OK now the releaser pheromones on the other hand produce rapid and reversible responses... and immediate changes... so whereas the primer pheromones are long-range... not reversible... the releaser pheromones are rapid... immediate... and reversible... and there are four types of releaser pheromones that scientists have come up with and primarily they're divided along functional lines... and they're not mutually exclusive... so different pheromones or different activities can belong to a number of the different categories... OK... the first type of releaser pheromone that the scientists have come up with is called an alarm pheromone... and as you can guess from the name... it's used to warn others of danger... and it's released in response to a threatening situation... such as an attack by an enemy... and usually the response to an alarm pheromone may be dispersal to an area of safety... or gathering followed by aggressive behavior... so for example... a mouse would
release an alarm pheromone which would cause other mice to flee. ... another type of animal might release an alarm pheromone which would cause other animals to gather. ... and attack.

OK the second type of releaser pheromone is called an *aggregation* pheromone. ... let me write that [on board] ... and again as you might guess by its name it's used to call members to one location. ... or one locale. ... and this could be for the purpose of food. ... shelter. ... mating. ... among other things. ... and primarily it's used to call members to one location. ... an example of this would be *honeybees*. ... who recognize the entrance to their specific colony by an odor. ... which is separate and distinct from one colony to another. ... so the honeybees know which colony is theirs by the odor which is present at the entrance of the colony. ... and this odor not only enables them to identify their home colony but it also acts as a stimulant to get them to return to their home colony. ... I'll bet some of your parents wish they had such a technique! ...

OK ... the third kind of releaser pheromone is the sex pheromone. ... and as you can see the names adequately describe each of these pheromones. ... the sex pheromone is used to sexually arouse and attract members of the species. ... and one of the most interesting examples I know of is the example of the snail. ... when a female snail is mature. ... a mature female snail. ... she emits a sex pheromone to attract immature. ... sexually undifferentiated. ... snails to her. ... so what she does. ... she's mature. ... she's female. ... she *attracts* immature snails to her. ... and immature snails are neither male nor female. ... they're sexually undifferentiated. ... so she *attracts* these undifferentiated snails to her. ... and once she attracts this immature snail to her. ... she releases a primer pheromone. ... which causes the immature snail to develop into a male. ... so they can mate. ... OK so here's an example where pheromones work in two different ways. ... the sex pheromone attracts the immature snail to the female. ... and the primer pheromone changes the immature snail to a male. ... so that they can mate. ...

OK ... finally. ... the last type of releaser pheromone is called a terrestrial trail pheromone. ... and terrestrial of course means having to do with the land. ... and this type of pheromone is used as a navigational guide for others to follow. ... and as I said. ... the pheromone is "terrestrial" because it's deposited on a solid base ... on land. ... and "trail" ... because the species maintain contact with the pheromone while they move along the trail. ... and you can probably guess the example I'm going to give you. ... *ants*. ... ants moving from food source towards their nest deposit a trail pheromone on the ground as they move along. ... and this tells other ants to follow the trail to reach a food source. ... when they *return* from food source they deposit additional trail pheromone as long as there's still food remaining at the source. ... and the interesting thing is that once the food source is exhausted. ... the returning ants no longer deposit the pheromone. ... and the pheromone dries up. ... and ants no longer follow it. ... so that explains how ants can follow this long path continuously. ... not getting lost. ... until the food dries up. ...

OK ... you might wonder why the study of pheromones is so important. ... well it's very important to agriculture. ... among other things. ... of course it's very important to our knowledge about how species communicate. ... but in terms of a practical use it's very important to agriculture. ... and that's because pheromones can be used to control animal behavior to protect crops. ... so for example. ... they can lead harmful insects to
traps where they can be killed... or they can lead helpful insects to a particular location... and they're much better than traditional insecticides which contain poisons... obviously these poisons in the traditional insecticides not only harm the insects which could hurt the plants but also could harm people who eat the plants or worked with the plants... but remember pheromones are highly specific... they have no effect on members of other species... so pheromones are much safer...

so pheromone communication clearly is not comparable to human language but each system does have its own complexity and usefulness... are there any questions?

Lecture 2: Robodoc

a lot of us... when we think about robots... we imagine these walking and talking mechanical men... you know, something that we might have seen on TV when we were children or read about in science-fiction stories or seen in movies... but that's not the case... robots are not designed to look human... and they're probably nothing like you imagined them in your mind...

now what I'm going to do in this lecture is talk a little bit about what a robot is... and then I'm going to talk specifically about how it's being used in our world today in one very important place... it's being used in many many different places of course... but... the place I'm going to focus on is the hospital operating room... uh... you might be surprised if you look up one of these days... and instead of seeing your doctor...

well you may see a robot doing some of the work...

so let's just start with a definition... what is a robot?... it's interesting because the word robot comes from a Czech word... I think the word might be something like robota... and the word means "forced labor"... so the idea is that the robot is something that we can get to work for us... the robot isn't taking over... the robot is assisting us... we're forcing it to do work... and follow our orders...

now... the Robot Industries Association... came up... many years ago... with a definition for robots that was more specific... and I'd like you to take this definition down because... it gives you a... a good sense about what um... what... what the qualities of all robots are... what do all robots have in common... so here's the definition... a robot... is. a reprogrammable... multifunctional... manipulator... designed to move materials... parts... tools... or specialized devices... through variable programmed motions... to perform a variety... of tasks... it's a long definition but it's worth looking at... and let me repeat it... a robot is a reprogrammable... multifunctional... manipulator... designed to move materials... parts... tools... or specialized devices... through variable programmed motions... to perform a variety of tasks... now the key words in that definition are reprogrammable and multifunctional... reprogrammable lets us know that all robots can get new instructions and we don't have to change the basic structure... the structure will remain the same but we can keep giving it new instructions... we can program it to do different things... so it can be taught a new task or a new routine... so it can change the order of activities... it can change the placement of materials... so it's some kind of machine where the basic structure stays the same but we can program different activities and tasks for it to do... multifunctional the other key word here... tells us that the robot can perform a variety of tasks... so the robot is not only going to do the
same movement over and over again. . . but it can do many types of tasks. . . it can check its work. . . it can make decisions. . . it can alter its performance as needed. . . uh as an example. . . there are robots that are being built today that can sense when there is something in its path. . . and they can then alter their direction or move around an object placed in the way. . . obviously they're not really seeing. . . but they're making decisions based on what is around them. . . and changing their performance accordingly. . .

now how do robots work? . . . OK all robots have some kind of microprocessor. . . like a computer chip. . . that acts as its. . . quote, brain. . . and this microprocessor activates different movements by the robot. . .

most robots are equipped with a single hand. . . we call that hand an "end. . . effector" . . . here let me write that on the board. . . an "end. . . effector" . . . and this end effector is at the end of a single arm. . . which has about five or six joints in it. . . OK so you have a single arm. . . with five or six joints. . . and a single hand at the end of that arm called the "end effector" . . . but don't imagine a human-looking hand here. . . some robots have two-fingered hands. . . which can be used like tongs to pick things up. . . but some robots have no recognizable hand at all. . . they just contain the tools that are necessary for the job. . . so maybe they contain something like scissors or a knife or something like that. . . but that. . . that hand part. . . is called the "end effector" . . . whether it's a two-fingered tong. . . or whether it's a tool. . . it's the end effector. . .

OK now as I said. . . I'm going to talk about one use of robots and that's their use in hospitals. . . and. . . robots can be seen in different parts of hospitals at this point. . . but one particular example that I'm going to discuss is the use in the operating room. . . of a robot called "Robodoc". . . and Robodoc is not necessarily very smart. . . but what it can do. . . it does brilliantly. . . and what it can do is work with a precision and a steadiness that can't be matched by even the best of surgeons. . . the steadiness of its hand. . . its end effector. . . is something that the best surgeon can't match. . . and observers are looking at Robodoc and saying that it is um. . . it's to medical robots what the first Apple computers were to microcomputing. . . that is, it's still in the first stages. . . it's first-generation technology of medical robots. . . but the future holds more and more sophisticated offspring. . . developed from this first-generation technology. . .

and the area that Robodoc is particularly excelling in. . . it's really showing its stuff. . . is in the area of hip replacement surgery. . . now, most of you are too young to even think about hip replacement surgery. . . but for elderly people. . . or older people. . . it's actually a very common surgery. . . there have been more than a half a million hip replacement surgeries performed worldwide. . . and that was part of the reason this is an obvious choice for researchers when they were looking at how to use robots in the operating room. . . they looked at hip replacement surgery, one, because it's a very common surgery. . . and the other thing. . . the other reason it's especially appropriate for robots is because it's a very physically demanding. . . physically laborious surgery. . . it takes a lot of physical labor on the part of the surgeon. . . to perform this surgery. . . and I'll explain this more in a second. . .

OK. . . in the past. . . and still now when not using Robodoc. . . what surgeons had to do is. . . when they wanted to do hip replacement surgery is. . . they carved a cavity in the patient's thighbone. . . and this carving is actually what it sounds like. . . it's almost like carpentry. . . the surgeons need to cut a cavity into the bone. . . and this is why I say it's a very laborious
operation. It's not an easy thing to do... and they also need to bore holes in the patient's thighbone. Another word for that bone is femur. And they have to do this carving and drilling manually. So like carpenters, they're carving... they're drilling... and often they use tools like a mallet and a chisel. Tools not exactly known for precision. And like crude woodwork, this process results in a very imprecise fit of the implant into the cavity. So here you've got an implant that you want to fit into the cavity. But... manually... surgeons just aren't able to achieve the precision that would be needed for a precise fit... and so the way surgeons get around this is they need to use a kind of cement to hold the implant in place. OK well that might work for a while... but the problem is that this cement loses its grip over time. Between five to ten years or so later... and what happens then is that many patients have to undergo a second replacement surgery...

And so what Robodoc does... it does the boring of the holes... it does the carving of the cavity... and in that process, it's able to fit the implant into the cavity within a tenth of a millimeter. Which is precision that no surgeon... even the best surgeon... could possibly achieve...

Let me give you a little detail about how this would work... now what happens is... a patient comes in for a hip replacement operation... and the surgeon first takes a CT scan of the patient's femur... the thigh bone... the large bone running from the hip to the knee... and this CT scan provides a three-dimensional picture of the bone and surrounding area... and then the surgeon transfers that 3-D image to a computer workstation... now the surgeon sits down at the computer and he or she is viewing the 3-D image in order to choose the correct hip implant for the patient... and the implant is chosen from a variety of sizes stored in the computer's memory... so the computer has information about a range of implants... and the physician chooses the best implant for the patient... and all of this is stored in the computer... all this information about the patient's hip and the implant is in the computer's memory...

OK now we get to the operating room... so far we've been in an office... working with computers... CT scans... but in the operating room... the surgeon... does what doctors do in operating rooms... the surgeon makes the incision which exposes the patient's femur... but what happens next is different... the computer then relays detailed instructions to the robot about the size, shape, and location of the implant cavity... so the computer then is transmitting this information to the robot saying "Here's the size... here's the shape... and here's the location of the implant cavity"... and then the robot goes to work... the robot drills the cavity into the patient's bone... so the robot is doing the cutting... now of course the surgeon is retaining full control over the robot during the operation... it's not the surgeon's opportunity to take a quick nap... the surgeon retains full control over the robot using a remote-control device with a stop button... now... when the robot is finished shaping the cavity... about twenty minutes later... it takes about twenty minutes for the robot to actually drill the cavity and bore the holes... the surgeon fits the implant into the cavity and then completes the ninety-minute surgery... closing up the incision and all that...

According to the robot's inventors... Robodoc is good at the things that surgeons aren't so good at. They combine a machine's precision with the human judgment. We need the human's judgment but we also can benefit from the machine's precision...
but now this doesn't mean that there hasn't been resistance to the idea of robots in the operating room. Some express concern that robots will replace surgeons. Others fear that the robots could "go crazy" and drill a hole, instead of the thighbone, for example. These are both pretty irrational... again... as I said before... developers insist that the robots are being developed to *assist* surgeons. That human judgment is still very important. and the robots are designed to *assist* surgeons. not replace them... and. in addition... they stress that numerous safety controls are built into the robot design...

so here we are... on the edge of the 21st century... we can only begin to imagine the changes that computers and technology will bring to us... remember that people are saying that Robodoc is probably only first-generation operating room robot technology... but I think that Robodoc can give us a glimpse at what that future might be.

**Lecture 3: Hall's Classification of Cultures**

OK... usually when we deal with different people, we deal with them as if we were all members of the same culture... however, it's possible that people from different cultures have different... unconscious... ingrained assumptions... about the world... regarding such important and basic ideas as interpersonal relationships... time... personal space... and basically this is the view of Edward Hall... and that's more or less what I'll talk about later on in more detail... and Edward Hall is an anthropologist who spent a large part of his life studying American Indians... their culture... their language... but he was different from lot of other anthropologists who just study one culture... he was interested rather... in the relations between cultures... how cultures interact... and basically Hall believes that cultures can be placed... or classified... by placing them on a continuum... ranging from what he called high-context... to low-context... and I'll do... I'll define those terms later on... and so what this talk is going to deal with are the two opposites on the continuum... the high-context culture... and the low-context culture...

OK... a high-context culture is a culture in which the context of the message... and you all understand context... context meaning surroundings... the context of the message... or the action... or an event... carries a large part of its meaning and significance... so what this means is that in a high-context culture... more attention is paid to what's happening in and around the message... or event... than to the message itself... OK... so more attention is paid to what's going on around the words... or the event... than to the actual event or message... and you'll get a better idea of what this all means when I give you examples... OK?

first of all, let's look in terms of interpersonal relationships... and I said I'm going to look at three areas... interpersonal relationships... personal space... and time... OK... in a high-context culture... in terms of interpersonal relationships... one thing that you might find very clearly is that there's a strong dependence on shared... or built-in preprogrammed information concerning a message or event... so for example... in terms of legal paperwork... contracts, etc... there's more dependence on the circumstances around it than just the words themselves... so you might care about who's doing the signing... where their family is from... how much um... how respectable the family is... rather than just the actual paperwork... the event itself... OK?... and you'd find in a high-context culture that people would trust someone's word rather than care so much about all the details being spelled out... because again... there's more reliance on
external messages... such as the society's expectations, etc... OK... and also in a high-context culture... again with this idea that if you share these built-in messages... there's also a lot of expectations or... uh what can I say?... focus placed on who you know... your networks... so uh for example... if I wanted to borrow money from you... if you went to a bank here in the States... they would just say "well, you've got to fill out all of these papers... tell me all about who you are"... whereas in another place where there's a high context culture... they might only say "who is your family?... oh, that family!... I know them... you can have the loan"... so there's a... in the high-context culture, there's a lot of dependence on built-in... uh shared expectations or information about an event... outside of the event itself... OK... also you might find that there's a strong dependence on social restrictions... rather than legal restrictions... so what I'm saying is that what the group thinks... the society thinks... restrains people... more than just the law... so for example... in a high-context culture... a person wouldn't break the law... well why wouldn't a person break the law in a high-context culture?... their reason would probably be "it would bring shame on my family... my family would be ashamed... society would be ashamed"... their reasons wouldn't be so much "oh, I'd have to go to jail... I'd have to pay a fine" but rather "my family or society would feel bad... or think less of me"... OK... and another thing about interpersonal relationships is that there's strong feelings of responsibility for the group... they really care about what's going to happen to the group... and not as much what happens to the individual self... and that could also be demonstrated in business... because in a high-context culture... the head of an organization... if something goes wrong... the head of the organization will take responsibility for the whole group... rather than just keep passing the responsibility... on to someone else... OK... so those are basically some of the characteristics of the high-context culture in terms of interpersonal relationships...

OK... what about personal space?... generally, in a high-context culture... because there's a greater dependency on group thinking... people lean toward heavier sensory involvement... or closeness... to people... and they have less respect for privacy... for personal space... or what we might call a "bubble" of personal space... and if you go into that culture... people might stand closer when they're talking to you... OK... they, they might touch more... and if they're jostled in a crowd or touched inadvertently... they won't feel as violated... as someone from a low-context culture... and also people from a high-context culture pay attention to body language... because remember what I said... the definition of a high-context culture is that more attention is paid to the context of the message than to the message itself... and part of the context is body language... so it's paying attention to all the other... things... around the message...

OK... what about time?... in high-context cultures... generally they're considered to have what is called a polychronic [on board] attitude toward time... and you can tell the word... chron, C-H-R-O-N, means "time"... poly, P-O-L-Y, means "many"... so that what they mean by a polychronic attitude toward time is that they believe that people... things... events... have their own time... that there can't be a standard system of time for everything... and what this leads them to believe is that you can't emphasize punctuality... things happen when they're supposed to happen... so there's a different attitude toward time... there's no set standard of time... or they don't see time in that way...
that is... there's a sense that... you can't control time... everything has its own sense of
time... OK so it's a culture that pays little attention to time... to clock time...

OK... what are the advantages or disadvantages of such a system?... in terms of
disadvantages we see that change comes to the society pretty slowly... that class structure... the family structure... is pretty rigid... because they have... because the system is so
strong... the group identification... the feeling of connection between all things... but it's
hard to make changes... all right... and another disadvantage is that
it often can make people feel bound... that they almost feel that they're restricted in what
they can do... and one of the advantages of course is that people feel more connected to
other people... there's a greater system of security... system of family connectedness... society connectedness... you don't have as much of a sense of alienation as you might have
in... what I'll talk about later... uh a low-context culture... OK... so
you've got all those things in a high-context culture... now when I talk about a low-context
culture you'll see the differences... and remember that I'm talking about extremes... not in
terms of... remember I said that most cultures will place on a continuum... not on the ends
or the extremes...

OK... a low-context culture is just the opposite... a low-context culture... is one in
which the message... the event... or the action... is a separate entity... having meaning
unto itself... regardless of the surroundings... regardless of the context... that the
message... the event... the action... has meaning in itself... OK so what this means in a
low-context culture is that people pay more attention to the event itself... rather than to the
context which surrounds the event... so... for example... interpersonal relationships... in a
high... in a low-context culture... there's going to be a lot of emphasis on getting things on
document... having a legal bond rather than just words... because... you don't trust anything
except the event itself... you're not going to worry about the social context... you're not
going to worry about the family... you just really want to have everything... contained...
in the event... in the message... so
we're going to rely... in a low-context culture... on a piece of paper more than someone's
words... and if you're in business, you want everything spelled out... you want everything
spelled out in negotiations... you don't take anything for granted... OK?... and again... just the opposite of the high-context culture... in terms of responsibility... because there's
not as much group identification... there's more individual identification... if you're the
president of a company... rather than taking responsibility for everyone in your company... basically you feel that individuals should take their own responsibility... OK so if something
goes wrong in your company... then that person will take the blame... not necessarily the
president... so it's possible to pass the buck... as they say...

OK what about personal space?... again that's the opposite of a high-context culture
... remember in a low-context culture there's more emphasis on individuality... and so the
concept of privacy is very very important... whereas before as I said... in a high-context
culture... they might not even be concerned with privacy or personal space... but in a low-
context culture... there's a feeling that we each have our own personal
space... if you get too close... if you don't knock on doors before entering... that's an
invasion of privacy... people feel violated... OK?... and as I said before... there's a
respect and a desire for privacy... which is not found in a low... I mean in a high-context
... you'll see that people stand farther apart ... and you'll also see that people might pay less attention to body language because as I said ... the message is "the message is everything" ... they're not going to worry about all the details around it ... what you say is the important thing ... or what you do is the important thing.

OK what about time? ... in terms of time ... I said before there was a polychronic sense of time in a high-context culture ... what do you think there would be in a low-context culture? ... monochronic [on board] ... a monochronic sense of time ... and by that we mean that there's one time ... and that concept means ... that people in a low-context culture believe that there's one standard of time ... and that should be for everything ... and so I'm not willing to hear "oh ... the traffic was heavy ... that's why I'm late" ... or "oh ... I slept late" ... people in a low-context culture will be much more upset with lateness ... because they feel that everyone should follow the same time ... OK? ... there shouldn't be all this flexibility with time ... they expect punctuality ... and they look at time as almost a commodity ... that they use expressions like "use time" ... "to waste time" ... "to spend time" ... uh "time is money" ... all of those expressions reinforce the concept that time is actually something you can hold onto.

what about the disadvantages and advantages? ... OK ... in terms of disadvantages ... what you'll find is ... that there's less commitment to a system ... people often can feel alienated ... separate ... because people move a lot ... they might not be as close to or as tied to a family ... to a society ... so there could be less connectedness ... less commitment ... less human trust ... now the advantages ... and remember ... Ed Hall points out ... that he doesn't make any value judgments about these cultures ... he basically says that there are differences ... he doesn't say that one is better than the other ... so they all have advantages and disadvantages ... but in terms of advantages for the low-context culture ... he says a great advantage is that change happens ... there's very ... there's often a lot of flexibility in what people do ... how they can be ... there's a lot more individuality ... people have freedom to change and be different ...

and let me just give you an example of the continuum ... of some cultures on the continuum between high-context and low-context ... and you can see that chart in your book. ... Hall puts the German-Swiss down here at the extreme low-context end ... the Germans ... the Scandinavians ... the Americans ... the French ... the English ... the Italians ... the Spanish ... the Greeks ... the Arabs ... and notice he doesn't have all cultures here. ... obviously he doesn't have one single Asian culture here at all ... so I'll let you look into that later. ... we'll talk about that another time ... where you might place your own culture on this continuum.

so ... basically what this is all about is that ... Hall stresses that ... people need to be aware of these different assumptions about reality ... and he thinks that this has all kinds of relevance no matter what you're doing ... if you're in business ... negotiations ... if you're in politics ... interpersonal relations ... if you're just dealing with people from different cultures in any way ... it's going to affect every part of your life ... because these assumptions that we make ... are so unconscious that we don't think about them ... we automatically assume that everyone thinks about time ... place ... personal relationships ... in the same way ... but he says ... these things that are so basic ... are actually different ... that we unconsciously learn these things ... and they're based on culture ... and he basically says that what we think of as mind ... is really internalized culture. ... OK? ... he's of the
belief that mind is basically your culture... your culture's imposition... and he stresses the fact that in any multicultural situation... that these assumptions need to be taken into account... for successful interactions.
APPENDIX B. SURVEY OF TOPICAL KNOWLEDGE

How much do you know about these lecture topics? Please indicate after each topic with the number 0-10. 0 means you know the least about a topic and 10 means you know the most about it.

1. How to deal with stress
2. Acid rain
3. Archaeological dating methods
4. Pheromones
5. The near side of the moon
6. Drink your green tea
7. Voter turnout in the United States
8. How to look at art
9. Paging Robodoc: Robots in Medicine
10. Earthquakes: Can they be predicted?
11. Hall’s Classification of cultures
12. The pyramids of Egypt: An engineering feast
13. Perfectionism

Country: Major:
APPENDIX C. WORD LIST

New Words

Please learn the following words carefully which you will encounter in the lectures that you will hear.

1. one-celled: (animals) having only one cell
2. give off: emit
3. hive: a container for housing honeybees
4. (ir)reversible: (not) capable of going through a series of actions (as changes) either backward or forward
5. mutual(ly): directed by each toward the other or the others
6. disperse(dispersal): to cause to become spread widely
7. flee: to run away often from danger or evil
8. aggregation: the collecting of units or parts into a mass or whole
9. arouse: to stimulate to action or to physiological readiness for activity
10. terrestrial: of or relating to land as distinct from air or water

1. brilliant(ly): bright(ly); excellent(ly)
2. precise (precision): minutely exact
3. show one’s stuff: do one’s good job
4. millimeter: a unit of length equal to one thousandth (10^-3) of a meter, or 0.0394 inch.
5. laborious: marked by or requiring long, hard work
6. carve: to cut into a desired shape
7. cavity: a hole
8. thighbone: the longest and thickest bone of the human skeleton; extends from the pelvis to the knee
9. carpenter: a skilled worker who makes, finishes, and repairs wooden objects and structures.
10. bore (v.): to make a hole in or through, with or as if with a drill
11. mallet: a short-handled hammer, usually with a cylindrical head of wood, used chiefly to drive a chisel or wedge
12. chisel: a metal tool with a sharp beveled edge, used to cut and shape stone, wood, or metal
13. implant: to graft or insert (a tissue) within the body
14. cement: a substance used for filling cavities or anchoring crowns, inlays, or other restorations
15. lose one's grip: fail to maintain control or one's ability to function
16. incision: a cut into a body tissue or organ, especially one made during surgery
17. retain: to maintain possession of
18. glimpse: a brief, incomplete view or look
19. manipulate (manipulator): To move, arrange, operate, or control by the hands or by mechanical means, especially in a skillful manner

1. ingrained: Firmly established; deep-seated
2. anthropologist: a social scientist who specializes in the scientific study of the origin, the behavior, and the physical, social, and cultural development of humans
3. continuum: a continuous extent, succession, or whole, no part of which can be distinguished from neighboring parts except by arbitrary division
4. restrain: to limit or restrict
5. jostle: To come in rough contact while moving; push and shove
6. rigid: not flexible or pliant; stiff
7. alienate (alienation): To cause to become unfriendly or hostile; estrange
8. entity: something that exists as a particular and discrete unit
9. bond: A binding agreement; a covenant
10. pass the buck: shift responsibility or blame elsewhere
11. invasion: violation
12. reinforce: to give more force or effectiveness to; strengthen
13. Scandinavian: people who live in region of northern Europe consisting of Norway, Sweden, and Denmark. Finland, Iceland, and the Faeroe Islands are often included in the region.

14. internalize: to take in and make an integral part of one's attitudes or beliefs
APPENDIX D. WEBSITES FOR LECTURES AND A SAMPLE SCREENSHOT

1. Websites

Session 1
http://iwrite.engl.iastate.edu/teaching/526S06/fushun/webpages/group1/group1_1/group1_1rameset.html
http://iwrite.engl.iastate.edu/teaching/526S06/fushun/webpages/group2/group2_1/group2_1rameset.html
http://iwrite.engl.iastate.edu/teaching/526S06/fushun/webpages/group3/group3_1/group3_1rameset.html

Session 2
http://iwrite.engl.iastate.edu/teaching/526S06/fushun/webpages/group1/group1_2/group1_2rameset.html
http://iwrite.engl.iastate.edu/teaching/526S06/fushun/webpages/group2/group2_2/group2_2rameset.html
http://iwrite.engl.iastate.edu/teaching/526S06/fushun/webpages/group3/group3_2/group3_2rameset.html

Session 3
http://iwrite.engl.iastate.edu/teaching/526S06/fushun/webpages/group1/group1_3/group1_3rameset.html
http://iwrite.engl.iastate.edu/teaching/526S06/fushun/webpages/group2/group2_3/group2_3rameset.html
http://iwrite.engl.iastate.edu/teaching/526S06/fushun/webpages/group3/group3_3/group3_3rameset.html

2. Sample screenshot
APPENDIX E. TEST QUESTIONS

Lecture 1: Pheromones

1. Please listen to lecture 1 carefully and take notes before you answer the multiple choice questions.

You will listen to the lecture only once. Do not start until you are asked to do so.

1. What is the main point of the lecture?
   A. A pheromone is a chemical substance that deals with harmful insects.
   B. A pheromone is a chemical substance released by one-celled animals.
   C. A pheromone is a chemical substance that animals use to communicate within the same species.
   D. A pheromone is a chemical substance emitted by an animal when it smells or tastes something.

2. What does the lecturer do to achieve her goal?
   A. She defines and classifies pheromones.
   B. She classifies the species that use pheromones to communicate.
   C. She defines and describes the chemical makeup of pheromones.
   D. She shows the similarities and differences between pheromones and other forms of animal communication.

3. Which of the following is a characteristic of pheromones?
   A. Pheromones may be detected by the sense of taste.
   B. Pheromones may be detected by the sense of touch.
   C. Pheromones may be detected by any species nearby.
   D. Pheromones must be produced in great quantities in order to be effective.

4. The lecturer mentions _____ major type(s) of pheromones.
   A. 1
   B. 2
   C. 3
   D. 4

5. Pheromones that cause physiological changes in the organism and affect its development and later behavior are called _____________.
   A. alarm pheromones
   B. primer pheromones
   C. releaser pheromones
   D. terrestrial trail pheromones

6. Why does the lecturer tell the audience about the mouse?
A. To explain why a mouse is an enemy.
B. To emphasize the aggressiveness of a mouse.
C. To demonstrate the function of an alarm pheromone.
D. To illustrate how a mouse releases a pheromone when under attack.

7. What is an aggregation pheromone?
   A. A pheromone that is emitted to trap honeybees.
   B. A pheromone that is emitted to identify parents' odor.
   C. A pheromone that is emitted to call members to one place.
   D. A pheromone that is emitted to prepare food and shelter for mating.

8. Which of the following is true about snails?
   A. A mature male snail emits a sex pheromone to attract the opposite sex.
   B. A mature female snail emits a sex pheromone to attract the opposite sex.
   C. A mature male snail emits a sex pheromone to attract an immature snail.
   D. A mature female snail emits a sex pheromone to attract an immature snail.

9. While ants are moving from a food source to their nest, they deposit a terrestrial trail pheromone on the ground until ________.
   A. they get lost
   B. the food runs out
   C. they get exhausted
   D. the pheromone dries up

10. Which of the following is true about pheromones?
    A. Pheromones can hardly tell us how animals communicate.
    B. Pheromones are the safest and the most effective type of insecticide.
    C. Pheromones can lead both harmful and helpful insects to a certain place.
    D. Pheromones are being used to protect crops from harmful insects on many farms.

II. Short answer questions
1. In your opinion, is the speech rate of the lecture fast, appropriate or slow for you?
   Please check one:   fast ____   appropriate ____   slow ____

2. Is the lecture difficult, appropriate or easy for you? Why?

Lecture 2: Robodoc

I. Please listen to lecture 2 carefully and take notes before you answer the multiple choice questions.

You will listen to the lecture only once. Do not start until you are asked to do so.

11. What aspect of robots does the lecture mainly discuss?
    A. The definition of a robot.
B. Various types of robots.
C. The use of robots in medicine.
D. Similarities and differences between robots and human beings.

12. What does the lecturer do to tell the audience about robots?
A. He describes the process of how Robodoc works.
B. He classifies different types of hospital-based robots.
C. He gives numerous examples of robots used in surgery.
D. He provides a historical background about the use of robots.

13. When the lecturer says that a robot can get new instructions with its basic structure unchanged, he means that a robot is ________.
A. manipulating
B. multifunctional
C. preprogrammed
D. reprogrammable

14. The essential parts of robots include ________.
A. the brain, an arm and a hand with five or six fingers
B. the brain and the end effector with a knife and scissors
C. the microprocessor, an arm with five or six joints, and the end effector
D. the microprocessor, a single arm and a two-fingered hand at the end of the arm

15. Why was hip surgery an obvious choice for researchers when they were exploring the use of robots in the operating room?
A. Because it is not performed frequently.
B. Because it is not very physically demanding.
C. Because it is cheaper when done with robot assistance.
D. Because it is more accurate when done with robot assistance.

16. Why does the lecturer mention carpenters?
A. To show that Robodoc can do woodwork.
B. To contrast a carpenter’s job and a surgeon’s job.
C. To demonstrate how complicated Robodoc’s work is.
D. To illustrate what a hip replacement surgeon’s work is like without Robodoc’s assistance.

17. What manual work do hip replacement surgeons have to do when not using Robodoc?
A. Replace the patient’s thighbone.
B. Carve a cavity in the patient’s hip.
C. Bore holes in the patient’s thighbone.
D. Drill holes in the cement prepared for the patient.
18. In the sentence "and the surgeon first takes a CT scan of the patient's femur, the thigh bone, the large bone running from the hip to the knee", why does the lecturer say "the thigh bone, the large bone running from the hip to the knee"?
A. To explain the meaning of a term.
B. To explain why he is discussing the surgery.
C. To give an example of a hip replacement operation.
D. To remind the audience of a point he has discussed previously.

19. The robot helps with hip replacement surgery by _________________.
A. choosing the best implant
B. cutting the cavity into the patient's bone
C. transferring 3-D images to a computer workstation
D. transmitting detailed instructions about the size, shape and location of the implant cavity

20. Which of the following does the lecturer tend to agree with?
A. Robots will replace surgeons.
B. Robots are developed to assist surgeons.
C. Robots may drill a hole in the wrong place.
D. Robots can have both a machine's precision and a human's judgment.

II. Short answer questions
1. In your opinion, is the speech rate of the lecture fast, appropriate or slow for you?
   Please check one: fast _____ appropriate ____ slow ____

2. Is the lecture difficult, appropriate or easy for you? Why?

Lecture 3: Hall's Classification of Cultures

I. Please listen to lecture 3 carefully and take notes before you answer the multiple choice questions.

You will listen to the lecture only once. Do not start until you are asked to do so.

21. What is the goal of this lecture?
   A. To increase the audience's awareness of the differences among people.
   B. To inform the audience of Hall's concepts of interpersonal relationships, time and personal space.
   C. To make the audience aware of Hall's classification of cultures on a continuum from low-context to high-context.
   D. To inform the audience of the process of how a high-context culture changes into a low-context culture and vice-versa.

22. What does the lecturer do to achieve his goal?
   A. He gives examples.
B. He describes a process.
C. He describes a causal relationship.
D. He makes a generalization and provides evidence.

23. Which of the following is true regarding the interpersonal relationship in a high-context culture?
A. Who your family is matters more than who you are.
B. Who you are matters more than who your family is.
C. What you say matters more than what you do in an event.
D. What you do matters more than what you say in an event.

24. Why wouldn't people in a high-context culture break the law?
A. Because they don't want to be fined or jailed.
B. Because they don't want to shame their family or society.
C. Because they want to be good citizens abiding by the law.
D. Because they think that it would negatively affect their individual future.

25. You will understand the words said by people from a high-context culture if you pay more attention to _________________.
A. their tone
B. their exact words
C. their body language
D. their attitude toward time

26. What is people's attitude toward time in a high-context culture?
A. Time is money.
B. You can't control time because time flies.
C. Things are supposed to happen with punctuality.
D. Everybody and everything has its own sense of time.

27. A low-context culture _________________.
A. has little human trust
B. emphasizes writing more than speaking
C. has more group identification than individual identification
D. has more individual identification than group identification

28. In terms of personal space, which of the following do people in a low-context culture value most?
A. respect
B. privacy
C. closeness
D. alienation

29. Generally, people in a low-context culture have a ________ sense of time.
A. flexible
B. positive
C. monochromic  
D. polychromic

30. The lecture indicates that _______________________________.  
   A. Low-context cultures are more advantageous than high-context cultures.  
   B. High-context cultures are more advantageous than low-context cultures.  
   C. People in low-context cultures are more flexible in what they do and the way they do it.  
   D. People in high-context cultures are less restricted than those in low-context cultures.

II. Short answer questions
   1. In your opinion, is the speech rate of the lecture fast, appropriate or slow for you?  
      Please check one:  fast _____  appropriate _____  slow _____
   3. Is the lecture difficult, appropriate or easy for you? Why?
### APPENDIX F. SUBJECTS’ RAW TEST SCORES

N = 11  Subjects labeled A-K

<table>
<thead>
<tr>
<th>Groups and subjects</th>
<th>Group 1</th>
<th>Group 2</th>
<th>Group 3</th>
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<tbody>
<tr>
<td>Lecture</td>
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ACKNOWLEDGEMENTS

I would like to extend my sincere thanks to:

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