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**The function of perception in the acquisition of non-native
inflectional morphology: The case of the past in English**

Man, David Gordon, Ph.D.

City University of New York, 1990

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A

THE FUNCTION OF PERCEPTION IN THE ACQUISITION OF NON-NATIVE
INFLECTIONAL MORPHOLOGY: THE CASE OF THE PAST IN ENGLISH

by

DAVID MAN

A dissertation submitted to the Graduate Faculty in
Linguistics in partial fulfillment of the requirements
for the degree of Doctor of Philosophy, The City
University of New York.

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Abstract

THE FUNCTION OF PERCEPTION IN THE ACQUISITION OF NON-NATIVE
INFLECTIONAL MORPHOLOGY: THE CASE OF THE PAST IN ENGLISH

by

David Man

Advisor: William S. Stewart

Adult second language learners of English often fail to produce inflectional forms in speech and writing. This study attempts to establish perception as a factor in problems of production by examining the extent to which a second language learner's representation of a target language's phonological system can determine the learner's ability to accurately perceive morphophonological material. Fourteen regular verbs were chosen on the basis of their stem final phonological environments, and a rank order made in terms of saliency. Each verb appeared in four different modes on a randomized list consisting of four examples of each of the fourteen verbs. Four groups of twenty-seven speakers, each group representing Spanish, Russian, Chinese, and Japanese, were asked to identify the presence or absence of the 'ed' morpheme, by deciding whether the pairs were the same or different. Subjects performed quite accurately on

salient environments, but in complex environments accuracy of identification was reduced considerably. The learner's native language and level of proficiency did not contribute to performance, but rather, the phonological system of the target language itself was the main determinant. A second identification test using the same morphological material within the context of sentences, was administered. The learners performed on certain items at the level of chance. Spectrograms revealed a gap of a few milliseconds longer between the inflected form and the word following. This cue, used by native speakers in identifying the past, may well lie beyond the reach of the non-native speaker, and can explain the difference in performance.

This Thesis is Dedicated to the Memory of
my Father

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Chapter One

INTRODUCTION1.1 Overview

1.1.1 English inflectional morphology marks the past on regular verbs by the addition of a suffix represented in writing by an "ed", while count noun plurality is marked by the addition of an "s". The semantics of the simple past is relatively straightforward, as is plurality, and hence it is not surprising to learn that children acquire these inflections fairly early. However, it can often appear to be a never failing source of difficulty for the non-native speaker who may well be advanced in his knowledge of the language and yet regularly fail to supply the necessary inflectional markings in speech and writing when required.¹

1.1.2 Given the level of sophistication of such a speaker it would seem somewhat redundant, if not absurd, to wonder whether he has yet grasped the notion and function of the past, or what may count as plural in English, or whether he knows how all of this is actually expressed by the language. Every learner, we may assume, comes equipped with some idea of the past and what counts as more than one, although what

¹ Details of the type of evidence on which this claim is based can be found in Chapter 2, section 2.9 'Second Language Investigations'.

he may not have is their particular realization in the target language. However, if one examines English it seems at first glance rather obvious how, apart from some irregularities, most of what is past and plural is manifested structurally. What we have here then, is a puzzling observation, common to many who have handled non-native learners of English, which is that in spite of his fairly advanced and overt knowledge of the language, there is a regular failure on the part of the non-native learner to realize that knowledge in actual speech or writing. The purpose of this study is to examine one possible explanation underlying this rather obvious gap between the competence and performance of the non-native speaker going about the business of acquiring and using English.

1.1.3 For a child acquiring his first language, it is reasonable to assume that he is faced with the task of deducing from the stream of utterances that constitute his linguistic experience the rules of his language. By means of hypothesis, testing regularities are perceived and exceptions noted. The evidence upon which these hypotheses are constructed and tested consists, for the most part, of streams of sound associated to meanings embedded in contexts of social interaction. Rarely, if ever, is recourse made to overt metalinguistic talk.

1.1.4 The second language learner, on the other hand, as

well as being older and linguistically more aware, is usually situated in a very different context. His task does not depend entirely on a stream of goal-directed talk but rather, pedagogic practice intervenes, ostensibly on his behalf, to make more directly available the evidence required to form the rules of the target language (TL). Thus, native and non-native speakers plainly have radically differing language learning experiences.

1.1.5 Among the earliest abilities a native speaker acquires, and one of the most important and obvious abilities for the non-native learner to attain in order to begin target language rule formation, is the ability to distinguish those sounds that are distinctive from these sounds that are not, i.e., to acquire phonological competence. This ability also includes knowing what counts as a permissible sequence of sounds and, among other things, knowing what can or cannot constitute a possible word boundary. Put at its most simple, this ability permits the learner to identify words and their boundaries.

1.1.6 However, not every word consists of an unbounded stem, for many are complicated by the addition of suffixes or prefixes that in turn create a pattern of interaction between the organization of permissible sequences of sounds and those that crucially reflect grammatical facts. Thus,

it is knowledge of phonological patterning that assists the learner in the task of identifying possible ultimate constituents of words, i.e., morphemes and their boundaries. If, for example, the native speaker of English hears the sound sequence /ros/ or /fens/, his knowledge of the phonological rules of the language will tell him that he can ignore the possibility of boundaries within the word. However, if he should hear the sequence /roz/ or /fenz/ the knowledge he has will alert him to the possibility that the sound sequence may in fact contain a boundary.²

1.1.7 Let us suppose that a particular learner of English as a second language is not completely aware of the extent and form of distribution operating at the phonemic level, i.e., his knowledge is, in some sense, impaired or distorted. That is to say, his abstract mental representation of the target language sound system does not have the same form and shape that we may assume underlies the native speaker's knowledge. There may be many reasons for such a distortion, including the effects of the learner's native language phonological system representation, and the inherent complexity of the target language's morpho-phonological structure.

² And when presented with strings as complex as /kst#/, /ngld#/, and /mbld#/, his morphophonological competence will tell him that there is necessarily a morpheme boundary before the final sound.

1.1.8 Let us say that in particular, this hypothetical learner is unable to discriminate among word final consonant clusters, because such clusterings have not yet, for whatever reason, come to be accurately represented in his idiosyncratic representation of the target language phonological system. As a result, the words 'men', 'mend', 'mends', and perhaps even 'mended' may be conflated and appear to him to all be just 'men'. In other words, he lacks awareness that the target language contains three separate lexical items that are not in fact homonyms. The native speaker occasionally faces similar problems, as on hearing, for instance, "passed"/ "past", or in some dialects, "residents"/"residence". However, in the case of the second language learner, his second language lexicon will probably be shot through with such pseudo-homophones. Furthermore, and more importantly, vast tracts of the language will be unavailable to him as evidence for the formation of morpho-syntactic rules, such as inflectional endings indicating plurality, or the regular past, etc.³

³ We are, of course, talking here of someone learning English with only regard to aural input, as is possible in the situation described in 2.9. However, this is rare, as most English as a second languages is acquired within formal settings, where the written form is also presented to the learner and ameliorates the conditions under which he learns. Hence, what we are investigating here can only be considered as one of a number of possible contributions to an explanation for failure to produce TL inflections. However, it is a factor which has been overlooked and, one which is probably also involved in the acts of reading and writing themselves since, in some sense, these include listening to oneself speaking (inwardly), and this too, may

1.1.9 Supposing, to take another possible example, a learner is unable to clearly distinguish between the following pairs: "hit" / "hid", "said" / "set", "wrote" / "rode", "meant" / "mend", etc., through the collapse of the voicing distinction. As a result of this phonologic conflation, a further series of false homonyms is created, and, what is more, at the syntactic level a whole class of verbs whose past and participle forms depend critically on this distinction will not be distinguishable. Thus, "bend"/"bent", "lend"/"lent", "send"/"sent", etc., will not be perceptibly distinguished, and hence will probably not be distinguished productively. If such a critical syntactic distinction is not made, even though it covers a relatively small class of verbs, we might then speculate as to the extent to which a grasp of the entire means of distinguishing past from present (including regulars and irregulars) is affected.

1.1.10 What we are claiming therefore is that a relationship holds among the various levels of linguistic organization within a language such that, for the second language learner, competence at one level may determine the level of competence attained at another. The system is, as it were, permeable; the levels inter-connect and form a whole such that distortion or misrepresentation at one level

involve the kind of perception we are talking about here.

cannot fail to have a consequence for the rest of the system. In particular, we are claiming that phonological competence has a bearing on what learners may be able to acquire at the morpho-syntactic level.

1.1.11 What we are suggesting here, therefore, is that it is too simplistic to regard the omission of the "+ed" or the "+s" inflections as further evidence that the student has failed to grasp the past or plural, and so yet another review of these syntactic-semantic points will have to be undertaken. Hence, much time may be wasted attempting to re-inform the student as to how the target language expresses the past or plurality when this is carried out purely in syntactic/semantic terms. Perhaps we should instead ask ourselves first whether in fact the student can accurately discriminate those critically distinctive sounds that involve the expression of the notions of past or plural. If indeed much of the consonant clustering in the target language appears to him as just some indiscriminate noise this may begin to explain our observation that many students whose knowledge of the target language is quite advanced regularly fail to provide inflectional endings.

1.1.12 Such a claim, the validation of which forms the basis of this study, will have a bearing on how we analyze

and treat as erroneous the products of the second language learner. If the possibility that, within a particular learner's interlanguage, intra-level distortion or interference may be taking place is ignored, then corrective practices that are in fact misguided will continue, since the cause of the error remains misidentified.

1.1.13 A concrete example of this comes from the claim that the learner has 'deleted' a sound based upon the observation that the form is not present. Such a claim requires that items that are not realized are present at some stage, but were subsequently removed, i.e. deleted⁴. If this is the case, then the learner has acquired a number of extra rules in his interlanguage that are quite complex and could possibly be unique. Among these are a rule that at some point produces the morpheme which is then, prior to its actual realization in speech, removed by another rule. One problem facing the deletion explanation concerns isolating those factors responsible for its operation. Since the rule is a variable one, we would like to be able to predict its operation, but so far in second language acquisition research there have been no reasonable suggestions.

1.1.14 The alternative explanation offered here is that the occurrence of the morpheme in production is contingent upon

⁴ These claims of deletion derive originally from work done on Black English Vernacular (BEV) by Labov et. al., (1968), and Labov, (1972) (see in particular 216-226).

how it is represented in the mind of the speaker, and that this representation is in part based on how the learner first perceives the target language.

1.1.15 The learner's perception of morphemes, unlike the native speaker's, may not be categorical for a number of reasons, such as their location within the target language sound system, his familiarity with the language, the effect his native language has on his discriminatory abilities, etc. If the learner is unable to perceive the presence of a form then it would seem unlikely that he will be able reproduce it.

1.1.16 To test the validity of our suggestion, it was decided to construct a test that would give us some insight into how non-native speakers perceive English. In particular we chose to study how English realizes the morphophonological structure of the regular past tense. But first we identify below three possible factors that could affect a learner's ability to successfully carry out target language discrimination tasks.

1.1.17 It is quite obvious that the formation of an accurate TL (target language) phonological representation in the mind of the learner is dependent upon a number of factors that do not arise in first language acquisition, and

which can result in the distortion or misrepresentation of the TL's sound system. Although the impact of the phonology of the first language has generally been assumed to be primary, in this study we also identify and include experience with the TL, as well as the phonetic environment in which the inflection occurs, as both being possible determinants of learner TL perception.

1.1.18 The purpose of this study, therefore, is to attempt to establish whether or not these factors do in fact play a role in determining the learner's ability to perceive and identify TL morphophonological material, and, if possible, the extent of their individual contribution to the process. Below we outline the contribution each of these may make and how they might interact.

1.2 Three Contributing Factors in Second Language Morphophonological Perception

i) The Effect of the Environment.

1.2.1 Without a native speaker's phonological representation guiding him, the SL (second language) learner is less equipped to make the fine discriminations required of the TL. Lacking a firm representation, individual sounds and sequences may well become distorted or have to be

ignored. As a result, we may expect the phonetic shape of the environment of the TL to contribute to the learners' ability to recover the inflected form. In other words, the complexity of the phonetic environment itself is likely to affect the non-native speaker's ability to detect the presence of TL inflectional endings. As sequences become more complicated and difficult, the learner will be less able to detect the presence of the morpheme and vice versa.

1.2.2 So, given two environments of the target language (English) that differ in their phonological structure in terms, let us say, of the length of sequence in final position (and both forms are inflected), we would expect the learner to perform less well on an identification task on the more complex of the two. In other words, lacking a robust model of the TL phonological system leads the learner into greater reliance on the phonetic shape of the form, and hence he is more likely to become liable to complexity at this level.

ii) Level of Proficiency

1.2.3 As a learner becomes increasingly proficient in the TL it is generally assumed that his representation of the sound system becomes concomitantly more accurate. The level of proficiency obtained by a learner on some general measure

can therefore be expected to reflect the extent and nature of his second language phonological knowledge and vice versa. Thus, the more experienced learner is more likely to make accurate perceptual discriminations in the target than the less experienced, and increasing accuracy in this domain is a reflection of a burgeoning capacity for the language as a whole.⁵

iii) Native Language

1.2.4 The ability to detect critical sound sequences depends not only upon familiarity with the language as reflected by proficiency, but also on the learner's native language. Those learners whose native languages are non-inflected and/or have phonological systems that are more restrictive than English (e.g. limit the number of word final consonants), could be at a disadvantage when constructing a representation of the target language's

⁵ What we have presented here is a 'lock-step' view of general and phonological TL ability in which the two necessarily progress along side each other in some kind of interdependent manner. We should, however, note that there is probably a great deal of individual variation in the ability to perceive phonological differences (so called 'having an ear for languages'). This is a particular ability that has wide individual variation which may effect differences found among 'beginner' and 'advanced' groups. So an individual beginner with heightened phonological ability may do well compared with an advanced learner with average skills in this area. However, we assume here an effect of groups which is sufficient to overcome this kind of individual variation.

phonological system. On the other hand, learners whose native languages approximate more closely to English may be at an advantage.

1.2.5 Furthermore, if we accept that what has been produced is evidence for what has been perceived, and if what has been produced can be explained in terms of the effects of the first language, then we can expect interference to play a role in perception. From this we can expect different language groups to respond to hearing English in a manner typical of that group. Further, the organization of morphological material in the native language may also affect the acquisition of English inflections. We would then expect learners from the same language background to behave in a way such that they would produce response patterns to the perception of the target language in a manner unique to that language.

1.2.6 The impact of native language phonologies on target language systems is one of the more salient features of interference phenomena in second language learning. However, the majority of the literature has concentrated on how the relationship between the two systems affects learner's target language productions, i.e., accent. The effect of interference on perception in second language acquisition has largely been ignored, as our survey of the

literature reveals.

1.3 How the Variables Might Interact

1.3.1 When the three variables discussed above are seen interacting, we would expect a variety of different responses based on differences in the relationship among them. We can illustrate some of these possibilities as follows:

- (a) Suppose L1 (first language) makes no difference, but proficiency does, then we can expect all learners to behave alike but to become increasingly target-like as they become more proficient.
- (b) Suppose L1 is a critical factor, and the other two less so, then we can expect a wide variety of response patterns among the different language groups which may hold to a degree through all levels of proficiency, depending on the strength of this variable.
- (c) If the effect of proficiency is increasingly added to (b), then variation can be expected to diminish and take on a more target-like appearance.
- (d) The impact of the target language system may order the

pattern of responses in terms of itself, so that regardless of language or proficiency the pattern of responses will be in terms of difficulty in the TL.

(e) Proficiency and L1 may interact with d) to produce a pattern whereby beginners respond differently from each other but begin to approach each other as proficiency increases. However, the overall pattern remains in terms of the TL phonetics.

1.3.2 The purpose of this study is to attempt determine the extent to which the three variables we have identified above affect the second language learner's ability to retrieve target language morphophonological material, and in particular the regularly inflected past tense form in English.⁶

⁶ This study does not build upon or extend other work as none, unfortunately, has been done previously. Thus, lacking any precedent, we have established our own testing procedures in order to investigate the nature of the interaction of the variables listed above (see Chapter Three). We hope, however, that the work done here may set its own precedent and that the important link with production, hinted at above, may receive the kind of empirical testing that we have subjected perception to in what follows.

Chapter Two

REVIEW OF THE LITERATURE

The phonological system of a language is like a sieve through which everything that is said passes. Only those phonic marks that are relevant for the identity of the phonemes remain in it ... Starting from childhood, each person becomes accustomed to analyzing what is said in this fashion. This analysis is carried out quite unconsciously. The system of "sieves", however, which makes such analysis possible is structured differently in each language. Each person acquires the system of his mother tongue. (Trubetzkoy, 1969, pp. 51-52)

2.1. The Inflectional Morpheme PAST in a Contemporary Grammar Model

2.1.1 Here, we shall review the position of the past tense inflectional morpheme in English as it appears in a generative type model of grammar first outlined by Chomsky and Halle (1968) in The Sound Pattern of English (SPE). We have chosen this particular example for a number of reasons. First, this model has enjoyed widespread acceptance amongst linguists and psycholinguists. Secondly, the location of inflectional morphology within this framework has remained remarkably stable since its inception not withstanding Andersen's objection⁷. Finally, inflectional morphology has traditionally not been regarded as an issue in grammar worthy of very much attention, and this is reflected by a

⁷ See S.R. Anderson's (1982) "Where's Morphology?".

dearth in the literature.⁸ However, as a result of the radical re-treatment of the phoneme within the generative framework, inflectional morphemes have come to occupy a unique position within the model.

2.1.2 In a generative grammar, most items that occur in the lexicon must be in a form that is easily interpretable by the phonological component in order to receive a phonetic representation. In other words, the degree of abstractness of lexical formatives must not be too great. However, some of these formatives, which eventually occur at the surface syntactic level, are not so easily interpretable by the phonological component. Among the class of forms that compose this group are the grammatical formatives traditionally known as inflectional morphemes. So, for example, the form of the allomorph {+t} is generated at the surface syntactic level of the grammar as PAST. However, such a form, according to Chomsky and Halle (C&H), is too abstract and quite inappropriate for interpretation by the phonological component. As a result, further operations need to be performed, and in order to carry these out a set of Readjustment Rules (RRs) was postulated. This set of rules operates between the surface syntactic level and the phonological level in order to convert PAST (and other types

⁸ Although see Bloch (1947) and Greenberg (1957 Chapter 2). But even so, these authors concentrate their attention on the strong verbs.

of grammatical formatives) into a more phonologically admissible form.

2.1.3 Thus, C&H claim that there are 'discrepancies' between the output of the syntactic component (surface structure) and the input to the phonological component. In the particular case of PAST, the form that the Readjustment Rules produce as output is the form {+d}, which is only then acceptable for interpretation by the phonological component. This process also involves converting the form {+d} at a later stage into one or other of its three possible phonetic representations, i.e., [id], or [d], or [t]. Thus, the Readjustment Rules lie between the surface structure and the phonological component and convert forms that the component cannot interpret into forms that it can. In summarizing their model C&H state that:

... the grammar must contain certain rules for converting surface structures generated by the syntactic component for use by the phonological component [which consists of readjustment rules, that] make various modifications in surface structure.⁹ (Chomsky and Halle, 1968, p.163)

⁹ This argument is at times reminiscent of that of the much earlier discussion between Pike and Hockett, where the latter took issue with the former's claim that: 'No grammatical facts of any kind are used in making phonological analysis'. Pike claimed to show that it is quite impossible for such a claim to be realized completely. Further, he claimed that it is undesirable to exclude grammatical facts because 'many of the phonological facts are inextricably interwoven with grammatical and structural relationships'. Pike then went on to say that 'The phonemic analysis cannot be completed until some initial grammatical steps are taken. Perhaps the most important of these is the identification of the morphemes' (p.118, in Fudge(1973)).

The reasons for these modifications have been given above. Thus the grammar undertakes the representation of the word 'mended' as follows:

DEEP STRUCTURE	Verb + NP [+restore]
SURFACE STRUCTURE	mend + PAST
READJUSTMENT RULES	mend + d
PHONOLOGICAL COMPONENT ¹⁰	/med d/
PHONETIC REPRESENTATION	[mendId]

2.1.4 The level of phonetic representation in this grammar, according to C&H, is not supposed to be a direct record of the speech signal but rather a representation of

¹⁰ Chomsky and Halle state that: 'The phonological component expresses the relationship between the surface structure of a sentence and its physical actualization in so far as this relationship is determined by grammatical rule in a very general sense.' p.293. Their enrichment of this level has been reinforced by researchers such as Liberman (1970), who has noted that when certain acoustic cues, such as the second formant transitions that are the cues for [d] in [di] and [du], are removed and presented in isolation they are heard as different (one is like a bird chirping the other like the glide of a pitch) but, if re-embedded they are again heard as the [d] of speech. Thus perception is at several removes from the acoustic structure. It does not directly mirror the external physical events that cause it but rather yields a unique linguistic event called [d] that cannot be described in auditory terms. Liberman therefore claims that perception in the speech mode is just as abstract as, say, deep structure.

what the speaker takes to be the phonetic properties of an utterance, given his hypotheses as to its surface structure and his knowledge of the rules of the phonological component. In other words, phonetics is also concerned with grammatically determined aspects of the signal.

2.1.5 Thus, a person's interpretation of a particular speech event is not determined merely by the physical properties constituting the event. The listener will not normally be aware of many properties in the signal, and at the same time his interpretation may involve elements which have no direct physical correlates since what is perceived - C&H argue - depends not only on the physical constitution of the signal, but also on the hearer's knowledge of the language, as well as on a host of extra-grammatical facts. It is this same argument which, when applied at the syntactic level to such forms as "Martha finds John easy to understand", speakers are said to 'know,' at least tacitly, what the subject of the embedded verb must be.

2.1.6 Therefore, the physical stimulus that strikes the hearer's ear is actively utilized by him to form hypotheses concerning the deep structure of the sentence. Thus, what is perceptually real is determined only in part by physical cues. Complex phonological and syntactic processes also play a role in determining perceptual reality, so that which

the hearer hears is internally generated by the rules. In other words, he will hear the phonetic shape determined by the postulated syntactic structure and the internalized rules. This, then, is an enriched and more abstract notion of the phonetic representation of a language than had been previously considered.

2.2. The Grammar Model as a Model for Speech Processing.

2.2.1 In the Sound Pattern of English, C&H also briefly discuss a possible model of language processing, in which the role played by the Readjustment Rules is central. In order for a listener to process utterances in the language, C&H, not untypically, envisage a two stage memory, the first of which is limited in space and time while the second is much larger. The first stage being limited in capacity must be constantly cleared in order to receive further incoming information. It is the task of the Readjustment Rules to convert incoming phonological shapes held briefly in the first stage into forms that are interpretable by the second larger capacity memory. However, this second stage can only operate on forms that are equivalent to the surface structure description in the model of grammar (see above). Hence, the phonetic form of the inflectional morpheme {ed} of the verb 'mended' is converted by the Readjustment Rules to the form PAST in order to clear short term memory and so

allow the incoming form to be given a semantic interpretation by the larger second stage of memory.

2.2.2 Thus we see in both these descriptions, the first of a grammar, the second of actual speech processing, that the role played by the Readjustment Rules is pivotal. In the grammar model it is to provide input for the phonological component, while in the processing model it is to convert the phonetic representation of the message into a form that is processable by long term memory (that is, phonetic forms are converted into surface syntactic forms). There are two aspects to this which are quite striking. The first is that the process model appears to be a kind of working version of the model of the grammar - only in reverse. The second is that the incoming phonetic representation of inflectional morphology, quite unlike any other area of the lexicon, is unacceptable and inappropriate for semantic interpretation unless converted by the Readjustment Rules¹¹. It is not, of course, clear whether this is merely a function of the design of the grammar or whether we are to assume the actual operation of psychological mechanisms on such a set of rules. Using C&H's model of speech perception, we can begin to outline what happens when a hearer is said to have processed a sentence that contains the regularly inflected

¹¹ Indeed the major motivation for positing a set of Readjustment Rules in the grammar model proposed by C&H was in order to handle inflectional morphemes.

past tense form of the verb 'to mend', i.e., MENDED.

2.2.3 Initially, the first stage of memory receives the phonetic representation of the word MENDED. Next, in order for this form to become semantically interpretable, it is operated upon by the Readjustment Rules such that the form [id] becomes /d/ which in turn is converted into the abstract form PAST. However, it is not clear from C&H's discussion whether it is the last form (PAST) that is retrieved into the second stage or whether {d} itself can receive an interpretation.

2.2.4 The positing of Readjustment Rules within the generative framework firstly supposes that the speaker of a language has such a set of rules, secondly, that the acquisition of them depends initially on the ability to retrieve the phonetic/phonological representations of formatives, and thirdly that their significance is understood. If learning a language (both L1 and L2) is largely taken up with hearing the language being spoken in order to derive evidence for the formation of rules, then the learner has to 'know' the significance of [id] as PAST, and further, he can only do so if he can first hear it. Thus although what he actually hears is [id], what he is supposed to understand is PAST. Learning the significance of the form [id] depends, therefore, on the formation of

Readjustment Rules to operate on the phonetic representation in order to recover this form and to give it the label PAST. Thus the learner's ability to form Readjustment Rules is dependent upon the ability to discriminate sounds.

2.3 The Role of Perception in the Development of First Language Phonologies

2.3.1 The substitutions of adult sounds by children has increasingly received an explanation based upon a perceptual component that, according to Velleman (1988) '... filters input according to the child's current hypothesis about distinctive contrasts' (p. 221). However, prior to Macken (1980), explanations as to how children arrive at hypotheses concerning the phonology of the ambient language generally excluded or down-played the role of perception, as Smith (1989) admits about his own research '... perception [was] not an explanation for the child's divergence from the adult norm' (p.42). Unfortunately, this position was held by most of those interested in L1 phonology acquisition until, as we have said, Macken (1980) who, according to Smith, '... proved that the child's perception really was crucially involved, contrary to my explicit claim ... it was necessary to assume [as a result of Macken's research] that [the child] had limited but real perceptual difficulties' (p. 45).

2.3.2 There are some earlier references to the role of perception in L1 acquisition before Macken. For example, one well-established observation of first language phonology acquisition concerns the production of open syllables before closed, and the gradual increase in the complexity of the closed syllable (Smith, 1973). As early as 1977, Jusczyk concluded that two-month-old-infants do not

... perceive initial-stop differences (dab vs. gab) any better than they do final stop differences (bad vs. bag) It was also observed that a contrast by a single [phonetic] feature (bad vs. bag) was as detectable for infants as one by several features (bag vs. bam). (p.453)

Jusczyk then goes on to suggest that the simplified final clusterings of children's L1 may be based upon a learning strategy by which initial segments are attended to before final segments. This early inclusion of perceptual factors in L1 phonology acquisition failed, however, to persuade most workers in the field that there was a need to include a perceptual filter as a means of explaining children's L1 products until Macken began to take Smith's work apart. Given the role of perception in L1 acquisition it is not surprising that when we turn to work in second language phonology acquisition, we should find the role of perception has been similarly overlooked.

2.4 Learning of Inflectional Morphology and the Role of Perception in the First Language

2.4.1 It has been shown that children go through several discrete stages in the acquisition of suffixes and function words (Cazden, 1968; R. Brown 1973). Adopting the four stages of Clark and Clark (1977), we may say that at Stage I and II (1.3 - 2.0 years) there is an absence of the form in the child's output. However, within about the second month of the second year, and soon after the appearance of certain frequent irregulars such as 'went' and 'broke', the regular inflectional endings of the past begin to emerge. One reason offered for their appearance at this third stage is that children invoke what Slobin (1973) has labeled Principle D, namely, "Pay attention to the ends of words", although this principle could well be a part of general phonological development in which syllables become more elaborately closed. Stage III is also characterized by the over-generalization of the morpheme onto irregulars to produce forms such as 'goed', 'bayed', and 'brokeed'.

2.4.2 Advocates of the innateness hypothesis have seized upon observations such as this as evidence in support of the child's active construction of rules in the acquisition process (Berko 1958; but see Natavico and Natavico, 1969). The acquisition of the regular past tense inflectional morpheme appears to be achieved fully in L1 by Stage IV

(Clark and Clark, 1977, p.343). In this fourth and final stage there is no confusion between regulars and irregulars except where a new irregular appears regularly inflected in the child's speech, in which case it may be necessary to refer the child explicitly to its peculiar status.

2.4.3 In a longitudinal study of three children acquiring their first language, Roger Brown (1973) listed an order of acquisition for fourteen grammatical morphemes which was remarkably consistent across the three children. Indeed, Brown was able to claim from his study that if one knew the mean length of utterance (mlu) produced by a particular child, it was quite possible to predict which morphemes would be present and which not.

2.4.4 The order of acquisition that Brown found was confirmed in a later cross-sectional study by De Villiers and De Villiers (1973) who concluded that

... as they (children) produce longer sentences, they add the basic grammatical morphemes, and the order in which they add these morphemes to their speech shows a remarkable degree of invariance. (p. 274)

2.4.5 Having clearly established the order of appearance of morphemes in first language acquisition, investigators have gone on to explore responsibility for this order. The De Villiers cite both semantic and grammatical complexity, but

their definition of these is vague and provides little insight. They do, however, briefly mention the possibility that perceptibility in speech may be among the factors responsible for shaping the order of acquisition. Porter (1977), summarizing the work done in L1 acquisition, states that¹²

They [Brown et al.] concluded that the order of morpheme acquisition could best be predicted by some combination of grammatical and semantic complexity, frequency and perceptibility in speech. (p.48)

2.5 The Order of Morphemes in Second Language Studies

2.5.1 Following Chomsky's repudiation of behaviorist accounts of first language acquisition, the field of second language acquisition became exposed to similar attack. As a result, the notion was advanced that hypothesis testing and rule construction underpinning much of L1 acquisition also played a similar role in second language acquisition. In support of this was the claim by such people as Dulay and Burt (1974), and Bailey, Madden and Krashen (1974), to have found consistency to the order of the acquisition of English

¹² Among possible explanations for the order of acquisition worthy of particular mention here is the work of Bloom et al. (1980), which has been perhaps the most refined and elaborate attempt to date. However, her perspective ignores the contribution of phonological development and concentrates on the role played by semantics. She notes that the actual semantics of the verb itself (action -v-state) '...was the major influence on the learning of verb inflections' (p.404), as was the relation between the verb and the item that received focus as subject.

morphology by non-native speakers. For instance, Dulay and Burt (1974) presented evidence showing approximately the same order of acquisition of eleven grammatical morphemes of English by two different linguistic groups of Chinese- and Spanish-speaking children. The explanation that these authors offered for these findings was that

... universal cognitive mechanisms are the basis for the child's organization of a target language, and that it is the L2 system, rather than the L1 system that guides the acquisition process. (p.52)

2.5.2 In the paper by Bailey, Madden, and Krashen (1974), the order found for Dulay and Burt's group was likewise approximated among adults, which led these investigators to conclude that

... adults use common strategies for second language learning. In addition ... these results also indicate that they [adults] process linguistic data in ways similar to younger learners ... [and] ... the results are also consistent with findings that errors in second language learning are not all the result of interference from first language ... our data imply that a major source of errors is intra-lingual rather than inter-lingual, and are due to the use of universal language processing strategies. (pp. 241-242)

These two studies set the tone of the following decade's worth of second language acquisition research, which sought either to confirm similar orders or instead demonstrate greater instability and variability.

2.5.3 Among those who have sought to disconfirm these earlier findings, there has been either outright rejection (as in Rosansky (1976) : 'It has never been demonstrated that L2 acquisition follows the same kind of developmental learning curve that L1 learning does. '), or particular aspects of the studies have been taken to task, e.g., the method of elicitation. Thus, Porter (1977), using the Bilingual Syntax Measure (a cross-sectional collection method used by Dulay and Burt), found no correspondence with the De Villiers and De Villiers L1 cross sectional study, but did find a correspondence with the Dulay and Burt study. Rosansky's (1976) and Hakuta's (1976) longitudinal studies of individuals have both shown different patterns from the cross sectional studies. Larsen Freeman (1975) found that the order of L2 morphemes varied across different L1 backgrounds according to different tasks (e.g., reading, writing, elicited imitation, etc.), although within each task the different L1s correlated quite well with each other.

2.5.4 However, in virtually none of these studies is reference made to the possible role of phonological saliency.¹³ The one exception to this is Abraham's (1984)

¹³ In a paper by Goodglass and Berko (1960), aphasics suffering from loss of inflectional morphology were compared with children and they concluded first that

'For aphasics, the difficulty of various inflectional

investigation of the use of the present tense third person singular {+s}. She comments that

A difficulty index for verbs ... suggests phonetic environment ... influences the attachment of the -s [and she goes on to suggest that] ... the third person singular -s is not acquired as an isolated morpheme, ... but enters the acquired knowledge system of the learner attached to a particular verb ... [and that what determines its presence is] ... frequency, perceptual saliency and ease of pronunciation. (p.67)

2.5.5 These conflicting findings and the overall disarray of the morpheme order of acquisition studies may in part be explained by the use of linguistic labels, such as 'the morpheme', that may not in fact be discrete enough to distinguish phenomena related to acquisition. It may be that the learning of inflectional morphology, if separated out for purposes of investigation from other morphological structures, will be found to chart a distinct within-category course of acquisition that is otherwise obscured by the use of the over-extensive term 'morpheme'.¹⁴

endings follows a definite order which is based on grammatical function, not phonological similarity [and that] phonological complexity is not as important for aphasics as for children in determining the difficulty of inflections.' (p.266).

¹⁴ Most of the attacks on the order of acquisition studies have been well deserved, although in Larsen Freeman's 1976 paper we find a somewhat futile behaviorist rear-guard action taking place. There, Larsen Freeman counted the frequency of morphemes used by the parents in Brown's original study and from this she concluded that there was a high degree of correlation between the parents' input in that study and the order of morphemes produced by second language learners and hence she concludes that '...

2.5.6 For example, in his study, Brown intended the 'morpheme' to refer to what has been traditionally included under the label 'functional' or 'grammatical' morphemes. This, unfortunately, is a very broad term as it includes at least four distinct types of morphological structure, i.e., free lexical items such as prepositions and articles; the irregular past and plural such as 'went' and 'children'; inflectionals such as the plural +s and the past +ed; as well as the discontinuous morphemes that make up aspect. Taking just the progressive, Brown and many others have shown that this form is acquired in L1 in two stages. First the +ing suffix is acquired and then the copula. It is therefore quite surprising to note that in SLA research, Anderson (1977) claims to have found evidence that learners of English as a second language in fact acquire the progressive in one stage. At the same time, in linguistic descriptions, at least since the publication of Syntactic Structures (1957), these two forms have been considered at some level as one.

2.5.7 How then did the morpheme order of acquisition research, besieged by such a deluge of criticism, come to hold such prominence in the field? Perhaps its significance lies in the fact that it was the first attempt

morpheme frequency of occurrence in the native speaker speech is the principle determinant of oral production of L2 learners morphemes.'

on the part of SLA researchers to take over from first language acquisition the idea of hypothesis testing and creative rule construction, and so infer similar processes at work in the second language learner. This was indeed a radical departure from what had preceded namely, a strictly behaviorist view in which the role of interference was paramount. Unfortunately, the zeal of some investigators to make L2 learning as closely based on principles of L1 learning as possible has lead to an area of investigation riddled with hurried conclusions based upon slim evidence.

2.6. The Role of Innate Capacities in the Acquisition of Native Phonological Contrasts

2.6.1 Since Chomsky's devastating review of Skinner's Verbal Behavior, the innateness hypothesis has been the dominant accounting for the processes involved in first language acquisition. It has also received some of its firmest and most dramatic support from infants' capacity to discriminate native and non-native phonological contrasts. The results of these experiments have been summed as follows

...infants are richly endowed with innate perceptual mechanisms, well adapted to the characteristics of human language, that prepare them for the linguistic world that they will encounter. (Eimas, p.48. 1985)

However, this position has not been without its critics, who are perhaps best represented in the work of Eilers et al.

Below, we review these two positions and examine how they might effect our understanding of non-native phonological perception.

2.6.2 Following work done by Lisker (1970), Abramson and Lisker (1970), and Lisker and Abramson (1964, 1967) on adult perception of stop consonants along the voice on-set time (VOT) continuum, it was left to Eimas et al. (1971) to apply the same paradigm to very young infants. Using a sucking technique as a measure of infants' perceptions of shifts in VOT values, these workers have provided evidence that very young infants can discriminate speech sounds along the voicing continuum in a manner approximating categorical perception. That is to say, when the change of stimuli came from within the same adult phonemic category there was no measurable increase in response, but when the change came from across the adult phonemic boundary, there was a significant increment in the response rate.

2.6.3 In a later paper (Eimas 1975), the same measure of infant discrimination of the phonemes [r] and [l] was applied. Having noted that adult American English speakers discriminate [r] and [l] categorically, while Japanese adults do not, Eimas went on to determine how well English L1 infants performed on the [r]-[l] distinction. According to Eimas, the data gathered on infants "corresponded well

with the adult data." In other words infants, like adults, were able to perceive the [r]-[l] distinction. In searching for an explanation as to why Japanese adults, performed poorly by comparison not only with English speaking adults but also infants, Eimas suggests that

If specific phonetic experience is not forthcoming within some broadly defined critical period, the phonetic feature detectors subserving the contrast in question will undergo some loss of sensitivity.¹⁵

2.6.4 Aslin et al.(1981) also tested English infants' ability to discriminate a VOT distinction in the minus region that was not phonemic in English. They report that

Infants from an English-speaking environment are capable of discriminating VOT differences that cross both the English adult voicing boundary and the voiced-voiceless unaspirated boundary employed phonemically in other languages such as Spanish and Thai.

This, then, reflects the basic position of those who hold that infants are innately endowed with the ability to make fine discriminations among sounds whether or not they become phonemic in the ambient environment, and that lack of exposure gradually leads to loss of sensitivity to the these distinctions. This position would suggest that for learners acquiring a second language, for those phonemic distinctions that do not occur in their first language for extreme

¹⁵ His argument might have been considerably reinforced if Japanese infants had been tested on the same set and found to behave in a manner similar to English infants.

difficulty will be encountered in the perception of the L2 contrasts.

2.6.5 The body of work contained in Eilers et al. (1975 (a) (b), 1977, 1979 (a) (b), 1980, 1982) attempts to counter the part played by innateness as an explanation by instead claiming a greater role for experience in the infant's ability to discriminate sounds in L1. In particular, they question some of the earlier findings contained in Eimas (1963), Eimas et al. (1971, 1973 (a) (b)), Eimas (1975) and Lasky, Syrdal-Lasky and Klein (1975), in which infants were purported to have been able to discriminate along the VOT continuum at boundaries that were not found in their native language. Eilers et al. (1979 (a) (b)) claim that only one out of the six reported studies concerned with English infants' abilities to discriminate a series of non-English voicing lead stops reached significance (Eimas, 1975). And, for that one report they claim that what may be responsible for the kinds of discrimination reported on there might in fact depend not on VOT as such, but rather the lag boundary that represents a special acoustic cue based on the absence of the first formant transition.

2.6.6 In other words, they claim that what infants are responding to is a universal psychoacoustic cue as opposed to anything linguistic. This contradicts the claim of the

innateness hypothesis, which would have infants capable of discriminating non-native phonetic contrasts because of special linguistic adapters. Eilers et al., on the other hand, propose a more eclectic model of the development of speech perception in which experience plays a more central role.¹⁶

2.6.7 In their 1979 (a) and (b) papers, Eilers et al. present evidence (in spite of their own strong objections to the use of VOT on non-linguistic grounds) of adult monolingual English speakers performing better than infants on a discrimination task along various VOT values. The infants were able to discriminate only the English /p/-/b/, while adults could out perform them by discriminating longer leads. Indeed they claim that

17 A further objection that Eilers et al have is to the actual use of the VOT continuum itself since evidence has come from work by Kuhl and Miller (1975) that

... the very same perceptual VOT boundaries that occur in humans also occur in the South American chinchilla, a member of the rodent family. In fact the slight shifts in the boundary reported for labial apical and velar stops among adult humans ... all occur with the chinchilla. (Eilers, Wilson and Moore, 1979).

They therefore conclude that since chinchillas perceive speech-like stimuli categorically and if, as Cutting and Rosner (1974) claim to show, a variety of non-speech musical instruments can also be perceived categorically, then any direct or exclusive relationship between categorical perception and specialized innate linguistic capacities is to be seriously questioned.

... the present study does not provide any support for the claim that infants discriminate among non-English lead contrasts [as predicted by the innateness hypothesis]. (p.15)

The reason for this, they argue, is that English infants have no experience of this contrast and hence do not acquire it, although they do not explain how the adults were then able to discriminate non-native long leads.

2.6.8 Further evidence in support of their position comes from comparisons of infants differing by a number of months, with the older 12 month old infants out-performing those 8 month old infants on a test of discrimination involving various phonemes of English (e.g., /s/, /s/, /z/, /f/ and /v/)¹⁷. The 6-8 month old infants could not discriminate /f/ from /v/, while the older infants could. However, as Eilers et al. point out

One cannot tell if the positive discrimination achieved by infants results from recognition cues that are largely insignificant in communicative situations. (p.18)

The specter still haunts of a possible non-linguistic explanation for the behavior found in infants, and even possibly adults. In other words, when the task is a discriminatory one it is difficult, under the test paradigms

¹⁷ Notice, however, that the sounds which were chosen were all sibilants, which as a class are well known for being acquired late and difficult to discriminate even by adults familiar with the language, so we should treat these conclusions with some caution.

used by these workers, to distinguish linguistic from possible non-linguistic cues in speech discrimination.

2.6.9 Indeed, these particular investigators are so sensitive to the possibility of confounding acoustic as opposed to linguistic cues, that they have extended their research to include discrimination tasks in which meaning is also involved. In Oller and Eilers (1983), 2 1/2 year-olds were investigated using natural tokens of actual L1 words paired with words containing a non-native phoneme.¹⁸ Children were found to be unable to respond to the task in the appropriate manner when the non-native stimuli were used, but they could perform to the L1 stimuli. It is not possible to tell from such a procedure whether the lack of response to the non-native token involves inhibition over time, since it could be that native contrasts are responded to through familiarity of experience. What seems more likely, according to these workers, is that a lack of exposure to non-native contrasts may result in the child ignoring what have become for him meaningless contrasts. This might also lead eventually to changes at lower levels

¹⁸ Indeed, this is a problem that Velleman (1988, p.244) notes on children's perceptions of L1 contrasts, in which toys representing no real animal in particular were given the label [fa] [Oa] [ba] and [da]. She found that the children's discriminations of such pairs as fa/ba were much worse than their discriminations of real world pairs, such as fox/box.

of perceptual ability.¹⁹

2.6.10 Another way around undermining the credibility of claims for early discriminatory ability followed by rapid loss for non L1 contrasts, is to show only a gradual discriminatory ability in young children perceiving token contrasts in their own language, as Simon and Fourcin (1978) attempted to do, but they are the only investigators who have chosen this path.

2.6.11 The outcome of the debate outlined above between the gradual loss of specific linguistic adapters as opposed to a general lack of experience has important consequences for explaining first language acquisition, but its impact is not, however, very great on SLA for the simple reason that by the time the learner starts on his second language, whichever of the two explanations is chosen, the product is the same, namely an overall lack of phonetic capacity in the second language. Thus, in spite of their importance in discussions of first language acquisition, both positions reviewed above could act equally well as an account for problems that adults encounter in discriminating non-native contrasts, and there is as yet no means available for

¹⁹ However, in an earlier paper Eilers, Gavin, and Oller (1982), the superior performance of Spanish infants' ability to discriminate Spanish tapped and trilled /r/'s as opposed to a more depressed score by English infants is explained by means of the term 'enhancement'.

choosing one over the other.

2.7 The Performance of Infants Compared with Adults on Native and Non-Native Contrasts

2.7.1 Most work on speech perception has involved the very early ontogeny of the capacity to make discriminations across phonetic category boundaries. As we have seen, infants can discriminate across phonetic categories that are not only distinctive in their ambient language but also in languages that are not a part of their environment. However, in studies of adult cross-language perception, the ability to discriminate non-native distinctions appears not to last. That is, the infants' capacity to make fine discriminations across boundaries that do not exist in the infants' future L1 is lacking in adults whose native languages do not employ, contrastively, the distinctions in question. Here we shall turn to studies that have set out to account for this apparent loss of an ability in adults.

2.7.2 Trehub (1976) was one of the first to explore the differences between infants' and adults' abilities to discriminate native and non-native contrasts. Taking a group of infants of English speaking parents, Trehub established an ability not only to discriminate between English /pa/ and /ba/ but also the pair /za/ and /ra/ found in Czech. Furthermore, the infants seemed to discriminate

the pairs equally well, or as she put it

...there was no basis for inferring greater discriminability by infants of the English contrasts ... compared to the Czech. (p.471)

These findings along with those reported on above, suggest that the infants' ability to discriminate does not depend on previous experience. By contrast, Trehub found that adult speakers of English exposed to the same /za/ and /ra/ pair scored slightly above chance, but in a manner that she claims 'implies substantial confusion ...' (p.470).

2.7.3 Trehub's paper was also one of the first to attempt to reverse the commonly held belief that perceptual development was characterized by gradual improvement, either with reference to experience or to the elaboration of linguistic and mental structures. Instead she has suggested that

... development might proceed in the direction of fine to gross distinctions, at least with respect to features which are irrelevant to one's own language. (p.471)

2.7.4 The work of Werker et al. (1981, 1983, 1984 (a), 1984 (b), 1985, 1988, 1989), as well as Tees (1984), has also helped to establish that adults are not able to perform discriminatory tasks nearly as well as infants. That is, adults are unable to make the kinds of discrimination on non-native contrasts that infants are capable of. Perhaps the more striking examples of this occurred in the

experiment reported on in Werker and Tees (1984(a)). There, a group of adult native speakers of English were asked to discriminate between Thompson /qi/ and /ki/²⁰. These sounds are both glotalized voiceless stops and are distinguished by means of place, the first being uvular, the second velar. Along with the adult English speakers, Werker and Tees also selected a group of infants whose ambient language was English as the language of the home, as well as a group of adult native Thompson speakers. The results showed that the performance of the adult English speakers was significantly worse than performance of either the adult Thompson or the infant English group. The difference between the English infants and the Thompson adults was not significant. These results, according to Werker and Tees, therefore show that ...young infants discriminate place of articulation contrasts according to linguistic categories without specific linguistic experience, whereas adult speech perceptual ability is more language specific ... reflecting discrimination of only those contrasts which are phonemic in the listeners native language. (p. 56)

In other words, English L1 infants are able to make as accurate discriminations on a set of L2 distinctions as are adult native speakers of the language. However, adult native English speakers were "poor" on this task, reaching less than chance.

²⁰ Thompson is a North American Indian language.

2.7.5 Having established a difference between infants and adults, these workers have gone on to ask what is responsible for this difference and when does the decline begin to occur. A third question, concerning the possible re-activation of lost discriminatory abilities in adulthood, has emerged as a consequence of the first two questions.

2.7.6 As we have seen, a number of models have been advanced that hope to account for the loss of discriminatory ability past infancy. Werker et al., like Trehub, select as the most adequate of these one in which a perceptual ability is fully developed prior to the onset of specific experience, which is required to maintain that capability. However, without adequate exposure the initial capability is lost. Certainly, the evidence of the research done by these workers would strongly support this maintenance/loss model. The model correctly predicts that very young infants can discriminate phonetic contrasts before they have gained experience listening, but that experience listening is necessary to maintain the ability to discriminate those phones that do not occur contrastively in the native language.

2.7.7 On the other hand, according to Best et al. (1988), there is evidence that both adults and infants can perform equally well on discrimination of certain non-native

contrasts. Unfortunately, the contrasts that the English speaking adults were tested on by these authors were quite unlike any sound in their L1 phonological system. The sounds that the subjects were asked to discriminate among were different Zulu clicks. It is perhaps not surprising, therefore, that adults were able to discriminate these as they are so obviously like nothing heard in English. As a result they could not be absorbed by the listeners into their native phonology, and hence they remained distinctive and so could be distinguished. Any competent contrastive analysis of the sound inventories of the two languages might well have been able to predict this result.

2.7.8 It would not appear that the evidence offered by Best et al. makes a particularly forceful argument on behalf of adults' discriminatory abilities, given the particular sounds which these authors used to stake their claim. Recognizing, however, that in general adults do have problems discriminating non-native speech sounds, despite their so-called counter evidence, Best et al. offer the notion of phonemic assimilation whereby non-native speech sounds that are like native speech sounds are heard as native ones. In other words, they would agree with Trubetzkoy's comment above. This would seem to support our argument against the use of clicks as a sound means of testing English adult discriminatory ability.

2.7.9 The poor performance of adults on discrimination tasks of non-native contrasts does not extend, however, to vowels. In a study by Stevens et.al.(1969), groups of adult Swedes and Americans were able to discriminate among each other's vowels quite well, and they therefore conclude that ... for vowels presented in isolation, the listener's linguistic experience has essentially no effect upon their ability to discriminate small differences in vowel formant frequencies (p.12)

They went on to compare the way in which stops were perceived, and as with earlier investigators, they confirmed the categorical nature of their perception leading them to conclude that: 'stops and steady state vowels may be perceived in different ways and indeed in different parts of the brain ... ' (p.21).

2.7.10 A further issue, much debated in the literature, has concerned responsibility for the loss in adults of non-native discrimination ability. According to Werker et al. there are three possibilities: it could be a sensory neural loss, or a shift in attentional focus, or the use of language-specific processing strategies.

2.7.11 The first of these explanations, loss of neural sensitivity or atrophy, appears to be countered as a result of experiments in which adults have been able to discern after training, phonetic contrasts that do not occur in their L1, although the closer these test conditions place

demands similar to those required in natural language processing, the less adults are able to make discriminations.

2.7.12 This would suggest that adults rely on various modes of perception, ranging from linguistic to acoustic. If discriminatory ability depended entirely on the maintenance of neural sensitivity, then presumably training would not have made the difference reported by Werker et al.

Furthermore, we may turn to our everyday observation of adults learning a second language where discriminations do appear to be made, at least on the basis of production. Neural atrophy implies such a profound loss of capacity that only under extreme circumstances of concentrated effort could that loss possibly be overcome. However, since we cannot be certain whether the adult is depending on linguistic or acoustic cues, neural atrophy may yet play a role where perception is of strictly linguistic differences.

2.7.13 A further concern of Werker et al. is the length of time that the ability to discriminate like an infant lasts. Is the capacity lost rapidly or gradually? The issue of declination of perceptual abilities forms part of a more general discussion relating to loss of the overall capacity for language acquisition through time - an issue which is of fundamental importance to the innateness hypothesis and its

impact on theories of second language acquisition.

2.7.14 In an experiment contrasting infants', four-year olds', eight-year olds', and adults' perceptions of non-native phonological contrasts, the loss of perceptual abilities appeared to be rapid across these age groups.²¹ Werker (1983) found that even the four-year olds in this study were unable to make the kinds of fine discriminations that the infants were capable of. In other words, when it comes to perceiving non-native phonological distinctions four-year olds performed as badly as adults. This would suggest then that early (pre-puberty) second language learning, at least at the level of phonological discriminations, may face problems, while the case for adults is even worse.

2.7.15 In a later paper, Werker and Tees (1984a) managed to establish a much earlier difference in a discrimination performance task among infants. There it was found that a group of 10-12 month old infants were much less able to perceive distinctions not present in their L1s than a group of 6-8 month olds. What this suggests is that the organization of linguistic abilities is set down very early indeed, and unless specific linguistic experience is

²¹ This is the opposite finding to that made by Eilers et al. noted above.

maintained, the ability to make phonetic discriminations is soon lost. Such findings push back the kind of cerebral flexibility that Brain (1961) and Lenneberg (1967) have spoken of to a much earlier stage of development. This means that, for adults acquiring a second language, the problem may be, at least for this particular level of linguistic organization, far more profound than has been commonly recognized.

2.7.16 In Werker and Tees (1984 b) there is evidence that adults who were once exposed to a language in infancy and hence to a particular phonetic category, but who have since not been re-exposed to that particular linguistic milieu, appear later on in their adulthood to be better able to discriminate the contrasts of their original linguistic experience as opposed to adults who had not had such previous exposure. This raises the tantalizing prospect that very early experiences appear to have profound and long lasting effects.

2.7.17 In spite of the claimed progress made by adults after discriminatory training, the discerned improvement is generally weak at best, and is not maintained for long. For example, a group of English speaking adults taking a course in Hindi were found, after one year and some training in the contrast, to be unable to discriminate Hindi ta / ta. This

poor performance was characterized by the authors as "disappointing".²²

2.7.18 There are, however, some reports in the literature, notably that of Alsin et al. (1980, 1981), and Pisoni (1983), that attest to adults' successful discrimination of non-native contrasts with only short training. These workers summarized their findings as follows

Our results suggest that the adult perceptual system, as used in processing voice information in stops {VOT}, is quite capable of responding quickly to a category that is not phonologically distinctive in the listener's native language. Thus the underlying sensory mechanism(s) are not lost, and the attentional strategies used in speech perception are far from being as rigid as many investigators have assumed in the past. (p.313)

However, the Pisoni et al. discrimination trials were based on synthesized VOT values, whereas the Werker et al. contrasts used actual speakers.

2.7.19 In their 1984b JASA paper, Werker and Tees presented subjects with Hindi and Thompson phonemes in two modes; either as a full syllable, or a shortened portion of the syllable which was not speech-like, but which contained the critical acoustic information specifying the difference between the phonemes. In particular, the acoustic form that

²² However, this would contradict Best et al.'s explanation for why adults performed well on Zulu clicks.

was excised was the ejective portion of the phoneme distinguishing Thompson velar /ki/ from glotalized uvular /qi/. To the listener these sounds under these conditions resemble 'drops of water falling into a bucket'. However, the two sounds appear to be quite different, as if the drops were entering buckets of different size. The results showed that subjects could discriminate the two exemplars in the shortened condition, but not when they were complete syllables. Thus the auditory capacity for discriminating the acoustic components of these stimuli is retained in adulthood, but when the processing of these stimuli becomes language-like this ability fails to occur.

2.7.20 However, Mochizuki (1981) found that Japanese adults' perceptions of /ra/ and /la/ spoken by a native English speaker were quite accurate compared to synthetic tokens of the same contrast. Thus differences of performance on natural tokens, as opposed to synthetic ones, can make influence performance although sometimes this is in favor of discrimination of synthetic sounds over natural tokens and sometimes the other way round. This conflict is also made more problematic, as we shall see when we review the results of Japanese learners' performance on natural and synthetic tokens of English /l/ and /r/ below.

2.7.21 In the tests described above, the natural tokens used are syllable pairs, in which a single phonetic value has acted as the significant contrastive feature because the ability to discriminate does not require any larger categories. However, in this study we examine the ability to detect morphological information manifested by a particular sound within a sequence. This is an even more natural task since sounds in a language do not appear in isolation, destitute of meaning, unaccompanied and unaffected by other sounds. The ambience in which these distinctions occur could therefore affect the learners' ability to perceive and acquire them. Furthermore, the elaborate lengths that English permits word-final consonant clustering to attain, presents the second language learner with a considerable task.

2.7.22 There also remains the problem of discriminating among sounds when these lack meaning. The second language learner must retrieve not only the particular sound, but in the case of the inflectional morphemes of English, the notion of past or plural, etc. Without such a semantic anchor, we can perhaps expect increased discriminatory difficulty, as Velleman (1988) has shown with children acquiring their L1s.

2.8 Bilingual Speech Perception

2.8.1 It has been observed that the perception of the phoneme boundary along the VOT continuum is different for monolinguals compared with bilinguals, with the latter occupying an intermediate position. This intermediate position is, according to Caramazza et al.(1973), a result of the influence of the dominant language. For instance, when asked to make perceptual judgments of English and French stop phoneme boundaries, the position along the continuum takes on a characteristic shift in bilinguals toward the dominant language. Furthermore, Caramazza et al. claim that the process of boundary shifting appears to be a gradual and continuous process that may never be completed. Here again we see the extent to which perception appears resistant to change. However, the more balanced the bilingual is, the more intermediate the boundary becomes. Also, Caramazza et al. claim from the results of measuring the VOTs of their subjects producing phonemes of their two languages, that 'bilinguals appear better able to adapt their production mechanisms than their perceptual mechanisms to the second language' (p.427). In other words, production was more accurate than perception, at least along this measure.²³

²³ However, Elman, Diehl, and Buchwald (1977) have found that it is possible to shift the position of VOTs in bilinguals' perceptions of various tokens of 'pa's and 'ba's depending upon the linguistic context (Spanish or English) in which the hearer hears the different tokens. Access to such higher level information would tend to contradict Caramazza et al.'s findings.

2.8.2 Williams (1977 and 1979) also chose to study perception and production, and like Caramazza et al., he also found a shift toward more target-like behavior over time. Williams' subjects were Spanish speakers ranging from 8 to 16 years old who had been learning English in the US over various periods of time. He also discovered a shift in the subjects' L1 behavior whereby Spanish was perceived and produced in an increasingly English-like way as accuracy in English increased. This he feels is a characteristic of becoming bilingual in that there is a

... true convergence over time of the acoustic-phonetic features of the two languages instead of the development of two separate phonetic systems. (1977, p.103)

Both these studies dealt with social settings in which English was the dominant language, i.e, the language in which schooling took place. This, Williams claims, was evidenced by a shift toward English in the perception of their L1, but in neither of the two studies did the bilinguals' perception of English come to resemble that of monolinguals.

2.9 Second Language Investigations - Original Observations

2.9.1 In the introduction to this dissertation (p.1), we claimed that learners of English often have problems with

the production of English inflectional morphology.²⁴ The evidence for this claim is based mainly upon the first-hand experience of the writer as a teacher of English as a Second Language at the National University of Singapore (1978-1981). The problem of failing to provide inflections on English past tense verb forms, as well as the +s plural on nouns, was particularly evident among speakers of Singapore English whose dialect of English could be partially characterizable by the omission of these inflected forms. Of course the dialect of English spoken in Singapore runs along a continuum, at the one end of which inflected forms are almost totally absent, while their presence increases the further along the continuum the speaker is located.

2.9.2 However, as Platt (1977) has noted, it is the lack of inflection and associated consonant cluster reduction that permeates the whole Singapore English system. For example, he writes that the defining features of the three main varieties of Singapore English are as follows :

²⁴ We also mentioned at the start (p.1) that these omissions may even continue to occur at quite advanced levels of education. Crewe (1977) states that:

Some of the 'errors' [found in the academic writings of Singaporeans at the university level] are so trivial in nature (e.g., subject-verb concord, count mass confusion, omission of +ed, etc.) that they are immediately associated with low educational attainment. It is unfortunate that a scholarly work may be considered 'strange', or 'foreign', or 'substandard', and by implication less reputable because of such minor 'linguistic errors'. p.104.

1) Acrolect - Mainly phonetically distinguished from other varieties of English e.g., by different stress patterns ... partial realization of final consonant clusters.

2) Mesoelect - [(As above) plus ...] variable lack of final stop or substitution by glottal stop, variable realization of the plural marker, variable realization of the third person singular present marking, ...

3) Basiclect - [(As above) plus ...] the replacement of the standard English tense system by an aspectual system. (p.84)

2.9.3 Platt goes on to give examples of some of these features of Singapore English as follows:

a) Simplification of consonant clusters (acrolect):
conflic(t), concep(t), rejec(t), hol(d), inves(t),
the res(t) of Southeas(t) Asia, etc.

b) Variable lack of past tense marking (basilect):

- i) My father bring my mother over
 - ii) I attend(ed) night school
 - iii) From there I pick(ed) up my English
 - iv) My wife she pass(ed) her Cambridge.
- (p.85)

Platt also observes that there is an ordering among these four sentences:

Of course simple deletion of the final consonant as in iii) and iv) is more common than the deletion of the vowel + stop as in ii) which, in turn, is more common than cases like (i) involving a change in the vowel of the stem. (p. 86)

As we shall see, the ordering informally stated by Platt with regard to ii) over iii) and iv) is strikingly borne out in the study conducted for this dissertation. Finally, Platt characterizes the basilect as follows:

- c) Deletion of most final consonants, especially stops (basilect) e.g.

- i) I wo(rk) abou(t) fo(ur) mon(th)s already
- ii) This here coffee house is qui(te) goo(d) also go(t) cus(t)omer(s). (p. 88)

2.9.4 Platt then goes on to show in more detail (see page 88) that speakers of Singapore English can be ranged along the continuum according to level of education. But what is perhaps more to the point, he does so using the presence or absence of inflected forms as his measure as follows:

Informant	Variable Non-realization of:		
	Noun Plural Affixation	Regular Past Tense Marking	3rd Person Singular
Mechanical Engineer (B.Sc)	8.8	0	0
Secretary (1 year business college)	19.0	35.7	25.0
Waitress (Cambridge level failed) (p. 88)	83.7	66.7	100

2.9.5 Richards (1977) also points out that the use of fixed adverbial phrases such as 'last time', 'before got', and 'that time', ensures that the speaker is understood as

referring to the past without the need for inflectional forms, for example: 'Last time work Lucky Plaza'; 'Before watch TV now no see'; 'That time I see him he tell me', etc. Thus a typical description of a series of events that occurred in the past takes the following form²⁵:

From there step by step I promoted, okay. From there I go where I say cannot do nigh(t) duty. So do change office. Now then the one work with me, together with me, we rotate shif(t). He say you always do morning while I always pao²⁶. How can? Cannot. So they transfer me. Transfer me where are OC clerk. About how to type. Nothing boy. Go down there and sit and then I do writing only. No need to learn. There one clerk to do work. I am MP vocation. They jus(t) only clerk. So I higher rank. Then I work in reservis(t).

2.9.6 Living in such a linguistic environment the question then seemed to pose itself - to what source can we trace this type of behavior? L1 transfer was of course an amenable explanation, but at what level? To state as Jung Chang (1977) does that: 'Chinese is non-inflecting [and that] what English achieves by changing verb forms Chinese expresses by means of adverbial, word order and context' (p.226) is uncontroversial in that it involves only the level of syntax. But, as we have stated in the introduction, our experience suggested that perhaps a phonological filter was imposing itself between the learner and the TL, and consequently the morphophonological form of

²⁵ See Richards in Crewe (1977)

²⁶ 'pao' = to be forced to do something (a borrowing from Hokkien)

the TL was not sufficiently available to base the kind of categorical rule for the use of the -ed in the TL.

2.10 Second Language Investigations

2.10.1 There have been few studies made of second language learners' phonological rules compared to their morphological or syntactic output, and virtually none on how learners perceive the TL phonology. A major reason for this oversight has been the zealous adherence by SLA theorists to empirical data collection methodology. For instance, Selinker (1974) claims that if we wish to characterize the second language learner's inter-language (IL) then we should ... focus our analytical attention upon the only observable data to which we can relate theoretical predictions: the utterances which are produced when the learner attempts to say a sentence in the L1 ... [and the] ...psychologically relevant data of second language learning are utterances in IL by second language learners. (p.34)

And, likewise Tarone (1982) says

The approach which I would advocate [is] the use of performance data consisting of learner's utterances [since the aim of most work done in SLA research is to provide a] description of the grammatical and phonological system which underlies learner performance [and that this description is a part of a broader goal which is] to develop a theory of non-primary language acquisition. (p.70)

2.10.2 Thus, it is production as evidence that has dominated the data collection on which understanding second language phonology has been based. Any consideration of

learners' perception of the TL has generally only been made in terms of synthetically produced VOT values, which have usually been placed in word initial position (see Donald, 1974, for Thai/English; Williams 1974 and 1977 for Spanish/English bilinguals; Gass 1984(b), for a variety of languages). The reason for such restrictive practice is that the continuum does at least ensure a measure of empirical objectivity. Before we look at the work done on second language perception, we shall briefly review descriptions and explanations of second language phonological systems.

2.10.3 Most studies of inter-language phonology attempt to identify possible reasons for the learner's interlanguage phonology being the way it is, i.e., not fully target like and often highly variable. Among the more generally accepted explanations that have been mooted are 1) neurological atrophy (Oyama, 1976; Scovel, 1969), 2) psychological inhibition, 3) native language interference (Wardough, 1970; Briere, 1966, 4) universal strategies and principles (Sato 1984; Tarone, 1987, 5) regression to L1 acquisition strategies (Oller, 1974; Wode, 1977) ²⁷, 6) the

²⁷ Wode's study of naturalistic L2 phonology concludes that children acquire the L2 phonological system in ordered developmental sequences. He goes on to state that

...naturalistic L2 phonological acquisition is like L1 acquisition. The difference is that children acquire the L2 phonological system through the grid of their L1 system. The latter serves as the starting point. (p.213)

effect of attention and task (Tarone, 1982), and 7) the effect of micro-linguistic environment (Eckman, 1977 and 1981). Below we shall review just some of these explanations, bearing in mind that all are attempts to account for learners' products only.²⁸

2.10.4 One means of accounting for the differences between the target language and the learner's own version is provided through the description of differences between the learner's native language and the target system. Known as the contrastive analysis hypothesis (CAH), this explanatory model claims that interference from the native language can account for the forms found in the learner's version of the target language. At its most straightforward its basic tenet was advanced by Lado (1957) as follows

In learning the sound system of a foreign language, one finds sounds that are not physically similar to those of the native language, that structure similarly to them and that are similarly distributed. Learning of such phonemes occurs by simple transfer without difficulty. On the other hand, one also finds sounds that are not part of the sound system of the native language, that structure differently, or that are differently distributed. Learning of these occurs more slowly and difficulty with them is more persistent. We therefore seek to find those problems, and we will find them in the structural comparisons of the two sound systems.
(p.53)

2.10.5 In spite of the lack of favor enjoyed by contrastive analysis in various domains of linguistic organization following the demise of behaviorist accounts of language

²⁸ We have already reviewed above in 2.7 the explanation offered by supporters of neural atrophy.

learning, contrastive analyses of L1/TL phonological systems have proved to be particularly helpful at providing explanations for learners' phonological production problems in the TL. However, most investigators in this field appear interested in vigorous descriptions of target-like sounds so as to set out more accurately the parameters that determine accent in L2.

2.10.6 Tarone (1982) endorses Lorna Dickerson's (1975) observation that the learner's interlanguage phonology is systematic and will vary accordingly because

The interlanguage is a continuum of styles along which the learner shifts variably, depending upon the degree to which attention is focused on language form. (p.82)

In particular, Tarone (1976) claims that the vernacular style in the IL exhibits the most stable forms, while tasks demanding a more metalinguistic focus elicit greater variability. This parallels Oyama's (1976) finding that casual speech showed less accent in the L2 than did reading a paragraph. However, both of these observations are contrary to the expectations derived from Labov's writings.

2.10.7 Furthermore, in her 1979 and 1974 papers, Tarone offers an explanation for the fact that many TL (English) forms which have a closed CVC(C) shape turn out in the IL to have a CV form. She reasons that learners use a strategy of

consonant final deletion that is motivated by a universal preference for open syllables. As evidence, she shows Cantonese and Korean speakers 'deleting' final consonant clusters in their English L2 production, while Portuguese speakers employ epenthesis in places where all three native languages do in fact permit a closed syllable.

2.10.8 However, as we discussed in the introduction, it is our contention that before we can talk of deletion it is necessary to establish the existence of the item that is deleted. We must assume that the learner's phonological representations of the TL include consonants in word final position, and that a rule of his IL phonology, known perhaps as "consonant final deletion" operates on the presence of the consonant in order to delete it. If this were not so, then we could not claim the term deletion for this process.

2.10.9 We would prefer not to talk in terms of deletion, and indeed question whether the item is present at all. It may be that learners do not have a sufficiently robust representation of the form in their IL phonology to enable them to reproduce it in their speech. If there is no opportunity for the operation of deletion to occur (unless it operates vacuously!), then what the learner has done is merely manifest the form in which his IL represents the TL. In this particular case it happens not to include (a)

consonant(s) in word-final position, and the reason is that he has not heard it sufficiently well to be able to build a representation in order for it to be present in production, let alone deleted.

2.10.10 Perhaps the most extensive work on SL phonological acquisition can be found in the work of Lorna Dickerson (1975) and Wayne Dickerson (1975, 1976 a and b). These investigators were the first to apply the sociolinguistic notion of a variable rule to capture the fact that different phonological environments can determine the form of a learner's TL output. In other words, they were able to show that the acquisition of an L2 phonology proceeds by the movement of variations within the environments of variable word classes; a process much akin to native language diachronic sound changes.

2.10.11 In particular, Dickerson (1976(a)) found Japanese learners' acquisition of English /l/ to be influenced by the environment in which the target sound occurred, with greater TL-like forms resulting before high vowels than before low vowels, etc. Furthermore, the changes over time of the learner's output showed a regularly patterned diminution of non-TL-like sounds across different phonological environments as proficiency increased. However, the problem of what makes a particular phonological environment more

favorable to the production of a more TL-like form than another is not directly addressed, although the somewhat vague term 'inherent difficulty' is used. And again, we should remind ourselves that all the works cited thus far have been attempts to account for learner's target language products without mention of the role played by perception.

2.10.12 Young's (1988) discussion of Chinese students' production of the +s plural marker includes, as one contributing factor to its presence or absence in the spoken interlanguage output, the phonological environment in which the sound appears. Preceding sibilants, according to Young, greatly inhibit the appearance of the +s. This finding parallels one in English first language acquisition (see Smith, 1973; Oller, 1972 and 1974), and is not difficult to reason why. Meanwhile, preceding nasals and laterals also inhibited the presence of the marker. However, Young found that where the context for the inclusion of the marker occurs between vowels, the presence of the +s marker seemed to be favored. He also notes that such an intervocalic context conserves one that is found in the first language as well. However, the effect of phonological environment has 'a significant effect only during the early stages of SLA' (p.297). This study is one of the very few in SLA research that has taken into account phonological environment as a possible determinant in the production of +s marker, or for

that matter any other inflectional morpheme in English.²⁹

2.11 Studies in Second Language Perception

2.11.1 In one of the earliest attempts to assess L2 learners' perceptual abilities, Scholes (1967, and 1968), presented native speakers of various languages (Persian, Russian, Korean, Greek and English) with a tape recording of synthetic vowel sounds. The manner in which these speakers responded to the task lead Scholes to conclude that

The categorization of these synthetic vocalic stimuli by a non-native speaker of English using English responses will parallel his native language categorization of these stimuli insofar as the native language categories have phonetically similar English counterparts a non-native speaker of English not only produces English utterances using his native language phonemes, but also perceives English in terms of his native language phonemic system. (1967, p.102)

However, as Basson (1986) points out

Interpretation of these results must be cautious as the study [by Scholes] does not report proficiency level or familiarity of the non-native speakers with English. (p.18)

2.11.2 In her study of perception, Gass (1984) chose to test learners' abilities to perceive English /b/ vs /p/ contrast along a synthesized VOT continuum in the tradition of

²⁹ It should be noted, however, that Fairbanks (1981) claims to have found in a pilot study that '... the third person singular verb forms are supplied variably, apparently depending on the degree of attention the learner pays to speech form.' In Tarone 1982, p.73.

Abramson and Lisker (1973). The task of discriminating synthesized productions of stops along such a continuum requires, according to Gass, that listeners '... make judgments about English words.' Although this may be questioned, the study itself fails to provide significant evidence of anything other than a general trend towards more target-like behavior over time. In particular, the study demonstrates that learners do not divide the VOT continuum in the categorical manner of native speakers. Instead, these learners exhibited perception of the English phoneme boundary that suggests continuity.

2.11.3 Furthermore, there is very little effect on such behavior over time, and the perception of the phoneme boundary remains fuzzy. Gass goes on to suggest that this non-categorical manner of perception implies that these learners would not be able to distinguish a /p/ from a /b/ so that, for instance, 'back' and 'pack' could not be discriminated. However, to suggest how listeners will respond to natural tokens of phonemes based on their responses to a synthesized VOT continuum, may not in fact be very sound, since other cues in actual speech may well be utilized to assist the learner in making the distinction. Thus to rely upon the perception of a synthesized VOT continuum alone to draw conclusions about what learners are capable of perceiving, may not be as straightforward as Gass

would have us believe.

2.11.4 A useful corollary to this study might have been for this difference to be tested by using actual words in a simple same/different paradigm. It could well be that learners in such a context can indeed perceive the difference, in which case we might question the role of the VOT continuum in tapping non-native perceptions of English phonemes. Furthermore, in the literature on infant L1 perception of the VOT continuum there is controversy over the extent to which the continuum does in fact tap linguistic capacities, as Eilers et al. have been led to suggest (see page 34 above).

2.11.5 Evidence that actual words, as opposed to synthesized sounds, can make a difference to learners' perceptions can be found in the work of Lobo and Yoshida (1982). In this study, Japanese learners of English were able to more accurately discriminate when the sounds were in familiar English words than when they were in words they did not know. However, according to Gass, this is clear evidence that learners are relying on non-linguistic factors in perceiving English. But she does not go on to specify what these might be unless perhaps familiarity at a semantic level is considered non-linguistic.

2.11.6 It is of interest to note that Gass also failed to find any significant shift in the perception of the VOT measures over time by the learners that she investigated. Indeed, after three months of exposure to English in the United States, with the support of formal settings, Gass reports no change in subjects' responses. The occasional individual is pulled forward for mention as having achieved some slight shift in boundary or steeper cline from one time to the next, but otherwise the study again confirms the degree to which perception of non-native sounds is a problem.

2.11.7 Much of the work of Flege (1980, 1981, 1984) has been spent in the analysis of learners' products with regard to shifts in acoustic parameters toward more target-like forms as learners become increasingly proficient in the TL. However, in Flege and Hillenbrand (1986) a test of perception was conducted to see not only whether increasing experience with the language permitted learners to make discriminations in the target language, but also whether more experienced learners were also beginning to rely upon the same set of acoustic cues as native speakers. They found that although the learners were able to make the TL discriminations, they all differed from the TL on the acoustic cue used to make the distinction. Here again, we witness the seeming viscosity of phonetic development in the

TL.

2.11.8 One non-VOT study by Black et al. (1965) attempted to correlate the intelligibility of non-native speakers and their aural comprehension skills. They claim to show that The better listeners were the more intelligible speakers; the better listeners were rated as having less foreignisms in their speech. (p.48)

Unfortunately, this is a somewhat vague statement, but it is one of the very few that can be found concerning the perception (listening) of actual non-native speech, reflecting as it does the minor role played by perception in SLA research. This dissertation, on the other hand, proposes quite a radical extension of the role of perception in second language acquisition.

2.12 The Work done on Japanese Learners of English

2.12.1 As we have seen, one particular focus of attention in second language perception has been on Japanese learners' ability to perceive the English /l/ and /r/ distinction in a categorical manner (see Goto, 1971; Miyawaki et al., 1975; MacKain et al., 1981; Sheldon and Strange, 1982; and Fujimara et al., 1978). This flurry of activity is in part because the /l/ and /r/ distinction is non-phonemic in Japanese and hence a paradigmatic problem in L2 phonology

acquisition. Bloch (1949, p.101) describes the Japanese /r/ as 'a short voiced alveolar flap occurring word initially (e.g., [riku]) and between certain vowels (e.g., [arimas]), but never occurs word finally or in consonant clusters, while /l/ does not occur. So although one of the distinctions occurs in the NL (native language), its phonetic form is quite different from the TL's. The studies listed above have produced two interesting results. The first concerns the relationship between perception and production, the second whether or not perception of TL phonemes is linguistic or auditory.

2.12.2 In his study of Japanese learners, Goto (1971) found that their ability to discriminate the English /l/ and /r/ distinction was exceeded by their accuracy at being able to produce the distinction. As part of his test paradigm, Goto required Japanese and American speakers to read a list of words containing tokens of both phonemes. No American listener had problems identifying either his own or those versions produced by Japanese speakers. However, the Japanese speakers had problems discriminating both their own and the American version of /r/ and /l/, a result which led Goto to conclude that accuracy of perception may lag behind production, apparently contradicting the long held view that production follows perception.

2.12.3 Building on this earlier work by Goto, Sheldon and Strange (1982) also found that adult Japanese learners were better able to produce tokens of /ra/ and /la/ than they were to perceive the contrast. Prior to these findings, it was generally held that the relationship between perception and production was asymmetric, with the former surpassing the latter. These results were unexpected, as they appeared to contradict commonly held assumptions. However, we should note that the nature of the task, reading a word list, might have influenced these results.

2.12.4 Another aspect of the Japanese based studies concerns the types of cues that native speakers and non-native learners use to discriminate phonemes. Miyawaki et al. (1981) created two sets of synthetic stimuli, one speech-like in that the third formant contained a subsequent transition into a vowel [a], and the other non-speech-like, consisting of an isolated F3. The variation in the initial stationary F3 was sufficient to produce a range of /ra/s and /la/s. According to Miyawaki et al., Japanese learners showed little evidence of accurate discrimination between /l/ and /r/ when the two sounds were presented in speech mode, whereas the native speakers discriminated the two sounds well in this mode. When both groups were exposed to the non-speech mode, performance was virtually identical

' ... both groups showed highly accurate discrimination of

all comparison pairs' (p.331).

Having found a difference in speech-sound discrimination between the two language groups ... we can see in the non-speech mode where the difference might lie. If we assume, as we do, that the difference between the two language groups reflects an effect of linguistic experience, then we can look to the non-speech functions to help us decide whether that effect was at the auditory level or whether, alternatively, it was specific to perception in the speech mode. (p.335)

If the effect were on auditory perception quite generally, then both groups would have behaved as they had done in the in-speech mode, but if the native speakers had used specifically linguistic cues on the speech mode, then Miyawaki et al. expected that the two groups would behave in a similar fashion in the non-speech mode. How then did the two groups respond to the /ra/ vs /la/ distinction in non-speech mode? According to these investigators, they were as bad as each other. They conclude from these findings that the differences between the two groups in the speech mode are a function of processes specific to the perception of speech. In particular

.... speech perception is a special mode of auditory perception that is accomplished in quite a different manner from general auditory perception. (p. 337)

2.12.5 Some of the Japanese subjects were capable of making discriminations in the speech mode. However, these were learners whose experience with English was extensive, stretching over a period of at least ten years, leading

Miyawaki et al. to suggest that

... considerable experience with the linguistic distinction is a pre-requisite to successful performance on discrimination tests like those employed here. (p. 337)

Here again we see that specific phonetic competence in adulthood probably requires rather intensive and specific phonetic experience prior to maturity.

2.12.6 McKain et al. (1981) also examined the performance of Japanese learners' abilities to discriminate /r/ and /l/, but unlike previous investigators they used an ABX discrimination task. They found that a group of learners that they labelled 'Not Experienced' showed near chance performance, while the so-called 'Experienced' group did perceive /r/ and /l/ categorically. However, what lay between these two groups was over ten years of experience with English.

2.12.7 In Sheldon and Strange (1982), results are given of Japanese learners' perceptions of American English /l/ and /r/ in four different positions (initial, second consonant in an initial two consonant cluster, medially and finally). The results of their findings displayed a pattern of difficulty that was not that expected from a strictly distributional comparison. The intervocalic position was more difficult for the learners to perceive than the word

final position. Sheldon and Strange's explanation relies entirely on a description of the acoustic effects of the third formant frequency of /r/ and /l/ changing across these environments. In particular, they show how liquids in word final position reach and maintain their steady state values, which would then explain, so they claim, the relative strength of /l/ and /r/ in word final position and hence its ease of perceptibility. This reliance on acoustic cues is summarized as follows

... it is reasonable to assume that the ease or difficulty in learning to perceive "foreign" phoneme contrasts is a complex function of both language dependent phonological interference and (perhaps universal) acoustic-phonetic factors which affect auditory perceptual and attentional processes. (p. 230)

One of the arguments of this thesis is that the contexts in which an inflected form occurs can determine the learners success at identifying the presence or absence of the inflected form.

Chapter Three

METHOD

EXPERIMENT I

3.1 The Choice of Tokens

3.1.1 In English there are well over seventy-eight different phonological closing environments³⁰ to which the regular past tense morpheme {+ed} can be suffixed. This categorization of the final sound sequence of regular verbs includes the whole coda of the last syllable which allows us to distinguish for example between the verb 'tangle' and 'stumble'. Although both end in /l/, this is preceded by the sequences /ng/ and /mb/³¹, and it is this difference as a whole that is counted here as distinguishing one word from the other.³²

³⁰ By 'closing' environment refer here to the phonological sequence that makes up the stem final, as well as the stem final + inflection. Such options could include #...v(+ed)#, #...vc(+d)#, #...vcc(+d), #...vcc(+d), etc.

³¹ In this dissertation, for convenience, we shall use a notation to represent sound sequences based on alphabet letters. Thus the final consonant cluster in 'strangled' will be 'ngld'. In 'plunged' the representation will be 'ngd', etc. This notation will be discussed in more detail below.

³² English is peculiar in that it quite freely permits such consonant clustering in this position. Greenberg (1966) has pointed out that, among the world's languages, there are more cluster types in word initial position (90) than there are in word final position (60), and that there are few languages that permit a two consonant cluster and even fewer that allow three, although he does not provide

3.1.2 It was decided, for the reasons given below, to base our study on fourteen out of the seventy or so possible sound sequences. For each of these fourteen environments, eleven actual words and one nonsense word were selected giving a total of twelve words for each of the fourteen environments ($12 \times 14 = 168$ words) (see Appendix A2). The fourteen environments along with two exemplars each are listed below. Also, as stated in footnote 34, we will use an alphabet notation within ' ' to represent the sounds and sound sequences.

1)	'v'	+ {d}	e.g. pray, brew, etc.
2)	'vr'	+ {d}	e.g. declare, cure, etc.
3)	'en'	+ {d}	e.g. shorten, open, etc.
4)	'p'	+ {t}	e.g. shop, redevelop, etc.
5)	'b'	+ {d}	e.g. describe, grab, etc.
6)	'k'	+ {t}	e.g. look, sidetrack, etc.
7)	'g'	+ {d}	e.g. drag, plague, etc.
8)	'mp'	+ {t}	e.g. bump, clamp, etc.
9)	'ks'	+ {t}	e.g. annex, tax, etc.
10)	'mbl'	+ {d}	e.g. stumble, scramble, etc.
11)	'ngl'	+ {d}	e.g. strangle, tangle, etc.
12)	'ndz'	+ {d}	e.g. plunge, challenge, etc.
13)	'nt'	+ {ed}	e.g. vent, confront, etc.
14)	'nd'	+ {ed}	e.g. hand, land, etc.

Table 1

exact figures. In general, longer sequences are formed from shorter sequences by morphological or syntactic combination such that the longer the sequence the more likely the sequence will contain a morphological or syntactic combination, and this is certainly the case for English.

He also points out that this restriction among the world's languages is evidence of the psychological difficulties speakers have with clusters, and he claims that this would seem to '...correlate with the diachronic tendency towards their simplification, since any simplification automatically reduces the number, both absolutely and proportionally of sequences of the length subject to reduction and increases in the number of shorter sequences.' (p.7)

3.1.3 As stated before, a second language learner's ability to retrieve a target language inflectional morpheme may, in part, be determined by the phonological environment in which it is located. Since there are no a priori measures of phonological saliency available, we have produced our own intuitively based measure. The above list is a partial reflection of this, since the first environment is regarded the least complex and hence most salient, while the twelfth environment is considered among the most complex and therefore the least salient.³³

3.1.4 Two main criteria were used to rank the environments in terms of perceptual saliency. The first of these was quantitative and consisted of the number of successive final consonants that made up the stem final sequence. So for

³³ This list is made in order to assign a numeric label to each environment. It is not constructed to reflect our beliefs about the order of difficulty expected of subjects' perception of these environments. Thus words taking the allomorph {ed} occur in positions 13 and 14 although these can be expected to be handled with relative ease compared say with 3 or 10. Thus the numeric value assigned to each environment is a convenience, and does not represent increasing levels of perceptual difficulty (indeed quite the contrary as we shall see).

We should also note that the symbols themselves such as 'ndj' or 'mb1' are not supposed to represent the actual sound sequence. They would otherwise have appeared between / /. Thus the symbols between the ' ' are mnemonic devices only. The alternative would have been to assign each environment its number from the above list, but this would have made it difficult for the reader to keep track. In the body of the text they will occur between ' ' but, if they appear on charts and/or tables we let them stand without quotations.

example, 'ks' (9) was chosen because it had one more consonant compared with 'k' (6), while 'ndj' (12) was chosen because it consisted, when inflected, of four consonants in a row. The most straightforward environment was 'v' (1) which consisted of only the inflected form {+d}.

3.1.5 The second criteria took the form of a count among the distinctive features making up each consonant, such that the fewer shared features a sequence had, the greater the contrast among them. From these two measures we derived the following rule of thumb: 'the greater the number of successive consonants that share more features, the less salient the environment.' This then gives us a range of words from the most salient open-ended #...CV# words, such as 'cry', to the least perceptible #...CVCCC# words, such as 'plunge.' After examining these and other environments, it was noticed that English appears to allow two consonants in a sequence to be distinguished minimally by just one feature, but where there are three or more in a sequence, the first and third are necessarily distinguished by two features. This observation is either an effect of the distinctive feature matrix or a property of language.³⁴

³⁴ The use of the Chomsky and Halle distinctive feature matrix in this dissertation, as a framework within which to describe phonological saliency, has a historical precedent in the literature. Hence, in an early study, Miller and Nicely (1956) ranked sounds according to their relative perceptibility through filtered noise, using articulatory features. In that study, they found that

3.1.6 A third reason for the choice of tokens was to compare the effect of voicing on perceptibility. For this purpose, the following pairs were chosen, the voiceless 'p' (4), e.g., #...vp {+t}, and the voiced 'b' (6), e.g., #...vb

consonants that differed by just one place of articulation were frequently confused with each other, while the greater the number of features that distinguished between consonant pairs, the less likely listeners were to confuse them. Furthermore, Klatt (1968), in summarizing such studies, claims that they serve as independent verification of the feature dimensions employed in the phonological component of the grammar.

Graham and House (1970) claim that studies of child perceptual development have supported the idea that '... consonant sounds are coded into a perceptual space described by the feature system and that as the number of feature differences increases, the perceptual distance between consonants increases and the confusion between consonants decreases' (p. 560).

Cole et al. (1978) found listeners were better able to detect mispronunciations of stops and affricates than they were of fricatives or nasals. Within the stop category, a change of place of articulation was detected much faster than a change in voicing. A combination of a change in both voicing and place produced the highest detection rate for mispronunciations. Cole et al. also noted that where the sound occurred in the word affected its perceptibility. Listeners were far better able to detect changes initially than finally, a finding that Cole et al. claim shows that '... listeners pay attention to the acoustic cues for pre-stressed word initial stops because they provide direct and reliable evidence about a word's identity' (p.55).

The lowered perceptibility of word final position combined with the strategy of attending to initial position would therefore appear to add a further burden to the psychological processing of inflectional endings. However, what is more pertinent to our discussion is the fact that these studies appear to show listeners' use of features in perception. Consequently, we have chosen to categorize levels of difficulty among the stimuli of our own test according to the feature matrix found in the Sound Pattern of English.

{+d}, and the voiceless 'k' (5), e.g., #...vk {+t}, and the voiced 'g' (7), e.g., #...vg {+d}. If non-native speakers are more dependent on surface phonetic features, then we can expect their accuracy scores on detecting the presence or absence of the morpheme to be reduced by the addition of the + along the voicing dimension.

3.1.7 A final reason for choosing these fourteen environments was that all three regular past tense allomorphs of English are represented. As follows

- 1) The allomorph {d} occurs on eight of the sequences ('v', 'vr', 'en', 'g', 'ngl', 'mbl', and 'ndj')
- 2) The allomorph {t} occurs on four of the sequences ('p', 'k', 'mp', and 'ks')
- 3) The allomorph {ed} occurs on two of the sequences ('nt' and 'nd')

3.2. A Description of the Environments Chosen

3.2.1 The environment 'v' was chosen because it is the most straightforward and hence most salient environment, and so one would expect subjects to score well on this condition. It is, for instance, an environment which occurs in all the world's languages and appears to be the first to occur in child language acquisition.

3.2.2 'vr' differs from 'v' through the addition of final /r/ on the former. Thus 'vr' was chosen on the assumption

that this minimal difference could contribute to the degree of perceptibility. If this were the case, then we might expect non-native speakers to perform less well on detecting the morpheme in this environment compared to the first. The actual sound shape of the vowel produced by the speaker on the test tapes was an intensely American colored schwa, a sound not found in RP, for instance, and also one which is quite rare among the world's languages. A distinctive feature description of the final sequence of this environment is shown in Table 2

r	+	{d}
+ vocalic		- vocalic
- consonantal		+ consonantal
- high		- high
- back		- back
- low		- low
- anterior		+ anterior
+ coronal		+ coronal
+ voice		+ voice
+ continuant		- continuant
- nasal		- nasal
- strident		- strident

ENVIRONMENT TWO

Table 2

We should note that there are four distinctive features that separate the stem from the inflection. These are, +/- vocalic, +/- consonantal, +/- anterior, +/- continuant, and as we have said, we would expect such dissimilarity to encourage and support perceptibility.

3.2.3 'en' is chosen for a variety of reasons. First, the

form +en is a quite productive derivational suffix, creating a large number of verbs out of adjectives, and so the following lexical items were selected to represent this fact.

blacken, frighten, fasten, shorten,
darken, widen, lengthen, strengthen

These in turn can be subdivided into endings where the stem final consonant is produced in the same place as the /n/ of the suffix, i.e., at the alveolar, in which case the /n/ of the suffix becomes syllabified as in 'fasten', 'frighten', 'shorten ', 'widen', etc. (Here we have a good argument for the UR of 'fasten' to include the /t/ finally.) When the inflectional ending is attached to such words a sequence of three consonants is created, all of which share the same place of articulation (+alveolar), and are only differentiated from each other by manner. This extremely tight fit between the distinctive features shared among these segments would lead us to expect second language learners to experience considerable difficulties detecting the presence of the morpheme.

3.2.4 In the remaining four bimorphemic words, i.e., 'blacken', 'darken', 'lengthen' and 'strengthen', the schwa of the suffix is retained because the place of articulation of the stem final consonant preceding it is different. Thus there are two sub-classes of bimorphemic words in which the derivational morpheme comes to be represented either as 'n'

or 'en', depending on the place of articulation of the last segment of the stem to which it is attached. In all these words, the final sound 'n' agrees with the past tense inflectional morpheme {+d} in all its distinctive features except +/- nasal. A description of the final consonant clustering in terms of distinctive features is shown in Table 3.

n	+	{d}
- vocalic		- vocalic
+ consonantal		+ consonantal
- high		- high
- back		- back
- low		- low
+ anterior		+ anterior
+ coronal		+ coronal
+ voice		+ voice
- continuant		- continuant
+ nasal		- nasal
- strident		- strident

ENVIRONMENT THREE

Table 3

3.2.5 'p' and 'b' were selected along with 'k' and 'g' because they each represent a straightforward #...CVC# pattern becoming #...CVC+C# with the addition of the past. The pairs were also chosen, as we stated above in section 3.1.5, to determine the effect of the voicing contrasts across two environments that otherwise were identical.

3.2.6 However, 'p' and 'b' also differ from 'k' and 'g' in that the formers' stems are distinguished from the

inflectional morpheme by just one feature, while the latter's stems differ from the inflectional morpheme by two features. Thus, in the case of 'p' and 'b', it is the single place feature of +/- coronal that distinguishes the stems from the morpheme as can be seen in Table 4.

p	+	t
- vocalic		- vocalic
+ consonantal		+ consonantal
- high		- high
- back		- back
- low		- low
+ anterior		+ anterior
- coronal		+ coronal
-/+ voice		-/+ voice
- continuant		- continuant
- nasal		- nasal
ENVIRONMENTS	FOUR	FIVE

Table 4

3.2.7 On the other hand 'k' and 'g' were selected because there are two place features separating the stems from the inflected endings, namely +/- anterior and +/-coronal. If the number of shared distinctive features is a measure of perceptual saliency across consonant clusters, then this difference could perhaps make the ending more discernible.

3.2.8 Thus, if this measure were to hold true, we would expect that the presence of the inflectional morpheme on 'p' when compared with 'k', and on 'b' when compared with 'g', to be less discernible. A description of 'k' and 'g' in terms of distinctive features is as follows as shown in

Table 5.

k	+	t		g	+	d
- vocalic		- vocalic		- vocalic		- vocalic
+ consonantal		+ consonantal		+ consonantal		+ consonantal
- high		- high		- high		- high
- back		- back		- back		- back
- low		- low		- low		- low
- anterior		+ anterior		- anterior		+ anterior
- coronal		+ coronal		- coronal		+ coronal
- voice		- voice		+ voice		+ voice
- continuant		- continuant		- continuant		- continuant
- nasal		- nasal		- nasal		- nasal
ENVIRONMENT		SIX		ENVIRONMENT		SEVEN

Table 5

3.2.9 Initially, the environment 'mp' was selected because it was thought that the stem ended with two consonants as opposed to the single consonant above ('p'), giving us the pattern ..CVCC#. However, as we shall see, the manner of articulation necessitated a re-description of this environment. Our original thinking on this environment concerned the addition of the penultimate consonant /m/, which was believed would lessen perceptibility not only by addition, but also because /m/ differs from /p/ by just the one feature of + nasal.

3.2.10 Furthermore, when inflected, the stem final /p/ differs from the morpheme {+t} by one feature, +/- coronal. So we thought that what we had here were three consonants in a string, [CVCCC (/m+p+{t})/], each differing from its immediate neighbor by one feature. The total number of features it was believed that distinguishes the elements of

this entire sequence from each other is three: +/- coronal, +/- nasal and, +/- voice. The description of this environment in terms of distinctive features is shown in Table 6.³⁵

m	+	p	+	t
- vocalic		- vocalic		- vocalic
+ consonantal		+ consonantal		+ consonantal
- high		- high		- high
- back		- back		- back
- low		- low		- low
+ anterior		+ anterior		+ anterior
- coronal		- coronal		+ coronal
+ voice		- voice		- voice
- continuant		- continuant		- continuant
+ nasal		- nasal		- nasal

ENVIRONMENT EIGHT

Table 6

3.2.11 The environment 'ks' was chosen because it included contiguous sounds that are distinct in terms of two features. Thus, the final sequence is distinguished along the dimension of +/- anterior (place) and the dimension +/- strident (manner). The stem final sound and the morpheme are distinguished by just the one feature of manner (+/- strident) (Table 7).

k	s	+	{t}
- vocalic	- vocalic		- vocalic
+ consonantal	+ consonantal		+ consonantal
- high	- high		- high
- back	- back		- back
- low	- low		- low

³⁵ As we shall see in the following chapter this is how the environment appeared, at least on paper, but as we have said, it turned out it was not articulated as such by the speaker.

- anterior	+ anterior	+ anterior
- coronal	+ coronal	+ coronal
- voice	- voice	- voice
- continuant	- continuant	- continuant
- nasal	- nasal	- nasal
- strident	+ strident	- strident

ENVIRONMENT NINE

Table 7

3.2.12 The two environments 'mbl' and 'ngl' both terminate in a lateral or dark /l/, which is commonly found as a stem final sound among verbs in English. They are also syllabified, which we shall discuss in our description of 'mbl' (11) meanwhile the description for 'ngl' (10) is shown in Table 8:

n	g	l	d
- vocalic	- vocalic	+ vocalic	- vocalic
+ cons	+ cons	+ cons	+ cons
+ high	+ high	- high	- high
+ back	+ back	- back	- back
- low	- low	- low	- low
- anterior	- anterior	+ anterior	+ anterior
- coronal	- coronal	+ coronal	+ coronal
+ voice	+ voice	+ voice	+ voice
- cont	- cont	+ cont	- cont
+ nasal	- nasal	- nasal	- nasal
- strident	- strident	- strident	- strident

ENVIRONMENT TEN

Table 8

Again, our rule above, which states that no two adjacent sounds may differ by more than one feature in English, is adhered to here except where there is a syllabic break, as between /g/ and /l/. However, there are a far greater number of features that do not agree across this environment; indeed, put at its most blunt the only common features among these four sounds are +consonantal, -low, and +nasal. We can expect from this that compared with 'mbl' (below) this environment ought to be more salient.

3.2.13 Turning to the eleventh environment ('mbl') there is some dissension as to how the final cluster is transcribed. In Chambers' Dictionary, for instance, in the word 'crumble' the lateral is syllabified, whereas in the New Webster a schwa is inserted³⁶. Here we will follow Chambers' description, and in so doing begin to approach the optimum number of stem final consonants, namely three. Of course, in such a numerically large environment, no two adjacent pairs can differ by more than one feature (except +/- voice) in word final position, although non-contiguous items may do so, e.g., /m/ and /l/. And when it does appear to be

³⁶ A dialect difference between British and American English exists involving the stem final ending of this word. In British English an apple pie made from short-crust pastry is referred to as 'apple crumble', whereas in America the same pie is called 'apple crumb'.

contradicted, English syllabifies on the second consonant giving rise to an epenthetic schwa.

3.2.14 We should note that in these complex environments the differences are either between pairs, or caused by a single sound. So for instance, the pair 'mb' differs from the pair 'ld' in terms of +/- coronal, /l/ differs from the other three in being +continuant and +vocalic, and /m/ differs from the others in being +nasal. Even for a numerically large sequence this is still quite a tight fit (Table 9).

m	b	l	d
- vocalic	- vocalic	+ vocalic	- vocalic
+ cons	+ cons	+ cons	+cons
- high	- high	- high	- high
- back	- back	- back	- back
- low	- low	- low	- low
+ ant	+ ant	+ ant	+ ant
- coronal	- coronal	+ coronal	+ coronal
+ voice	+ voice	+ voice	+ voice
- cont	- cont	+ cont	- cont
+ nasal	- nasal	- nasal	- nasal
- stri	- stri	- stri	- stri

ENVIRONMENT ELEVEN

Table 9

3.2.15 With the twelfth environment ('ndz') we reach the numerical apotheosis of this study. This is the most complex of environments, and the one that we would therefore expect would give non-natives the greatest amount of difficulty. The within-stem sequence consists of a three-feature difference of one place (+/- anterior) and three manners (+/-nasal, +/- continuant, and +/-strident). What differentiates the stem final consonant in 'ndz' from the inflectional morpheme is just the one feature of place (+/- anterior) and +/- strident (Table 10).

n	d	z	+ {d}
- vocalic	- vocalic	- vocalic	- vocalic
+ cons	+ cons	+ cons	+ cons
- high	- high	+ high	- high
- back	- back	- back	- back
- low	- low	- low	- low
+ anterior	+ anterior	- anterior	+ anterior
+ coronal	+ coronal	+ coronal	+ coronal
+ voice	+ voice	+ voice	+ voice
+ cont	- cont	+ cont	- cont
+ nasal	- nasal	- nasal	- nasal
- strident	- strident	+ strident	- strident

ENVIRONMENT TWELVE

Table 10

Also, unlike the other two stem final sequences that have three consonants in a row ('mbl' and 'ngl'), this sequence is not divided up by any form of syllabification. We can expect that this should add to the processing burden of listeners, especially when attempting to identify the

presence of the addition of the inflected form.

3.2.16 'nt' and 'nd' were selected firstly because they represent environments that take the third allomorph of the regular past, i.e., {ed}. Secondly, when these words receive the final inflection a further syllable is formed as in CVCC + VC. This syllabification of the inflection separates it from the stem, which may as a result highlight its perceptual saliency and allow learners to be better able to detect its presence. A description of 'nt' (13) is given in Table 11.

n	t	+	e	d
- vocalic	- vocalic		+ vocalic	- vocalic
+ cons	+ cons		- cons	+ cons
- high	- high		- high	- high
- back	- back		- back	- back
- low	- low		- low	- low
+ ant	+ ant			+ ant
+ coronal	+ coronal			+ coronal
+ voice	- voice		+ voice	+ voice
- cont	- cont			- cont
+ nasal	- nasal			- nasal
- stride	- stride			- stride

ENVIRONMENT THIRTEEN

Table 11

The only difference between 'nt' (13) and 'nd' (14) is the voicing dimension of the second consonant t/d.

3.2.17 Since we were examining the nature of final place perception only, the form of the initial consonant, i.e.,

whether it be a cluster or not, as in 'pay' / 'play', was not taken into account. The number of syllables that a word consisted of was also not considered a factor in selection, except that, wherever possible, the upper limit was confined to two syllables.

3.2.18 Twelve distractor words were selected, consisting of pairs that were distinguished from each other by the presence or absence of a nasal immediately preceding another consonant within the word, e.g., rubble - rumble, set - sent, apple - ample etc. Since the distinction achieved by the addition of the nasal was another word, we should strictly speak of only six distractor words since the equivalent distinction in the actual words used was achieved by the addition of the inflectional ending, which was not then counted as another word.

3.3 The Construction of the Tapes

3.3.1 The eleven words and one nonsense word that represented each of the fourteen environments gave us one hundred and sixty eight words ($14 \times (11 + 1) = 168$), which, along with the six distractors, gave us a total of one hundred and seventy four words.

3.3.2 These one hundred and seventy four words were then

presented in four different modes. For the words representing the environments, these four modes appeared as follows:

1)	bump	-	bump	(same)
2)	bumped	-	bumped	(same)
3)	bumped	-	bump	(different)
4)	bump	-	bumped	(different)

This then gave us a total of six hundred and seventy two ($14 \times 12 \times 4 = 672$).

3.3.3 For the distractors, the four modes of presentation appeared as:

1)	rubble	-	rubble	(same)
2)	rumble	-	rumble	(same)
3)	rubble	-	rumble	(different)
4)	rumble	-	rubble	(different)

This then gave us twenty four distractors ($6 \times 4 = 24$).

3.3.4 Unfortunately, this number of items would have meant the creation of a tape that would have lasted well over two hours. So in order to reduce the listening time to a manageable length, the six hundred and seventy two (672) word pair stimuli were first randomized as a whole, and then divided across three tapes giving us three separate two hundred and twenty four (224) word stimuli on each tape. The $6 \times 4 = 24$ distractors were all placed on each tape giving a total of two hundred and forty eight ($224 + 24 = 248$) items on each tape.

3.3.5 On each of the three tapes, each environment was represented in the same position and in the same mode, but by a different word. A list of tokens as they appeared on the tapes is given in the Appendix (A2).

3.3.6 The Psycholinguistics Laboratory of the Linguistics Program of the Graduate School of the City University of New York provided a sound attenuated room along with recording equipment. An American male voice, speaking into a standard omnidirectional microphone connected to a two-channel stereo cassette recorder, was used to make the recordings.

3.3.7 In recording the word pairs, an approximate pace of three seconds across each word pair, and two seconds between word pairs, was maintained, totaling five seconds in all from the beginning of one pair to the next. This five second interval between pairs multiplied by the total number of word pairs (248×5) gave a tape length of one thousand two hundred and forty seconds, or a little over twenty minutes. Because the subjects were tested in their paid-for-in-class-time and were expecting to be taught rather than tested, it was necessary during the presentation of the test to insert a number of intermissions consisting of unrelated activities in order to make the experience tolerable.

3.4 The Subjects

i) The Languages

3.4.1 To attempt to establish the extent to which a second language learner's first language influences his perception of the target language phonology, four main language groups, Spanish, Russian, Japanese, and Chinese, along with a variety of others, which will be listed below, were recruited.

ii) Recruitment

3.4.2 To recruit subjects, a number of language teaching institutions were contacted. The principal source of subjects (the Japanese, Chinese, Spanish, and Other language speakers) was the International English Language Institute (IELI) at Hunter College. The Russian population was drawn from the SCS Language School at 1400 Broadway as part of the New York Association for New Americans (NYANA) program. Both these institutions are located in New York City. However, the majority of subjects were selected from within the same institution (IELI at Hunter College) to maintain not only equivalency of proficiency across as much of the population as possible, but also equivalency of general educational experience.

3.4.3 While procuring this population, we also ran across and picked up along the way, speakers of other languages that did not form the original focus of this study. These speakers were tested and scored at the same time, and so form a heterogeneous group (labelled 'other'). When the four main language groups and these others were combined, the label 'all' was applied. The different languages and numbers of speakers of each language that made this group up are listed in Appendix X.

iii). Level of Proficiency

3.4.4 Among second language practioners it is generally agreed that learners can be divided into three levels of proficiency, referred to as beginner, intermediate, and advanced. In the institutions used by this study, these three categories were also recognized and the division of the subjects for analysis was based upon where the institution itself had originally placed the subject. However, in this study we cannot talk properly of the beginners in the sense of learners having had no previous experience with English. Instead, these beginners perhaps would be better characterized by the label 'false beginners', as they have all had a number of years of experience with English prior to their arrival in this country. Furthermore, this experience may have also varied in its quality, some having been taught by native speakers

using fairly sophisticated methodology, while others may have been exposed only to ESL teachers of the same L1 as themselves, or even different L1s, but not English.

3.4.5 Because the gauging of proficiency among subjects depended upon the placement procedures of the institutions involved, it was not possible to control for equivalence of proficiency across the institutions. However, since we were dealing in all cases with highly professional organizations with long established records of delivering well regarded ESL programs to people from around the world, the placement policy of the institution was relied upon to give us our three levels of proficiency. Thus, when the data had been collected and submitted for analysis, the subjects were given one of three labels, A (= beginner), B (= intermediate), and C (= advanced).

iv) Age and Experience

3.4.6. All of the subjects were over 17 years old, thus alleviating any concern with non-lateralization of linguistic abilities, etc. The age range was quite broad ranging from 17 years to 60 years. This range was also reflected in the individuals' learning experiences with English, which was quite broad, although the majority stated that they had learned English formally in their own countries and had, in general, spent less than a year

learning English in the United States. Again, because of the large numbers and the circumstances under which they were recruited and tested, it was not possible to control for the type of educational experience each subject had encountered, as our discussion of false beginners has indicated.

3.4.7 We also recruited from among teachers and students at Hunter College, a set of ten native speakers of English who made up our control group on the word pair discrimination task, and a different set of ten native speakers for the sentence task. None of the individuals taking the test knew the purpose of the task until after it had been administered. We refer to this group in the discussion that follows by the initials CGNS = Control Group of Native Speakers.

3.5 The Task

3.5.1 The instructions the subjects received were given orally, and reinforced by means of a practice pre-trial test (see Appendix A1) in which the subjects were required to listen to the tape on which the tokens had been recorded and to mark on an answer sheet whether the pairs of words that they heard were the same or different. If they thought the word pairs were the same, they were to shade in the circle

containing the letter A on the answer sheet; if they thought the word pairs were different, then they were to shade in the circle containing the letter B. Because of the length of the test and the design of the answer sheets, it was decided to split the test into two halves of 124 word pairs each (see Appendix A5).

3.5.2 The pre-trial practice test consisted of thirty word pairs differentiated by the plural morpheme. The task was exactly the same as for the main test and proved useful as no subject was unaware, by the time the main test was given, of what was expected of him. Because so many subjects expressed an interest in how well they had performed, the answers to the pre-trial were given, if there was time, at the end of the session.

3.5.3 Having established the nature of the task, the instructions were repeated on presentation of the main trial. That is to say, the subjects were asked to listen to the tape and to decide whether or not the word pairs he heard were the same or if they were different. The same Sharp tape recorder was used in the sample collected both from Hunter College and from the SCS.

Experiment II

3.6 Introduction

3.6.1 It has been observed that, in English, the alveolar stop consonants (/t/ and /d/) do not seem to appear when the following sound is made at or near the same place of articulation. So for example when the final /t/ of 'sent' is followed by exactly the same sound, as in 'sent to', the /t/ of 'sent' is totally assimilated with the following /t/ of 'to'. This observation might also help to explain the non-appearance in writing of the +ed form on participial adjectives. Examples of this and other similar processes collected from various signs, notices, menus, and other pieces of textual realia are as follows:

I. 'ed' omitted before non-stop consonants

- 1) corn beef (menu)
- 2) can fruit (supermarket sign)
- 3) advance post (New York Times article)
- 4) old fashion ground coffee (cafeteria sign)
- 5) hack chicken (on a menu)
- 6) frienship (student essay)
- 7) sof pak (a type of packaging)
- 8) stan pipe (student essay)
- 9) Granfury (a type of car)
- 10) put pay to (for 'put paid to')
- 11) grease lightening (student essay)

II. 'ed' omitted before stops consonants

- 10) price to sell (advertisement)
- 11) ice tea (on a menu)
- 12) fas teeth (a denture gell)
- 13) close Tuesdays (shop sign)
- 14) licence to kill (film title - ambiguous)
- 15) use to (student essay)
- 16) stain glass (student essay)

3.6.2 The past tense is also prone to this form of elision whereby the inflectional ending is collapsed with the initial sound of the word following. Consequently, the {+ed} of sentence a) below is probably less perceptible than that of b), for the reasons we have been discussing:

- a) She pushed through the door
- b) She pushed a lot harder

The likelihood of assimilation occurring in contexts such as a), may depend on the type of consonant following the inflected form. In our example we have an interdental fricative; however, in c) below there is a greater chance of assimilation occurring for the obvious reason that the inflected form and the sound following are identical.

- c) She pushed too hard

3.6.3 Thus, the past tense inflectional morpheme can occur in environments where it is hardly, if at all, discernible. Of interest here is whether or not native speakers are able to detect the presence of the suffix more reliably than non-

natives do. This would imply that at the more gross phonological level the appearance of the non-presence of a form may be misleading, and that native speakers are able to retrieve the 'missing' form, as evidenced by their ability to correctly identify its presence.

3.6.4 To discover if there was a difference between the native and non-native populations with regard to this ability, it was decided to create a set of sentences which varied along the dimensions listed below.

ii) The Design.

3.6.5 The following ten verbs were selected: 'approve', 'advertise', 'predict', 'miss', 'shop', 'blend', 'fish', 'look', 'stroll', and 'scribble'. The principal reason for choosing these ten verbs was that they each end in a different sound.³⁷ These different endings create environments which may, as we have said, make the presence of the inflected ending more or less perceptible (see Appendix 6b). All three past tense allomorphs are represented, and except for 'look', none occurred on the primary word-pair test.

³⁷ /v/ , /z/ , /l/, and /bl/ - taking the {+d}
allomorph
/k/ , /s/ , /p/, and /t/ - taking the {+t}
allomorph
/kt/ and /nd/ - taking the {+ed}
allomorph

3.6.6 Each verb was placed in four sentences representing four environments that were a) uninflected followed by a consonant, b) inflected (+ ed) followed by a consonant, c) uninflected followed by a vowel, and d) inflected (+ ed) followed by a vowel. This gives us four different contexts, e.g.:

- a) They approve the plan
- b) They approved the plan
- c) They approved a plan
- d) They approve a plan

3.6.7 In selecting the form of the sentence, control was maintained on the number of syllables following the verb, so that for each pair (a) and (b), the number of syllables remained the same. The initial consonant of the word following the verb generally shared the same place of articulation as the preceding past tense morpheme when it occurred, i.e., an alveolar. The idea was to make the environments in which the inflected form occurred as homorganic with the following sound as possible, and hence lower the level of perceptibility.

3.6.8 All ten verbs in these four versions were randomized, and a list of forty sentences composed and recorded on tape. The forty sentences were listed in two versions (inflected and non-inflected, A and B (see Appendix A3)), and were

placed on the answer sheet given to the subjects.³⁸ They were then asked to listen to the tape and to circle either A or B depending on which of the two forms they believed that they had heard.

3.7 Scoring the Data

3.7.1 Once the data had been collected on both the main word pair test and the sentences, it was optically scanned by the Hunter College office administration computer and placed on a 3M reel to reel tape, which was then downloaded on to a five and a quarter inch floppy disk. The data then had to be sorted and readied for statistical analysis by means of the BMDP statistical program package. This required each subject to be assigned a unique code, which consisted of:

- 1) two letters representing the subject's first language e.g., SP = Spanish, Ru = Russian, Ja = Japanese, and Ch = Chinese.³⁹

³⁸ The subjects in this instance were a subgroup of the main population. The decision to give a particular group the sentences depended on the time available, so not all groups were given this test.

³⁹ The codes for languages were Sp = Spanish, Ch = Chinese, Ja = Japanese, Ru = Russian, Gr = Greek, It = Italian, Tu = Turkish, Ko = Korean, Ar = Arabic, Po = Polish, Th = Thai, He = Hebrew, Gr = German, Fr = French, Hu = Hungarian etc.

- 2) a number which identified the subject uniquely within the subject's language group
- 3) one of three letters (a,b,or c) which indicated the subject's level of proficiency⁴⁰.

3.7.2 Thus, a typical subject was given the following designation, for example, SP10A which represented in code that he was a beginner whose native language was Spanish, and that within this group he was counted as the tenth member. Appendix X demonstrates how the data were initially stored before scoring. The number 1 indicates that the subject responded to the stimulus as the same, and 2 as different. Because the tokens had been randomized for the test, it was necessary before scoring to re-sort the data in such a way that the sixteen representatives for each of the fifteen environments occurred as an ordered group with respect to each other such that, for example, all those stimuli for the first environment were grouped together in the following order :

- 1) same without inflection (e.g. cry vs cry)
- 2) same with inflection (e.g. cried vs cried)
- 3) different inflected then non-inflected (e.g. cried vs cry)
- 4) different non-inflected then inflected (e.g. cry vs cried)

This pattern was repeated across all fifteen environments.

⁴⁰ The proficiency levels were A = beginner, B = intermediate and C = advanced.

3.7.3 Once the data had been readied in this way, a series of staistical programs were run, the results of which are reported in the following chapter. For the sentence experiment, the randomized sentences were first de-randomized allowing the sentences to be re-grouped for scoring purposes as follows:

1)	_____	#	C	(10,22,35,25,31,7,8,29,37,39)
2)	+ed	#	C	(21, 2,14,17,19,11,26,4,15,28)
3)	...	#	V	(1,12,9,30,5,27,16,33,34,24)
4)	+ed	#	V	(40,38,23,20,13,36,32,18,3,6)

Chapter Four

RESULTS

I EXPERIMENT ONE

4.1 Introduction

4.1.1 Subjects responses indicate that they experienced particular difficulties with those environments that had been identified as problematic, whereas on those those considered straightforward, subjects experienced less difficulty.⁴¹ Thus, all language groups at all levels of proficiency managed the phonologically simple environments with relative ease, while the more complex environments were handled only with difficulty. These results suggest that learners, in attempting to detect the presence or absence of the TL inflected form, were more dependent on the surface phonetic structure than native speakers who, on the other hand, experienced virtually no differences among the environments, treating them all with comparative ease. The native speakers also failed to produce an order of difficulty which could be understood in the same terms as the non-native speakers.

⁴¹ Since we refer here only to the inflected forms, the fifteenth environment which consisted of distractors is not considered unless we specifically mention it.

4.1.2 There was some variation in the response patterns among the different first languages, although different levels of proficiency produced virtually no differences in responses. However, the beginners behaved less consistently across languages than both the intermediates and the advanced groups, who increasingly began to resemble each other. Thus, as one progresses through the levels of proficiency one finds greater consistency among the responses across the different languages.

4.1.3 It would appear from this that the impact of the first language begins to weaken as learners move in proficiency toward the target language. However, if we compare the control group of native speakers (CGNS) response pattern with the non-native's, we see that it is quite unlike any found among the non-native speaker groups (see the figure labelled 'All Non-Natives Vs. Natives in Appendix), and the form of this difference remains across all levels of proficiency. Thus, even though with increasing proficiency the different language groups begin to cohere, they do not do so in a manner which bears an increasing resemblance to the NSCG as we would have expected them to, but rather the pattern of their responses remains uniquely their own. The implications of this finding are discussed below in 4.5.

4.1.4 Table 12 gives an overview of how the different subject groups⁴² performed on each environment and how each environment was treated with respect to every other environment. This shows the actual scores on each environment, as well as the least significant difference number for each group. To determine whether or not a group treated a particular environment as significantly more difficult or significantly less difficult with respect to any other environment, the score on that environment is subtracted from that of the environment with which it is being compared. The resulting value, if greater than the least significant difference number (in column 14) indicates that a significant difference exists between the two environments. For ease of reference we show the same information that results from this process graphically displayed in Appendix Ten labelled Materials Analysis. There the symbol 0 represents no significant difference, while 1 represents a significant difference.

⁴² On Table 12 the labels represent the different groups as follows: All = All Non-Natives, Ch = Chinese, Ja = Japanese, Ru = Russian, Sp = Spanish, Oth = All Non-Natives other than Ch, Ja, Ru, and Sp; A = Beginners, B = Intermediates, C = Advanced, N = control group of native speakers. We will maintain these labels throughout our discussion in this chapter.

	1	2	3	4	5	6	7	Least Sig Difference
	'v'	'vr'	'en'	'p'	'b'	'k'	'g'	
ALL	.718	.748	.589	.766	.651	.710	.651	.125
Ch	.744	.777	.654	.761	.679	.718	.689	.139
Ja	.778	.857	.613	.823	.730	.808	.713	.165
Sp	.647	.616	.553	.734	.536	.623	.605	.128
Ru	.662	.709	.546	.784	.653	.685	.585	.204
Oth	.748	.756	.574	.744	.651	.720	.664	.127
A	.723	.716	.630	.722	.630	.672	.677	.106
B	.723	.777	.590	.777	.666	.731	.645	.142
C	.695	.705	.519	.810	.647	.717	.627	.171
N	.987	.981	.943	.906	.843	.862	.931	.119

	8	9	10	11	12	13	14	
	'mp'	'ks'	'nj'	'mb1'	'ngl'	'nt'	'nd'	
All	.794	.679	.587	.683	.639	.834	.836	.125
Ch	.804	.713	.621	.702	.656	.789	.802	.139
Ja	.853	.772	.651	.783	.736	.882	.884	.165
Sp	.722	.543	.513	.564	.538	.810	.829	.128
Ru	.806	.645	.512	.628	.566	.852	.817	.204
Oth	.787	.709	.628	.728	.689	.847	.858	.127
A	.769	.693	.622	.659	.630	.814	.828	.106
B	.803	.687	.595	.695	.647	.843	.842	.142
C	.812	.637	.512	.694	.631	.844	.834	.171
N	.987	.912	.881	.943	.906	.930	.981	.119

Significant Differences Across All
Environments for All Groups

Table 12

4.1.5 A typical rank order of difficulty in the perception of the inflectional ending across the entire sequence of fifteen environments is given below.⁴³

⁴³ For this purpose we use the group called ALL which, as its label suggests, includes all non-native language groups across all levels of proficiency.

ALL - 'ndz', 'en', 'ngl', 'b', 'g', 'ks', 'mbl', 'k', 'v',
'vr', 'p', 'mp', 'nt', 'nd'.

Addressing first the issue of what value we may attach to this ordering with regard to significance, the following difference were found:

- 1) 'ndz' and 'en' were treated as significantly more difficult compared with 'v', 'vr', 'p', 'mp', 'nt', 'nd'.
- 2) 'ngl' was treated as significantly more difficult than 'p', 'mp', 'nt' and, 'nd'
- 3) 'b' and 'g' was treated as significantly more difficult than 'mp', 'nt' and, 'nd'
- 4) 'ks' and 'mbl' were treated as significantly more difficult than 'nt' and 'nd'
- 5) 'k' was treated as significantly more difficult than 'nd'

Thus it can be seen that the more complex environments were generally treated as more difficult than the more straightforward environments, as we had anticipated.

4.1.6 The ordering above therefore represents, from right to left, a hierarchical ranking which suggests that subjects experienced increasing difficulty in identifying the presence or absence of the inflected form across the different environments. Conversely, as one moves from left to right there is a gradual and significant diminution of difficulty as subjects were increasingly able to make the correct choice.

4.1.7 Furthermore, this ordering closely reflects the predictions made in the previous chapter concerning the perceptual saliency of each environment, so that the environments which were considered least salient, such as 'ndz' and 'en', created most difficulty. This, then, suggests that a subject's success at identifying morphophonemic material depended crucially on the environment in which the morpheme was located. If this had not been the case, then we would not have found any significant difference among the environments, with all subjects responding equally well in all cases. In section 4.5 we compare directly the response pattern of the native speaker controls with this group ('ALL').

4.1.8 We stated in Chapter Three that two factors may contribute to perceptual difficulty, one being quantitative and the other qualitative. Thus, the number of contiguous consonants in word final position and the number of shared distinctive features could conspire to make it more or less difficult to perceive the presence of the inflectional form. If we turn to the first three of the most difficult environments ('ndz', 'en', and 'ngl') above for the group 'ALL', we see that our intuitive notion of perceptual difficulty is borne out. The most difficult environment consists of #(C)CVndz+d# ('plunged', 'singed'); here we not only have the maximal sequence of consonants, but also a

stem final form which shares many features with the inflectional form.⁴⁴ We predicted in Chapter Three that this number of consecutive consonants would cause learners the greatest difficulty, as indeed it did for nearly all language groups. So, the group 'ALL' found this environment to be significantly more difficult than six of the others, whereas the native speakers did not treat it as any more difficult.

4.1.9 In the case of the second most problematic environment ('en', e.g. 'shorten', 'widen', 'frighten', etc.), the suffix form +en was produced such that the suffix formed a syllabified alveolar nasal.⁴⁵ Such a construction created two contributing difficulties. The first resulted in there being only one feature (+/-nasal) distinguishing the stem from the inflected form. Secondly, by having a syllabified nasal as the suffix form, the configuration of consonants in final position is #C(C)VCC+D#, a redoubtable sequence leading to the kind of response from learners that we find here. Native speakers on the other hand dismissed the form as relatively easy.

⁴⁴ A similar phonological configuration holds for the third most difficult environment ('ngl'), where a broad transcription gives us the form: #(C)CV ngl+d# as in 'strangled' and 'mangled'.

⁴⁵ This is natural, since almost every speaker of English would articulate this form in this manner and a narrower transcription would be [waydnd] for the word 'widened'.

4.1.10 By contrast, all groups of subjects scored highest on the two environments in which the allomorph of the past consists of a separate VC syllable ('nt'+ed and 'nd'+ed). We assume that responsibility for this fact lies in the configuration of the syllable structure, which was sufficiently salient to allow subjects to be able to detect more accurately the presence or absence of the morpheme. Native speakers, on the other hand, placed 'nt' in a central position and 'nd' not far from this, indicating that the extra syllable formed by the inflection did not make the difference that it did to non-natives.

4.1.11 To underscore the consistency of the responses across all groups, we note that on the three most difficult environments, 'ndz', 'en' and/or 'ngl', eleven out of twelve possible combinations of language and proficiency (4 languages X 3 levels = 12), received the lowest scores. Similarly, nt+ed and nd+ed appear(s) within the last two (most easy) places ten out of twelve times. Contrast this with native speakers, where none of these environments occupied either the highest or lowest scoring positions. We present below in section 4.6 a separate analysis of each of the environments and how they were reacted to by the subjects.

4.2 Proficiency Levels Within Languages Compared

4.2.1 In order to discuss differences in response patterns across languages and proficiency, we will employ a notion of 'rank shifting', in which an environment is said to have undergone a shift in rank across two or more groups (either by language and/or proficiency) if it has changed position by two or more places. Secondly, to lend this intuitive count a measure of objectivity, we also supply Spearman rank coefficients. In this study a coefficient figure of greater than .570 is statistically significant. Where two groups score this figure or above they can be considered to have behaved in a like manner, while those that score below this figure cannot be said to have treated the material in a similar manner.

4.2.2 As we have said, the different language groups patterned slightly differently from each other in their responses, i.e, there was some variation in the way they behaved, but that as proficiency increased so did the similarity in responses.⁴⁶ It may have been the case that

⁴⁶ We should note that there are two response differences among the languages that we can compare. The first is the pattern of ranking in which the environments are ordered with respect to each other, and then there is the degree of accuracy with which each language performed. On these two measures of 'response pattern' and 'accuracy', there was a difference. In the case of the response pattern among the languages, there was only slight variation, whereas in the case of accuracy there were significant

our test instrument was not tuned finely enough to pick out cross-language differences in target- language phonological perception. We are therefore left to conclude that, although there were differences among the language groups responses which we shall discuss below, the first language itself was not the main determinant in the response patterns of subjects.

4.2.3 As an example of consistency within a particular language group's responses across levels, take the following order from the Japanese intermediate (B) and advanced (C) groups:

- B - en, ndz, g, ngl, b, ks , mbl, v, k, p, dis, mp, vr,
nd, nt
- C - ndz, en, g, b, v, ngl, ks, mbl, nt, k, dis, mp, vr,
p, nd

Japanese - Intermediate and Advanced

The only two-place shift to occur here involves environments 'v', 'ngl', 'nt', 'p', and 'nd'. Otherwise, there is very little change among the environments across the two levels of proficiency. Using the Spearman rank correlation figure of .570 to establish the degree of consistency between the two groups, the score is a high .871.

differences. Thus some languages were better able to detect the presence or absence of the morpheme than other languages, although the manner in which they responded was similar.

4.2.4 It should be noted from this, and the examples to follow, that the sounds least liable to undergo movement (i.e., which display greatest agreement across groups) are generally found at the lowest or highest ends of the scale. In other words, those that were treated with the greatest ease (e.g., 'nt', 'nd', and 'mp'), and those which were found most difficult (e.g., 'en', 'ndz', and 'ngl') barely shifted at all. In these cases what effect increasing proficiency had on improving learners' abilities to detect the presence or absence of the inflected form was mitigated for or against by the environment itself. Likewise, across different languages there was greater agreement among the easiest and most difficult environments, while those that could be considered as lying between the two extremes were more volatile. Again, this suggests that the effect of the TL phonological system itself was to level difference among the languages and to impose its own criteria of difficulty.

4.2.5 A further example of within-language-across-proficiency consistency can be seen if we compare first the Russian intermediates and advanced, and then the Chinese.

B - en, ndz, g, ngl, mbl, v, ks, b, k, vr, nd, p, mp, nt
 C - ndz, ngl, en, g, b, mbl, ks, k, vr, v, p, nd, mp, nt

Russian - Intermediate and Advanced

Here, just four environments ('en', 'ngl', 'b', 'v') undergo a shift and the Spearman rank correlation figure is .953, while the Chinese intermediates and advanced display a similar consistency, with a change among only 'ks', 'mbl', 'vr', 'p', and 'mp', as follows:

- B - ndz, en, g, ngl, b, ks, mbl, v, k, p, mp,
vr, nd, dis, nt
C - en, ndz, g, ks, ngl, b, vr, v, k, mbl, dis,
nd, mp, nt, p

Chinese - Intermediate and Advanced

This results in a correlation figure of .853, suggesting a cohesiveness between the two levels, although one that is not as great as for the two other languages. We shall discuss the Spanish below.

4.2.6 Thus, what is striking about this within-language-across-proficiency behavior is the relative stability of the ordering of the environments relative to one another. But notice that we have only been comparing the advanced groups with the intermediates. As one moves down through the levels of proficiency within a language, the picture changes and one encounters less agreement among the levels of proficiency. Thus, the beginner group in each language tends to be least like the advanced while the intermediate group holds a position between the two. However, whether

the latter are more like the beginners or more like the advanced group depends upon the native language. In the case of the Spanish and Russian groups, the intermediates behaved more like their beginners, as opposed to the Chinese and Japanese, whose intermediates behaved more like the advanced, as we shall see below.

4.2.7 To illustrate how, within a particular language, there were greater differences between the advanced and the beginners as opposed to the intermediates and the advanced, let us first take the Japanese, where we see the following pattern⁴⁷

Ja. a/b	-	10	(.650)
Ja. b/c	-	3	(.871)
Ja. a/c	-	9	(.385)

Japanese - Across Levels of Proficiency

(The figure following levels indicates the number of environments that do not share the same position by two places.)

Inspecting the rank correlation figures we see how very different the advanced and the beginners are. We notice too, that the intermediates are behaving more like the advanced than they are the beginners. This same pattern is maintained among the Chinese:

Ch. a/b	-	10	(.710)

⁴⁷ However, if one inspects the % score figures for the Japanese advanced and intermediates on each environment, the beginners score better.

Ch. b/c - 4 (.853)
 Ch. a/c - 12 (.489)

Chinese - Across Levels of Proficiency

Here again, the greatest disparity lies between the beginner and advanced groups, while the closest relation is between the intermediate and the advanced. Also, as with the Japanese, what is particularly striking is how unlike the beginners and the advanced are (.489), compared with the advanced and the intermediate groups (.853).

4.2.8 On the other hand, across the levels of proficiency among the Russians there is far greater consistency, with only four environments changing position between the beginners and the advanced:

Ru. a/b - 3 (.953)
 Ru. b/c - 4 (.928)
 Ru. a/c - 4 (.903)

Russian - Across Levels of Proficiency

Unlike the Chinese and Japanese, the Russian intermediates are closer to the beginners than they are to the advanced.

4.2.9 The Spanish language group behaved a little differently, so that, according to our Spearman rank correlation figures, there is no difference between the pattern of response among the three levels of proficiency except for a very slight but non-significant difference

between the advanced and the intermediates. However, our intuitive rank shift count does show that the Spanish behave like the other groups, with seven environments shifting position between the advanced and the beginners:⁴⁸

Sp.	a/b	-	2	(.921)
Sp.	b/c	-	4	(.850)
Sp.	a/c	-	6	(.921)

Spanish - Across Levels of Proficiency

4.2.10 The Spanish and the Russians thus behave slightly differently from the Japanese and Chinese, first in that the difference between the beginners and the advanced in the latter two groups are significantly unlike each other, whereas in the former the differences are not significant. Secondly, although across all the language groups the beginners behave unlike the advanced, in the case of the Russians and the Spanish the intermediates behave in a manner more like the beginners than the advanced, whereas the reverse of this pattern occurred between the Chinese and Japanese intermediates.

⁴⁸ The labels that we use here such as 'Spanish' or 'Russian' do not refer directly to the language itself but rather to the group of nationals representing the language who took part in this experiment, and who therefore represent the language in this capacity. This point should be borne in mind when inspecting the figures in the appendix labelled by environments.

4.2.11 To illustrate the manner in which the advanced and the beginners do not relate as well as the intermediates across all four languages consider Table 13.

	SP B	SP C
SP A	.921	.757
SP B		.850

Spanish

	RU B	RU C
RU A	.953	.903
RU B		.928

Russian

	JA B	JA C
JA A	.650	.385
JA B		.871

Japanese

	CH B	CH C
CH A	.710	.489
CH B		.850

Chinese

Intercorrelations Between Proficiency
Groups By Language

Table 13

4.2.12 If we take the scores for all the non-native speakers, we can see that the greatest similarity lies between the advanced and the intermediates. The Spearman rank correlations figures for all languages across proficiency are as follows:

	B	C
A	.889	.853
B		.967

This pattern indicates a gradual progression among the subjects from a more disparate to a more cohesive response pattern as proficiency increases, and confirms the behavior of the individual languages that we have discussed above.

4.3 Accuracy Scores Across Languages

4.3.1 As we have discussed already above (see footnote 47), there are two response measures that can be obtained across the languages, which we have called 'the response pattern' and 'accuracy'. Here we shall discuss the differences among the languages with regard to 'accuracy'. It was found that there were significant differences among the different language groups ⁴⁹: some language groups were able to detect more accurately the presence or absence of the morpheme than others. One of the greatest differences occurred between the CGNS and all the non-native group (ALL) ($t=7.99$, $df=229$, $p.< .05$). The accuracy scores for the four main language groups, the CGNS, and all other non-natives, is as follows: ⁵⁰

⁴⁹ The one exception to this was the Chinese group compared with all the other non-native speakers.

⁵⁰ Note that we have ranked the languages so that the Japanese are the most accurate while the Spanish speakers are the least. The differences among the language groups on

Natives	= 930
Japanese	= 781
Chinese	= 727
Others	= 726
All	= 711
Russian	= 678
Spanish	= 642

Accuracy Scores

Table 14

4.3.1 To compare the different groups with each other we give the difference scores for each group against every other group. The greater the number is after each comparison, the less alike the two groups were behaving in terms of how accurately each group was scoring on the test. Thus the group that behaved least like any of the other groups was the Chinese (Table 15).

Chinese

Ch/Ru	= 93
Ch/Sp	= 94
Ch/Ja	= 81

Russian

Ru/Ch	= 93
Ru/Sp	= 79
Ru/Ja	= 76

Japanese

Ja/Ch	= 81
Ja/Sp	= 67
Ja/Ru	= 76

Spanish

Sp/Ch	= 94
Sp/Ja	= 67
Sp/Ru	= 79

Others

Oth/Ch	= 105
Oth/Sp	= 91
Oth/Ru	= 100
Oth/Ja	= 88

Language Comparisons of Accuracy Scores

Table 15

this score are significant.

4.3.2 Since we are finding here a consistent difference among the languages, we might have found an effect of native language on the perception of the target language. It is not possible, however, to determine whether the differences we find here among the language groups is uniquely attributable to this effect of L1 or whether motivation, or educational experience, or attentional factors or other extra-linguistic factors may not also be involved. In spite of this we are left with significant differences on this score among the four languages. This contrasts with differences in proficiency level, which went against our expectations by failing to make a difference.

4.4 Across Language Within Proficiency Compared

4.4.1 From now on we shall discuss the second measure of response namely the 'response pattern' which displays the way in which the different languages ranked the order of the environments. In particular, we discuss in this section the differences that were found across different languages within the same level of proficiency. First, we begin by contrasting the Russian and Japanese beginners:

Ru	-	ndz, en, ngl, g, v, ks, mbl, b, k, vr,
		mp, p, nt, nd
Ja	-	en, b, p, ngl, mbl, k, g, ks, ndz, vr,
		nd, v, nt, mp

Russian and Japanese Beginners

Using our two-place-shift to measure a difference between languages, we find that between Russian and Japanese, nine environments differ from each other, i.e., more than half the environments shift in rank order across these two languages. Furthermore, the Spearman rank correlation figure of .578 suggests that these two groups are behaving quite unlike each other. This, then, suggests that the two groups are responding to the tokens in ways that may reflect the effects of their respective first languages. However, as proficiency increases, so the dissimilarity among the languages decreases. The Spearman rank correlation figure rises to .729 between the two advanced groups, which suggests that these two groups are behaving more alike and hence in a less language-specific manner than the beginners.⁵¹

4.4.2 As a further example, take the Spanish beginners compared with the Chinese:

Sp - b, ngl, ndz, en, mbl, k, ks, vr, g, v, mp, p, nd, nt
 Ch - nz, ngl, mbl, k, b, en, p, g, ks, vr, v, ndz, mp, nt

Spanish and Chinese Beginners

⁵¹ Again, if we take the Spanish beginners and their Japanese counterparts as a further example:

Sp - b, ngl, ndz, en, mbl, k, ks, vr, g, v, mp,
 p, nd, nt
 Ja - en, b, p, ngl, mbl, k, g, ks, ndz, vr, nd,
 v, nt, mp

We see that the number of changed positions is seven and the Spearman rank correlation figure is .700, which, although not indicating un-like behavior, is nonetheless lower than the equivalent for the advanced.

The number of environments that change position by more than one place totals nine⁵², while the Spearman rank correlation figure is .792.

4.4.3 However, if we compare the advanced proficiency groups across these two languages, we again find that the impact of the first language is reduced, and the different groups begin to resemble each other more. Here, we have only four environments that are not in common ('ngl', 'mbl', 'mp', 'ndz') compared with nine for the beginners:

SP	-	ndz, en, ks, g, b, vr, ngl, mbl, v, k, mp,
		nt, p, nd
CH	-	en, ndz, g, ks, ngl, b, vr, v, k, mbl, nd,
		mp, nt, p

Spanish and Chinese Advanced

And, if we take the correlation figures, we find that for the two advanced groups it is .942, suggesting far greater consistency in behavior than between the two beginner groups. Indeed, if we compare the beginners and the advanced across all the languages, we find that there is a far greater lack of congruity among the beginners than there is among the advanced.

⁵² 'b', 'ndz', 'mbl', 'k', 'en', 'ks', 'p', 'vr' and 'mp'.

4.4.4 We can summarize the observations we have been making here by contrasting all three levels across the different languages (see Table 16).

<u>Beginners</u>	<u>Intermediates</u>	<u>Advanced</u>
Ru - Ja .578	Ru - Ja .921	Ru - Ja .792
Sp - Ja .700	Sp - Ja .817	Sp - Ja .811
Sp - Ch .792	Sp - Ch .860	Sp - Ch .942
Ch - Ja .746	Ch - Ja .975	Ch - Ja .817
Ru - Ch .603	Ru - Ch .907	Ru - Ch .889
Sp - Ru .725	Sp - Ru .767	Sp - Ru .853

Correlations Among
All Languages Across Proficiency

Table 16

We can see from Table 16 that the Russians and the Japanese were least alike across all levels of proficiency although they conformed with the trend, up to a point, toward more consistent cross-language behavior as proficiency increased. This pattern is repeated between the Spanish and the Chinese. What is also quite striking, is how the Spanish beginners were the most disparate, and how the advanced group closed the gap between the other languages to reduce this disparity. The Russians, too, start out behaving quite unlike the other languages. Witness its score against the Chinese (.603) and Spanish (.725), but the advanced overtake the Japanese in their agreement with the Chinese (.889), and there is also increased agreement with the Russians (.853).

4.4.5 Of course, the greatest disparity among the groups occurs when we combine a difference of language with

proficiency. Thus, if we compare the beginner and advanced groups from different languages, we can see that in the majority of the cases the correlation scores are quite low. However, the correlations across the different languages are reduced when the comparisons are made between the intermediate and the advanced levels indicating the effect of proficiency⁵³ (Table 17)

<u>Beginners & Advanced</u>	<u>Intermediates & Advanced</u>
Spa / jac .646	Spb / jac .728
Jaa / chc .435	Jab / chc .853
Cha / spc .517	Chb / spc .846
Cha / jac .557	Chb / jac .850
Jaa / ruc .642	Jab / ruc .925
Jaa / spc .421	Jab / spc .828
Spa / ruc .875	Spb / ruc .900

Correlations Among Different Languages Across
Different Levels of Proficiency

Table 17

4.4.6 The findings presented above are consistent with the notion that language specific influences will decrease across proficiency, and that as this happens, the different languages will begin to resemble one another as proficiency

⁵³ What is quite interesting, is that the languages that share similar phonological systems, such as the Japanese and Chinese, did not correlate better with each other compared with languages whose phonological systems were quite unlike. For example, the Russians and Chinese did better when compared with each other, as opposed to the Chinese and the Japanese who fared quite badly. Indeed, they scored among the lowest and hence were least like each other in certain instances.

increases. It might be reasonable to infer from this kind of behavior firstly, that the beginners are more influenced by the effects of their first language, and secondly, that the cohesiveness across different languages as proficiency increases is due to the increasing assimilation of the target language. In other words, that the learners, as they advance, begin to perceive differences in the target language in terms of the target language. Unfortunately, this apparently obvious observation does not appear to be the case, as we shall see in the next section.

4.5 The Native and Non-Natives Compared

4.5.1 If we turn to the rank order for the group labelled 'ALL' and compare this with the order produced by the control group of native speakers (CGNS), we note a substantial difference between the two groups:

ALL	-	ndz, en, ngl, b, g, ks, mbl, k, v, vr p,
		mp, nt, nd
CGNS	-	b, k, ndz, p, ngl, ks, nt, g, en, mbl, nd,
		vr, mp, v

All Non-Natives Compared with Control Group of Natives

Here, across the two groups, only two environments ('ks' and 'mp') share positions or are even close, whereas the remaining twelve environments occupy positions that are

substantially apart from one another. In other words, the two groups of native and non-native speakers are very unlike indeed in the ordering of their responses, and this dissimilarity is confirmed by the Spearman rank correlation score, which is .511.

4.5.2 Furthermore, none of the Spearman rank correlation figures for any of the non-native groups, whichever way they are divided either by level of proficiency and/or by language, indicates behavior that can be described as being like or resembling that of the native speakers, except for the Chinese and Japanese beginners.⁵⁴ The figure labelled 'All Non-Natives All 3 Levels Vs. Natives' in the appendix visibly displays this type of disparity. Looking at this chart, we can see how it appears that the two groups are counter-balanced, so that where one group's scores may be increasing, the other's are decreasing, and vice versa. This visual impression of the groups' behavior reinforces the fact that nearly all the non-native groups were responding to the items in a unique manner, which in no way resembled that of native speaker perception. Thus, there was more cohesiveness among non-native groups, especially at

⁵⁴ The fact that the Chinese and Japanese beginners did so well compared with their intermediate and advanced counterparts cannot be explained in the terms that we have been using thus far. Perhaps other factors, such as the circumstances under which they were tested and their overall socio-psychological profiles, were sufficiently advantageous to create the necessary advantage.

the more advanced levels, than there was between native and any non-native group.

4.5.3 We have already noted above that the more proficient groups across the different languages began to increasingly resemble each other, and we have stated that this might be due to the influence of the target language. However, this explanation does not hold true, for if the order for all the beginners and all the advanced is compared with that of the CGNS, we can see that in the latter case twelve of the environments are in positions that are not shared by the CGNS, while in the former eleven are not.

CGNS	-	b, k, ndz, p, ngl, ks, nt, g, en, mbl, nd, vr, mp, v
A	-	ndz, b, en, ngl, mbl, k, g, ks, vr, p, v, mp, nt, nd
C	-	ndz, en, g, ngl, ks, b, mbl, v, vr, k, p, mp, nd, nt

Native Speakers Compared with Non Native
Beginners (A) and Advanced (C)

4.5.4 Furthermore, our Spearman rank correlation figure across the different levels of proficiency is counter-intuitive, in that the more advanced the groups behave less like the natives than do the beginners:

A .603
B .410
C .328

Correlations of Across Proficiency
With Natives

Table 18

This is not what we would have expected if the more advanced groups had been perceiving in a more target-like manner. That is to say, if increased proficiency had involved a more target-like ability among learners, then we would have expected the more proficient to behave in a more native-like way, but they clearly do not. Hence, we cannot claim to explain the obvious differences among the beginners and the gradual similarity among the advanced groups as an artefact of anything to do with the target language. Thus, although the more advanced groups were moving toward each other, they were doing so in a unique manner, quite unlike the natives that they were supposedly approaching (Table 19).

	Russians	Spanish	Japanese	Chinese
A	.235	.510	.617	.746
B	.196	.532	.425	.425
C	.457	.274	.332	.242

The Four Languages and Three Levels
Compared With Natives

Table 19

4.5.5 Taking each language in turn we see that the Russians are behaving somewhat in the expected direction such that, if we ignore the intermediates, we see a marked improvement between the beginners and the advanced. Likewise, with the Spanish there is an improvement between the beginners and the intermediates, i.e. the intermediates are moving towards the natives, but this does not last. The case of the Japanese, Chinese and Spanish advanced groups is entirely contrary to our expectations, indeed there is a radical unlikeness of their behavior compared with natives whom they were presumed to be approaching. It is probably the case that the overall low score of the advanced group for all languages was depressed because of the behavior of these particular groups. The Russian advanced do quite well, although they too are unlike the natives.

4.5.6 In order to confirm that non-natives were being pulled down by the more complex environments, we decided to take the non-native score away from the native on each environment to see whether the gap between the more complex environments was greater, as we would expect. If this were the case we would have a further support for our argument.

ndz = 30%, en = 36%, ngl = 27%, b = 19%, g = 28%,
 ks = 24%, mbl = 26%, k = 15%, v = 27%, vr = 22%,
 p = 14%, mp = 19%, nt = 13%, nd = 15%

% Difference Between CGNS Scores and All Non-Natives

Table 20

In general, our assumptions are once again confirmed. Taking the two most difficult environments ('ndz' and 'en'), we see that there is a 30% and 36% difference between the two groups whereas, on the easiest two environments ('nt' and 'nd') there is a 13% and 15% difference.

4.6 Environment by Environment

4.6.1 Below, we shall review the responses made to each environment according to the scores achieved by all subjects divided along the three levels of proficiency. However, before we review each example, we should note some general points about the way the three levels behaved.

4.6.2 First, as we have witnessed above, there is little difference in the behavior among the non-natives as a whole, although below we shall mention some of the differences that occurred among the three levels of proficiency. This lack of difference can be most immediately seen by the percentage of total scores on all the environments that each group received:

A -	Beginners	- 70.1%
B -	Intermediates	- 71.7%
C -	Advanced	- 70.2%

Secondly, we should note that the beginners scored slightly better on six out of the fifteen environments than either

the intermediates or the advanced⁵⁵.

4.6.3 There is also a difference in the number of items that were found to be significant among the groups. The potential for significance among all the tokens is 98, which is the total number of items on the test that could be significantly different from all other items. If we inspect the total number of items that reached significance from each other across the three levels we see the following:

A - Beginner	-	49
B - Intermediate	-	69
C - Advanced	-	54

It is probably safe to assume that the more items found to be significantly different from each other, the more likely the group is experiencing difficulties. If this is the case then the beginners were having a better time of things than the other two groups.

⁵⁵ 'v', 'vr', 'en', 'g', and 'ndz'

Environment 1 / 'v' (e.g., cry, pray, enjoy, etc.)

Controls	-	.987	
All	-	.718	
Beginners	-	.723	[5/7/2] ⁵⁶
Intermediate	-	.723	[5/4/5]
Advanced	-	.695	[2/10/2]

4.6.4⁵⁷ Among the beginners there were five environments ('ndz', 'b', 'en', 'ngl', 'mbl') that were more difficult than this one, while just two were found to be easier ('nt' and 'nd'). Likewise, for the intermediates, five environments were found more difficult ('en', 'ndz', 'g', 'ngl', 'b'), and five easier ('p', 'vr', 'mp', 'nd', 'nt'). Except for 'b' and 'g', these two groups share exactly the same set of less salient environments. The advanced group of learners found that only 'ndz' and 'en' were more difficult, while four environments ('p', 'mp', 'nd', and 'nt') were easier. The advanced and the intermediates placed this environment in a central position while the beginners placed it quite low. Thus, the behavior across

⁵⁶ The figures 5/7/2 refer to the number of environments that were either 1) significantly more difficult [5/] than the environment being discussed, or 2) not treated as either significantly more difficult or more easy than the environment being discussed [7], and 3) treated as significantly easier than the environment being discussed [/2]. It should be noted that the measure used to reach this was the within means significance number (see Appendix - Scores).

⁵⁷ In this discussion, when we say that a particular environment is easier or more difficult in relation to others, the measure of ease or difficulty is always significant using the within means significance score.

the three levels varied, with beginners treating 'v' as easier than the other two groups. We had expected all three groups to treat 'v' as among the most easy to perceive, causing little difficulty since it filled our criterion of saliency, being the most straightforward CV form. But, as we have just seen, that was not the case. On the other hand, our control group of native speakers placed this environment exactly where we had anticipated it, by scoring it the highest.

4.6.5 Looking at the responses of the individual languages does not give us a clue to why the non-natives behaved the way they did. All the languages perform roughly in the same manner, indeed the Chinese in particular exemplify the process we are describing here.

Environment 2 / 'vr' (e.g., shower, fire, consider, etc.)

Controls - .981

All	-	.743
Beginners	-	.716 [5/7/2]
Intermediate	-	.777 [8/4/2]
Advanced	-	.705 [4/8/2]

4.6.6 This environment was originally chosen because it differed from the first by the addition of only an /r/ in final position. By means of this minimal extension, we were attempting to take account of how vulnerable subjects could

be to just a singular addition of material. Thus, we expected scores to be slightly depressed on this environment by comparison with the first environment ('v'). This, as it turned out, was indeed the case with the beginners, but the intermediate and the advanced groups reversed this by treating it as easier. However, in the case of the advanced, this failed to reach significance. For all groups, nearly all other environments were less salient than this one, while the advanced group found four others which were easier, as opposed to just two for the beginners and intermediates. The native speaker controls, on the other hand, again performed as we had expected them to by placing 'v' slightly above the first environment but without any significance. The four separate language groups all followed the behavior reported above.⁵⁸

⁵⁸ Comparing across twenty-one different groups, it was discovered that in twelve cases 'v' was ranked slightly higher than 'vr', and although this does not permit us to draw the conclusion that we would have liked, it should be noted that the two tended to be located most of the time close by one another, i.e., they were being treated in a similar manner, as we would have expected.

Environment 3 / 'en' (e.g. shorten, widen, open, etc.⁵⁹)

Controls	-	.943
All	-	.589
Beginners	-	.630 [0/7/7]
intermediate	-	.590 [0/2/12]
Advanced	-	.519 [0/2/12]

4.6.7 For the intermediate group, no other environment was more of a problem than this one, while the beginners and the advanced placed it second after 'ndz'.⁶⁰ The beginners found this environment as difficult as six other environments, and more difficult than seven other environments, while the other two groups found eleven environments were easier than this one. This suggests that this environment is more of a problem for the latter two groups compared with the beginners. If we attempt to account for the better behavior of the beginners in terms of the four main languages, we can point to the fact that the Japanese and Chinese scored quite high (70.8% and 70.6%), while the advanced of these two language groups scored only 43.7% and 52.5%, and that in no other environment and among none of the other languages do the advanced group dip so steeply below the beginners.

⁵⁹ It should be noted that the not all the words representing this environment were bimorphemic, although they all underwent the phonological process described here.

⁶⁰ This statement holds for proficiency groups but the position of 'en' is replaced by 'ndj.'

4.6.8 We have already discussed in section 4.3.7 the possible reasons why this environment should have been such a problem. In terms of its phonological make up, we noted there that only the feature +/-nasal differentiated the stem from, the inflected form as well as the fact that the vowel of the +en form 'disappeared', leaving a syllabified nasal resulting in a crippling three consonant cluster.

Environment 4 / 'p' (e.g., slip, snap, prop, etc.)

Controls	-	.906
All	-	.766
Beginners	-	.722 [5/7/2]
Intermediates	-	.777 [8/4/2]
Advanced	-	.810 [10/4/0]

4.6.9 All three groups treated this as among the easiest of environments, although the beginners and intermediates continued to treat 'nt' and 'nd' as much easier. What is notable, is that for the advanced group all ten of the environments to the left of 'p' were treated as more difficult, and this pattern was followed closely by the intermediates, with eight out of nine environments being treated as more difficult. On the other hand, for the beginners, only five out of nine environments were more difficult. This would indicate that the advanced and the intermediate groups found this to be a particularly easy environment. Furthermore, there was very little variation among the four main language groups in their treatment of

this environment. In Chapter Three we stated that this environment had been selected because it was considered easier than most others. However, as we shall see when we discuss environment 'mp' below, this assumption needed to be qualified, especially in the light of the native speaker control group who ranked this the fourth most difficult.

Environment 5 / 'b' (e.g., club, bribe, throb, etc.)

Controls	-	.843
All	-	.651
Beginners	-	.630 [0/7/7]
Intermediates	-	.666 [2/5/7]
Advanced	-	.647 [2/8/4]

4.6.10 The learners' responses to this environment, across all three levels of proficiency, indicate that they found the addition of the single feature, + voice, burdensome enough so as to treat it as more difficult than the fourth environment ('p'). This pattern occurred among all three groups, as well as across the four main language groups. The beginners positioned this environment in the second most troublesome spot, however as one moves up through the proficiency levels it becomes easier, giving the impression that the negative effect of voicing is gradually eased. So, for instance, the intermediates and the advanced groups found that two other environments were more difficult ('ndz' and 'en'). The beginners treated it as equally

problematical as the most highly ranked environments. The kind of difficulties learners experienced with this environment had been anticipated as we can see from 3.3. There, the single feature +/-coronal between stem and inflection had been identified as a major impediment to learners' recovery of the morpheme.

4.6.11 Across the four main language groups, it is of interest to note that the Japanese and Chinese were hardly affected by the difference in voicing between 'k' and 'g', however the Russians, and especially the Spanish, were. The Spanish in fact dropped by almost 20% between 'p' and 'b'.

4.6.12 Surprisingly, the native speaker controls placed 'b' at the top of the list in terms of difficulty overriding all the other environments that might have caused more difficulty, such as the complex cluster endings. However, the gap between this environment and its voiceless counterpart is not great enough to make a difference for the native speakers unlike the non-native speakers who consistently treated the addition of the voice as a burden. This pattern is repeated below for the environments 'k' and 'g'.

Environment 6 / 'k' (e.g. look, attack, prick, etc.)

Controls	-	.843	
All	-	.710	
Beginners	-	.672	[0/11/3]
Intermediates	-	.731	[5/6/3]
Advanced	-	.717	[5/5/4]

4.6.13 The behavior of 'k' is quite volatile across the three levels of proficiency. It starts out in the sixth position with the beginners (quite difficult), and descends to the tenth position for the advanced (fairly easy). In fact this volatility leads it from being ranked above its voiced counterpart 'g' for the beginners, to being treated as less difficult than 'g' for the intermediates and advanced.

4.6.14 In Chapter Three we considered the possibility that this and the following environment 'g' might be more easily discernible than 'p' and 'b', because with 'k' and 'g' we have two features (-/+ anterior and -/+ coronal) that distinguish the stems from the form of the inflection, whereas in 'p' and 'b' only one feature separates them (-/+ coronal). We claimed, for the reasons given there, that this difference in terms of features could result in 'k' and 'g' being more discernible than 'p' and 'b'. However we have some conflicting results.

4.6.15 Firstly, if we take a look at the performance among

the four main language groups at the beginner level, we can see that this at least is how the Japanese beginners treated it. However, among the other three languages there was little difference between 'p' and 'k', although in general 'p' was ranked below 'k', i.e., it was treated as easier. The same behavior is reflected among all languages across the three levels of proficiency. In other words, the two place feature difference on this voiceless pair ('p' and 'k') did not make the expected difference.

4.6.16 However, across all four languages at the beginner level, environment 'g' (the voiced version of 'k') was ranked below 'b' (the voiced version of 'p'). In other words, practically all four languages at the beginner level treated the environment that had fewer shared distinctive features 'g' as easier than the environment containing only a one feature difference 'b'. Thus when the voicing feature is added, the relationship is reversed, confirming our original expectations. However, this state of affairs is not maintained among the intermediates and the advanced, where 'g' is ranked above and hence treated as more difficult than 'b'.

4.6.17 When we turn to the native speakers, we can only be struck by the fact that they fared quite poorly on this one, placing it immediately after 'b', and whereas our

explanation with respect to the effect of voicing can account for the behavior of the non-natives, no such understanding can be applied to the natives, since they placed this well above the environment that follows.

Environment 7 / 'g' (e.g., snag, plug, drug, etc.)

Controls	-	.931
All	-	.651
Beginners	-	.677 [0/11/3]
Intermediates	-	.645 [2/4/8]
Advanced	-	.627 [2/6/6]

4.6.18 This environment was reacted to in a manner quite contrary to its voiceless counterpart 'k', in that it climbed into a higher (more difficult) position among the intermediates and the advanced while the beginners kept it near the median. Whereas the beginners had only three environments that were any easier, the intermediates had eight environments that were easier, while the advanced had six. Although the beginners found 'g' to be as difficult as the most highly ranked environments the intermediates and the advanced found it easier than two of the environments, ('ndz' and 'en'). In other words, the effect of voicing on this environment, as with 'b', was to lead non-native speakers into treating this as much more difficult.

4.6.19 When we compare the behavior of the different

proficiency groups with the native controls on the environments 'p', 'b', 'k' and 'g', we are struck by the differences. Firstly, the voiced environment 'g' was ranked above its voiceless counterpart 'k' by nearly all the non-natives (i.e., the effect of voicing depressed the scores), whereas the exact opposite happened amongst the natives, in that 'k' is ranked above 'g'. However, the non-native and the natives do agree with regard to the effect of voicing on 'b'. Secondly, as we have noted, our expectations as to the effect of added feature differences appear to work only at the beginner level.

4.6.20 We can summarize how these four environments behaved with respect to each other among the native and non-native groups, as well as how well they compared with our original postulation, as follows, where left to right is an increase in difficulty -:

Our Expectations	'k', 'g', 'p', 'b'
All Non-Natives	'b', 'g', 'k', 'p'
Beginners	'p', 'k', 'g', 'b'
Advanced	'g', 'p', 'k', 'b'
Natives	'p', 'k', 'b', 'g'

None of the groups above altogether agree with each other, although there is some agreement, for instance all the groups treated the voiced counterpart of 'p', namely 'b', as more difficult than 'p'.

Environment 8 / 'mp' (e.g., tramp, clamp, dump, etc.)

Controls	-	.987
All	-	.794
Beginners	-	.769 [8/6/0]
Intermediates	-	.803 [9/5/0]
Advanced	-	.812 [10/4/0]

4.6.21 In Chapter Three we considered the sequence 'mp+t' to be less salient than 'p+t' on the basis of our first criterion of perceptual difficulty, which involved a straightforward phoneme count. In other words, because this environment had the added bilabial nasal ('m') before the voiceless stop, as opposed to 'p', which did not, then this single addition was considered a potential burden to perceptual processing. However, as it turned out, this environment was consistently placed above 'p' by all groups although it was never treated as significantly easy.

4.6.22 A careful listening to how the speaker actually produced these two forms ('mp+t' and 'p+t') can readily explain the response pattern that we see between them. The sequence in 'mp+t' was in fact produced as /m+t/ with no /p/ between the /m/ and the inflectional morpheme, and as a result, our second criterion comes into play because now the number of distinctive features that are not shared is

greater between /m/+(t) than between /p/+(t) ⁶¹.

Consequently, we can now expect, based on this criterion of dissimilarity, that 'mp' would be more salient than 'p', which indeed it was. Also, the actual production of this token by the speaker reduced the number of environments of our original sequence of three (m+p+t), to just two (m+t). A further contribution to 'p's' depressed score compared with 'mp's' is that the latter's final sequence was produced unreleased which added to the burden of hearing. We should also note that the environment 'mp' does not shift position across the groups which is a characteristic of those environments that were found at either end of the scale. The natives behaved in a similar fashion to the non-natives, placing 'mp' in the second easiest position.

Environment 9 / 'ks' (e.g. tax, relax, fix, etc.)

Controls	-	.912
All	-	.679
Beginners	-	.693 [4/7/3]
Intermediates	-	.687 [2/7/5]
Advanced	-	.637 [2/7/5]

⁶¹ The distinctive features that /m/ and {t} do not share are, +/- coronal, +/- voice and +/- nasal, whereas /p/ and {t} share all features bar +/- coronal.

It should also be noted that, of course, the way these sounds were said on the tape was quite natural and that our original selection and ordering in Chapter Three was made without taking articulatory reality sufficiently into account.

4.6.23 The intermediate and the advanced groups placed this environment within the top six places, although only two other environments were more difficult. The beginners, however, placed this in the eighth position with four other environments being more problematic. This suggests that this group were better able to handle this environment than the other two groups. The controls treated this environment in a similar fashion placing it in the sixth most difficult position. Indeed, if one compares the NSCG ranking with the ALL (non-native) group, the two groups placed 'ks' in the same position, although of course the scores differed by almost 30% indicating that non-natives found this a problem.

4.6.24 This environment was originally chosen, in part, because it differed from the sixth environment 'k' by the addition of a single consonant (/s/) on the stem, which in turn contrasted with the inflected form by only one feature +/- strident. We speculated, therefore, whether this addition would affect the ability of non-natives to retrieve the morpheme's presence or absence as opposed to just 'k'. In the case of the intermediates and the advanced, who did not score as well on this as the beginners, the extension of /s/ on 'k' lowered the score compared with 'k'; that is, they treated it as more difficult, while for the beginners as well as the CGNS the addition made no difference. We

should note that the beginners here did better than the advanced and the intermediates.

4.6.25 Among the different languages, this environment was ranked pretty much in the same central position and each time they placed it above 'k'. Even so, there was a great deal of disparity among the way the four languages treated this environment. The Spanish bordered on near chance in their perception of it (47.5% / 56.5%), while the Japanese coped quite well (83.3% / 74.3%).

Environment 10 / 'mbl' (e.g. stumble, tremble, gamble, etc.)

Controls	-	.943
All	-	.683
Beginners	-	.659 [0/8/6]
Intermediates	-	.695 [4/3/7]
Advanced	-	.694 [2/8/4]

4.6.26 We had expected the learners to perform less well on this environment for the reasons given in the third chapter, and our expectations were borne out by the scores. The intermediates and the advanced groups placed this environment in the same position, while the beginners had greater difficulties and placed it two positions beyond the others. What is really quite surprising is the response of the controls who treated it amongst the easiest, scoring it higher than 'p', 'b' and 'k'. It would appear then, that for the non-native speakers the effect of the four contiguous

consonants (m+b+l+d) may have effectively conspired to reduce the saliency of this environment across all levels of proficiency. However, for the intermediates it was easier than 'ngl' with which we were directly comparing it. Indeed all the groups placed this environment below the twelfth ('ngl'), suggesting perhaps that the extra aspiration associated with the features +anterior and -back may have been of some use in retrieving the inflectional ending, as opposed to the -anterior and +back of the twelfth environment which suggests a lesser degree of saliency.

Environment 11 / 'ngl' (e.g. mangle, strangle, entangle, etc.)

Controls - .906

All - .639

Beginners - .630 [0/7/7]

Intermediates - .647 [2/4/8]

Advanced - .631 [2/6/6]

4.6.27 This environment was placed by all groups in the same position, the fourth most difficult. The intermediates treated it as more difficult than the eleventh environment ('mbl'), whereas the other two groups found it as equally as difficult. The advanced and Intermediates placed 'ndz' and 'en' above it, and hence treated them as more difficult, while for the beginners, this difference was not significant and they treated it as equally difficult as six other environments. All of this seems to be typical of non-native speaker behavior on environments that are complex, in that the effect of proficiency is reduced, while the nature

of the TL environment itself determines the extent to which the learner is able to recover the form.

4.6.28 If we compare how the controls handled the two environments 'mbl' and 'ngl', we see not only a reverse in the order, but the eleventh environment ('mbl') was also treated as much easier compared with the twelfth ('ngl'). One of the widest gaps opened up here between the natives and non-natives, with a 27% difference between the two groups.

Environment 12 / 'ndz' (e.g. plunge, singe, scrounge, etc.)

Controls - .881

All - .587

Beginners - .622 [0/7/7]

intermediates - .595 [0/2/12]

Advanced - .512 [0/2/12]

4.6.29 This environment was responded to with considerable difficulty by all groups, which is understandable if one first looks at its feature composition. Only +/- anterior and +/- strident distinguish the final two stem consonants from each other, while the final stem form and the inflection are distinguished by just +/- anterior. Secondly, the feature +voice across all three consonants undoubtedly contributed to making this such a treacherous form as to cause the Russian intermediates and the Chinese and Spanish advanced groups to score below the level of chance. Thirdly, and perhaps more importantly, unlike 'mbl'

and 'ngl', the consonant cluster does not form a separate syllable and so consists, when inflected, of four consonants in a row.

4.6.30 In trying to explain the reverse position of the scores obtained by the advanced and beginner groups, it is necessary to go within the language groups. In doing so we are again struck by the behavior of the Chinese and Japanese advanced compared to their beginner counterparts. The % scores on this environment are as follows -:

	A	C
Japanese	83.3%	51.5%
Chinese	66.2%	43.7%

This is among one of the largest gaps between proficiency groups found anywhere in our corpus, which may help to explain why the beginners as a whole did better than the advanced. The Russian and Spanish language groups did not differ very much across proficiency, hovering as they all did around the 51% mark. As for the natives, they placed this in the third most difficult position.

4.6.31 Practically all the groups did worse on this environment than on 'ngl' (10) and 'mbl' (11). This may be in part because, as we have said, 'ngl' and 'mbl' have less

features in common among their consonants in comparison with 'ndz'. This same explanation also holds for why 'en' proved so burdensome, and why 'mp' proved so easy having as it did more features that did not share the same +/-value.

Environment 13 / 'nt' (e.g. want, haunt, comment, etc.)

Controls - .930

All - .834

Beginners - .814 [11/3/0]

Intermediates - .843 [11/3/0]

Advanced - .844 [10/4/0]

Environment 14 / 'nd' (e.g. wound, land, extend, etc.)

Controls - .981

All - .836

Beginners - .828 [11/3/0]

Intermediates - .842 [11/3/0]

Advanced - .834 [10/4/0]

4.6.32 Given the set of criteria upon which subjects' responses had been predicated, we can nowhere find a more typical example of the kind of response that we had been expecting than on these two environments. It is also with these two that we get the most agreement among the languages (see chart 'All Four Languages All 3 Levels') which would suggest that it is the target language itself which determines the extent of retrieval. This is the other side of the same coin on which the least salient environments can be found.

4.6.33 As we noted in Chapter Three, these two environments

were the only ones in which the morpheme itself forms a separate syllable of the form +VC. This appears to have created a sufficiently salient environment for the subjects to score well on. The reliance by non-native speakers on the phonological context in which TL morphological material occurs, which this thesis has attempted to establish, is well supported by the result that we find here.

4.6.34 There was no difference in the treatment of these two environments among all groups and all levels, who consistently placed them within the last three positions. What is striking, however, is the behavior of the native controls who placed these two environments in quite dissimilar positions to the non-natives. Instead of treating them as among the easiest, they placed them in central positions, which suggests that dependence on environment does not play the central role for native speakers as it does for non-natives.

EXPERIMENT II.

4.7 Introduction

4.7.1 The purpose of the second experiment was to attempt to establish the extent to which the context in which morphophonemic material was embedded could determine learners' abilities to identify the presence or absence of the inflected form. The following four contexts were chosen:

- Context 1 - Uninflected followed by a consonant
(They approve the plan)
- Context 2 - Inflected followed by a consonant
(They approved the plan)
- Context 3 - Uninflected followed by a vowel
(They approve a loan)
- Context 4 - Inflected followed by a vowel
(They approved a loan)

The four contexts were chosen on the assumption that if learners relied upon the salience of the surface phonetic context in their ability to identify the presence or absence of the inflected form, then we could expect scores to vary across these four contexts in an ordered and predictable manner.

4.7.2 The main effect for context differences was not statistically significant due to the highly erratic responses on a number of sentences. This uncharacterizable behavior on just a few samples is probably attributable to the manner those particular sentences were articulated by

the speaker. However, if we look at which sentences are involved, we should note that they all concern either one of the two most complex contexts, and hence although they disallow us from making quantitative statements, they may yet stand as witnesses to the extent of the problem. The sentences on which the scores fell below chance, and in some instances well below, were:

They approved the plan.	36.0%
They advertised donuts.	45.9%
They scribbled down numbers.	29.7%
We shop till the end.	37.8%
We fished till dawn.	42.3%
They look to the left.	18.9%

As a result, the discussion that follows is necessarily only a qualitative description of the subjects' responses.

4.7.3 The performance of the subjects across the four contexts, as evidenced by their scores, seems to bear out the possibility suggested above. In the least salient of the contexts (#1 and #2), subjects showed extreme difficulties in identifying the presence or absence of the morpheme, whereas there was some slight but significant improvement on the contexts that encouraged the perceptibility of the form (#3 and #4). We can therefore assume that the effect of context had a considerable impact on the way subjects retrieved the target language material.

4.7.4 If we take the average score for each of the four

contexts, we can see how the different contexts determined the subjects' performance:

	<u>Non-Natives</u>	<u>Natives</u>
Context 1. -	54.3%	82.0%
Context 2. -	54.4%	87.0%
Context 3. -	70.9%	100.0%
Context 4. -	60.5%	98.0%

Non-Native vs Native Speaker Scores
Within Contexts

Table 21

The first two contexts are obviously far more of a problem than the third and fourth and this is what we had expected. Thus, the following vowel in the last two contexts assisted learners in recovering, the form whereas the following consonant did not. Also, subjects were better able to detect the absence of the form than its presence, which would further suggest a reliance on surface form. However, in the first two contexts there was virtually no difference in subjects' ability to recover the inflected as opposed to the uninflected form and vice versa. There were differences in performance among the different verbs (Table22).

	1	2	3	4	5
	approve,	advertise,	stroll,	scribble,	shop,
1)	50	59	52	63	37
2)	36	45	53	29	73
3)	90	79	64	77	56
4)	25	48	76	57	53

	6 fish,	7 look,	8 miss,	9 predict,	10 blend.
1)	56	18	70	41	85
2)	42	66	44	90	62
3)	87	53	81	35	83
4)	72	54	59	87	71

% Scores On Each Verb Across the Four Contexts

Table 22

4.7.5. Because of the considerable difference in performance between the native and non-native speakers in determining the absence or presence of the past tense morpheme across the various sentence contexts, it was decided to make spectrograms⁶² in order to help determine what acoustic cues natives used in retrieving the morphological material. For this purpose the following sentence pairs were selected:

- 1) They approve/approved the plan
- 2) They stroll/strolled down hill
- 3) We shop/shopped till the end
- 4) We fish/fished till dawn
- 5) They look/looked to the left
- 6) You miss/missed too much

We may summarise the performance of the natives and non-native on these six forms below

⁶² These spectrograms can be found in the Appendix

	<u>native</u> <u>speakers</u>		<u>non-native</u> <u>speakers</u>	
	(a)	(b)	(a)	(b) ⁶³
1)	90%	80%	50%	36%
2)	100%	90%	52%	53%
3)	60%	80%	37%	73%
4)	100%	60%	56%	42%
5)	100%	70%	18%	66%
6)	80%	70%	77%	44%

Native vs Non-Native Scores
on Six Sentences

Table 23

4.7.7 A cursory comparison of the two forms (a) and (b) as produced by the speaker and recorded on tape across these twelve contexts, gives the initial impression that there is no discernible difference between the two. However, both sets of subjects were asked to listen carefully and specifically for the presence or absence of the morpheme and to select accordingly. As can be seen, the native speakers are at an advantage at this task in spite of the apparent lack of any obvious difference, while non-natives were at a great loss in making an accurate identification.

4.7.8 A careful examination of the spectrograms made of these six sentences reveals a slightly increased gap between the release of the inflected form and the voicing on-set

⁶³ The (a) column represents the uninflected forms while the (b) column represents the inflected forms.

time of the following consonant compared with the non-inflected form. This gap is only a few milliseconds longer on the (b) forms than on the (a) forms. Likewise, the closure period on the inflected form (b) also appears to be slightly longer. Furthermore, the slightly darker shading of the bursts following the release of the inflected form indicates that the intensity of the burst itself may have been used as another cue. However, the formants of the following vowels does not appear to shift sufficiently across the two contexts (a) and (b) to make a difference. Thus, the cues that we have identified here as the ones used by native speakers to identify the presence/absence of the morpheme are very fine indeed, and operate at a level of description that defies any kind of possible overt training, i.e., at a level below which we cannot possibly expect the native to be made aware. It may well be that this extreme fine detail eludes the non-native speaker, and may in part be responsible for the fact that however proficient he becomes, he nevertheless remains 'outside' the language with regard to this particular ability. ⁶⁴

4.7.9 The fact that non-native speakers did so poorly here may then be partly explained, by the fact that the cue for

⁶⁴ A thorough on-line search of the Bell Laboratories speech research data base for literature that might have made some reference to the finding here resulted in no work which could be considered relevant or appropriate.

the distinction between inflected and uninflected forms discussed is sub-phonemic. As such, it is an aspect of native speaker articulation that operates at a level that escapes consciousness. This then precludes the non-native speaker access to it, and hence as a non-native speaker it is unlikely that one will ever know this as being the cue used for identifying the distinction. This may in part explain why on the first experiment non-native speakers never approached the condition of the natives. The cue is simply too finely tuned for those not operating within the language to be able to utilize. Acquisition of it may require early exposure when the learner's neurological feature detectors (see Chapter Two) are in a permissive enough state, after which neural atrophy sets in and the cue can never be invoked.

4.8 The Ten Verbs and their Four Contexts

1. Approve

	<u>Non- Native</u>	<u>Native</u>
1. They approve the plan	50.4 %	90%
2. They approved the plan	36.0 %	80%
3. They approve a loan	90.9 %	100%
4. They approved a loan	25.2 %	100%

4.8.1 In the uninflected context before a consonant (1), the absence of the morpheme was slightly more accurately perceived than in the inflected version. One explanation

for this might be that in this first uninflected context two features (+/-coronal and +/- strident) separate the stem final [v] from the following consonant while only +/- continuant differentiates the inflected form from the following consonant.

4.8.2 There is however a major difference between the uninflected and inflected forms on this verb across the third and fourth context. In the former the score was 90.9% (the highest score for any verb in any context), while in the latter it was one of the lowest 25.2%. However, this difference is accounted for by a careful listening to the tape, where it was found that in fact the speaker had barely articulated the (+ed). However, the native speakers all heard the form correctly as uninflected.

2. Advertise

	Non- <u>Native</u>	<u>Native</u>
1. They advertise donuts	59.4%	80%
2. They advertised donuts	45.9%	70%
3. They advertise apples	79.2%	100%
4. They advertised apples	48.6%	90%

4.8.3 In neither context did the subjects do well, although they detected the absence of the morpheme better than they did its presence. If we examine the feature matrix of the sentences in the appendix for this context, we can see that there is nothing separating the inflected form from the following word, i.e., they share exactly the same set of

features. In the case of the uninflected form however, there are two features (+/-continuant and +/-strident) separating the stem from the following form, and we can perhaps identify this difference as being responsible for the improvement in the score.

3. Stroll

	<u>Non-</u> <u>Native</u>	<u>Native</u>
1. They stroll down hill	52.2%	100%
2. They strolled down hill	53.0%	90%
3. They stroll in the park	64.8%	100%
4. They strolled in the park	76.5%	100%

4.8.4 In the first two contexts the subjects performed a little above the level of chance. We interpret this as evidence of the difficulty of this particular verb in these particular contexts. The dark [ɫ] is rare in the world's languages, especially in this final position. But perhaps more importantly, the context in which it occurred made it even more intangible since in #2 there are only two features not shared among the final consonants of the verb's stem and the following word's initial consonant (+/-vocalic and +/-continuant).

4.8.5 We should also note that retrieval was better on the form's presence than its absence, which may in part be understood by the fact that the /ɫ/ shares two important vowel features (+continuant and +vocalic), whereas in the

fourth context the inflected form is a consonant straddling two similar forms which contributed to its saliency.

4. Scribble

	<u>Non- Native</u>	<u>Native</u>
1. They scribble down numbers	63.9%	100%
2. They scribbled down numbers	29.7%	50%
3. They scribble on paper	77.4%	100%
4. They scribbled on paper	57.6%	100%

4.8.6 The strikingly low score achieved on context 2 can unfortunately be easily explained by the fact that the speaker produced a form that was virtually indistinguishable from that of the first context, even by the native speakers. This verb was partly selected in order to compare the effect of the addition of the /b/ before /l/, as opposed to just the /l/ of the third environment. If quantity makes a difference then we might expect subjects to experience greater difficulty here as opposed to on 'stroll', but our results are equivocal on this point since 'scribble' does better in the first and fourth context, although we cannot speak for the second. However, in the third context 'scribble' suffers considerably, falling almost 20% below 'stroll'.

5. Shop

	<u>Non- Native</u>	<u>Native</u>
1. We shop till the end	37.8%	60%
2. We shopped till the end	73.8%	80%
3. We shop at the mall	56.7%	100%
4. We shopped at the mall	53.1%	100%

4.8.7 With regard to the feature matrix that makes up this verb when it is inflected, we should note that only one feature (+/-coronal) distinguishes the stem itself from the inflected form. Likewise, the same configuration holds between the uninflected form and the following word, and furthermore, there is no distinctive feature difference between the stem final consonant of the inflected verb and the initial consonant of the word following. This, then, appears as one of the least salient of environments.

6. Fish

	<u>Non- Native</u>	<u>Native</u>
1. We fish till dawn	56.7%	100%
2. We fished till dawn	42.3%	60%
3. We fish all day	87.3%	100%
4. We fished all day	72.9%	100%

4.8.8 There are obvious problems again in the first and second contexts, which can also in part be explained in terms of the distinctive features that make up the contexts. There are three features that distinguish the uninflected form of the verb stem and the following word's initial consonant, i.e., +/- anterior, +/-continuant, +/- strident, but there are none to distinguish the inflected form and the next word's consonant.

7. Look

	<u>Non- Native</u>	<u>Native</u>
1. They look to the left	18.9%	100%
2. They looked to the left	66.6%	70%
3. They look at each one	53.1%	100%
4. They looked at each one	54.0%	90%

4.8.9 Perhaps one of the more interesting results is the gap between the verb 'look' across these two contexts (18% for context 1, and 66% for context 2). Indeed, for both natives and non-natives this was a problem verb, however the natives scored 100% in context 1 and 70% in context 2 - the opposite of the non-natives.⁶⁵ Some of the problem is understandable given the fact that the inflected form is homorganic with the following consonant, but the dissimilarity in behavior between the native and non-natives is puzzling.

4.8.10 There is no consistency in the recovery pattern between these two contexts, in that the subjects did not choose hearing the presence of the inflected form over not hearing it or vice versa. So we cannot say that a particular strategy is at work, rather each verb by itself determined its own response. In general though, there was better performance on hearing the absence than there was on

⁶⁵ A careful listening to the tape reveals that the speaker produced an extremely occluded form of the inflected ending which can explain the poor performance of the non-native speakers, however the ability of the natives to manage so well indicates that the use of acoustic cues that have yet to be investigated.

hearing the presence.

8. Miss

	<u>Non- Native</u>	<u>Native</u>
1. You miss too much	77.4%	70%
2. You missed too much	44.1%	70%
3. You miss a lot	81.0%	100%
4. You missed a lot	59.4%	100%

4.8.11 Again we have a fairly straightforward explanation for the difference between contexts 1 and 2, where the inflected form is homorganic with the following consonant. This similarity was even too much for the natives who scored only 70% on the first and second context.

9. Predict

	<u>Non- Native</u>	<u>Native</u>
1. We predict disaster	41.4%	100%
2. We predicted disaster	90.9%	100%
3. We predict a victory	35.1%	100%
4. We predicted a victory	87.3%	100%

4.8.12 This pattern is quite striking for in two of the contexts the score is among the highest the subjects achieved, while in the other two the subjects are operating at below chance. We can explain this wild swing as follows. The verb 'predict' was one of only two verbs in which the morpheme formed a separate VC syllable, and so when it occurred inflected in the contexts of 2 and 4 it was salient

enough to be detected. However, it was more salient in 2 than in 4 which reverses the trend.

4.8.13 As for the low scores in contexts 1 and 3, it is quite possible that the subjects mis-analysed the final /t/ of the stem as a morpheme, as indeed it could be in words such as 'licked', 'cracked', 'blocked' etc. and so they may have responded to the form in these contexts as if it were inflected. In other words, subjects were being sensitive to English, but in this case it didn't help them. Perhaps what this teaches us is that unfamiliarity with actual words, i.e., sounds not properly associated with meanings, was forcing the subject to mis-analyse the form. The native speakers on the other hand performed 100% across all four contexts.

11. Blend

	<u>Non-</u> <u>Native</u>	<u>Native</u>
1. You blend diced fruit	85.5%	100%
2. You blended diced fruit	62.1%	100%
3. You blend iced tea	83.7%	100%
4. You blended iced tea	71.1%	100%

4.8.14 The verb 'blend' was selected on the same basis as 'predict', except that in the case of 'blend' we have the addition of voicing. The performance on this verb was quite the opposite to 'predict', in that the uninflected form was always recovered better than the inflected form. This would

confirm our explanation of the subjects' mis-analysis of 'predict' as 'predic + t', since this was not possible for 'blend'. As a result, the uninflected form of 'blend' was correctly selected 85% as opposed to 41% for 'predict'. However, the effect of voicing contributed to subjects' difficulty in recovering the inflected form, as the score here was only 62%, as opposed to 90% for 'predict', and 71% as opposed to 87% for 'predict'.

Chapter Five

SUMMARY

5.1.1 It is a common observation that learners of English as a second or foreign language appear to often omit inflected forms in speech and writing. It has been suggested, although never actually tested, that one reason for this may be the effect of the target language morphophonological environment on perception. That is to say, not being entirely familiar with the phonological representation of English, non-native speakers may not be able to discriminate accurately morphological forms, and hence fail to reproduce them in their own second language speech.

5.1.2 Given this observation, we have in this study attempted to demonstrate (by means of a discrimination test) whether the putative relationship that is claimed between the complexity of the phonetic environment in which a morpheme can appear, and the ability on the part of non-native speakers successfully to discriminate its presence or absence, in fact exists. If we can demonstrate that learners show a critical dependence on the nature of the phonological context in which the inflected form occurs in order to be able to retrieve TL forms, then the explanation offered above for the observation stated there may begin to

take on empirical validity. We also assume that native speakers, by definition, do not depend on phonological context in this manner.

5.1.3 Fourteen phonological environments in which the past tense inflectional morpheme can occur were chosen on the basis of their varying degrees of saliency, i.e., whether they consisted of either single consonants or sequences of consonants, as well as the degree of similarity or dissimilarity among the distinctive features that they shared. An ordering was then made among the tokens based in part on such considerations of saliency. A same/different discrimination test was then devised to determine the effect of each of the fourteen environments on the learner-as-a-listener's ability to discriminate the presence or absence of the morpheme.

5.1.4 Two further possibilities were also considered as making a contribution to learners' abilities to accurately retrieve TL morphological material. These were the learners' native language and the level of proficiency attained in learning English as a second language. Thus, if a learner's native language shared a phonological inventory similar to that of English, and if his level of proficiency in English was more advanced then he would be better able to perform on the discrimination task than a learner whose

language was not similar to English in this respect, and whose level of proficiency was not as advanced.

5.1.5 Approximately 345 non-native subjects were asked to take the test, which consisted of 248 pairs of words that were presented in four modes: either both pairs were uninflected (same), or both were inflected (same), or the first of the pair was inflected, the other not (different), or the first was uninflected, while the second was not (different).

5.1.6 When the three variables discussed above (TL phonological environment, native language, and level of proficiency) are said to interact with one another, there are a number of possible outcomes that can result.

5.1.7 It was discovered that the target language phonological environment itself made the single most significant contribution to the learner's ability to retrieve the morphological material. The environments that were the most straightforward, and hence most salient, were handled by subjects with greatest accuracy. On those environments that were more complex and less salient, the presence/absence of the inflected form was significantly more difficult to detect, as evidenced by the much lower scores. In other words, the differing environments were

hierarchically ranked by the subjects in an order of difficulty based upon their degree of perceptual saliency. This was not the case for the native speakers, who found little difference among the tokens, indicating that they were unaffected by the complexities of the phonological contexts compared with the second language learners.

5.1.8 With regard to the effect of the native language, although it was expected that Russian and Spanish learners, whose languages both share more phonological features with, and inflect in a similar fashion to English, would have an advantage compared with Chinese and Japanese speakers, whose languages are most dissimilar to English, no such advantage could be detected. Indeed quite the opposite was the case.

5.1.9 With regard to increasing proficiency it was found that the beginner groups across the different languages behaved less like each other compared to the more advanced groups, which increasingly began to resemble each other. This would suggest that the impact of the L1 on the ability to retrieve TL material is greater the less proficient the learner is, and that as proficiency increases so the impact of the L1 decreases (although this effect is not very significant compared with the impact of the TL phonological environment).

5.1.10 However, as it turned out, although the more advanced groups across the different languages resembled each other more than they did the less advanced groups, they nonetheless did not do so in terms approaching the native speakers. That is to say, in spite of the increasing cohesiveness across the different first languages, the advanced groups did not achieve this in terms that reflected the impact of the target language. Thus it would appear that non-native speakers, as they increased in proficiency, took on shared characteristics, but they remained uniquely non-native.

5.1.11 In an attempt to probe further for the reason non-natives were precluded from native like performance we embedded inflected and uninflected verb forms within sentences. It was decided to then obtain spectrograms in order to view the cue used to identify the morpheme in the context of a sentence. From this it was discovered that the cue used was a within milliseconds gap or pause between the verb and what followed which was about a millisecond longer in the inflected form. It was concluded from this that the cue was beyond conscious retrieval and so could, in part, explain why non-natives failed to reach the position of the natives.

5.1.11 One of our findings that does not fit with our original hypotheses is the scores achieved by those among the beginners who were sometimes slightly better than the advanced and intermediate groups. We can in part explain this by extraneous factors, such as the collection method and the population's socio-linguistic profile.

APPENDIX ONETOKENS FOR PRE TRIAL

1)	CAT	-	CATS
2)	WANDS	-	WANDS
3)	DOG	-	DOG
4)	CAT	-	CAT
5)	DRESS	-	DRESSES
6)	WISHES	-	WISHES
7)	WAND	-	WAND
8)	DRESS	-	DRESS
9)	WISHES	-	WISH
10)	SOUP	-	SOUP
11)	DRESSES	-	DRESSES
12)	WISH	-	WISHES
13)	DOGS	-	DOGS
14)	DRESSES	-	DRESS
15)	CATS	-	CAT
16)	PICKS	-	PICKS
17)	SOUPS	-	SOUPS
18)	WAND	-	WANDS
19)	PICKS	-	PICK
20)	HORSES	-	HORSES
21)	CATS	-	CATS
22)	WANDS	-	WAND
23)	SOUPS	-	SOUP
24)	DOGS	-	DOG

25)	PICK	-	PICK
26)	WISH	-	WISH
27)	DOG	-	DOGS
29)	SOUP	-	SOUPS

APPENDIX TWOWORD LIST

1)		
TANGLE	TANGLE	
SINGLE	SINGLE	38,111,242
DISENTANGLE	DISENTANGLE	
2)		
GAG	GAGGED	
DRUG	DRUGGED	33,153,216
SHRUG	SHRUGGED	
3)		
GRAB	GRABBED	94,136,175
"SNIB"	"SNIBBED"	
PROBE	PROBED	
4)		
SHOWERED	SHOWERED	20,106,217
FIRED	FIRED	
CURED	CURED	
5)		
CLIMAX	CLIMAXED	
RELAX	RELAXED	82,207,243
INDEX	INDEXED	
6)		
PLUNGE	PLUNGE	
SCROUNGE	SCROUNGE	102,125,164
SINGE	SINGE	
7)		
ASSEMBLED	ASSEMBLE	
"SCRIMBLED"	"SCRIMBLE"	154,201,248
RESEMBLED	RESEMBLE	
8)		
CRAMP	CRAMP	
SCRIMP	SCRIMP	86,132,194
DUMP	DUMP	
9)		
RUBBLE	RUMBLE	40,134,219
10)		
OPEN	OPEN	
"CLATTEN"	"CLATTEN"	48,95,156
FASHION	FASHION	

11) SWALLOW RESCUE "NOY"	SWALLOWED RESCUED "NOYED"	36,114,130
12) HANDED WOUNDED LANDED	HAND WOUND LAND	59,116,203
13) "LINGE" ARRANGE RANGE	"LINGE" ARRANGE RANGE	58,191,222
14) FASTEN SHORTEN WIDEN	FASTENED SHORTENED WIDENED	56,135,230
15) DISSEMBLE MUMBLE GAMBLE	DISSEMBLE MUMBLE GAMBLE	71,169,215
16) CLUBBED BRIBED THROBED	CLUBBED BRIBED THROBED	133,184,249
17) BLACKEN GLISTEN STRAIGHTEN	BLACKEN GLISTEN STRAIGHTEN	100,126,220
18) GESTURE "GREAR" DISCOVER	GESTURED "GREARED" DISCOVERED	96,151,186
19) SADDLE	SADDLE	65,104,155
20) SHOWER FIRE CURE	SHOWER FIRE CURE	4,106,271
21) FRIGHTEN DARKEN LENGTHEN	FRIGHTEN DARKEN LENGTHEN	115,183,239

22)	MANGLE STRANGLE TINGLE	MANGLE STRANGLE TINGLE	166,188,223
23)	LOOKED SMIRKED "DILICKED"	LOOK SMIRK "DILICK"	57,179,212
24)	GOSSIPED WORSHIPED ESCAPED	GOSSIPED WORSHIPED ESCAPED	138,193,237
25)	MENTAL	MENTAL	49,119,231
26)	PLUGGED CLOGGED SNAGGED	PLUGGED CLOGGED SNAGGED	124,187,240
27)	REVAMPED SLUMPED TRUMPED	REVAMPED SLUMPED TRUMPED	70,109,205
28)	JINGLED ENTANGLED "BRONGLED"	JINGLE ENTANGLE "BRONGLE"	43,170,214
29)	CRY PLAY STEW	CRY PLAY STEW	87,108,141
30)	LIMP "GRIMP" STAMP	LIMPED "GRIMPED" STAMPED	68,120,233
31)	ANNEXED TRANSFIXED OUTFOXED	ANNEX TRANSFIX OUTFOX	93,165,211
32)	CRUMBLE TUMBLE	CRUMBLED TUMBLED	84,112,181

FUMBLE	FUMBLED	
33)		
GAGGED	GAG	
DRUGGED	DRUG	2,153,216
SHRUGGED	SHRUG	
34)		
RETIRED	RETIRED	
ASSURED	ASSURED	137,161,213
APPEARED	APPEARED	
35)		
"PAND"	"PANDED"	
COMMAND	COMMANDED	182,209,221
HOUND	HOUNDED	
36)		
SWALLOWED	SWALLOWED	
RESCUED	RESCUED	11,114,130
"NOYED"	"NOYED"	
37)		
MIX	MIX	
FLEX	FLEX	88,129,160
"MOX"	"MOX"	
38)		
TANGLED	TANGLED	
SINGLED	SINGLED	1,111,242
DISENTANGLED	DISENTANGLED	
39)		
SCAVENGED	SCAVENGE	
IMPINGED	IMPINGE	67,97,238
INFRINGED	INFRINGE	
40)		
RUMBLE	RUBBLE	9,134,219
41)		
REMINDED	REMIND	
EXTENDED	EXTEND	117,173,218
BLENDED	BLEND	
42)		
BUMPED	BUMPED	
TRAMPED	TRAMPED	90,144,236
CLAMPED	CLAMPED	
43)		
JINGLE	JINGLE	
ENTANGLE	ENTANGLE	28,170,214

"BRONGLE"	"BRONGLE"	
44) FROLICKED REBUKED PRICKED	FROLICKED REBUKED PRICKED	99,171,235
45) UNCLOGGED SAGGED SWIGGED	UNCLOG SAG SWIG	63,131,146
46) PROP DEVELOP SLIP	PROP DEVELOP SLIP	103,147,199
47) SNOWED ALLOWED ENJOYED	SNOWED ALLOWED ENJOYED	128,152,232
48) OPENED "CLATTENED" FASHIONED	OPEN "CLATTEN" FASHION	8,95,156
49) METAL	MENTAL	25,119,231
50) "DRIG" CATALOGUE FLOG	"DRIGGED" CATALOGUED FLOGGED	72,174,246
51) CHALLENGE HINGE REVENGE	CHALLENGE HINGE REVENGE	69,118,177
52) BORED BARED CONSIDERED	BORE BAR CONSIDER	123,190,234
53) REVOKE ATTACK EMBARK	REVOKED ATTACKED EMBARKED	83,149,176

54) AMPLE	APPLE	172,185,202
55) CAPPED SHAPED GRIPPED	CAPPED SHAPED GRIPPED	85,62,168
56) FASTEN SHORTEN WIDEN	FASTEN SHORTEN WIDEN	14,135,230
57) LOOKED SMIRKED "DILICK"	LOOKED SMIRKED "DILICKED"	23,179,212
58) "LINGED" ARRANGED RANGED	"LINGE" ARRANGE RANGE	58,191,222
59) HAND WOUND LAND	HAND WOUND LAND	12,116,203
60) CONFRONT SUPPLANT TORMENT	CONFRONT SUPPLANT TORMENT	105,122,195
61) SPANGLE MINGLE WRANGLE	SPANGLED MINGLED WRANGLED	79,145,247
62) CAP SHAPE GRIP	CAP SHAPE GRIP	55,85,168
63) UNCLOGGED SAGGED SWIGGED	UNCLOGGED SAGGED SWIGGED	45,131,146
64) PANT INVENT	PANTED INVENTED	78,157,178

COMMENT	COMMENTED	
65) SANDAL	SADDLE	19,104,155
66) PACK MOCK SQUEAK	PACKED MOCKED SQUEAKED	89,163,226
67) SCAVENGED IMPINGED INFRINGED	SCAVENGED IMPINGED INFRINGED	39,97,238
68) LIMPED "GRIMPED" STAMPED	LIMP "GRIMP" STAMP	30,120,233
69) CHALLENGE HINGE REVENGE	CHALLENGED HINGED REVENGED	51,118,177
70) REVAMPED SLUMPED TRUMPED	REVAMP SLUMP TRUMP	27,109,205
71) DISSEMBLE MUMBLE GAMBLE	DISSEMBLED MUMBLED GAMBLED	15,169,215
72) "DRIGGED" CATALOGUED FLOGGED	"DRIGGED" CATALOGUED FLOGGED	50,174,246
73) STINK	STINK	127,148,244
74) APPOINTED RELENTED AUGMENTED	APPOINTED RELENTED AUGMENTED	181,225,227
75) TAXED WAXED	TAXED WAXED	98,140,192

FIXED	FIXED	
76) PRETENDED SURROUNDED MINDED	PRETEND SURROUND MIND	200,206,245
77) STUMBLED RAMBLED TREMBLED	STUMBLED RAMBLED TREMBLED	101,139,197
78) PANTED INVENTED COMMENTED	PANT INVENT COMMENT	64,157,178
79) SPANGLED MINGLED WRANGLED	SPANGLE MINGLE WRANGLE	61,145,247
80) "BRIPPED" SNAPPED UNWRAPPED	"BRIP" SNAP UNWRAP	142,204,228
81) SET	SET	92,167,210
82) CLIMAX RELAX INDEX	CLIMAX RELAX INDEX	5,207,243
83) REVOKE ATTACK EMBARK	REVOKE ATTACK EMBARK	53,149,176
BREAK		
84) CRUMBLE TUMBLE FUMBLE	CRUMBLE TUMBLE FUMBLE	32,112,181
85) CAP SHAPE	CAPPED SHAPE	55,62,168

GRIP	GRIP	
86)		
CRAMP	CRAMPED	
SCRIMP	SCRIMPED	8,132,194
DUMP	DUMPED	
87)		
CRIED	CRIED	
PLAYED	PLAYED	29,108,141
STEWED	STEWED	
88)		
MIX	MIXED	
FLEX	FLEXED	37,129,160
"MOX"	"MOX"	
89)		
PACK	PACK	
MOCK	MOCK	66,163,226
SQUEAK	SQUEAK	
90)		
BUMP	BUMP	42,144,236
TRAMP	TRAMP	
CLAMP	CLAMP	
91)		
PERTURBED	PERTURB	
ABSORBED	ABSORB	162,196,222
DISTURB	DISTURB	
92)		
SET	SENT	81,167,210
93)		
ANNEX	ANNEXED	
TRANSFIX	TRANSFIXED	31,165,211
OUTFOX	OUTFOXED	
94)		
GRAB	GRAB	
"SNIB"	"SNIB"	3,136,175
PROBE	PROBE	
95)		
OPEN	OPENED	
"CLATTEN"	"CLATTENED"	10,48,156
FASHION	FASHIONED	
96)		
GESTURED	GESTURED	

"GREARED" DISCOVERED	"GREARED" DISCOVERED	18,151,186
97) SCAVENGE IMPINGE INFRINGE	SCAVENGED IMPINGED INFRINGED	39,67,238
98) TAXED WAXED FIXED	TAX WAX FIX	75,140,192
99) FROLICKED REBUKED PRICKED	FROLIC REBUKE PRICK	44,171,235
100) BLACKENED GLISTENED STRAIGHTENED	BLACKENED GLISTENED STRAIGHTENED	17,126,220
101) STUMBLED RAMBLED TREMBLED	STUMBLE RAMBLE TREMBLE	77,139,197
102) PLUNGED SCROUNGED SINGED	PLUNGE SCROUNGE SINGE	6,125,164
103) PROPPED DEVELOPED SLIPPED	PROPPED DEVELOPED SLIPPED	46,147,198
104) SANDAL	SANDAL	65,104,155
105) CONFRONTED SUPPLANTED TORMENTED	CONFRONT SUPPLANT TORMENT	60,122,195
106) SHOWERED FIRED CURED	SHOWER FIRE CURE	4,20,217

107)	SWABBED PRESCRIBED DISROBED	SWAB PRESCRIBE DISROBE	143,189,224,
108)	CRIED PLAYED STEWED	CRY PLAY STEW	29,87,141
109)	REVAMP SLUMP TRUMP	REVAMP SLUMP TRUMP	27,70,205
110)	HAUNTED WANTED "FUNTED"	HAUNTED WANTED "FUNTED"	113,150,159
111)	TANGLE SINGLE DISENTANGLE	TANGLED SINGLED DISENTANGLE	1,38,242
112)	CRUMBLED TUMBLED FUMBLED	CRUMBLE TUMBLE FUMBLE	32,84,181
113)	HAUNT WANT "FUNT"	HAUNTED WANTED "FUNTED"	110,150,159
114)	SWALLOWED RESCUED "NOYED"	SWALLOW RESCUE "NOY"	11,36,130
115)	FRIGHTEN DARKEN LENGTHEN	FRIGHTENED DARKENED LENGTHENED	21,183,239
116)	HANDED WOUNDED LANDED	HANDED WOUNDED LANDED	12,59,203
117)	REMIND	REMINDED	

EXTEND BLEND	EXTENDED BLENDED	41,173,218
118) CHALLENGED HINGED REVENGED	CHALLENGE HINGE REVENGE	51,69,177
119) METAL	METAL	25,49,231
120) LIMP "GRIMP" STAMP	LIMP "GRIMP" STAMP	30,68,233
121) IMPLIED CONVEYED ENJOYED	IMPLY CONVEY ENJOY	158,198,208
122) CONFRONT SUPPLANT TORMENT	CONFRONTED SUPPLANTED TORMENTED	60,105,195
123) BORED BARRED CONSIDERED	BORED BARRED CONSIDERED	52,190,234
124) PLUG CLOG SNAG	PLUG CLOG SNAG	26,187,240
125) PLUNGED SCROUNGED SINGED	PLUNGED SCROUNGED SINGED	6,102,164
126) BLACKEN GLISTEN STRAIGHTEN	BLACKENED GLISTENED STRAIGHTENED	17,100,220
127) STINK	STICK	73,148,244
128) SNOW	SNOW	

ALLOW ENJOY	ALLOW ENJOY	47,152,232
129) MIXED FLEXED "MOXED"	MIX FLEX "MOX"	37,88,160
130) SWALLOW RESCUE "NOY"	SWALLOW RESCUE "NOY"	11,36,114
131) UNCLOG SAG SWIG	UNCLOGGED SAGGED SWIGGED	45,63,146
132) CRAMPED SCRIMPED DUMPED	CRAMP SCRIMP DUMP	8,86,190
133) CLUB BRIBE THROB	CLUBBED BRIBED THROB	16,184,241
134) RUMBLE	RUMBLE	9,40,219
135) FASTENED SHORTENED WIDENED	FASTENED SHORTENED WIDENED	14,56,230
136) GRABBED "SNIBBED" PROBED	GRABBED "SNIBBED" PROBED	3,94,175
137) RETIRE ASSURE APPEAR	RETIRED ASSURED APPEARED	34,161,213
138) GOSSIPED WORSHIPPED ESCAPED	GOSSIP WORSHIP ESCAPE	24,193,237

139)	STUMBLE RAMBLE TREMBLE	STUMBLE RAMBLE TREMBLE	77,101,197
140)	TAX WAX FIX	TAX WAX FIX	75,98,192
141)	CRY PLAY STEW	CRIED PLAYED STEWED	29,87,108
142)	"BRIPPED" SNAPPED UNWRAPPED	"BRIPPED" SNAPPED UNWRAPPED	80,204,228
143)	SWAB PRESCRIBE DISROBE	SWAB PRESCRIBE DISROBE	107,189,224,
144)	BUMPED TRAMPED CLAMPED	BUMP TRAMP CLAMP	42,90,236
145)	SPANGLED MINGLED WRANGLED	SPANGLED MINGLED WRANGLED	61,79,247
146)	UNCLOG SAG SWIG	UNCLOG SAG SWIG	45,63,131
147)	PROP DEVELOP SLIP	PROPPED DEVELOPED SLIPPED	46,103,131
148)	STICK	STINK	73,127,244
149)	REVOKED	REVOKED	

ATTACKED EMBARKED	ATTACKED EMBARKED	53,83,176
150) HAUNT WANT "FUNT"	HAUNT WANT "FUNT"	110,113,159
151) GESTURE "GREAR" DISCOVER	GESTURE "GREAR" DISCOVER	18,96,186
152) SNOWED ALLOWED ENJOYED	SNOW ALLOW ENJOY	47,128,231
153) GAG DRUG SHRUG	GAG DRUG SHRUG	2,33,216
154) ASSEMBLE "SCRIMBLE" RESEMBLE	ASSEMBLED "SCRIMBLED" RESEMBLED	7,202,248
155) SADDLE	SANDAL	19,65,104
156) OPENED "CLATTENED" FASHIONED	OPENED "CLATTENED" FASHIONED	8,48,95
157) PANT INVENT COMMENT	PANT INVENT COMMENT	64,78,178
158) IMPLY CONVEY VALUE	IMPLIED CONVEYED VALUED	121,198,208
159) HAUNTED WANTED "FUNTED"	HAUNT WANT "FUNT"	110,113,150

160)	MIXED FLEXED "MOXED"	MIXED FLEXED "MOXED"	37,88,129
161)	RETIRED ASSURED APPEARED	RETIRE ASSURE APPEAR	34,137,213
162)	PERTURB ABSORB DISTURB	PERTURBED ABSORBED DISTURBED	91,196,229
163)	PACKED MOCKED SQUEAKED	PACKED MOCKED SQUEAKED	66,89,226
164)	PLUNGE SCROUNGE SINGE	PLUNGED SCROUNGED SINGED	6,102,125
165)	ANNEXED TRANSFIXED OUTFOXED	ANNEXED TRANSFIXED OUTFOXED	31,93,211
166)	MANGLED STRANGLED TINGLED	MANGLE STRANGLE TINGLE	22,223,188
167)	SENT	SET	81,92,210
168)	CAPPED SHAPED GRIPPED	CAP SHAPE GRIP	55,62,85
BREAK			
169)	DISSEMBLED MUMBLED GAMBLED	DISSEMBLED MUMBLED GAMBLED	15,71,215
170)			

JINGLED ENTANGLED "BRONGLED"	JINGLED ENTANGLED "BRONGLED"	28,43,214
171) FROLIC REBUKE PRICK	FROLIC REBUKE PRICK	44,99,235
172) APPLE	APPLE	54,186,202
173) REMIND EXTEND BLEND	REMIND EXTEND BLEND	41,117,218
174) "DRIG" CATALOGUE FLOG	"DRIG" CATALOGUE FLOG	50,72,246
175) GRABBED "SNIBBED" PROBED	GRAB "SNIB" PROBE	3,94,136
176) REVOKED ATTACKED EMBARKED	REVOKE ATTACK EMBARK	53,83,149
177) CHALLENGED HINGED REVENGED	CHALLENGED HINGED REVENGED	51,69,118
178) PANTED INVENTED COMMENTED	PANTED INVENTED COMMENTED	64,78,157
179) LOOK SMIRK "DILICK"	LOOK SMIRK "DILICK"	23,57,212
180) APPOINTED RELENTED AUGMENTED	APPOINT RELENT AUGMENT	74,225,227

181)	CRUMBLED TUMBLED FUMBLED	CRUMBLED TUMBLED FUMBLED	32,84,112
182)	"PAND COMMAND HOUND	"PAND" COMMAND HOUND	35,209,221
183)	FRIGHTENED DARKENED LENGTHENED	FRIGHTENED DARKENED LENGTHENED	21,115,239
184)	CLUB BRIBE THROB	CLUB BRIBE THROB	16,133,241
185)	AMPLE	AMPLE	54,171,202
186)	GESTURED "GREARED" DISCOVERED	GESTURE "GREAR" DISCOVER	18,96,150
187)	PLUGGED CLOGGED SNAGGED	PLUG CLOG SNAG	26,124,240
188)	MANGLE STRANGLE TINGLE	MANGLED STRANGLED TINGLED	22,166,223
189)	SWABBED PRESCRIBED DISROBE	SWABBED PRESCRIBED DISROBE	107,143,224
190)	BORE BAR CONSIDER	BORE BAR CONSIDER	52,123,234
191)	"LINGED" ARRANGED RANGED	"LINGED" ARRANGED RANGED	13,58,222

192)		
TAX	TAXED	
WAX	WAXED	75,98,140
FIX	FIXED	
193)		
GOSSIP	GOSSIPED	
WORSHIP	WORSHIPPED	24,138,237
ESCAPE	ESCAPED	
194)		
CRAMPED	CRAMPED	
SCRIMPED	SCRIMPED	8,86,132
DUMPED	DUMPED	
195)		
CONFRONTED	CONFRONTED	
SUPPLANTED	SUPPLANTED	60,105,122
TORMENTED	TORMENTED	
196)		
PERTURB	PERTURB	
ABSORB	ABSORB	91,162,229
DISTURB	DISTURB	
197)		
STUMBLE	STUMBLED	
RAMBLE	RAMBLED	77,101,139
TREMBLE	TREMBLED	
198)		
IMPLIED	IMPLIED	
CONVEYED	CONVEYED	121,158,208
VALUED	VALUED	
199)		
PROPPED	PROP	
DEVELOPED	DEVELOP	46,103,147
SLIPPED	SLIP	
200)		
PRETEND	PRETENDED	
SURROUND	SURROUNDED	76,206,245
MIND	MINDED	
201)		
ASSEMBLED	ASSEMBLED	
"SCRIMBLED"	"SCRIMBLED"	7,154,248
RESEMBLED	RESEMBLED	

202) APPLE	AMPLE	54,172,185
203) HAND WOUND LAND	HANDED WOUNDED LANDED	12,59,116
204) "BRIP" SNAP UNWRAP	"BRIPPED" SNAPPED UNWRAPPED	80,142,228
205) REVAMP SLUMP TRUMP	REVAMPED SLUMPED TRUMPED	27,70,109
206) PRETENDED EXTENDED BLENDED	PRETENDED EXTENDED BLENDED	76,200,245
207) CLIMAXED RELAXED INDEXED	CLIMAX RELAX INDEX	5,82,243
208) IMPLY CONVEY VALUE	IMPLY CONVEY VALUE	121,158,198
209) "PANDED" COMMANDED HOUNDED	"PANDED" COMMANDED HOUNDED	35,182,221
210) SENT	SENT	81,92,167
211) ANNEX TRANSFIX OUTFOX	ANNEX TRANSFIX OUTFOX	31,93,165
212) LOOK SMIRK "DILICK"	LOOKED SMIRKED "DILICKED"	23,57,179

213)	RETIRE ASSURE APPEAR	RETIRE ASSURE APPEAR	34,137,161
214)	JINGLE ENTANGLE "BRONGLE"	JINGLED ENTANGLED "BRONGLED"	28,43,170
215)	DISSEMBLED MUMBLED GAMBLED	DISSEMBLE MUMBLE GAMBLE	15,71,169
216)	GAGGED DRUGGED SHRUGGED	GAGGED DRUGGED SHRUGGED	2,33,153
217)	SHOWER FIRE CURE	SHOWERED FIRED CURED	4,20,106
218)	REMINDED EXTENDED BLENDED	REMINDED EXTENDED BLENDED	41,117,173
219)	RUBBLE	RUBBLE	9,40,134
220)	BLACKENED GLISTENED STRAIGHTENED	BLACKEN GLISTEN STRAIGHTEN	17,100,126
221)	"PANDED" COMMANDED HOUNDED	"PAND" COMMAND HOUND	35,182,209
222)	"LINGE" ARRANGE RANGE	"LINGED" ARRANGED RANGED	13,58,191
223)	MANGLED STRANGLED	MANGLED STRANGLED	22,166,188

TINGLED	TINGLED	
224)		
SWAB	SWABBED	
PRESCRIBE	PRESCRIBED	107,143,189
DISROBE	DISROBED	
225)		
APPOINT	APPOINT	
RELENT	RELENT	74,181,227
AUGMENT	AUGMENT	
226)		
PACKED	PACK	
MOCKED	MOCK	66,89,163
SQUEAKED	SQUEAK	
227)		
APPOINT	APPOINTED	
RELENT	RELENTED	74,180,225
AUGMENT	AUGMENTED	
228)		
"BRIP"	"BRIP"	
SNAP	SNAP	80,142,204
UNWRAP	UNWRAP	
229)		
PERTURBED	PERTURBED	
ABSORBED	ABSORBED	91,162,196
DISTURBED	DISTURBED	
230)		
FASTENED	FASTEN	
SHORTENED	SHORTEN	14,56,135
WIDENED	WIDEN	
231)		
METAL	METAL	25,49,119
232)		
SNOW	SNOWED	
ALLOW	ALLOWED	47,128,152
ENJOY	ENJOYED	
233)		
LIMPED	LIMPED	
"GRIMPED"	"GRIMPED"	30,68,120
STAMPED	STAMPED	

234)		
BORE	BORED	
BAR	BARRED	52,123,190
CONSIDER	CONSIDERED	
235)		
FROLIC	FROLICKED	
REBUKE	REBUKED	44,99,171
PRICK	PRICKED	
236)		
BUMP	BUMPED	
TRAMP	TRAMPED	42,90,144
CLAMP	CLAMPED	
237)		
GOSSIP	GOSSIP	
WORSHIP	WORSHIP	24,138,193
ESCAPE	ESCAPE	
238)		
SCAVENGE	SCAVENGE	
IMPINGE	IMPINGE	39,67,97
INFRINGE	INFRINGE	
239)		
FRIGHTENED	FRIGHTEN	
DARKENED	DARKEN	21,115,183
LENGTHENED	LENGTHEN	
240)		
PLUG	PLUGGED	
"CLOG"	"CLOGGED"	26,124,187
SNAG	SNAGGED	
241)		
CLUBBED	CLUB	
BRIBED	BRIBE	16,133,184
THROBED	THROB	
242)		
TANGLED	TANGLE	
SINGLED	SINGLE	1,38,111
DISENTANGLED	DISENTANGLE	
243)		
CLIMAXED	CLIMAXED	
RELAXED	RELAXED	5,82,207
INDEXED	INDEXED	
244)		
STICK	STICK	73,127,148

245)			
PRETEND	PRETEND		
SURROUND	SURROUND	76,200,206	
MIND	MIND		
246)			
"DRIGGED"	"DRIG"		
CATALOGUED	CATALOGUE	50,72,174	
FLOGGED	FLOG		
247)			
SPANGLE	SPANGLE		
MINGLE	MINGLE	61,79,145	
WRANGLE	WRANGLE		
248)			
ASSEMBLE	ASSEMBLE		
"SCRIMBLE"	"SCRIMBLE"	7,154,201	
RESEMBLE	RESEMBLE		

THE END

APPENDIX THREEThe Distribution of the Environments
Across the Tapes

Tape I	Tape II	Tape III
ENVIRONMENT 1.		
cry swallow imply snow	play plough rescue allow	stew "noy" value enjoy

-		
ENVIRONMENT 2.		
bore shower retire gesture	fire bar assure "grear"	cure consider appear discover

-		
ENVIRONMENT 3.		
fasten frighten open blacken	shorten darken "clatten" glisten	widen lengthen fashion straighten

-		
ENVIRONMENT 4.		
cap "brip" gossip prop	shape snap worship develop	grip unwrap escape slip

ENVIRONMENT 5.		
club grab perturb swab	bribe "snib" absorb prescribe	throb probe disturb disrobe

ENVIRONMENT 6.

look	smirk	"dilick"
pack	mock	squeak
frolic	rebuke	prick
revoke	attack	embark

ENVIRONMENT 7.

gag	drug	shrug
plug	clog	snag
"drig"	catalogue	flog
unclog	sag	swig

ENVIRONMENT 8.

bump	tramp	clamp
limp	"grimp"	stamp
revamp	slump	trump
cramp	scrip	dump

ENVIRONMENT 9.

tax	wax	fix
mix	flex	"mox"
annex	transfix	outfox
climax	relax	index

ENVIRONMENT 10.

mangle	strangle	tingle
jingle	entangle	"brongle"
spangle	mingle	wrangle
tangle	single	disentangle

ENVIRONMENT 11.

stumble	ramble	tremble
crumble	tumble	fumble

assemble
disassemble

"scrimble"
mumble

resemble
gamble

ENVIRONMENT 12.

plunge
"linge"
scavenge
challenge

scrounge
arrange
impinge
hinge

singe
range
infringe
revenge

ENVIRONMENT 13.

haunt
pant
confront
appoint

want
invent
supplant
relent

"funt"
comment
torment
augment

-
ENVIRONMENT 14.

hand
"pand"
remind
pretend

wound
command
extend
surround

land
hound
blend
mind

DISTRACTORS

metal / mental
rubble / rumble
set / sent

saddle / sandal
apple / ample
stick / stink

APPENDIX FOUR

Feature Matrixes of Sentences

1. They approved the plan

v	+	{d}	#	#	th
- vocalic		- vocalic			- vocalic
+ consonantal		+ consonantal			+ consonantal
- high		- high			- high
- back		- back			- back
- low		- low			- low
+ anterior		+ anterior			+ anterior
- coronal		+ coronal			+ coronal
+ voice		+ voice			+ voice
+ continuant		- continuant			+ continuant
- nasal		- nasal			- nasal
+ strident		- strident			- strident

2. You missed too much

s	+	{t}	#	#	t
- vocalic		- vocalic			- vocalic
+ consonantal		+ consonantal			+ consonantal
- high		- high			- high
- back		- back			- back
- low		- low			- low
+ anterior		+ anterior			+ anterior
+ coronal		+ coronal			+ coronal
- voice		- voice			- voice
+ continuant		- continuant			- continuant
- nasal		- nasal			- nasal
+ strident		- strident			- strident

3. We shopped till dawn

p	+	{t}	#	#	t
- vocalic		- vocalic			- vocalic
+ consonantal		+ consonantal			+ consonantal
- high		- high			- high
- back		- back			- back
- low		- low			- low
+ anterior		+ anterior			+ anterior
- coronal		+ coronal			+ coronal
- voice		- voice			- voice
- continuant		- continuant			- continuant
- nasal		- nasal			- nasal
- strident		- strident			- strident

4. We fished till dawn

s	+	{t}	#	#	t
- vocalic		- vocalic			- vocalic
+ consonantal		+ consonantal			+ consonantal
+ high		- high			- high
- back		- back			- back
- low		- low			- low
- anterior		+ anterior			+ anterior
+ coronal		+ coronal			+ coronal
- voice		- voice			- voice
+ continuant		- continuant			- continuant
- nasal		- nasal			- nasal
+ strident		- strident			- strident

5. They looked to the left

k	+	{t}	#	#	t
- vocalic		- vocalic			- vocalic
+ consonantal		+ consonantal			+ consonantal
+ high		- high			- high
+ back		- back			- back
- low		- low			- low
- anterior		+ anterior			+ anterior
- coronal		+ coronal			+ coronal
- voice		- voice			- voice
- continuant		- continuant			- continuant
- nasal		- nasal			- nasal
- strident		- strident			- strident

6. They strolled down the hill

l	+	{d}	#	#	d
+ vocalic		- vocalic			- vocalic
+ consonantal		+ consonantal			+ consonantal
- high		- high			- high
- back		- back			- back
- low		- low			- low
+ anterior		+ anterior			+ anterior
+ coronal		+ coronal			+ coronal
+ voice		+ voice			+ voice
+ continuant		- continuant			- continuant
- nasal		- nasal			- nasal
- strident		- strident			- strident

7.

They scribbled down numbers

b	+	l	#	#	d
- vocalic		+ vocalic			- vocalic
+ consonantal		+ consonantal			+ consonantal
- high		- high			- high
- back		- back			- back
- low		- low			- low
+ anterior		+ anterior			+ anterior
- coronal		+ coronal			+ coronal
+ voice		+ voice			+ voice
- continuant		+ continuant			- continuant
- nasal		- nasal			- nasal
- strident		- strident			- strident

8.

They advertized doughnuts

z	+	d	#	#	d
- vocalic		- vocalic			- vocalic
+ consonantal		+ consonantal			+ consonantal
- high		- high			- high
- back		- back			- back
- low		- low			- low
+ anterior		+ anterior			+ anterior
+ coronal		+ coronal			+ coronal
+ voice		+ voice			+ voice
+ continuant		- continuant			- continuant
- nasal		- nasal			- nasal
+ strident		- strident			- strident

APPENDIX FIVESentences Answer Sheet

PRESENT

PAST

1.	A. They approve a loan	B. They approved a loan
2.	A. They advertise donuts	B. They advertised donuts
3.	A. They predict a victory	B. They predicted a victory
4.	A. You miss too much	B. You missed too much
5.	A. We shop at the mall	B. We shopped at the mall
6.	A. You blend iced tea	B. You blended iced tea
7.	A. We fish till dawn	B. We fished till dawn
8.	A. They look to the left	B. They looked to the left
9.	A. They stroll in the park	B. They strolled in the park
10.	A. They approve the plan	B. They approved the plan
11.	A. We fish till dawn	B. We fished till dawn
12.	A. They advertise apples	B. They advertised apples
13.	A. We shop at the mall	B. We shopped at the mall
14.	A. They stroll down the hill	B. They strolled down the hill
15.	A. We predict disaster	B. We predicted disaster

16. A. They look at each one B. They looked at each one
17. A. They scribble down the numbers
 B. They scribbled down numbers
18. A. You miss a lot B. You missed a lot
- 19 A. We shop till the end B. We shopped till the end
20. A. They scribble on paper B. They scribbled on paper
21. A. They approve the plan B. They approved the plan
22. A. They advertise donuts B. They advertised donuts
23. A. They stroll in the park B. They strolled in the park
24. A. You blend iced tea B. You blended iced tea
25. A. They scribble down numbers
 B. They scribbled down numbers
26. A. They look to the left B. They looked to the left
27. A. We fish all day B. We fished all day
28. A. You blend diced fruit B. You blended diced fruit
29. A. You miss too much B. You missed too much
30. A. They scribble on paper B. They scribbled on paper
31. A. We shopped till the end B. We shopped till the end
32. A. They look at each one B. They looked at each one

33.	A. You miss a lot	B. You missed a lot
34.	A. We predict a victory	B. We predicted a victory
35.	A. They stroll down the hill	B. They strolled down the hill
36.	A. We fish all day	B. We fished all day
37.	A. We predict disaster	B. We predicted disaster
38.	A. They advertise apples	B. They advertised apples
39.	A. You blend diced fruit	B. You blended diced fruit
40.	A. They approve a loan	B. They approved a loan

APPENDIX SIXHow the Scores Were Computed

1 = Same 2 = different

AAA
 12212122211122112112112211121221122122121222111112212121111
 122211122111212212222121111212212112221212211212122211222211
 1211
 JA16A
 12211122211212112112112211121121122122121222121111111121221
 11121111111112222221122121211211222121221112122121222111
 1111
 TH02A
 112121222121221122211121211211212221211212122111211121112
 21221112122122222211211222121121112111121121122111122112
 1111
 CH19A
 122121212112211121222122111212211221221222211221212112222121
 12221112212112222222221121212222112221211211212122221221221
 1211
 KR04A
 122121111221211211121221121121122122122221111111121121111
 11221112211112221122212111122221211222121121212122211221111
 1211
 KR03A
 122121222112121121121212122111211221221212221221112212221111
 1122111221111121222212112121211211222121221121122221222112
 1111
 CH18A
 122121222112211222112122221211221221221121211121212212222211
 11222111212111222222211121211222221122222121121222222222121
 2211
 CH17A
 122121222212111121112121211211221221222112211211111211222221
 112211122221112222222112111222212112221211212112112122111
 1111
 CH16A
 1211212221122212211221211121122122122111212221112212122111
 1212112221111122222221111112112112221212211212122221222111
 1211
 CH13A
 122121222112122121111111121112212212211121122121221111221
 11212211121112121122211212111111121122121121112121121122
 2111
 CH15A
 2221212221222211222121221112112112112211121111112222122111
 1121111212211221222122112221222211222121121111211221111221
 1211
 SP36A
 1221122211111112211112221112211222211111211211211112121111
 11112111222112121121221121112211211221212111222111111111

1111
CH21A
22211112211222112112112112112221222121222121221212212111
11121122221111222222211122212122112222222121222221122221
1211
CH20A
12212121211212211121221112112112212111221112111221112111
1122121211111221222212111212122112221112112112122111112
1211
OU01A
1222211211121122111122111212211221211112212111121112111
2212111211111221221111111122121122111221221212121122111
2111
GR02A
1221212221122112211211221112222112212212122212112221121112
121211122212112212211121121222212112221212221212121122111
1211
JA17A1121212211112211211211222111221122122122221111111121
21112

APPENDIX SEVEN
SCORES ON WORD PAIRS

The within means significance numbers are -:

ALL	.033
ALL A	.059
ALL B	.046
ALL C	.071
JAPANESE	.077
CHINESE	.071
RUSSIAN	.062
SPANISH	.079
OTHERS	.066
LAST	.094
NATIVES	.064

For The Analysis Based of Materials Variance
the numbers are -:

ALL	.125
ALL A	.106
ALL B	.142
ALL C	.171
C-RUSSIANS	.197
JAPANESE	.165
CHINESE	.139
RUSSIAN	.204
SPANISH	.128
OTHERS	.127
NATIVES	.119

All

Env	Score
ndz	58771
en	58941
ngl	63918
b	65138
g	65191
ks	67960
mb1	68387
k	71018
v	71804
vr	74381
p	76643
dis	79401
mp	79443
nt	83461
nd	83654

Controls

Env	Score
b	84340
g	86240
ndz	88100
p	90600
ngl	90600
ks	91220
nt	93080
g	93120
en	94350
mb1	94350
dis	96650
nd	98110
vr	98120
mp	98740
v	98740

BY PROFICIENCY

<u>Level</u> A		<u>Level</u> B		<u>Level</u> C	
Beginners		Intermediate		Advanced	
Env	Score	Env	Score	Env	Score
ndz	62297	en	59092	ndz	51250
b	63013	ndz	59557	en	51959
en	63099	g	64520	g	62764
ngl	63099	ngl	64754	mb1	63189
mb1	65960	b	66685	ks	63748
k	67297	ks	68785	b	64755
g	67743	mb1	69543	mb1	69436
ks	69347	v	72342	v	69570
vr	71674	k	73165	vr	70566
p	72211	p	77719	k	71714
v	72386	vr	77720	dis	76200
mp	76940	mp	80349	p	81080
dis	79733	dis	80500	mp	81223
nt	81404	nd	84259	nd	83493
nd	82830	nt	84384	nt	84489

Level - C Without Russians

Env	Score
en	46608
ndz	50692
ks	63192
g	63681
b	66331
ngl	68250
v	69438
vr	72565
mb1	73054
k	75462
dis	77854
mp	80981
p	83142
nt	83385
nd	85304

BY LANGUAGE

CHINESE

Env	Score
ndz	62104
en	65480
ngl	65600
b	67978
g	68976
mb1	70220
ks	71354
k	71852
v	74470
p	76100
vr	77724
nt	78976
dis	80052
nd	80222
mp	80472

JAPANESE

Env	Score
en	61339
ndz	65121
g	71376
b	73085
mb1	73658
ks	77242
v	77815
mb1	78388
k	80842
p	82364
dis	83927
mp	85391
vr	85779
nt	88233
nd	88424

SPANISH

Env	Score
ndz	51361
b	53625
ngl	53800
ks	54317
en	55358
mb1	56406
g	60564
vr	61606
k	62303
v	64725
mp	72200
p	73411
dis	80758
nt	81053
nd	82958

RUSSIANS

Env	Score
ndz	51227
en	54693
ngl	56638
g	58589
mb1	62896
ks	64553
b	65396
v	66218
k	68591
vr	70942
dis	73211
p	78451
mp	80669
nd	81780
nt	85253

OTHERS

Env	Score
en	57432
ndz	62807
b	65112
g	66425
ngl	68942
ks	70916
k	72018
mb1	72891
p	74423
v	74867
vr	75632
mp	78704
dis	80239
nt	84739
nd	85821

Ordering

ALL FOUR LANGUAGES

Level A

RUA	SPA	JAA	CHA
ndz - 514	b - 522	en - 708	ndz - 662
en - 548	ngl - 531	b - 708	ngl - 664
ngl - 572	ndz - 535	p - 729	mb1 - 668
g - 577	en - 544	ngl - 792	k - 678
v - 615	mb1 - 558	mb1 - 812	b - 684
ks - 615	k - 567	k - 812	en - 706
mb1 - 630	ks - 567	g - 812	p - 706
b - 654	vr - 580	ks - 833	g - 740
k - 692	g - 594	ndz - 833	ks - 744
dis - 702	v - 625	vr - 854	nt - 744
vr - 711	mp - 687	nd - 875	vr - 762
mp - 740	p - 723	v - 896	v - 775
p - 745	nd - 777	nt - 917	nd - 812
nt - 836	dis - 818	dis - 930	dis - 812
nd - 841	nt - 844	mp - 937	mp - 818

Level B

RUB	SPB	JAB	CHB
en - 482	ndz - 515	en - 633	ndz - 611
ndz - 500	ngl - 529	ngl - 676	en - 641
g - 558	b - 537	g - 713	g - 664
ngl - 571	ks - 544	ngl - 744	ngl - 673
mb1 - 611	mb1 - 551	b - 753	b - 676
v - 660	en - 588	ks - 775	ks - 706
ks - 674	g - 643	mb1 - 787	mb1 - 724
b - 692	vr - 658	v - 795	v - 724
k - 710	k - 658	k - 801	k - 747
vr - 750	v - 669	p - 821	p - 791
dis - 753	p - 709	dis - 829	mp - 794
nd - 808	mp - 739	mp - 841	vr - 796
p - 826	nt - 779	vr - 855	nd - 798
mp - 857	dis - 809	nd - 889	dis - 798
nt - 857	nd - 853	nt - 889	nt - 822

Level C

RUC	SPC	JAC	CHC
ndz - 521	ndz - 450	ndz - 515	en - 437
ngl - 559	en - 462	en - 523	ndz - 437
en - 597	ks - 475	g - 679	g - 583
g - 614	g - 512	b - 680	ks - 583
b - 625	b - 575	v - 687	ngl - 583
mb1 - 642	vr - 575	ngl - 695	b - 687
ks - 645	ngl - 587	ks - 742	vr - 708
k - 663	mb1 - 625	mb1 - 765	v - 729
vr - 677	v - 637	nt - 812	k - 729
v - 698	k - 662	k - 828	mb1 - 729
dis - 738	mp - 762	dis - 833	dis - 750
p - 781	dis - 775	mp - 859	nd - 770
nd - 809	nt - 825	vr - 867	mp - 812
mp - 816	p - 850	p - 867	nt - 812
nt - 861	nd - 900	nd - 875	p - 854

ALL FOUR LANGS ALL 3 LEVELS TOGETHER

	v	vr	en	p	b	k	g	mp	ks	ndz	mb1	ng1	nt	nd	dis
CH	744	777	654	761	679	718	689	804	713	621	702	656	789	802	800
JA	778	857	613	823	730	808	713	853	772	651	783	736	882	884	839
SP	647	616	553	734	536	623	605	722	543	513	564	538	810	829	807
RU	662	709	546	784	653	685	585	806	645	512	628	566	852	817	732

LEVEL - A - FOUR LANGUAGES

	v	vr	en	p	b	k	g	mp	ks	ndz	mb1	ng1	nt	nd	dis
RUA	615	711	548	745	654	692	577	740	615	514	630	572	836	841	702
JAA	896	854	708	729	708	812	812	937	833	833	812	792	917	875	930
CHA	775	762	706	706	684	678	740	818	744	662	668	644	744	812	812
SPA	625	580	544	723	522	567	594	687	567	535	558	531	844	777	818

LEVEL - B - FOUR LANGUAGES

	v	vr	en	p	b	k	g	mp	ks	ndz	mb1	ng1	nt	nd	dis
RUB	660	750	482	826	692	710	558	857	674	500	611	571	857	808	753
JAB	795	855	633	821	753	801	713	841	775	676	787	744	889	889	829
CHB	724	796	641	791	676	747	664	794	706	611	724	673	822	798	798
SPB	669	658	588	709	537	658	643	739	544	515	551	529	779	853	809

LEVEL - C - FOUR LANGUAGES

	v	vr	en	p	b	k	g	mp	ks	ndz	mb1	ng1	nt	nd	dis
RUC	698	677	597	781	625	663	614	816	645	521	642	559	861	809	738
JAC	687	867	523	867	680	828	679	859	742	515	765	695	851	875	833
CHC	729	708	437	854	687	729	583	812	583	437	729	583	812	770	750
SPC	637	575	462	850	575	662	512	762	475	450	625	587	825	900	775

ALL (non-Natives) NAT(ives) Other (non-natives)

	v	vr	en	p	b	k	g	mp	ks	ndz	mb1	ng1	nt	nd	dis
ALL	718	743	589	766	651	710	651	794	679	587	718	639	834	836	794
NAT	987	981	943	906	843	862	931	987	912	881	943	906	930	981	966
OTH	748	756	574	744	651	720	664	787	709	628	748	689	847	858	802

OTHER LANGUAGES

LEVEL A (Beginners)

	v	vr	en	p	b	k	g	mp	ks	ndz	mb1	ng1	nt	nd	dis
2AR	875	781	781	719	719	719	656	781	813	750	781	656	906	844	833
2GR	750	750	656	719	656	781	656	781	844	750	719	750	844	969	771
1IT	1000	937	687	875	750	875	937	812	812	875	937	812	1000	875	958
3KR	750	687	687	771	625	771	687	792	833	687	729	687	916	916	778
3PT	750	792	458	708	687	687	729	833	708	583	646	646	729	875	847
1TH	625	750	562	437	437	500	625	437	500	625	437	562	687	937	750
3TU	812	687	687	812	583	666	791	895	708	583	708	729	896	875	889

LEVEL B (Intermediate)

	v	vr	en	p	b	k	g	mp	ks	ndz	mb1	ng1	nt	nd	dis
7AR	687	848	580	767	670	714	625	821	723	589	732	678	857	893	803
3FR	791	854	708	666	542	708	646	854	729	667	771	708	1000	958	875
2HE	844	812	438	781	625	719	562	812	625	656	813	594	844	937	896
1IR	750	687	437	875	562	625	500	875	500	312	562	625	875	812	750
5KR	762	800	687	837	700	762	700	837	762	625	712	712	852	925	808
3PL	666	729	562	729	771	750	687	791	750	729	812	708	771	833	805
2TH	719	719	625	625	844	688	594	750	594	625	594	500	906	750	833
2TU	812	750	437	813	625	656	500	750	688	531	750	594	844	750	771

LEVEL C (Advanced)

	v	vr	en	p	b	k	g	mp	ks	ndz	mb1	ng1	nt	nd	dis
2GE	712	750	406	844	625	812	781	906	687	719	875	750	937	906	833
1GR	812	812	187	687	812	875	625	937	562	437	812	875	812	1000	708
1IR	812	562	500	875	750	625	750	625	625	687	687	625	750	812	833
1IT	750	812	500	875	687	875	750	875	625	625	750	937	937	937	791
2TU	500	469	469	625	719	813	594	719	594	375	625	656	656	531	625

NATIVE SPEAKER CONTROLS

b) 84340		k) 86240		ndz) 88100	
k	- 0.01900	b	- 0.01900	b	- 0.03760
ndz	- 0.03760	ndz	- 0.01860	k	- 0.01860
p	- 0.06260	p	- 0.04360	p	- 0.02500
ngl	- 0.06260	ngl	- 0.04360	ngl	- 0.02500
ks	- 0.06880	ks	- 0.04980	ks	- 0.03120
nt	- 0.87400	nt	- 0.06840	nt	- 0.04980
g	- 0.87400	g	- 0.06880	g	- 0.05020
en	- 0.10010	en	- 0.08110	en	- 0.06250
mb1	- 0.10010	mb1	- 0.08110	mb1	- 0.06250
dis	- 0.12310	dis	- 0.10410	dis	- 0.08550
nd	- 0.13770	nd	- 0.11870	nd	- 0.10010
vr	- 0.13780	vr	- 0.11880	vr	- 0.10020
mp	- 0.14400	mp	- 0.12500	mp	- 0.10640
v	- 0.14400	v	- 0.12500	v	- 0.10640

p) 90600		ngl) 90600		ks) 91220	
b	- 0.06260	b	- 0.06260	b	- 0.06880
k	- 0.04360	k	- 0.04360	k	- 0.04980
ndz	- 0.02500	ndz	- 0.02500	ndz	- 0.03120
ngl	- 0.00000	p	- 0.00000	p	- 0.00620
ks	- 0.00620	ks	- 0.00620	ngl	- 0.00620
nt	- 0.02480	nt	- 0.02480	nt	- 0.01860
g	- 0.02520	g	- 0.02520	g	- 0.01900
en	- 0.03750	en	- 0.03750	en	- 0.03130
mb1	- 0.03750	mb1	- 0.03750	mb1	- 0.03130
dis	- 0.06050	dis	- 0.06050	dis	- 0.05430
nd	- 0.07510	nd	- 0.07510	nd	- 0.06890
vr	- 0.07520	vr	- 0.07520	vr	- 0.06900
mp	- 0.08140	mp	- 0.08140	mp	- 0.07520
v	- 0.08140	v	- 0.08140	v	- 0.07520

nt) 93080			g) 93120			en) 94350		
b	-	0.06840	b	-	0.06880	b	-	0.10010
k	-	0.06840	k	-	0.06880	k	-	0.08110
ndz	-	0.04980	ndz	-	0.05020	ndz	-	0.06250
p	-	0.02480	p	-	0.02520	p	-	0.03750
ngl	-	0.02480	ngl	-	0.02520	mb1	-	0.03750
ks	-	0.01860	ks	-	0.01900	ks	-	0.03130
g	-	0.00040	nt	-	0.00040	nt	-	0.01270
en	-	0.01270	en	-	0.01230	g	-	0.01230
mb1	-	0.01270	mb1	-	0.01230	mb1	-	0.00000
dis	-	0.03570	dis	-	0.03530	dis	-	0.02300
nd	-	0.05030	nd	-	0.04990	nd	-	0.03760
vr	-	0.05040	vr	-	0.05000	vr	-	0.03770
mp	-	0.05660	mp	-	0.05620	mp	-	0.04390
v	-	0.05660	v	-	0.05620	v	-	0.04390
mb1) 94350			dis) 96650			nd) 98110		
b	-	0.10010	b	-	0.12310	b	-	0.13770
k	-	0.08110	k	-	0.10410	k	-	0.11870
ndz	-	0.06250	ndz	-	0.08550	ndz	-	0.10010
p	-	0.03750	p	-	0.06050	p	-	0.07510
ngl	-	0.03750	ngl	-	0.06050	ngl	-	0.07510
ks	-	0.03130	ks	-	0.05430	ks	-	0.06890
nt	-	0.01230	nt	-	0.03570	nt	-	0.05030
g	-	0.01230	g	-	0.03530	g	-	0.04990
en	-	0.00000	en	-	0.02300	en	-	0.03760
mb1	-	0.02300	mb1	-	0.02300	mb1	-	0.03760
nd	-	0.03760	nd	-	0.01460	nd	-	0.01460
vr	-	0.03770	vr	-	0.01470	vr	-	0.00010
mp	-	0.04390	mp	-	0.02090	mp	-	0.00630
v	-	0.04390	v	-	0.02090	v	-	0.00630
vr) 98120			mp) 98740			v) 98740		
b	-	0.13780	b	-	0.14400	b	-	0.14400
k	-	0.11880	k	-	0.12500	k	-	0.12500
ndz	-	0.10020	ndz	-	0.10640	ndz	-	0.10640
p	-	0.07520	p	-	0.08140	p	-	0.08140
ngl	-	0.07520	ngl	-	0.08140	ngl	-	0.08140
ks	-	0.06900	ks	-	0.07520	ks	-	0.07520
nt	-	0.05040	nt	-	0.05660	nt	-	0.05660
g	-	0.05000	g	-	0.05620	g	-	0.05620
en	-	0.03770	en	-	0.04390	en	-	0.04390
mb1	-	0.03770	mb1	-	0.04390	mb1	-	0.04390
dis	-	0.01470	dis	-	0.02090	dis	-	0.02090
nd	-	0.00010	nd	-	0.00630	nd	-	0.00630
mp	-	0.00620	vr	-	0.00620	vr	-	0.00620
v	-	0.00620	v	-	0.00000	mp	-	0.00000

ALL

ndz) 58771		en) 58941		mb1) 63918	
en	- 0.00170	ndz	- 0.00170	ndz	- 0.05147
ngl	- 0.05147	ngl	- 0.04977	en	- 0.04977
b	- 0.06367	b	- 0.06197	b	- 0.01220
g	- 0.06420	g	- 0.06250	g	- 0.01273
ks	- 0.09189	ks	- 0.09019	ks	- 0.04042
mb1	- 0.09616	mb1	- 0.09446	mb1	- 0.04469
k	- 0.12247	k	- 0.12077	k	- 0.07100
v	- 0.13033	v	- 0.12863	v	- 0.07886
vr	- 0.15610	vr	- 0.15440	vr	- 0.10463
p	- 0.17872	p	- 0.17702	p	- 0.12725
dis	- 0.20630	dis	- 0.20460	dis	- 0.15483
mp	- 0.20672	mp	- 0.20502	mp	- 0.15525
nt	- 0.24690	nt	- 0.24520	nt	- 0.19543
nd	- 0.24883	nd	- 0.24713	nd	- 0.19736

b) 65138		g) 65191		ks) 67960	
ndz	- 0.06367	ndz	- 0.06420	ndz	- 0.09189
en	- 0.06197	en	- 0.06250	en	- 0.09019
mb1	- 0.01220	mb1	- 0.01273	mb1	- 0.04042
g	- 0.00053	b	- 0.00053	g	- 0.02822
ks	- 0.02822	ks	- 0.02769	b	- 0.02769
mb1	- 0.03249	mb1	- 0.03196	mb1	- 0.00427
k	- 0.05880	k	- 0.05827	k	- 0.03058
v	- 0.06666	v	- 0.06613	v	- 0.03844
vr	- 0.09243	vr	- 0.09190	vr	- 0.06421
p	- 0.11505	p	- 0.11452	p	- 0.08683
dis	- 0.14263	dis	- 0.14210	dis	- 0.11441
mp	- 0.14305	mp	- 0.14252	mp	- 0.11483
nt	- 0.18323	nt	- 0.18270	nt	- 0.15501
nd	- 0.18516	nd	- 0.18463	nd	- 0.15694

mb1)	68387	k)	71018	v)	71804
ndz	- 0.09616	ndz	- 0.12247	ndz	- 0.13033
en	- 0.09446	en	- 0.12077	en	- 0.12863
ngl	- 0.04469	ngl	- 0.07100	ngl	- 0.07886
b	- 0.03249	b	- 0.05880	b	- 0.06666
g	- 0.03196	g	- 0.05827	g	- 0.06613
ks	- 0.00427	ks	- 0.03058	ks	- 0.03844
k	- 0.02631	mb1	- 0.02631	mb1	- 0.03417
v	- 0.03417	v	- 0.00786	k	- 0.00786
vr	- 0.05994	vr	- 0.03363	vr	- 0.02577
p	- 0.08256	p	- 0.05625	p	- 0.04839
dis	- 0.11014	dis	- 0.08383	dis	- 0.07597
mp	- 0.11056	mp	- 0.08425	mp	- 0.07639
nt	- 0.15074	nt	- 0.12443	nt	- 0.11657
nd	- 0.15267	nd	- 0.12636	nd	- 0.11850
vr)	74381	p)	76643	dis)	79401
ndz	- 0.15610	ndz	- 0.17872	ndz	- 0.20630
en	- 0.15440	en	- 0.17702	en	- 0.20460
ngl	- 0.10463	ngl	- 0.12725	ngl	- 0.15483
b	- 0.09243	b	- 0.11505	b	- 0.14263
g	- 0.09190	g	- 0.11452	g	- 0.14210
ks	- 0.06421	ks	- 0.08683	ks	- 0.11441
mb1	- 0.05994	mb1	- 0.08256	mb1	- 0.11014
k	- 0.03363	k	- 0.05625	k	- 0.08383
v	- 0.02577	v	- 0.04839	v	- 0.07597
p	- 0.02262	vr	- 0.02262	vr	- 0.05020
dis	- 0.05020	dis	- 0.02758	p	- 0.02758
mp	- 0.05062	mp	- 0.02880	mp	- 0.00042
nt	- 0.09080	nt	- 0.06818	nt	- 0.04060
nd	- 0.09273	nd	- 0.07011	nd	- 0.04253
mp)	79443	nt)	83461	nd)	83654
ndz	- 0.20672	ndz	- 0.24690	ndz	- 0.24883
en	- 0.20502	en	- 0.24520	en	- 0.24713
ngl	- 0.15525	ngl	- 0.19543	ngl	- 0.19736
b	- 0.14305	b	- 0.18323	b	- 0.18516
g	- 0.14252	g	- 0.18270	g	- 0.18463
ks	- 0.11483	ks	- 0.15501	ks	- 0.15694
mb1	- 0.11056	mb1	- 0.15074	mb1	- 0.15267
k	- 0.08425	k	- 0.12443	k	- 0.12636
v	- 0.07639	v	- 0.11657	v	- 0.11850
vr	- 0.05062	vr	- 0.09080	vr	- 0.09273
p	- 0.02800	p	- 0.06818	p	- 0.07011
dis	- 0.00042	dis	- 0.04060	dis	- 0.04253
nt	- 0.04018	mp	- 0.04018	mp	- 0.04211
nd	- 0.04211	nd	- 0.00193	nt	- 0.00193

BY PROFICIENCY

Level A - Beginners

ndz) 62297	b) 63013	ngl) & en) 63099
b - 0.00716	ndz - 0.00716	ndz - 0.00802
en - 0.00802	en - 0.00086	b - 0.00086
ngl - 0.00802	ngl - 0.00086	en - 0.00076
mb1 - 0.00663	mb1 - 0.02947	mb1 - 0.02886
k - 0.05000	k - 0.04284	k - 0.04198
g - 0.05446	g - 0.04733	g - 0.04644
ks - 0.07055	ks - 0.06334	ks - 0.06248
vr - 0.09377	vr - 0.08661	vr - 0.08575
p - 0.09914	p - 0.09198	p - 0.09112
v - 0.10089	v - 0.09373	v - 0.09287
mp - 0.14643	mp - 0.13927	mp - 0.13841
dis - 0.17436	dis - 0.16720	dis - 0.16634
nt - 0.19107	nt - 0.18391	nt - 0.18305
nd - 0.20533	nd - 0.19817	nd - 0.19731

mb1) 65960	k) 67297	g) 67743
ndz - 0.03663	ndz - 0.05000	ndz - 0.05446
b - 0.02947	b - 0.04284	b - 0.04730
en - 0.02861	en - 0.04198	en - 0.04644
ngl - 0.02861	ngl - 0.04198	ngl - 0.04644
k - 0.01337	mb1 - 0.01337	mb1 - 0.01783
g - 0.01783	g - 0.00446	g - 0.00446
ks - 0.03387	ks - 0.02055	ks - 0.01604
vr - 0.05714	vr - 0.04377	vr - 0.03931
p - 0.06251	p - 0.04914	p - 0.04468
v - 0.06426	v - 0.05089	v - 0.04643
mp - 0.10980	mp - 0.09643	mp - 0.09197
dis - 0.13773	dis - 0.12436	dis - 0.11990
nt - 0.15444	nt - 0.14107	nt - 0.13661
nd - 0.16877	nd - 0.15533	nd - 0.15087

ks) 69347

ndz - 0.07055
 b - 0.06334
 en - 0.06248
 ngl - 0.06248
 mbl - 0.03387
 k - 0.02055
 g - 0.01604
 vr - 0.02327
 p - 0.02864
 v - 0.03039
 mp - 0.07593
 dis - 0.10387
 nt - 0.12057
 nd - 0.13483

v) 72386

ndz - 0.10089
 b - 0.09373
 en - 0.09287
 ngl - 0.09287
 mbl - 0.06426
 k - 0.05089
 g - 0.04643
 ks - 0.03039
 vr - 0.00712
 p - 0.00175
 mp - 0.04554
 dis - 0.07347
 nt - 0.09018
 nd - 0.10444

nt) 81404

ndz - 0.19107
 b - 0.18391
 en - 0.18305
 ngl - 0.18305
 mbl - 0.15444
 k - 0.14107
 g - 0.13661
 ks - 0.12057
 vr - 0.09730
 p - 0.09193
 v - 0.09018
 mp - 0.04464
 dis - 0.01671
 nd - 0.01426

vr) 71674

ndz - 0.09377
 b - 0.08661
 en - 0.08575
 ngl - 0.08575
 mbl - 0.05714
 k - 0.04377
 g - 0.03931
 vr - 0.02327
 p - 0.00537
 v - 0.00712
 mp - 0.05266
 dis - 0.08059
 nt - 0.09730
 nd - 0.11156

mp) 76940

ndz - 0.14643
 b - 0.13927
 en - 0.13841
 ngl - 0.13841
 mbl - 0.10980
 k - 0.09643
 g - 0.09197
 ks - 0.07593
 vr - 0.05266
 p - 0.04729
 v - 0.04554
 dis - 0.02793
 nt - 0.04464
 nd - 0.05890

nd) 82830

ndz - 0.20533
 b - 0.19817
 en - 0.19731
 ngl - 0.19731
 mbl - 0.16870
 k - 0.15533
 g - 0.15087
 ks - 0.13483
 vr - 0.11156
 p - 0.10619
 v - 0.10444
 mp - 0.05890
 dis - 0.03097
 nt - 0.01426

p) 72211

ndz - 0.09914
 b - 0.09198
 en - 0.09112
 ngl - 0.09112
 mbl - 0.06251
 k - 0.04914
 g - 0.04468
 vr - 0.02864
 p - 0.00537
 v - 0.00175
 mp - 0.04729
 dis - 0.07522
 nt - 0.09193
 nd - 0.10619

dis) 79733

ndz - 0.17463
 b - 0.16720
 en - 0.16634
 ngl - 0.16634
 mbl - 0.13773
 k - 0.12436
 g - 0.11990
 ks - 0.10387
 vr - 0.08059
 p - 0.07520
 v - 0.07347
 mp - 0.02793
 nt - 0.01671
 nd - 0.03097

BY PROFICIENCY

Intermediate all level B = 0.46

en) 59092		ndz) 59557		g) 64520	
ndz	- 0.00465	en	- 0.00465	en	- 0.05428
g	- 0.05428	g	- 0.04963	ndz	- 0.04963
ngl	- 0.05662	ngl	- 0.05197	ngl	- 0.00234
b	- 0.07593	b	- 0.07128	b	- 0.02165
ks	- 0.09693	ks	- 0.09228	ks	- 0.04265
mb1	- 0.10361	mb1	- 0.09896	mb1	- 0.05023
v	- 0.13250	v	- 0.12785	v	- 0.07822
k	- 0.14073	k	- 0.13608	k	- 0.08645
p	- 0.18627	p	- 0.18162	p	- 0.13199
vr	- 0.18628	vr	- 0.18163	vr	- 0.13200
mp	- 0.21257	mp	- 0.20792	mp	- 0.15829
dis	- 0.21408	dis	- 0.20943	dis	- 0.15980
nd	- 0.25167	nd	- 0.24702	nd	- 0.19739
nt	- 0.25292	nt	- 0.24827	nt	- 0.19864

ngl) 64750		b) 66585		ks) 68785	
en	- 0.05662	en	- 0.07593	en	- 0.09693
ndz	- 0.05197	ndz	- 0.07128	ndz	- 0.09228
ngl	- 0.00234	ngl	- 0.02165	ngl	- 0.04265
b	- 0.01931	b	- 0.01931	b	- 0.04031
ks	- 0.04031	ks	- 0.02100	dis	- 0.02100
mb1	- 0.04789	mb1	- 0.02858	mb1	- 0.00758
v	- 0.07588	v	- 0.05657	v	- 0.03537
k	- 0.08411	k	- 0.06480	k	- 0.04380
p	- 0.12965	p	- 0.11034	p	- 0.08934
vr	- 0.12966	vr	- 0.11035	vr	- 0.08935
mp	- 0.15595	mp	- 0.13664	mp	- 0.11564
dis	- 0.15746	dis	- 0.13815	dis	- 0.11715
nd	- 0.19505	nd	- 0.17574	nd	- 0.15474
nt	- 0.19630	nt	- 0.17699	nt	- 0.15599

mbl) 69543

en - 0.10451
 ndz - 0.09986
 ngl - 0.05023
 g - 0.04789
 b - 0.02858
 ks - 0.00758
 v - 0.02799
 k - 0.03622
 p - 0.08176
 vr - 0.08177
 mp - 0.10806
 dis - 0.10957
 nd - 0.14716
 nt - 0.14841

v) 72342

en - 0.13250
 ndz - 0.12785
 ngl - 0.07822
 g - 0.07588
 b - 0.05657
 ks - 0.03557
 mbl - 0.02799
 k - 0.00823
 p - 0.05377
 vr - 0.05378
 mp - 0.08007
 dis - 0.08158
 nd - 0.11917
 nt - 0.12042

k) 73165

en - 0.14073
 ndz - 0.13608
 ngl - 0.08645
 g - 0.08411
 b - 0.06480
 ks - 0.04380
 mbl - 0.03622
 v - 0.00823
 p - 0.04554
 vr - 0.04555
 mp - 0.07184
 dis - 0.07335
 nd - 0.11094
 nt - 0.11219

p) 77719

en - 0.18627
 ndz - 0.18162
 ngl - 0.12965
 g - 0.13199
 b - 0.12965
 ks - 0.11034
 mbl - 0.08934
 v - 0.05377
 k - 0.04554
 vr - 0.00001
 mp - 0.02630
 dis - 0.02781
 nd - 0.06540
 nt - 0.06665

vr) 77720

en - 0.18628
 ndz - 0.18163
 ngl - 0.13200
 g - 0.12966
 b - 0.11035
 ks - 0.08935
 mbl - 0.08177
 v - 0.05378
 k - 0.04555
 p - 0.00001
 mp - 0.02629
 dis - 0.02780
 nd - 0.06545
 nt - 0.06664

mp) 80349

en - 0.21257
 ndz - 0.20792
 ngl - 0.15829
 g - 0.15595
 b - 0.13664
 ks - 0.11564
 mbl - 0.10806
 v - 0.08006
 k - 0.07184
 p - 0.02630
 vr - 0.02629
 dis - 0.00151
 nd - 0.03910
 nt - 0.04035

dis) 80500

en - 0.21408
 ndz - 0.20943
 ngl - 0.15980
 g - 0.15746
 b - 0.13815
 ks - 0.11715
 mbl - 0.10957
 v - 0.08158
 k - 0.07335
 p - 0.02781
 vr - 0.02780
 mp - 0.00151
 nd - 0.03759
 nt - 0.03884

nd) 84259

en - 0.25167
 ndz - 0.24702
 ngl - 0.19739
 g - 0.19505
 b - 0.17574
 ks - 0.15474
 mbl - 0.14716
 v - 0.11917
 k - 0.11094
 p - 0.06540
 vr - 0.06539
 mp - 0.03910
 dis - 0.03759
 nt - 0.00125

nt) 84384

en - 0.25292
 ndz - 0.24827
 ngl - 0.19864
 g - 0.19630
 b - 0.17699
 ks - 0.15599
 mbl - 0.14841
 v - 0.12042
 k - 0.11219
 p - 0.06665
 vr - 0.06664
 mp - 0.04035
 dis - 0.03884
 nt - 0.00125

BY PROFICIENCY

Level C (all)

ndz) 51250		en) 51959		g) 62764	
en	- 0.00709	ndz	- 0.00709	ndz	- 0.11514
g	- 0.11514	g	- 0.10805	en	- 0.10805
ngl	- 0.11939	ngl	- 0.11230	ngl	- 0.00425
ks	- 0.12498	ks	- 0.11789	ks	- 0.00984
b	- 0.13505	b	- 0.12796	b	- 0.01991
mb1	- 0.18186	mb1	- 0.17477	mb1	- 0.06672
v	- 0.18320	v	- 0.17611	v	- 0.06806
vr	- 0.19316	vr	- 0.18607	vr	- 0.07802
k	- 0.20464	k	- 0.19755	k	- 0.08950
dis	- 0.24950	dis	- 0.24241	dis	- 0.13436
p	- 0.29830	p	- 0.29121	p	- 0.18316
mp	- 0.29973	mp	- 0.29264	mp	- 0.18459
nd	- 0.32243	nd	- 0.31534	nd	- 0.20729
nt	- 0.33239	nt	- 0.32530	nt	- 0.21725

ngl) 63189		ks) 63748		b) 64755	
ndz	- 0.11939	ndz	- 0.12498	ndz	- 0.13505
en	- 0.11230	en	- 0.11789	en	- 0.12796
g	- 0.00425	g	- 0.00984	g	- 0.01991
ks	- 0.00559	ngl	- 0.00559	ngl	- 0.01566
b	- 0.01566	b	- 0.01007	ks	- 0.01007
mb1	- 0.06247	mb1	- 0.05688	b	- 0.04681
v	- 0.06381	v	- 0.05822	v	- 0.04815
vr	- 0.07377	vr	- 0.06818	vr	- 0.05811
k	- 0.08525	k	- 0.07966	k	- 0.06959
dis	- 0.13011	dis	- 0.12452	dis	- 0.11445
p	- 0.17891	p	- 0.17332	p	- 0.16325
mp	- 0.18034	mp	- 0.17475	mp	- 0.16468
nd	- 0.20304	nd	- 0.19745	nd	- 0.18738
nt	- 0.21300	nt	- 0.20741	nt	- 0.19734

mbl) 69436

ndz - 0.18186
 en - 0.17477
 g - 0.06672
 ngl - 0.06247
 ks - 0.05688
 b - 0.04681
 v - 0.00134
 vr - 0.01130
 k - 0.02278
 dis - 0.06764
 p - 0.11644
 mp - 0.11787
 nd - 0.14057
 nt - 0.15053

v) 69570

ndz - 0.01832
 en - 0.17611
 g - 0.06806
 ngl - 0.06381
 ks - 0.05822
 b - 0.04815
 v - 0.00134
 vr - 0.00996
 k - 0.02144
 dis - 0.06330
 p - 0.11510
 mp - 0.11653
 nd - 0.13923
 nt - 0.14919

vr) 70566

ndz - 0.19136
 en - 0.18607
 g - 0.07802
 ngl - 0.07377
 ks - 0.06818
 b - 0.05811
 v - 0.01130
 vr - 0.00996
 k - 0.01148
 dis - 0.05634
 p - 0.10514
 mp - 0.10657
 nd - 0.12927
 nt - 0.13923

k) 71714

ndz - 0.20464
 en - 0.19755
 g - 0.08950
 ngl - 0.08525
 ks - 0.07966
 b - 0.06959
 v - 0.02278
 dis - 0.02144
 vr - 0.01148
 dis - 0.04486
 p - 0.09366
 mp - 0.09509
 nd - 0.11779
 nt - 0.12775

dis) 76200

ndz - 0.24950
 en - 0.24241
 g - 0.13436
 ngl - 0.13011
 ks - 0.12452
 b - 0.11445
 v - 0.06764
 p - 0.06630
 vr - 0.05634
 k - 0.04486
 p - 0.04880
 mp - 0.05023
 nd - 0.07293
 nt - 0.08289

p) 51250

ndz - 0.29830
 en - 0.29121
 g - 0.18316
 ngl - 0.17891
 ks - 0.17332
 b - 0.16325
 v - 0.11644
 v - 0.11510
 vr - 0.10514
 k - 0.09366
 dis - 0.04880
 mp - 0.00143
 nd - 0.02413
 nt - 0.03409

mp) 81223

ndz - 0.29973
 en - 0.29264
 g - 0.18459
 ngl - 0.18034
 ks - 0.17475
 b - 0.16468
 v - 0.11787
 v - 0.11653
 vr - 0.10657
 k - 0.09509
 dis - 0.05023
 p - 0.00143
 nd - 0.02270
 nt - 0.03266

nd) 83493

ndz - 0.32243
 en - 0.31534
 g - 0.20729
 ngl - 0.20304
 ks - 0.19745
 b - 0.18738
 v - 0.14057
 v - 0.13923
 vr - 0.12927
 k - 0.11779
 dis - 0.07293
 p - 0.02413
 mp - 0.02270
 nt - 0.00960

nt) 84489

ndz - 0.33239
 en - 0.32530
 g - 0.21725
 ngl - 0.21300
 ks - 0.20741
 b - 0.19734
 v - 0.15053
 v - 0.14919
 vr - 0.13923
 k - 0.12775
 dis - 0.08289
 p - 0.03409
 mp - 0.03266
 nd - 0.00960

BY LANGUAGE

CHINESE

ndz) 62104	en) 65480	ngl) 65600
en - 0.03376	ndz - 0.03376	ndz - 0.03496
ngl - 0.03496	ngl - 0.00120	en - 0.00120
b - 0.05874	b - 0.02498	b - 0.02378
g - 0.06872	g - 0.03496	g - 0.03376
v - 0.08116	v - 0.04740	v - 0.04620
ks - 0.09250	ks - 0.05874	ks - 0.05754
k - 0.09748	k - 0.06372	k - 0.06252
v - 0.12366	v - 0.08990	v - 0.08870
vr - 0.13996	vr - 0.10620	vr - 0.10500
p - 0.15620	p - 0.12244	p - 0.12124
nt - 0.16872	nt - 0.13496	nt - 0.13376
dis - 0.17948	dis - 0.14572	dis - 0.14452
nd - 0.18118	nd - 0.14742	nd - 0.14622
mp - 0.18368	mp - 0.14992	mp - 0.14872

b) 67978	g) 68976	mb1) 70220
ndz - 0.05874	ndz - 0.06872	ndz - 0.08116
en - 0.02498	en - 0.03496	en - 0.04740
ngl - 0.02378	ngl - 0.03376	ngl - 0.04622
g - 0.00998	b - 0.00998	b - 0.02242
v - 0.02242	v - 0.01244	g - 0.01244
ks - 0.03376	ks - 0.02378	ks - 0.01134
k - 0.03874	k - 0.02876	k - 0.01632
v - 0.06492	v - 0.05494	v - 0.04250
vr - 0.08122	vr - 0.07124	vr - 0.05880
p - 0.09746	p - 0.08748	p - 0.07504
nt - 0.10998	nt - 0.10000	nt - 0.08756
dis - 0.12074	dis - 0.11076	dis - 0.09832
nd - 0.12244	nd - 0.11246	nd - 0.10002
mp - 0.12494	mp - 0.11496	mp - 0.10252

ks) 71354

ndz - 0.09250
 en - 0.05874
 ngl - 0.05754
 b - 0.03376
 g - 0.02378
 v - 0.01134
 k - 0.04980
 v - 0.03116
 vr - 0.04746
 p - 0.06370
 nt - 0.07622
 dis - 0.08698
 nd - 0.08868
 mp - 0.09118

vr) 76100

ndz - 0.13996
 en - 0.10620
 ngl - 0.10500
 b - 0.08122
 g - 0.07124
 v - 0.05880
 ks - 0.04746
 k - 0.04248
 v - 0.01630
 p - 0.01624
 nt - 0.02876
 dis - 0.03952
 nd - 0.04122
 mp - 0.04372

dis) 80052

ndz - 0.17948
 en - 0.14572
 ngl - 0.14452
 b - 0.12074
 g - 0.11076
 v - 0.09832
 ks - 0.08698
 k - 0.08200
 v - 0.05582
 vr - 0.03952
 p - 0.02328
 nt - 0.00170
 nd - 0.04200
 mp - 0.00420

k) 71852

ndz - 0.09748
 en - 0.06372
 ngl - 0.06252
 b - 0.03874
 g - 0.02876
 v - 0.01632
 ks - 0.04980
 v - 0.02681
 vr - 0.04248
 p - 0.05872
 nt - 0.07124
 dis - 0.08200
 nd - 0.08370
 mp - 0.08620

p) 77724

ndz - 0.15620
 en - 0.12244
 ngl - 0.12124
 b - 0.09746
 g - 0.08748
 v - 0.07504
 ks - 0.06370
 k - 0.05872
 v - 0.03254
 vr - 0.01624
 nt - 0.01252
 dis - 0.02328
 nd - 0.02498
 mp - 0.02748

nd) 80222

ndz - 0.18118
 en - 0.14742
 ngl - 0.14422
 b - 0.12244
 g - 0.11246
 v - 0.10002
 ks - 0.08868
 k - 0.08377
 v - 0.05752
 vr - 0.04122
 p - 0.02498
 nt - 0.01246
 dis - 0.00170
 mp - 0.00250

v) 74470

ndz - 0.12366
 en - 0.08990
 ngl - 0.08870
 b - 0.06492
 g - 0.05494
 v - 0.04250
 ks - 0.03116
 k - 0.02618
 vr - 0.01630
 p - 0.03254
 nt - 0.04506
 dis - 0.05582
 nd - 0.05752
 mp - 0.06002

nt) 78976

ndz - 0.16872
 en - 0.13496
 ngl - 0.13376
 b - 0.10998
 g - 0.10000
 v - 0.08756
 ks - 0.07622
 k - 0.07124
 v - 0.04506
 vr - 0.02876
 p - 0.01252
 dis - 0.01076
 nd - 0.01246
 mp - 0.01496

mp) 80472

ndz - 0.18368
 en - 0.14992
 ngl - 0.14872
 b - 0.12494
 g - 0.11496
 v - 0.10252
 ks - 0.09118
 k - 0.08620
 v - 0.06002
 vr - 0.04372
 p - 0.02748
 nt - 0.01496
 dis - 0.00420
 nd - 0.00250

SPANISH

ndz) 51361			b) 53625			ngl) 53800		
b	-	0.02264	ndz	-	0.02264	ndz	-	0.02439
ngl	-	0.02439	ngl	-	0.00175	b	-	0.00175
ks	-	0.02956	ks	-	0.00692	ks	-	0.00517
en	-	0.03997	en	-	0.01733	en	-	0.01558
mb1	-	0.05045	mb1	-	0.02781	mb1	-	0.02606
g	-	0.09203	g	-	0.06939	g	-	0.06764
vr	-	0.10245	vr	-	0.07981	vr	-	0.07806
k	-	0.10942	k	-	0.08678	k	-	0.08503
v	-	0.13364	v	-	0.11100	v	-	0.10925
mp	-	0.20839	mp	-	0.18575	mp	-	0.18444
p	-	0.22050	p	-	0.19786	p	-	0.19611
dis	-	0.29397	dis	-	0.27133	dis	-	0.26958
nt	-	0.29692	nt	-	0.27428	nt	-	0.27253
nd	-	0.31597	nd	-	0.29333	nd	-	0.29158

ks) 54317			en) 55358			mb1) 56406		
mb1	-	0.02956	mb1	-	0.03997	en	-	0.05045
b	-	0.00692	b	-	0.01733	b	-	0.02781
ngl	-	0.00517	ngl	-	0.01558	ngl	-	0.02606
en	-	0.01041	ks	-	0.01041	ks	-	0.02089
mb1	-	0.02089	mb1	-	0.01048	en	-	0.01048
g	-	0.06247	g	-	0.05206	g	-	0.04158
vr	-	0.07289	vr	-	0.06248	vr	-	0.05200
k	-	0.07986	k	-	0.06945	k	-	0.05897
v	-	0.10408	v	-	0.09367	v	-	0.08319
mp	-	0.17883	mp	-	0.16842	mp	-	0.15794
p	-	0.19094	p	-	0.18053	p	-	0.17005
dis	-	0.26441	dis	-	0.25444	dis	-	0.24352
nt	-	0.26736	nt	-	0.25695	nt	-	0.24647
nd	-	0.28641	nd	-	0.27660	nd	-	0.26552

g) 60564			vr) 61606			k) 62303		
ndz	-	0.09203	ndz	-	0.10245	ndz	-	0.10942
b	-	0.06939	b	-	0.07981	b	-	0.08677
ngl	-	0.06764	ngl	-	0.07806	ngl	-	0.08503
ks	-	0.06247	ks	-	0.07289	ks	-	0.07986
en	-	0.05206	en	-	0.06248	en	-	0.06945
mb1	-	0.04158	mb1	-	0.05200	mb1	-	0.05897
vr	-	0.01042	g	-	0.01042	g	-	0.01739
k	-	0.01739	k	-	0.00697	vr	-	0.00697
v	-	0.04161	v	-	0.03119	v	-	0.02422
mp	-	0.11636	mp	-	0.10594	mp	-	0.09897
p	-	0.12847	p	-	0.11805	p	-	0.11108
dis	-	0.20194	dis	-	0.19152	dis	-	0.18455
nt	-	0.20489	nt	-	0.19447	nt	-	0.18750
nd	-	0.22394	nd	-	0.21352	nd	-	0.20655
v) 64725			mp) 72200			p) 73411		
ndz	-	0.13364	ndz	-	0.20839	ndz	-	0.22050
b	-	0.11000	b	-	0.18575	b	-	0.19786
ngl	-	0.10925	ngl	-	0.18400	ngl	-	0.19611
ks	-	0.10408	ks	-	0.17883	ks	-	0.19094
en	-	0.09367	en	-	0.16842	en	-	0.18053
mb1	-	0.08319	mb1	-	0.15794	mb1	-	0.17005
g	-	0.04161	g	-	0.11636	g	-	0.12847
vr	-	0.03119	vr	-	0.10594	vr	-	0.11805
k	-	0.02422	k	-	0.09897	k	-	0.11108
mp	-	0.07475	v	-	0.07475	v	-	0.08686
p	-	0.08686	p	-	0.01211	mp	-	0.01211
dis	-	0.16033	dis	-	0.08558	dis	-	0.07347
nt	-	0.16328	nt	-	0.08853	nt	-	0.07642
nd	-	0.18233	nd	-	0.10758	nd	-	0.09547
dis) 80758			nt) 81053			nd) 82958		
ndz	-	0.29397	ndz	-	0.29692	ndz	-	0.31597
b	-	0.27133	b	-	0.27428	b	-	0.29333
ngl	-	0.26958	ngl	-	0.27253	ngl	-	0.29158
ks	-	0.26441	ks	-	0.26736	ks	-	0.28641
en	-	0.25400	en	-	0.25695	en	-	0.27600
mb1	-	0.24352	mb1	-	0.24647	mb1	-	0.26552
g	-	0.20194	g	-	0.20489	g	-	0.22394
vr	-	0.19152	vr	-	0.19447	vr	-	0.21352
k	-	0.18455	k	-	0.18750	k	-	0.20655
v	-	0.16033	v	-	0.16328	v	-	0.18233
mp	-	0.08558	mp	-	0.08853	mp	-	0.10758
p	-	0.07347	p	-	0.07642	p	-	0.09544
nt	-	0.00295	dis	-	0.00295	dis	-	0.02200
nd	-	0.02200	nd	-	0.01905	nt	-	0.01905

RUSSIANS

ndz) 51227

en - 0.03466
 ngl - 0.05411
 g - 0.07362
 mbl - 0.11669
 ks - 0.13326
 b - 0.14169
 v - 0.14991
 k - 0.17364
 vr - 0.19715
 dis - 0.21984
 p - 0.27224
 mp - 0.29442
 nd - 0.30553
 nt - 0.34026

en) 54693

ndz - 0.03466
 ngl - 0.01945
 g - 0.03896
 mbl - 0.08203
 ks - 0.09860
 b - 0.10703
 v - 0.11525
 k - 0.13898
 vr - 0.16249
 dis - 0.18518
 p - 0.23758
 mp - 0.25976
 nd - 0.27087
 nt - 0.30560

ngl) 56638

ndz - 0.05411
 en - 0.01945
 g - 0.01951
 mbl - 0.06258
 ks - 0.07915
 b - 0.08758
 v - 0.09580
 k - 0.11953
 vr - 0.14304
 dis - 0.16573
 p - 0.21813
 mp - 0.24031
 nd - 0.25142
 nt - 0.28615

g) 58589

ndz - 0.07362
 en - 0.03896
 ngl - 0.01951
 mbl - 0.04307
 ks - 0.05964
 b - 0.06807
 v - 0.07629
 k - 0.10002
 vr - 0.12353
 dis - 0.14622
 p - 0.19862
 mp - 0.22088
 nd - 0.23191
 nt - 0.26664

mbl) 62896

ndz - 0.11669
 en - 0.08203
 ngl - 0.06258
 g - 0.04307
 ks - 0.01657
 b - 0.00255
 v - 0.03322
 k - 0.05695
 vr - 0.08046
 dis - 0.10315
 p - 0.15550
 mp - 0.17773
 nd - 0.18884
 nt - 0.22357

ks) 64553

ndz - 0.13326
 en - 0.09860
 ngl - 0.07915
 g - 0.05964
 mbl - 0.01657
 b - 0.00843
 v - 0.01665
 k - 0.04038
 vr - 0.06389
 dis - 0.08658
 p - 0.13898
 mp - 0.16116
 nd - 0.17227
 nt - 0.20700

b) 65396

ndz - 0.14169
 en - 0.10703
 ngl - 0.08758
 g - 0.06807
 mbl - 0.02500
 ks - 0.00843
 v - 0.00822
 k - 0.03195
 vr - 0.05546
 dis - 0.07815
 p - 0.13055
 mp - 0.15273
 nd - 0.16384
 nt - 0.19857

v) 66218

ndz - 0.14991
 en - 0.11525
 ngl - 0.09580
 g - 0.07629
 mbl - 0.03322
 ks - 0.01665
 b - 0.00822
 k - 0.02373
 vr - 0.04724
 dis - 0.06993
 p - 0.12233
 mp - 0.14451
 nd - 0.15562
 nt - 0.19035

k) 68591

ndz - 0.17364
 en - 0.13898
 ngl - 0.11953
 g - 0.10002
 mbl - 0.05695
 ks - 0.04038
 b - 0.03195
 v - 0.02373
 vr - 0.02351
 dis - 0.04620
 p - 0.09860
 mp - 0.12078
 nd - 0.13189
 nt - 0.16662

vr) 70942

ndz - 0.19715
 en - 0.16249
 ngl - 0.14304
 g - 0.12353
 mbl - 0.08046
 ks - 0.06389
 b - 0.05546
 v - 0.04724
 k - 0.02351
 dis - 0.02269
 p - 0.07509
 mp - 0.09727
 nd - 0.10838
 nt - 0.14311

dis) 73211

ndz - 0.21984
 en - 0.18518
 ngl - 0.16573
 g - 0.14622
 mbl - 0.10315
 ks - 0.08658
 b - 0.07815
 v - 0.06993
 k - 0.04620
 vr - 0.02269
 p - 0.05240
 mp - 0.07458
 nd - 0.08569
 nt - 0.12042

p) 78451

ndz - 0.27224
 en - 0.23758
 ngl - 0.21813
 g - 0.19862
 mbl - 0.15555
 ks - 0.13898
 b - 0.13055
 v - 0.12233
 k - 0.09860
 vr - 0.07509
 dis - 0.05240
 mp - 0.02218
 nd - 0.03329
 nt - 0.06802

mp) 80669

ndz - 0.29442
 en - 0.25976
 ngl - 0.24031
 g - 0.22080
 mbl - 0.17773
 ks - 0.16116
 b - 0.15273
 v - 0.14451
 k - 0.12078
 vr - 0.09727
 dis - 0.07458
 p - 0.02218
 nd - 0.01111
 nt - 0.04584

nd) 81780

ndz - 0.30553
 en - 0.27087
 ngl - 0.25142
 g - 0.23191
 mbl - 0.18884
 ks - 0.17227
 b - 0.16384
 v - 0.15562
 k - 0.13189
 vr - 0.10838
 dis - 0.08569
 p - 0.03329
 mp - 0.01111
 nt - 0.03473

nt) 85253

ndz - 0.34026
 en - 0.30560
 ngl - 0.28615
 g - 0.26664
 mbl - 0.22357
 ks - 0.20700
 b - 0.19857
 v - 0.19035
 k - 0.16662
 vr - 0.14311
 dis - 0.12042
 p - 0.06802
 mp - 0.04584
 nd - 0.03473

JAPANESE

en) 61339		ndz) 65121		g) 71376	
ndz	- 0.03782	ndz	- 0.03782	en	- 0.10037
g	- 0.10037	g	- 0.06255	ndz	- 0.06255
b	- 0.11746	b	- 0.07964	b	- 0.01709
ngl	- 0.12319	ngl	- 0.08536	ngl	- 0.02282
ks	- 0.15903	ks	- 0.12121	ks	- 0.05886
v	- 0.16476	v	- 0.12694	v	- 0.06439
mb1	- 0.17049	mb1	- 0.13267	mb1	- 0.07012
k	- 0.19503	k	- 0.15721	k	- 0.09466
p	- 0.21025	p	- 0.17243	p	- 0.10988
dis	- 0.22588	dis	- 0.18806	dis	- 0.12551
mp	- 0.24052	mp	- 0.20270	mp	- 0.14015
vr	- 0.24440	vr	- 0.20658	vr	- 0.14403
nt	- 0.26894	nt	- 0.23112	nt	- 0.16857
nd	- 0.27085	nd	- 0.23303	nd	- 0.17048

b) 73085		ngl) 73658		ks) 77242	
en	- 0.11476	en	- 0.12319	en	- 0.15903
ndz	- 0.07964	ndz	- 0.08537	ndz	- 0.12121
g	- 0.01709	g	- 0.02282	g	- 0.05866
ngl	- 0.00573	b	- 0.00573	b	- 0.04157
ks	- 0.04157	ks	- 0.03584	ngl	- 0.03584
v	- 0.04730	v	- 0.04157	v	- 0.00573
mb1	- 0.05303	mb1	- 0.04730	mb1	- 0.01146
k	- 0.07757	k	- 0.07184	k	- 0.03600
p	- 0.09279	p	- 0.08706	p	- 0.05122
dis	- 0.10842	dis	- 0.10269	dis	- 0.06685
mp	- 0.12306	mp	- 0.11733	mp	- 0.08149
vr	- 0.12694	vr	- 0.12121	vr	- 0.08537
nt	- 0.15148	nt	- 0.14575	nt	- 0.10991
nd	- 0.15339	nd	- 0.14766	nd	- 0.11182

v) 77815			mbl) 78388			k) 80842		
en	-	0.16476	en	-	0.17049	en	-	0.19503
ndz	-	0.12694	ndz	-	0.13267	ndz	-	0.15721
g	-	0.06439	g	-	0.07012	g	-	0.09466
b	-	0.04730	b	-	0.05303	b	-	0.07757
ngl	-	0.04157	ngl	-	0.04730	ngl	-	0.07184
ks	-	0.00573	ks	-	0.01146	ks	-	0.03600
mbl	-	0.00573	v	-	0.00573	v	-	0.03027
k	-	0.03027	k	-	0.02454	mbl	-	0.02454
p	-	0.04549	p	-	0.03976	p	-	0.01522
dis	-	0.06112	dis	-	0.05539	dis	-	0.03085
mp	-	0.07576	mp	-	0.07003	mp	-	0.04549
vr	-	0.07964	vr	-	0.07391	vr	-	0.04937
nt	-	0.10418	nt	-	0.09845	nt	-	0.07391
nd	-	0.10609	nd	-	0.10036	nd	-	0.07582
p) 82364			dis) 83927			mp) 85391		
en	-	0.21025	en	-	0.22588	en	-	0.24052
ndz	-	0.17243	ndz	-	0.18806	ndz	-	0.20270
g	-	0.10988	g	-	0.12551	g	-	0.14015
b	-	0.09279	b	-	0.10842	b	-	0.12306
ngl	-	0.08706	ngl	-	0.10269	ngl	-	0.11733
ks	-	0.05122	ks	-	0.06685	ks	-	0.08149
v	-	0.04549	v	-	0.06112	v	-	0.07576
mbl	-	0.03976	mbl	-	0.05539	mbl	-	0.07003
k	-	0.01522	k	-	0.03085	k	-	0.04549
dis	-	0.01563	p	-	0.01563	p	-	0.03027
mp	-	0.03027	mp	-	0.01464	dis	-	0.01464
vr	-	0.03451	vr	-	0.01852	vr	-	0.00388
nt	-	0.05869	nt	-	0.04306	nt	-	0.02842
nd	-	0.06060	nd	-	0.04497	nd	-	0.03033
vr) 85779			nt) 88233			nd) 88424		
ndz	-	0.24440	ndz	-	0.26894	ndz	-	0.27085
en	-	0.20658	en	-	0.23112	en	-	0.23303
g	-	0.14403	g	-	0.16857	g	-	0.17048
b	-	0.12694	b	-	0.15148	b	-	0.15339
ngl	-	0.12121	ngl	-	0.14575	ngl	-	0.14766
ks	-	0.08537	ks	-	0.10991	ks	-	0.11182
v	-	0.07964	v	-	0.10418	v	-	0.10609
mbl	-	0.07391	mbl	-	0.09845	mbl	-	0.10036
k	-	0.04937	k	-	0.07391	k	-	0.07582
p	-	0.03415	p	-	0.05869	p	-	0.06060
dis	-	0.01852	dis	-	0.04306	dis	-	0.04497
mp	-	0.00388	mp	-	0.02842	mp	-	0.03033
nt	-	0.02454	vr	-	0.02454	vr	-	0.02645
nd	-	0.02645	nd	-	0.00191	nt	-	0.00191

ALL THE OTHERS

en) 57432		ndz) 62807		b) 65112	
ndz	- 0.05375	en	- 0.05375	en	- 0.07680
b	- 0.07680	b	- 0.02305	ndz	- 0.02305
g	- 0.08993	g	- 0.01313	g	- 0.01313
ngl	- 0.11510	ngl	- 0.03830	ngl	- 0.03830
ks	- 0.13484	ks	- 0.05804	ks	- 0.05804
k	- 0.14586	k	- 0.06906	k	- 0.06906
mb1	- 0.15459	mb1	- 0.07779	mb1	- 0.07779
p	- 0.16991	p	- 0.09311	p	- 0.09311
v	- 0.17435	v	- 0.09755	v	- 0.09755
vr	- 0.18200	vr	- 0.10520	vr	- 0.10520
mp	- 0.21272	mp	- 0.13592	mp	- 0.13592
dis	- 0.22807	dis	- 0.15127	dis	- 0.15127
nt	- 0.27307	nt	- 0.19627	nt	- 0.19627
nd	- 0.28389	nd	- 0.20709	nd	- 0.20709

g) 66425		ngl) 68942		ks) 70916	
en	- 0.08993	en	- 0.11510	en	- 0.13484
ndz	- 0.03618	ndz	- 0.06135	ndz	- 0.08109
b	- 0.01313	b	- 0.03830	b	- 0.05804
ngl	- 0.02517	g	- 0.02517	g	- 0.04491
ks	- 0.04991	ks	- 0.01974	ngl	- 0.01974
k	- 0.05593	k	- 0.03076	k	- 0.01102
mb1	- 0.06466	mb1	- 0.03949	mb1	- 0.01975
p	- 0.07998	p	- 0.05481	p	- 0.03507
v	- 0.08442	v	- 0.05925	v	- 0.03951
vr	- 0.09207	vr	- 0.06690	vr	- 0.04716
mp	- 0.12279	mp	- 0.09762	mp	- 0.07788
dis	- 0.13814	dis	- 0.11297	dis	- 0.09323
nt	- 0.18314	nt	- 0.15797	nt	- 0.13823
nd	- 0.19396	nd	- 0.16879	nd	- 0.14905

k) 72018			mbl) 72891			p) 74423		
en	-	0.14586	en	-	0.15459	en	-	0.16991
ndz	-	0.09211	ndz	-	0.10084	ndz	-	0.11616
b	-	0.06906	b	-	0.07779	b	-	0.09311
g	-	0.05593	g	-	0.06466	g	-	0.07998
ngl	-	0.03076	ngl	-	0.03949	ngl	-	0.05481
ks	-	0.01102	ks	-	0.01975	ks	-	0.03507
mbl	-	0.00873	k	-	0.00873	k	-	0.02405
p	-	0.02405	p	-	0.01532	mbl	-	0.01532
v	-	0.02849	v	-	0.01976	v	-	0.00444
vr	-	0.03614	vr	-	0.02741	vr	-	0.01209
mp	-	0.06686	mp	-	0.05813	mp	-	0.04281
dis	-	0.08221	dis	-	0.07348	dis	-	0.05816
nt	-	0.12721	nt	-	0.11848	nt	-	0.10316
nd	-	0.13830	nd	-	0.12930	nd	-	0.11398
v) 74867			vr) 75632			mp) 78704		
en	-	0.17435	en	-	0.18200	en	-	0.21272
ndz	-	0.12060	ndz	-	0.12825	ndz	-	0.15897
b	-	0.09755	b	-	0.10520	b	-	0.13592
g	-	0.08422	g	-	0.09207	g	-	0.12279
ngl	-	0.05925	ngl	-	0.06690	ngl	-	0.09762
ks	-	0.03951	ks	-	0.04716	ks	-	0.07788
k	-	0.02849	k	-	0.03614	k	-	0.06686
mbl	-	0.01976	mbl	-	0.02741	mbl	-	0.05813
p	-	0.00444	p	-	0.01209	p	-	0.04281
vr	-	0.00765	v	-	0.00765	v	-	0.03837
mp	-	0.03837	mp	-	0.03072	vr	-	0.03072
dis	-	0.05372	dis	-	0.04607	dis	-	0.01535
nt	-	0.09872	nt	-	0.09107	nt	-	0.06035
nd	-	0.10954	nd	-	0.10189	nd	-	0.07117
dis) 80239			nt) 84739			nd) 85821		
en	-	0.22807	en	-	0.27307	en	-	0.28389
ndz	-	0.17432	ndz	-	0.21932	ndz	-	0.23014
b	-	0.15127	b	-	0.19627	b	-	0.20709
g	-	0.13814	g	-	0.18314	g	-	0.19396
ngl	-	0.11297	ngl	-	0.15797	ngl	-	0.16879
ks	-	0.09323	ks	-	0.13823	ks	-	0.14905
k	-	0.08221	k	-	0.12721	k	-	0.13803
mbl	-	0.07348	mbl	-	0.11848	mbl	-	0.12930
p	-	0.05816	p	-	0.10316	p	-	0.11398
v	-	0.05372	v	-	0.09872	v	-	0.10954
vr	-	0.04607	vr	-	0.09107	vr	-	0.10189
mp	-	0.01535	mp	-	0.06035	mp	-	0.07117
nt	-	0.04500	dis	-	0.04500	dis	-	

APPENDIX EIGHTSCORES ON SENTENCES

Environment # 1 = # ... v(c)c # cv...

1	10	50400	They approve the plan
2	22	59400	The advertise donuts
3	35	52200	They stroll down hill
4	25	63900	They scribble down numbers
5	31	37800	We shop till the end
6	07	56700	We fish till dawn
7	08	18900	They look to the left
8	29	77400	You miss too much
9	37	41400	We predict disaster
10	39	85500	You blend diced fruit

Environment # 2 = #....v(c)c + {ed} # cv...

11	21	36000	They approved the plan
12	02	45900	They advertized donuts
13	14	53100	The strolled down the hill
14	17	29700	They scribbled down numbers
15	19	73800	We shopped till the end
16	11	42300	We fished till dawn
17	26	66600	They looked to the left
18	04	44100	You missed too much
19	15	90900	We predicted disaster
20	28	62100	You blended diced fruit

Environment # 3 = #....v(c)c# v....

21	01	90900	They approve a loan
22	12	79200	They advertise apples
23	09	64800	They stroll in the park
24	30	77400	They scribble on paper
25	05	56700	We shop at the mall
26	27	87300	We fish all day
27	16	53100	We look at each one
28	33	81000	You miss a lot
29	34	35100	We predict a victory
30	24	83700	You blend ice tea

Environment #4 = ...v (c) c {+ed} # v(c)...

31	40	25200	They approved a loan
32	38	48600	They advertised apples
33	23	76500	They strolled in the park
34	20	57600	They scribbled on paper
35	13	53100	We shopped at the mall
36	36	72900	We fished all day

37	32	54000	They look at each one
38	18	59400	You missed a lot
39	03	87300	They predicted a victory
40	06	71100	You blended ice tea

1.	They look to the left	18900	1
2.	They approved a loan	25200	4
3.	They scribbled down numbers	29700	2
4.	We predict a victory	35100	3
5.	They approved the plan	36000	2
6.	We shop till the end	37800	1
7.	We predict disaster	41400	1
8.	We fished till dawn	42300	2
9.	You missed too much	44100	2
10.	They advertized donuts	45900	2
11.	They advertised apples	48600	4
12.	They approve the plan	50400	1
13.	They stroll down hill	52200	1
14.	We shopped at the mall	53100	4
15.	They strolled down hill	53100	2
16.	We look at each one	53100	3
17.	They looked at each one	54000	4
18.	We fish till dawn	56700	1
19.	We shop at the mall	56700	3
20.	They scribbled on paper	57600	4
21.	They advertise donuts	59400	1
22.	You missed a lot	59400	4
23.	You blended diced fruit	62100	2
24.	They scribble down numbers	63900	1
25.	They stroll in the park	64800	3
26.	They looked to the left	66600	2
27.	You blended iced tea	71100	4
28.	We fished all day	72900	4
29.	We shopped till the end	73800	2
30.	They strolled in the park	76500	4
31.	They scribble on paper	77400	3
32.	You miss too much	77400	1
33.	They advertise apples	79200	3
34.	You miss a lot	81000	3
35.	You blend ice tea	83700	3
36.	You blend diced fruit	85500	1
37.	We fish all day	87300	3
38.	They predicted a victory	87300	4
39.	They approve a loan	90900	3
40.	We predicted disaster	90900	2

APPENDIX NINEBETWEEN ENVIRONMENT DIFFERENCE

(1 = Significant, 0 = Not Significant)

ALL

	ndz	en	ngl	b	g	ks	mb1	k	v	vr	p	mp	nt	nd
ndz	Z	0	1	1	1	1	1	1	1	1	1	1	1	1
en	0	Z	1	1	1	1	1	1	1	1	1	1	1	1
mb1	1	1	Z	0	0	1	1	1	1	1	1	1	1	1
b	1	1	0	Z	0	0	0	1	1	1	1	1	1	1
g	1	1	0	0	Z	0	0	1	1	1	1	1	1	1
ks	1	1	1	0	0	Z	0	0	1	1	1	1	1	1
mb1	1	1	1	0	0	0	Z	0	1	1	1	1	1	1
k	1	1	1	1	1	0	0	Z	0	1	1	1	1	1
v	1	1	1	1	1	1	1	0	Z	0	1	1	1	1
vr	1	1	1	1	1	1	1	1	0	Z	0	1	1	1
p	1	1	1	1	1	1	1	1	1	0	Z	0	1	1
dis	1	1	1	1	1	1	1	1	1	1	0	0	1	1
mp	1	1	1	1	1	1	1	1	1	1	0	Z	1	1
nt	1	1	1	1	1	1	1	1	1	1	1	1	Z	0
nd	1	1	1	1	1	1	1	1	1	1	1	1	0	Z

BY PROFICIENCYLEVEL A - ALL BEGINNERS

	ndz	b	en	ngl	mb1	k	g	ks	vr	p	v	mp	nt	nd
ndz	Z	0	0	0	0	0	0	1	1	1	1	1	1	1
b	0	Z	0	0	0	0	0	1	1	1	1	1	1	1
en	0	0	Z	0	0	0	0	1	1	1	1	1	1	1
ngl	0	0	0	Z	0	0	1	1	1	1	1	1	1	1
mb1	0	0	0	0	Z	0	0	0	1	1	1	1	1	1
k	0	0	0	0	0	Z	0	0	0	0	0	1	1	1
g	0	0	0	0	0	0	Z	0	0	0	0	1	1	1
ks	1	1	1	1	0	0	0	Z	0	0	0	1	1	1
vr	1	1	1	1	1	0	0	0	Z	0	0	0	1	1
p	1	1	1	1	1	0	0	0	0	Z	0	0	1	1
v	1	1	1	1	1	1	0	0	0	0	Z	0	0	1
mp	1	1	1	1	1	1	1	1	0	0	0	Z	0	0
nt	1	1	1	1	1	1	1	1	1	1	1	0	Z	0
nd	1	1	1	1	1	1	1	1	1	1	1	0	0	Z

LEVEL B - ALL INTERMEDIATE

	en	ndz	g	ngl	b	ks	mb1	v	k	p	vr	mp	nd	nt
en	Z	0	1	1	1	1	1	1	1	1	1	1	1	1
ndz	0	Z	1	1	1	1	1	1	1	1	1	1	1	1
g	1	1	Z	0	0	0	1	1	1	1	1	1	1	1
ngl	1	1	0	Z	0	0	1	1	1	1	1	1	1	1
b	1	1	0	0	Z	0	0	1	1	1	1	1	1	1
ks	1	1	0	0	0	Z	0	0	0	1	1	1	1	1
mb1	1	1	1	1	0	0	Z	0	0	1	1	1	1	1
v	1	1	1	1	1	0	0	Z	0	1	1	1	1	1
k	1	1	1	1	1	0	0	0	Z	0	0	1	1	1
p	1	1	1	1	1	1	1	1	0	Z	0	1	1	1
vr	1	1	1	1	1	1	1	1	0	0	Z	1	1	1
mp	1	1	1	1	1	1	1	1	1	0	0	0	0	0
nd	1	1	1	1	1	1	1	1	1	1	1	Z	0	0
nt	1	1	1	1	1	1	1	1	1	1	1	0	Z	Z

LEVEL C - ALL ADVANCED

	ndz	en	g	ngl	ks	b	mb1	v	vr	k	p	mp	nd	nt
ndz	Z	0	1	1	1	1	1	1	1	1	1	1	1	1
en	0	Z	1	1	1	1	1	1	1	1	1	1	1	1
g	1	1	Z	0	0	0	0	0	1	1	1	1	1	1
ngl	1	1	0	Z	0	0	0	0	1	1	1	1	1	1
ks	1	1	0	0	Z	0	0	0	0	1	1	1	1	1
b	1	1	0	0	0	Z	0	0	0	0	1	1	1	1
mb1	1	1	0	0	0	0	Z	0	0	0	1	1	1	1
v	1	1	0	0	0	0	0	Z	0	0	1	1	1	1
vr	1	1	1	1	0	0	0	0	Z	0	1	1	1	1
k	1	1	1	1	1	0	0	0	0	Z	1	1	1	1
p	1	1	1	1	1	1	1	1	1	1	Z	0	0	0
mp	1	1	1	1	1	1	1	1	1	1	0	Z	0	0
nd	1	1	1	1	1	1	1	1	1	1	0	0	Z	0
nt	1	1	1	1	1	1	1	1	1	1	0	0	0	Z

LEVEL C - WITHOUT RUSSIANS (.094)

	en	ndz	ks	g	b	ngl	v	vr	mb1	k	mp	p	nt	nd
en	Z	0	1	1	1	1	1	1	1	1	1	1	1	1
ndz	0	Z	1	1	1	1	1	1	1	1	1	1	1	1
ks	1	1	Z	0	0	0	0	0	1	1	1	1	1	1
g	1	1	0	Z	0	0	0	0	0	1	1	1	1	1
b	1	1	0	0	Z	0	0	0	0	0	0	1	1	1
ngl	1	1	0	0	0	Z	0	0	0	0	1	1	1	1
v	1	1	1	0	0	0	Z	0	0	0	1	1	1	1
vr	1	1	0	0	0	0	0	Z	0	0	0	1	1	1
mb1	1	1	1	0	0	0	0	0	Z	0	0	1	1	1
k	1	1	1	1	0	0	0	0	0	Z	0	0	0	1
mp	1	1	1	1	1	1	1	0	0	0	Z	0	0	0
p	1	1	1	1	1	1	1	1	1	0	0	Z	0	0
nt	1	1	1	1	1	1	1	1	1	0	0	0	Z	0
nd	1	1	1	1	1	1	1	1	1	1	0	0	0	Z

BY LANGUAGEALL SPANISH

	ndz	b	ngl	ks	en	mb1	g	vr	k	v	mp	p	nt	nd
ndz	Z	0	0	0	0	0	1	1	1	1	1	1	1	1
b	0	Z	0	0	0	0	0	1	1	1	1	1	1	1
ngl	0	0	Z	0	0	0	0	0	1	1	1	1	1	1
ks	0	0	0	Z	0	0	0	0	1	1	1	1	1	1
en	0	0	0	0	Z	0	0	0	0	1	1	1	1	1
mb1	0	0	0	0	0	Z	0	0	0	1	1	1	1	1
g	1	0	0	0	0	0	Z	0	0	0	1	1	1	1
vr	1	1	0	0	0	0	0	Z	0	0	1	1	1	1
k	1	1	1	1	0	0	0	0	Z	0	1	1	1	1
v	1	1	1	1	1	1	0	0	0	Z	0	1	1	1
mp	1	1	1	1	1	1	1	1	1	0	Z	0	1	1
p	1	1	1	1	1	1	1	1	1	1	0	Z	1	1
nt	1	1	1	1	1	1	1	1	1	1	1	1	Z	0
nd	1	1	1	1	1	1	1	1	1	1	1	1	0	Z

ALL RUSSIANS

	ndz	en	ngl	g	mb1	ks	b	v	k	vr	p	mp	nd	nt
ndz	Z	0	0	1	1	1	1	1	1	1	1	1	1	1
en	0	Z	0	0	1	1	1	1	1	1	1	1	1	1
ngl	0	0	Z	0	0	1	1	1	1	1	1	1	1	1
g	1	0	0	Z	0	0	1	1	1	1	1	1	1	1
mb1	1	1	0	0	Z	0	0	0	0	1	1	1	1	1
ks	1	1	1	0	0	Z	0	0	0	1	1	1	1	1
b	1	1	1	1	0	0	Z	0	0	0	1	1	1	1
v	1	1	1	1	0	0	0	Z	0	0	1	1	1	1
k	1	1	1	1	0	0	0	0	Z	0	0	1	1	1
vr	1	1	1	1	1	0	0	0	0	Z	0	1	1	1
p	1	1	1	1	1	1	1	1	1	0	Z	0	0	0
mp	1	1	1	1	1	1	1	1	1	1	0	Z	0	0
nd	1	1	1	1	1	1	1	1	1	1	1	0	Z	0
nt	1	1	1	1	1	1	1	1	1	1	1	1	0	Z

ALL JAPANESE

	en	ndz	g	b	ngl	ks	v	mb1	k	p	mp	vr	nt	nd
en	Z	0	1	1	1	1	1	1	1	1	1	1	1	1
ndz	0	Z	0	1	1	1	1	1	1	1	1	1	1	1
g	1	0	Z	0	0	0	0	1	1	1	1	1	1	1
b	1	1	0	Z	0	0	0	0	1	1	1	1	1	1
ngl	1	1	0	0	Z	0	0	0	0	1	1	1	1	1
ks	1	1	0	0	0	Z	0	0	0	0	1	1	1	1
v	1	1	0	0	0	0	Z	0	0	0	0	1	1	1
mb1	1	1	0	0	0	0	0	Z	0	0	0	0	1	1
k	1	1	1	1	0	0	0	0	Z	0	0	0	0	0
p	1	1	1	1	1	0	0	0	0	Z	0	0	0	0
mp	1	1	1	1	1	1	0	0	0	0	Z	0	0	0
vr	1	1	1	1	1	1	1	0	0	0	0	Z	0	0
nt	1	1	1	1	1	1	1	1	0	0	0	0	Z	0
nd	1	1	1	1	1	1	1	1	0	0	0	0	0	Z

ALL CHINESE

	ndz	en	ngl	b	g	mb1	ks	k	v	p	vr	nt	nd	mp
ndz	Z	0	0	0	0	1	1	1	1	1	1	1	1	1
en	0	Z	0	0	0	0	0	0	1	1	1	1	1	1
ngl	0	0	Z	0	0	0	0	0	1	1	1	1	1	1
b	0	0	0	Z	0	0	0	0	0	1	1	1	1	1
g	0	0	0	0	Z	0	0	0	0	1	1	1	1	1
mb1	1	0	0	0	0	Z	0	0	0	0	1	1	1	1
ks	1	0	0	0	0	0	Z	0	0	0	0	1	1	1
k	1	0	0	0	0	0	0	Z	0	0	0	1	1	1
v	1	1	1	0	0	0	0	0	Z	0	0	0	0	0
p	1	1	1	1	1	0	0	0	0	Z	0	0	0	0
vr	1	1	1	1	1	1	0	0	0	0	Z	0	0	0
nt	1	1	1	1	1	1	1	1	0	0	0	Z	0	0
nd	1	1	1	1	1	1	1	1	0	0	0	0	Z	0
mp	1	1	1	1	1	1	1	1	0	0	0	0	0	Z

ALL OTHERS

	en	ndz	b	g	ngl	ks	k	mb1	p	v	vr	mp	nt	nd
en	Z	0	1	1	1	1	1	1	1	1	1	1	1	1
ndz	0	Z	0	0	1	1	1	1	1	1	1	1	1	1
b	1	0	Z	0	0	0	1	1	1	1	1	1	1	1
g	1	0	0	Z	0	0	0	0	1	1	1	1	1	1
ngl	1	1	0	0	Z	0	0	0	0	0	1	1	1	1
ks	1	1	0	0	0	Z	0	0	0	0	0	1	1	1
k	1	1	1	0	0	0	Z	0	0	0	0	1	1	1
mb1	1	1	1	0	0	0	0	Z	0	0	0	0	1	1
p	1	1	1	1	0	0	0	0	Z	0	0	0	0	1
v	1	1	1	1	0	0	0	0	0	Z	0	0	0	1
vr	1	1	1	1	1	0	0	0	0	0	Z	0	0	1
mp	1	1	1	1	1	1	1	0	0	0	0	Z	0	0
nt	1	1	1	1	1	1	1	1	1	1	1	0	Z	0
nd	1	1	1	1	1	1	1	1	1	1	1	1	0	Z

APPENDIX TENMATERIALS ANALYSISALL (.126)

	ndz	en	ngl	b	g	ks	mb1	k	v	vr	p	mp	nt	nd
ndz	Z	0	0	0	0	0	0	0	1	1	1	1	1	1
en	0	Z	0	0	0	0	0	0	1	1	1	1	1	1
ngl	0	0	Z	0	0	0	0	0	0	0	1	1	1	1
b	0	0	0	Z	0	0	0	0	0	0	0	1	1	1
g	0	0	0	0	Z	0	0	0	0	0	0	1	1	1
ks	0	0	0	0	0	Z	0	0	0	0	0	0	1	1
mb1	0	0	0	0	0	0	Z	0	0	0	0	0	1	1
k	0	0	0	0	0	0	0	Z	0	0	0	0	0	1
v	1	1	0	0	0	0	0	0	Z	0	0	0	0	0
vr	1	1	0	0	0	0	0	0	0	Z	0	0	0	0
p	1	1	1	0	0	0	0	0	0	0	Z	0	0	0
mp	1	1	1	1	1	0	0	0	0	0	0	Z	0	0
nt	1	1	1	1	1	1	1	0	0	0	0	0	Z	0
nd	1	1	1	1	1	1	1	1	0	0	0	0	0	Z

ALL BEGINNERS (.106)

	ndz	b	ngl	en	mb1	k	g	ks	vr	p	v	mp	nt	nd
ndz	Z	0	0	0	0	0	0	0	0	0	0	1	1	1
b	0	Z	0	0	0	0	0	0	0	0	0	1	1	1
ngl	0	0	Z	0	0	0	0	0	0	0	0	1	1	1
en	0	0	0	Z	0	0	0	0	0	0	0	1	1	1
mb1	0	0	0	0	Z	0	0	0	0	0	0	1	1	1
k	0	0	0	0	0	Z	0	0	0	0	0	0	1	1
g	0	0	0	0	0	0	Z	0	0	0	0	0	1	1
ks	0	0	0	0	0	0	0	Z	0	0	0	0	1	1
vr	0	0	0	0	0	0	0	0	Z	0	0	0	0	1
p	0	0	0	0	0	0	0	0	0	Z	0	0	0	1
v	0	0	0	0	0	0	0	0	0	0	Z	0	0	0
mp	1	1	1	1	1	1	1	0	0	0	0	Z	0	0
nt	1	1	1	1	1	1	1	1	0	0	0	0	Z	0
nd	1	1	1	1	1	1	1	1	1	1	0	0	0	Z

ALL INTERMEDIATE (.142)

	en	ndz	g	ngl	b	ks	mb1	v	k	p	vr	mp	nd	nt
en	Z	0	0	0	0	0	0	0	0	1	1	1	1	1
ndz	0	Z	0	0	0	0	0	0	0	1	1	1	1	1
g	0	0	Z	0	0	0	0	0	0	0	0	1	1	1
ngl	0	0	0	Z	0	0	0	0	0	0	0	1	1	1
b	0	0	0	Z	0	0	0	0	0	0	0	0	1	1
ks	0	0	0	0	0	Z	0	0	0	0	0	0	1	1
mb1	0	0	0	0	0	0	Z	0	0	0	0	0	1	1
v	0	0	0	0	0	0	0	Z	0	0	0	0	0	0
k	0	0	0	0	0	0	0	0	0	Z	0	0	0	0
p	1	1	0	0	0	0	0	0	0	0	Z	0	0	0
vr	1	1	0	0	0	0	0	0	0	0	Z	0	0	0
mp	1	1	1	1	0	0	0	0	0	0	0	Z	0	0
nd	1	1	1	1	1	1	1	0	0	0	0	0	Z	0
nt	1	1	1	1	1	1	1	0	0	0	0	0	0	Z

ALL ADVANCED - (.171)

	ndz	en	g	ngl	ks	b	mb1	v	vr	k	p	mp	nd	nt
ndz	Z	0	0	0	0	0	1	1	1	1	1	1	1	1
en	0	Z	0	0	0	0	1	1	1	1	1	1	1	1
g	0	0	Z	0	0	0	0	0	0	0	1	1	1	1
ngl	0	0	0	Z	0	0	0	0	0	0	1	1	1	1
ks	0	0	0	0	Z	0	0	0	0	1	1	1	1	1
b	0	0	0	0	0	Z	0	0	0	0	0	0	1	1
mb1	1	1	0	0	0	0	Z	0	0	0	0	0	0	0
v	1	1	0	0	0	0	0	Z	0	0	0	0	0	0
vr	1	1	0	0	0	0	0	0	Z	0	0	0	0	0
k	1	1	0	0	0	0	0	0	0	Z	0	0	0	0
p	1	1	1	1	1	0	0	0	0	0	Z	0	0	0
mp	1	1	1	1	1	0	0	0	0	0	0	Z	0	0
nd	1	1	1	1	1	1	0	0	0	0	0	0	Z	0
nt	1	1	1	1	1	1	0	0	0	0	0	0	0	Z

LEVEL C - ADVANCED WITHOUT RUSSIANS (.197)

	en	ndz	ks	g	b	ngl	v	vr	mb1	k	mp	p	nt	nd
en	Z	0	0	0	1	1	1	1	1	1	1	1	1	1
ndz	0	Z	0	0	0	0	0	1	1	1	1	1	1	1
ks	0	0	Z	0	0	0	0	0	0	0	0	1	1	1
g	0	0	0	Z	0	0	0	0	0	0	0	0	1	1
b	1	0	0	0	Z	0	0	0	0	0	0	0	0	1
ngl	1	0	0	0	0	Z	0	0	0	0	0	0	0	0
v	1	0	0	0	0	0	Z	0	0	0	0	0	0	0
vr	1	1	0	0	0	0	0	Z	0	0	0	0	0	0
mb1	1	1	0	0	0	0	0	0	Z	0	0	0	0	0
k	1	1	0	0	0	0	0	0	0	Z	0	0	0	0
mp	1	1	0	0	0	0	0	0	0	0	Z	0	0	0
p	1	1	1	0	0	0	0	0	0	0	0	Z	0	0
nt	1	1	1	1	0	0	0	0	0	0	0	0	Z	0
nd	1	1	1	1	0	0	0	0	0	0	0	0	0	Z

BY LANGUAGEALL CHINESE (.139)

	ndz	en	ngl	b	g	mb1	ks	k	v	vr	p	nt	nd	mp
ndz	Z	0	0	0	0	0	0	0	0	1	1	1	1	1
en	0	Z	0	0	0	0	0	0	0	0	0	0	1	1
ngl	0	0	Z	0	0	0	0	0	0	0	0	0	0	1
b	0	0	0	Z	0	0	0	0	0	0	0	0	0	0
g	0	0	0	0	Z	0	0	0	0	0	0	0	0	0
mb1	0	0	0	0	0	Z	0	0	0	0	0	0	0	0
ks	0	0	0	0	0	0	Z	0	0	0	0	0	0	0
k	0	0	0	0	0	0	0	Z	0	0	0	0	0	0
v	0	0	0	0	0	0	0	0	Z	0	0	0	0	0
vr	1	0	0	0	0	0	0	0	0	Z	0	0	0	0
p	1	0	0	0	0	0	0	0	0	0	Z	0	0	0
nt	1	0	0	0	0	0	0	0	0	0	0	Z	0	1
nd	1	1	1	0	0	0	0	0	0	0	0	0	Z	0
mp	1	1	1	0	0	0	0	0	0	0	0	0	0	Z

ALL SPANISH (.128)

	ndz	b	ngl	ks	en	mb1	g	vr	k	v	mp	p	nt	nd
ndz	Z	0	0	0	0	0	0	0	0	1	1	1	1	1
b	0	Z	0	0	0	0	0	0	0	0	1	1	1	1
ngl	0	0	Z	0	0	0	0	0	0	0	1	1	1	1
ks	0	0	0	Z	0	0	0	0	0	0	1	1	1	1
en	0	0	0	0	Z	0	0	0	0	0	1	1	1	1
mb1	0	0	0	0	0	Z	0	0	0	0	1	1	1	1
g	0	0	0	0	0	0	Z	0	0	0	0	1	1	1
vr	0	0	0	0	0	0	0	Z	0	0	0	0	1	1
k	0	0	0	0	0	0	0	0	Z	0	0	0	1	1
v	1	0	0	0	0	0	0	0	0	Z	0	0	1	1
mp	1	1	1	1	1	1	0	0	0	0	Z	0	0	0
p	1	1	1	1	1	1	1	0	0	0	0	Z	0	0
nt	1	1	1	1	1	1	1	1	1	1	0	0	Z	0
nd	1	1	1	1	1	1	1	1	1	1	0	0	0	Z

RUSSIANS (.204)

	ndz	en	ngl	g	mb1	ks	b	v	k	vr	p	mp	nd	nt
ndz	Z	0	0	0	0	0	0	0	0	0	1	1	1	1
en	0	Z	0	0	0	0	0	0	0	0	1	1	1	1
ngl	0	0	Z	0	0	0	0	0	0	0	1	1	1	1
g	0	0	0	Z	0	0	0	0	0	0	0	1	1	1
mb1	0	0	0	0	Z	0	0	0	0	0	0	0	0	1
ks	0	0	0	0	0	Z	0	0	0	0	0	0	0	1
b	0	0	0	0	0	0	Z	0	0	0	0	0	0	0
v	0	0	0	0	0	0	0	Z	0	0	0	0	0	0
k	0	0	0	0	0	0	0	0	Z	0	0	0	0	0
vr	0	0	0	0	0	0	0	0	0	Z	0	0	0	0
p	1	1	1	0	0	0	0	0	0	0	Z	0	0	0
mp	1	1	1	1	0	0	0	0	0	0	0	Z	0	0
nd	1	1	1	1	0	0	0	0	0	0	0	0	Z	0
nt	1	1	1	1	1	1	0	0	0	0	0	0	0	Z

JAPANESE (.165)

	en	ndz	g	b	ngl	ks	v	mb1	k	p	mp	vr	nt	nd
en	Z	0	0	0	0	0	0	1	1	1	1	1	1	1
ndz	0	Z	0	0	0	0	0	0	0	1	1	1	1	1
g	0	0	Z	0	0	0	0	0	0	0	0	0	1	1
b	0	0	0	Z	0	0	0	0	0	0	0	0	0	0
ngl	0	0	0	0	Z	0	0	0	0	0	0	0	0	0
ks	0	0	0	0	0	Z	0	0	0	0	0	0	0	0
v	0	0	0	0	0	0	Z	0	0	0	0	0	0	0
mb1	1	0	0	0	0	0	0	Z	0	0	0	0	0	0
k	1	0	0	0	0	0	0	0	Z	0	0	0	0	0
p	1	1	0	0	0	0	0	0	0	Z	0	0	0	0
mp	1	1	0	0	0	0	0	0	0	0	Z	0	0	0
vr	1	1	0	0	0	0	0	0	0	0	0	Z	0	0
nt	1	1	1	0	0	0	0	0	0	0	0	0	Z	0
nd	1	1	1	0	0	0	0	0	0	0	0	0	0	Z

OTHERS (.127)

	en	ndz	b	g	ngl	ks	k	mb1	p	v	vr	mp	nt	nd
en	Z	1	1	1	0	0	0	0	0	0	0	0	0	1
ndz	0	Z	0	0	0	0	0	0	0	0	0	1	1	1
b	0	0	Z	0	0	0	0	0	0	0	0	1	1	1
g	0	0	0	Z	0	0	0	0	0	0	0	0	1	1
ngl	0	0	0	0	Z	0	0	0	0	0	0	0	1	1
ks	1	0	0	0	0	Z	0	0	0	0	0	0	1	1
k	1	0	0	0	0	0	Z	0	0	0	0	0	1	1
mb1	1	0	0	0	0	0	0	Z	0	0	0	0	0	1
p	1	0	0	0	0	0	0	0	Z	0	0	0	0	0
v	1	0	0	0	0	0	0	0	0	Z	0	0	0	0
vr	1	1	0	0	0	0	0	0	0	0	Z	0	0	0
mp	1	1	1	0	0	0	0	0	0	0	0	Z	0	0
nt	1	1	1	1	1	1	1	0	0	0	0	0	Z	0
nd	1	1	1	1	1	1	1	1	0	0	0	0	0	Z

APPENDIX ELEVENSIGNIFICANCE SCORES ACROSS
PROFFICIENCY LEVELSEnvironment 1 / 'v'

62,63,63,63,65, 67,67,69,71,72,72,77, 81,82
 59,60,64,65,67, 69,70,72,73, 78,78,80,84,84
 51,52, 63,63,64,65,69,70,70,72,81,81, 83,84

A - ndz, b, en, nql, mb1, k, g, ks, vr, p, v, mp, nt, nd
 B - en, ndz, g, nql, b, ks, mbl, v, k, p, vr, mp, nd, nt
 C - ndz, en, g, nql, ks, b, mbl, v, vr, k, p, mp, nd, nt

Environment 2 / 'vr'

62,63,63,63,65, 67,67,69,71,72,72,77, 81,82
 59,60,64,65,67,69,70,72, 73,78,78,80, 84,84
 51,52,63,63, 64,65,69,70,70,72,81,81, 83,84

A - ndz, b, en, nql, mb1, k, g, ks, vr, p, v, mp, nt, nd
 B - en, ndz, g, nql, b, ks, mb1, v, k, p, vr, mp, nd, nt
 C - ndz, en, g, nql, ks, b, mbl, v, vr, k, p, mp, nd, nt

Environment 3 / 'en'

62,63,63,63,65,67,67, 69,71,72,72,77,81,82
 59,60, 64,65,67,69,70,72,73,78,78,80,84,84
 51,52, 63,63,64,65,69,70,70,72,81,81,83,84

A - ndz, b, en, nql, mbl, k, g, ks, vr, p, v, mp, nt, nd
 B - en, ndz, g, nql, b, ks, mb1, v, k, p, vr, mp, nd, nt
 C - ndz, en, g, nql, ks, b, mb1, v, vr, k, p, mp, nd, nt

Environment 4 / 'p'

62,63,63,63,65, 67,67,69,71,72,72,77, 81,82
 59,60,64,65,67,69,70,72, 73,78,78,80, 84,84
 51,52,63,63,64,65,69,70,70,72, 81,81,83,84

A - ndz, b, en, nql, mb1, k, g, ks, vr, p, v, mp, nt, nd
 B - en, ndz, g, nql, b, ks, mb1, p, k, v, vr, mp, nd, nt
 C - ndz, en, g, nql, ks, b, mb1, v, vr, k, p, mp, nd, nt

Environment 5 / 'b'

62, 63, 63, 63, 65, 67, 67, 69, 71, 72, 72, 77, 81, 82
 59, 60, 64, 65, 67, 69, 70,
 72, 73, 78, 78, 80, 84, 84 81, 52, 63, 63, 64, 65, 69, 70, 70, 72
 81, 81, 83, 84

A - ndz, b, en, ngl, mbl, k, g, ks, vr, p, v, mp, nt, nd
 B - en, ndz, g, ngl, b, ks, mbl, v, k, p, vr, mp, nd, nt
 C - ndz, en, g, ngl, ks, b, mbl, v, vr, k, p, mp, nd, nt

Environment 6 / 'k'

62, 63, 63, 63, 65, 67, 67, 69, 71, 72, 72, 77, 81, 82
 59, 60, 64, 65, 67, 69, 70, 72, 73, 78, 78, 80, 84, 84
 51, 52, 63, 63, 64, 65, 69, 70, 72, 81, 81, 83, 84

A - ndz, b, en, ngl, mbl, k, g, ks, vr, p, v, mp, nt, nd
 B - en, ndz, g, ngl, b, ks, mbl, v, k, p, vr, mp, nd, nt
 C - ndz, en, g, ngl, ks, b, mbl, v, vr, k, p, mp, nd, nt

Environment 7 / 'g'

62, 63, 63, 63, 65, 67, 68, 69, 71, 72, 72, 77, 81, 82
 59, 60, 64, 65, 67, 69, 70, 72, 73, 78, 78, 80, 84, 84
 51, 52, 63, 63, 64, 65, 69, 70, 70, 72, 81, 81, 83, 84

A - ndz, b, en, ngl, mbl, k, g, ks, vr, p, v, mp, nt, nd
 B - en, ndz, g, ngl, b, ks, mbl, v, k, p, vr, mp, nd, nt
 C - ndz, en, g, ngl, ks, b, mbl, v, vr, k, p, mp, nd, nt

Environment 8 / 'mp'

62, 63, 63, 63, 65, 67, 67, 69, 71, 72, 72, 77, 81, 82
 59, 60, 64, 65, 67, 69, 70, 72, 73, 78, 78, 80, 84, 84
 51, 52, 63, 63, 64, 65, 69, 70, 70, 72, 81, 81, 83, 84

A - ndz, b, en, ngl, mbl, k, g, ks, vr, p, v, mp, nt, nd
 B - en, ndz, g, ngl, b, ks, mbl, v, k, p, vr, mp, nd, nt
 C - ndz, en, g, ngl, ks, b, mbl, v, vr, k, p, mp, nd, nt

Environment 9 / 'ks'

62, 63, 63, 63, 65, 67, 67, 69, 71, 72, 72, 77, 81, 82
 59, 60, 64, 65, 67, 69, 70, 72, 73, 78, 78, 80, 84, 84
 51, 52, 63, 63, 64, 65, 69, 70, 70, 72, 81, 81, 83, 84

A - ndz, b, en, nql, mbl, k, g, ks, vr, p, v, mp, nt, nd
 B - en, ndz, g, nql, b, ks, mbl, v, k, p, vr, mp, nd, nt
 C - ndz, en, g, nql, ks, b, mbl, v, vr, k, p, mp, nd, nt

Environment 10 / 'nql'

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 60, 64,65,67,69,70,72,73,78,78,80,84,84
 51,52, 63,63,64,65,69,70,70,72,81,81,83,84

A - ndz, b, en, nql, mbl, k, g, ks, vr, p, v, mp, nt, nd
 B - en, ndz, g, nql, b, ks, mbl, v, k, p, vr, mp, nd, nt
 C - ndz, en, g, nql, ks, b, mbl, v, vr, k, p, mp, nd, nt

Environment 11 / 'mbl'

62,63,63,63,65,67,67,69, 71,72,72,77,81,82
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 51,52, 63,63,64,65,69,70,70,72, 81,81,83,84

A - ndz, b, en, nql, mbl, k, g, ks, vr, p, v, mp, nt, nd
 B - en, ndz, g, nql, b, ks, mbl, v, k, p, vr, mp, nd, nt
 C - ndz, en, g, nql, ks, b, mbl, v, vr, k, p, mp, nd, nt

Environment 12 / 'ndz'

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 51,52, 63,63,64,65,69,70, 70,72,81,81,83,84

A - ndz, b, en, nql, mbl, k, g, ks, vr, p, v, mp, nt, nd
 B - en, ndz, g, nql, b, ks, mbl, v, k, p, vr, mp, nd, nt
 C - ndz, en, g, nql, ks, b, mbl, v, vr, k, p, mp, nd, nt

Environment 13 / 'nt'

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 59,60,64,65,67,69,70,72,73,78,78, 80,84,84
 51,52,63,63,64,65,69,70,70,72, 81,81,83,84

A - ndz, b, en, nql, mbl, k, g, ks, vr, p, v, mp, nt, nd
 B - en, ndz, g, nql, b, ks, mbl, v, k, p, vr, mp, nd, nt
 C - ndz, en, g, nql, ks, b, mbl, v, vr, k, p, mp, nd, nt

Environment 14 / 'nd'

62,63,63,63,65,67,67,69,71,72,72, 77,81,82
 59,60,64,65,67,69,70,72,73,78,78, 80,84,84
 51,52,63,63,64,65,69,70,70,72, 81,81,83,84

A - ndz, b, en, nql, mb1, k, g, ks, vr, p, v, mp, nt, nd
 B - en, ndz, g, nql, b, ks, mb1, v, k, p, vr, mp, nd, nt
 C - ndz, en, g, nql, ks, b, mb1, v, vr, k, p, mp, nd, nt

APPENDIX TWELVESPEARMAN RANK CORRELATION

	B	C	Ch	Ja	Sp	Ru	RA	SA	JA	CA	RB	SB	JB	CB	RC	SC	JC	CC
B		967	946	975	878	960	925	821	678	703	928	860	985	989	939	871	857	882
C			921	939	892	982	953	792	553	646	953	871	953	946	960	928	857	942
Ch				925	889	935	878	857	732	857	889	900	932	932	950	817	857	825
Ja					835	925	925	757	625	650	892	803	989	960	892	839	910	850
Sp						882	814	935	589	739	778	985	842	875	907	892	757	821
Ru							964	817	578	721	971	875	953	942	971	875	839	892
RA								725	428	603	953	796	932	907	903	850	892	885
SA									700	792	735	921	778	817	875	757	646	728
JA										746	532	614	650	642	642	421	385	435
CA											632	803	682	710	782	517	557	489
RB												767	921	907	928	828	835	896
SB													817	860	900	850	728	775
JB														975	925	828	871	853
CB															921	846	850	853
RC																853	792	889
SC																	817	942
JC																		817
CC																		

APPENDIX THIRTEENContrastive Analysis of Russian,
Spanish, Japanese and Chinese.

This phonological analysis of the four main languages used in this study contrasts only those environments that appeared on the test with possible equivalent forms. Furthermore, this analysis will contrast the sounds only in word final position in the four language.

1. Russian

In general Russian has a devoicing rule in word final position but, it is quite constrained in that its application depends in part on the form of the word that follows as.

In Russian the first environment ('v') is possible. When inflected the final /d/ is usually devoiced but not necessarily (i.e., it is allophonic). The second environment ('vr') is possible but not with a + {d}. /n/ is possible word finally but it is never followed by {d}. /p/ is possible followed by {+t} but /b/ does not occur. /k/ is possible and with {+t} following. /g/ is allowable and does occur but, it is very unlikely so that if a borrowed word is taken into Russian with a /g/ in final position it will remain as such. /mp/ is totally out, it occurs nowhere in

the language. /ks/ is possible in word final position but not when inflected. /ndz/, /mbl/, and /ngl/ are not possible in word final position Russian.

2. Spanish

In Spanish only the first three environments ('v', 'vr' and 'en') are allowed. On the first environment when inflected the {+d} form would be pronounced in Spanish in that position as a voiced (apico)-inter-dental fricative.

The second environment occurs since verbs in the infinitive end with /r/. The third environment /n/ is possible since it is the third person plural morpheme (e.g. tienen 'have'). None of these three can occur with +d following. None of the other environments occur.

3. Chinese (Mandarin)

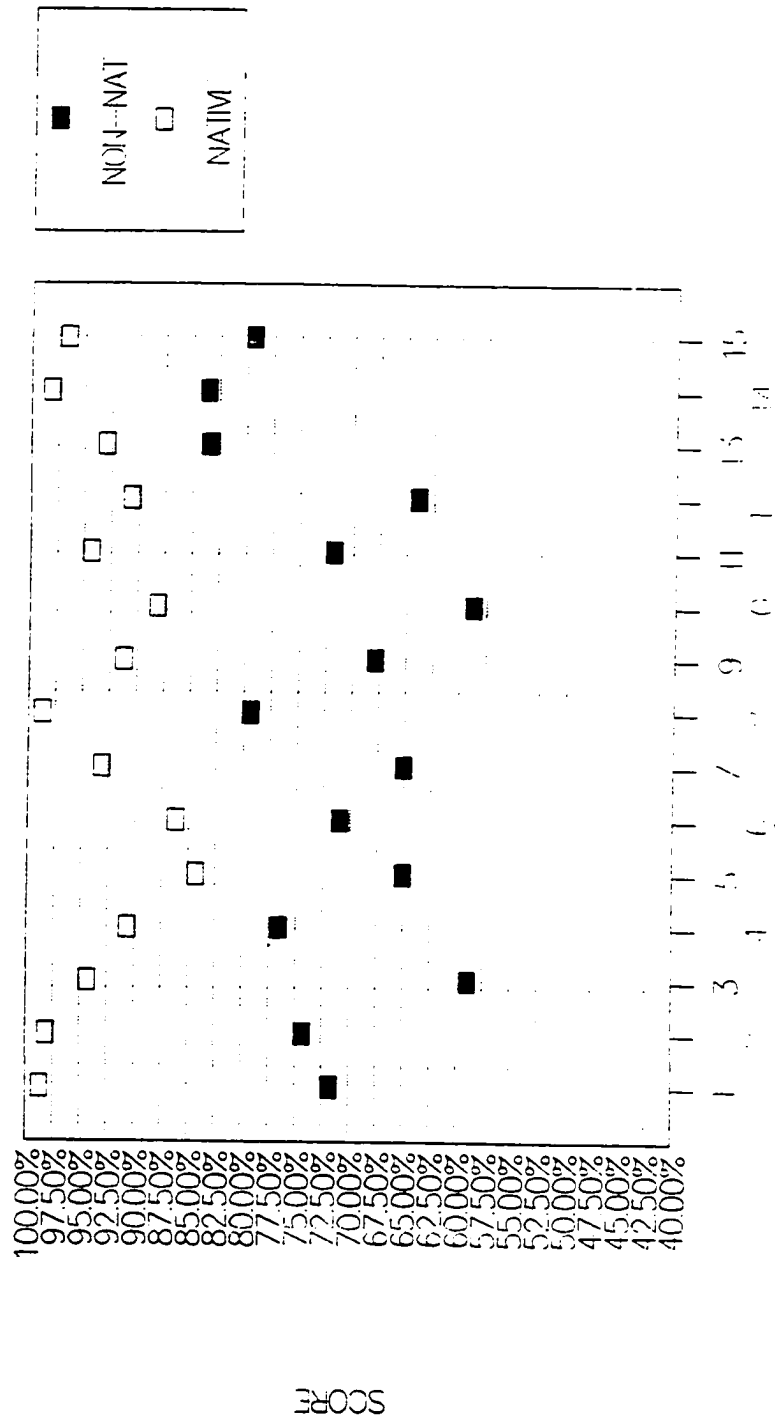
All words in Chinese (Mandarin) must end in a vowel so that the basic structure is CV with an optional added V and or an /n/ in final position. Only the first environment on the test when uninflected fitted this pattern all the other environments do not exist in Chinese. In initial position /b/, /k/, and /g/ may occur but not /p/. None of the consonant cluster endings that occur on the test occur in any position in Chinese.

4. Japanese

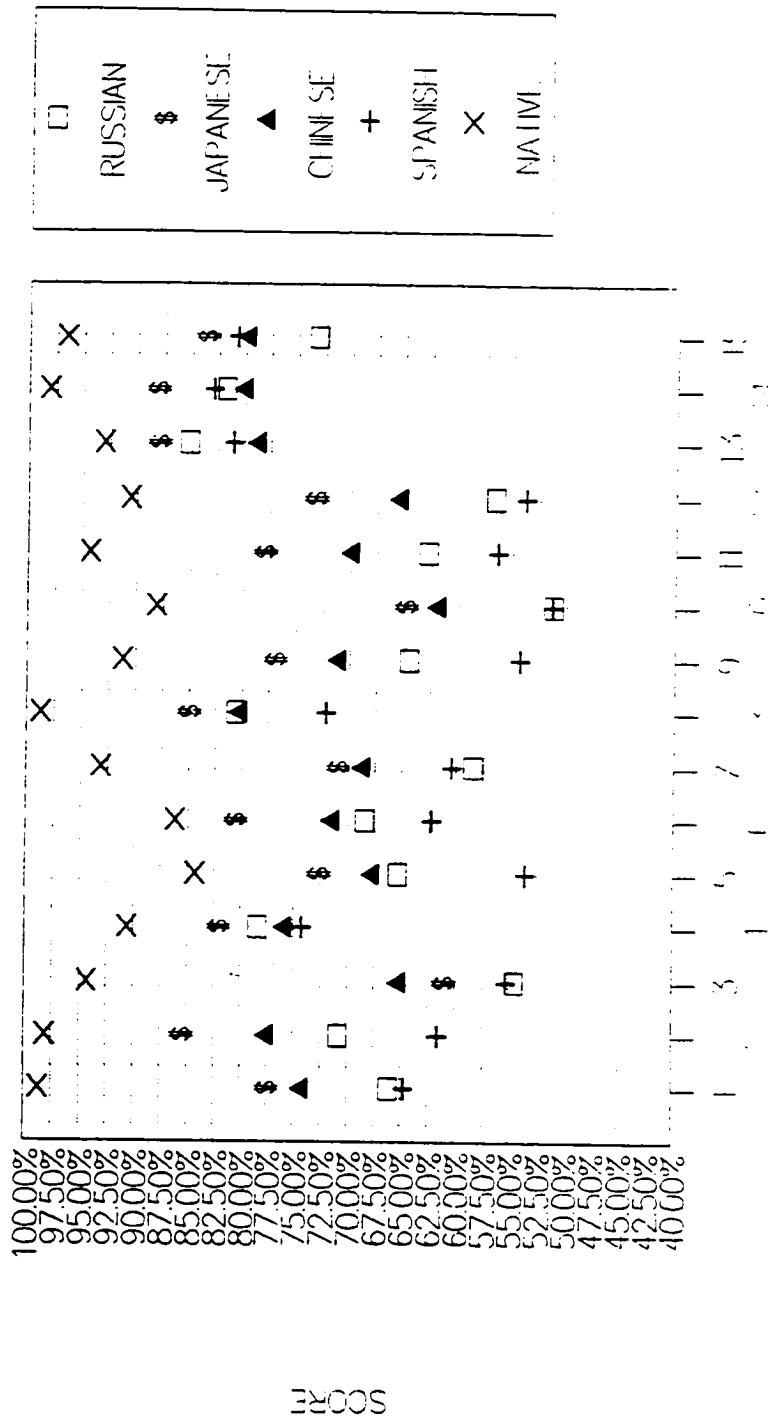
A consonant can only be followed by a vowel in Japanese, and thus the uninflected form of the first environment on the test is the only form that is directly shared between English and Japanese.

ALL NON--NATIVES

ALL 3 LEVELS VS. NATIVES

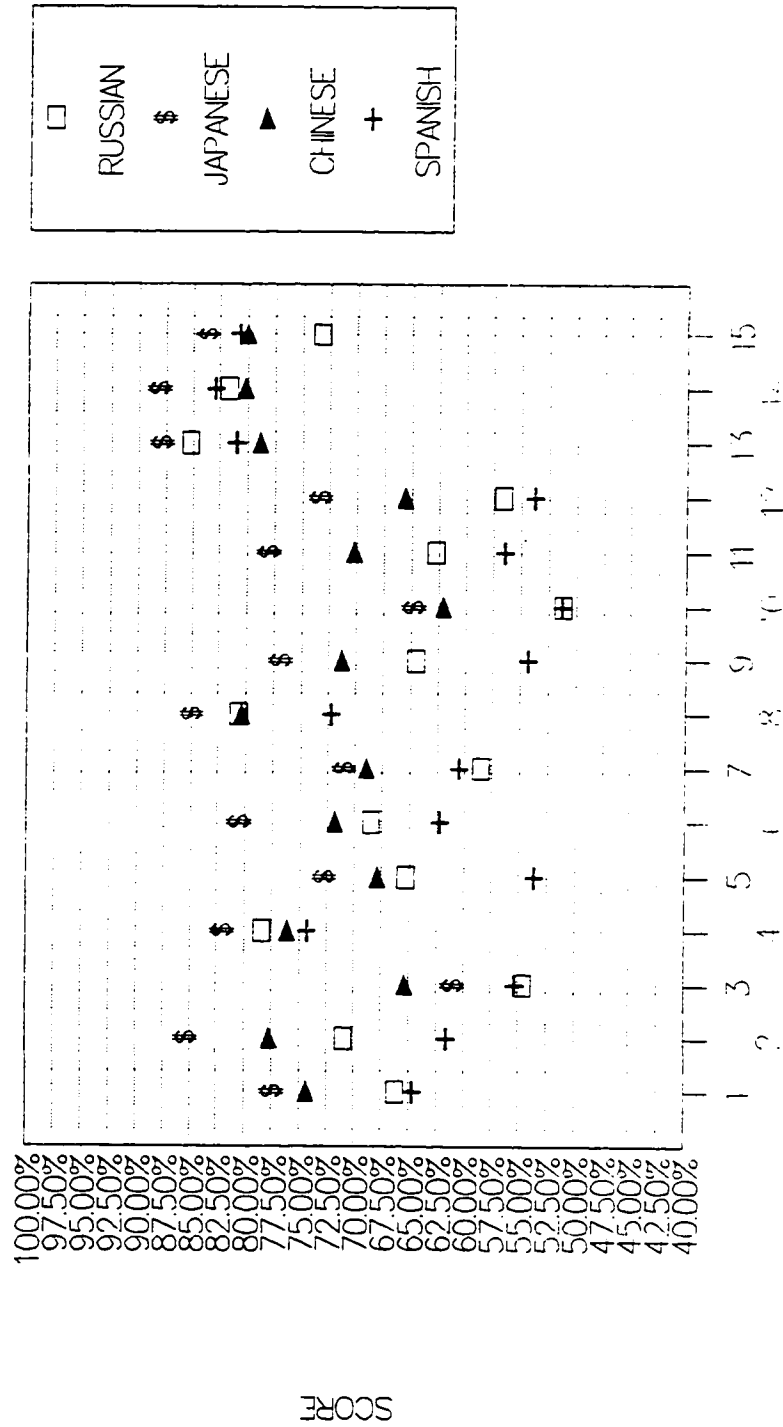


NON-NATIVES (ALL GROUPS) VS. NATIVES



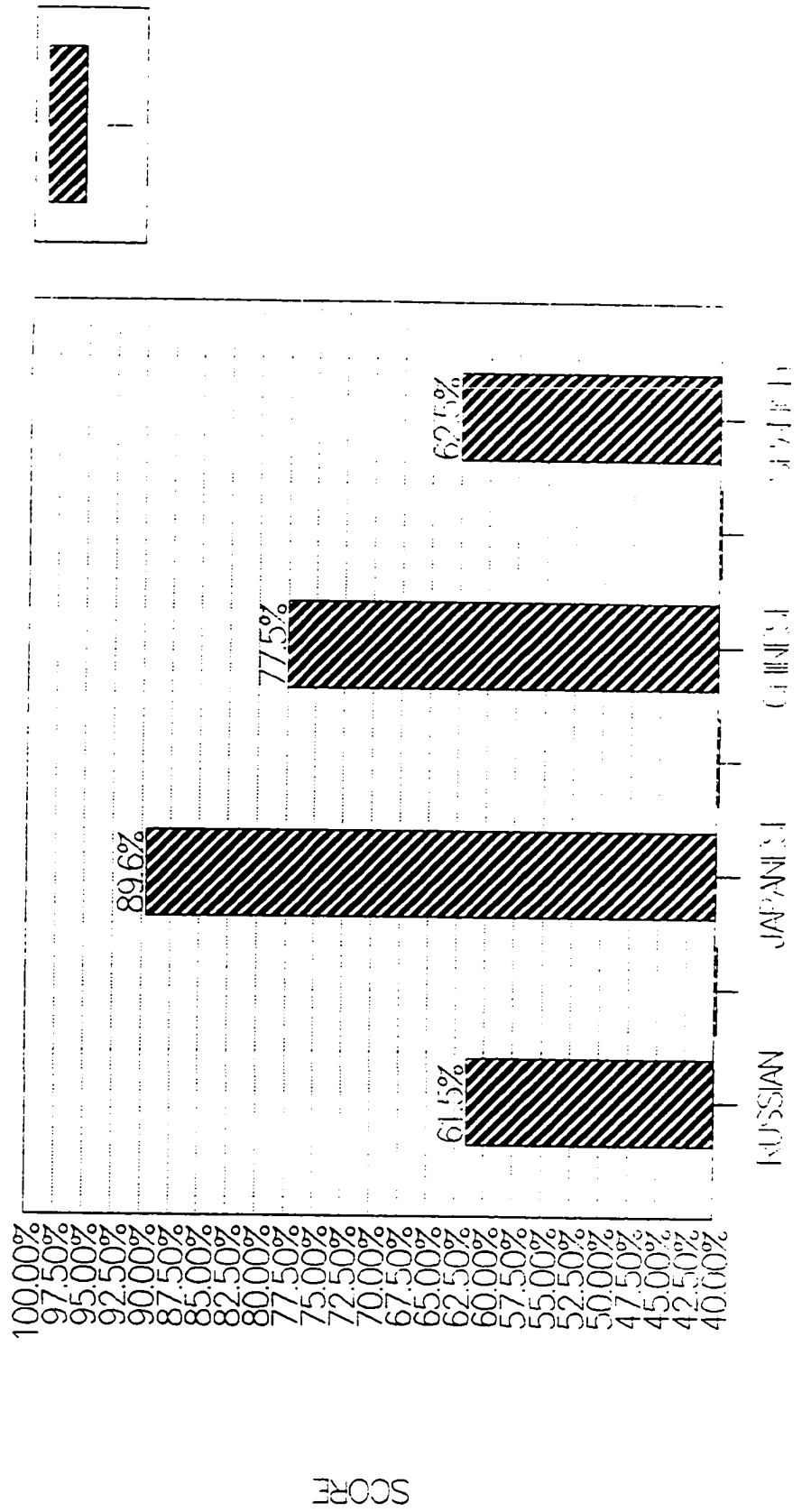
ALL FOUR LANGUAGES

ALL 3 LEVELS

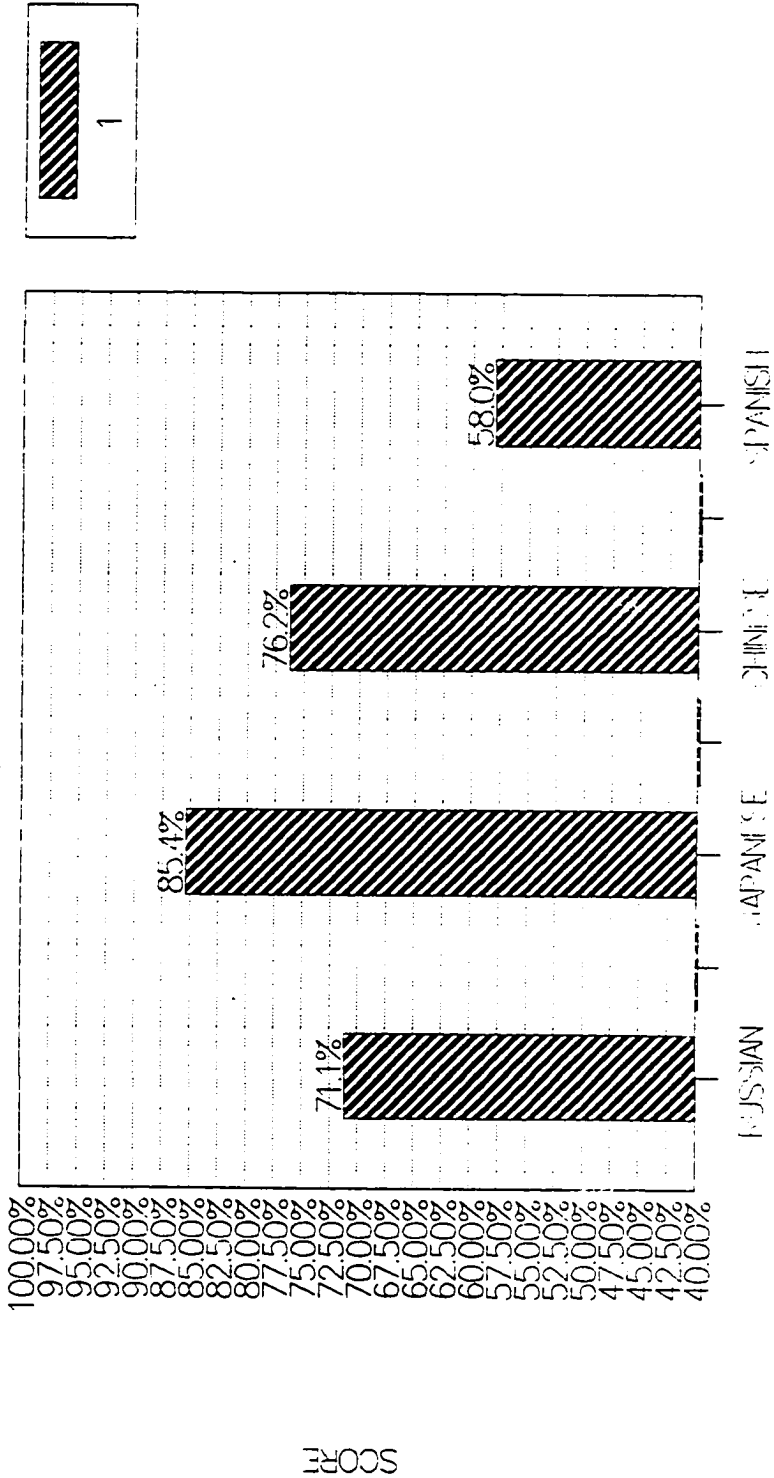


LEVEL A

ENVIRONMENT 1

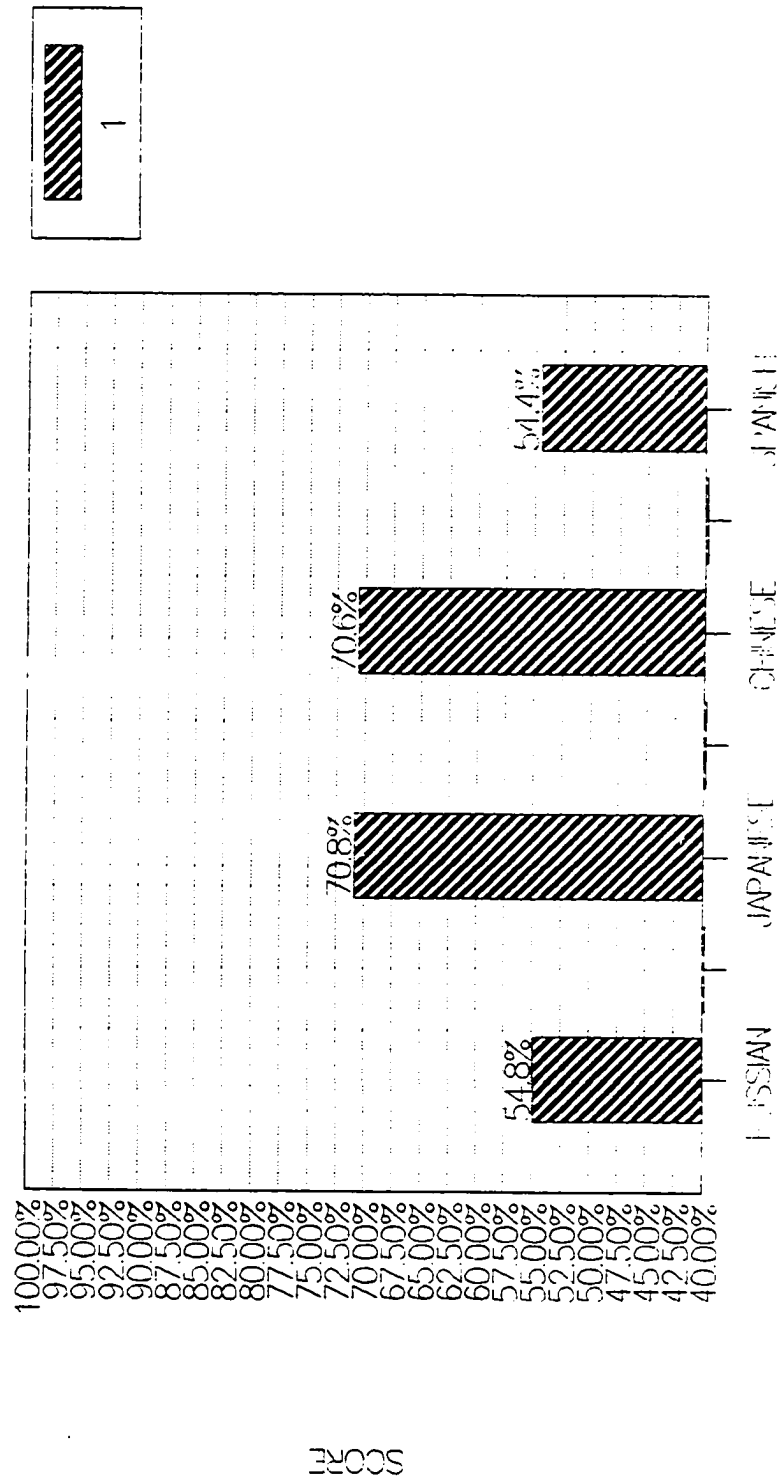


LEVEL A
ENVIRONMENT 2



LEVEL A

ENVIRONMENT 3

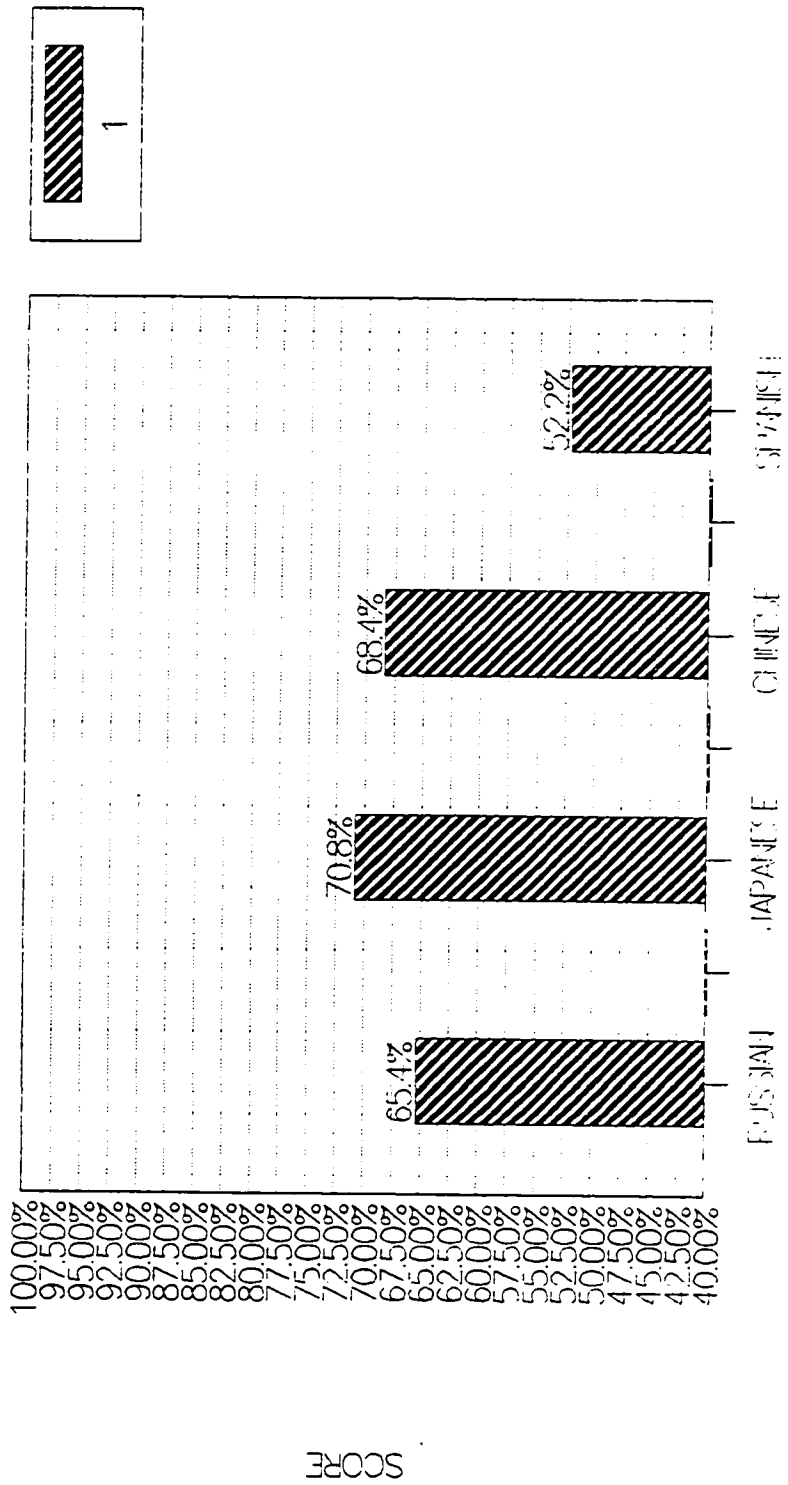


LEVEL A

ENVIRONMENT 4

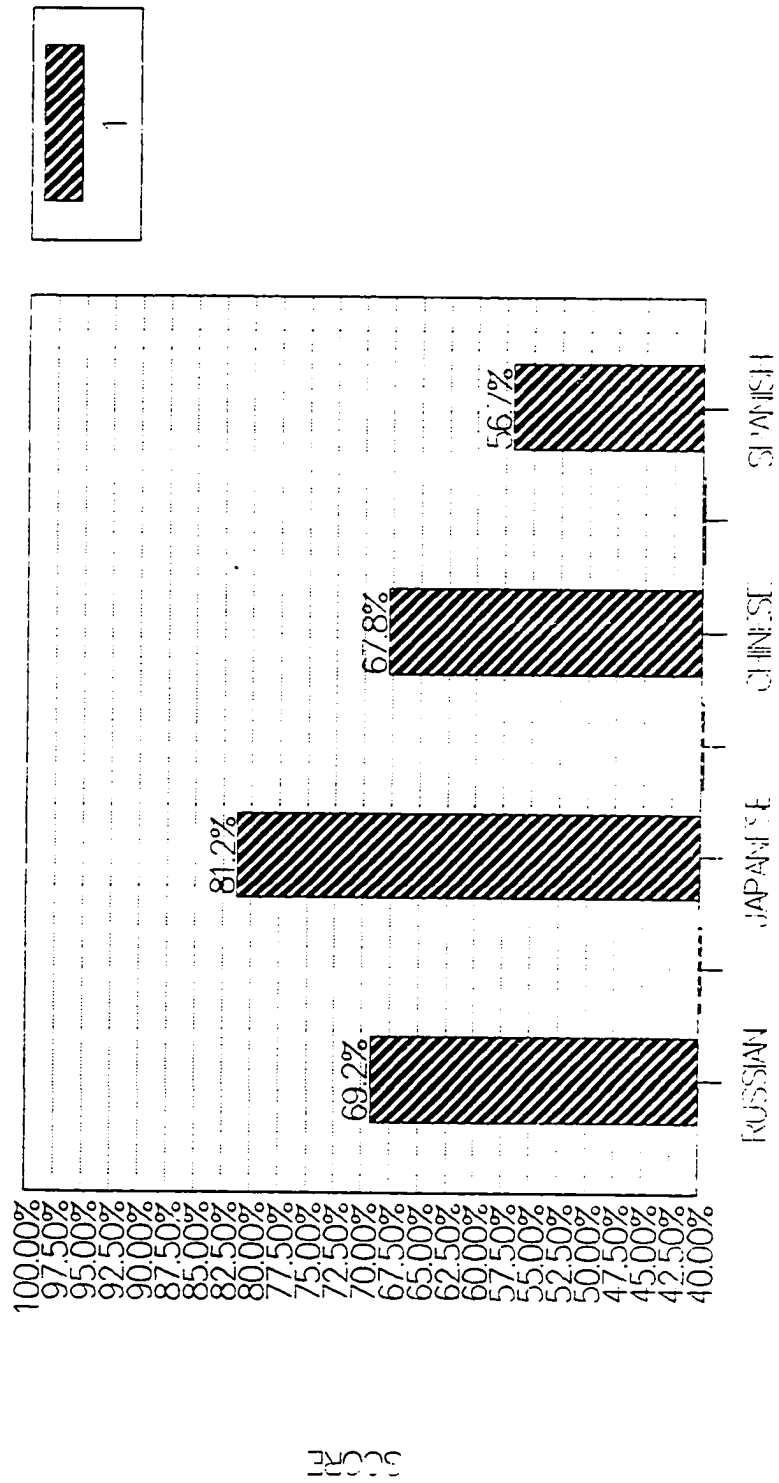


LEVEL A
ENVIRONMENT 5



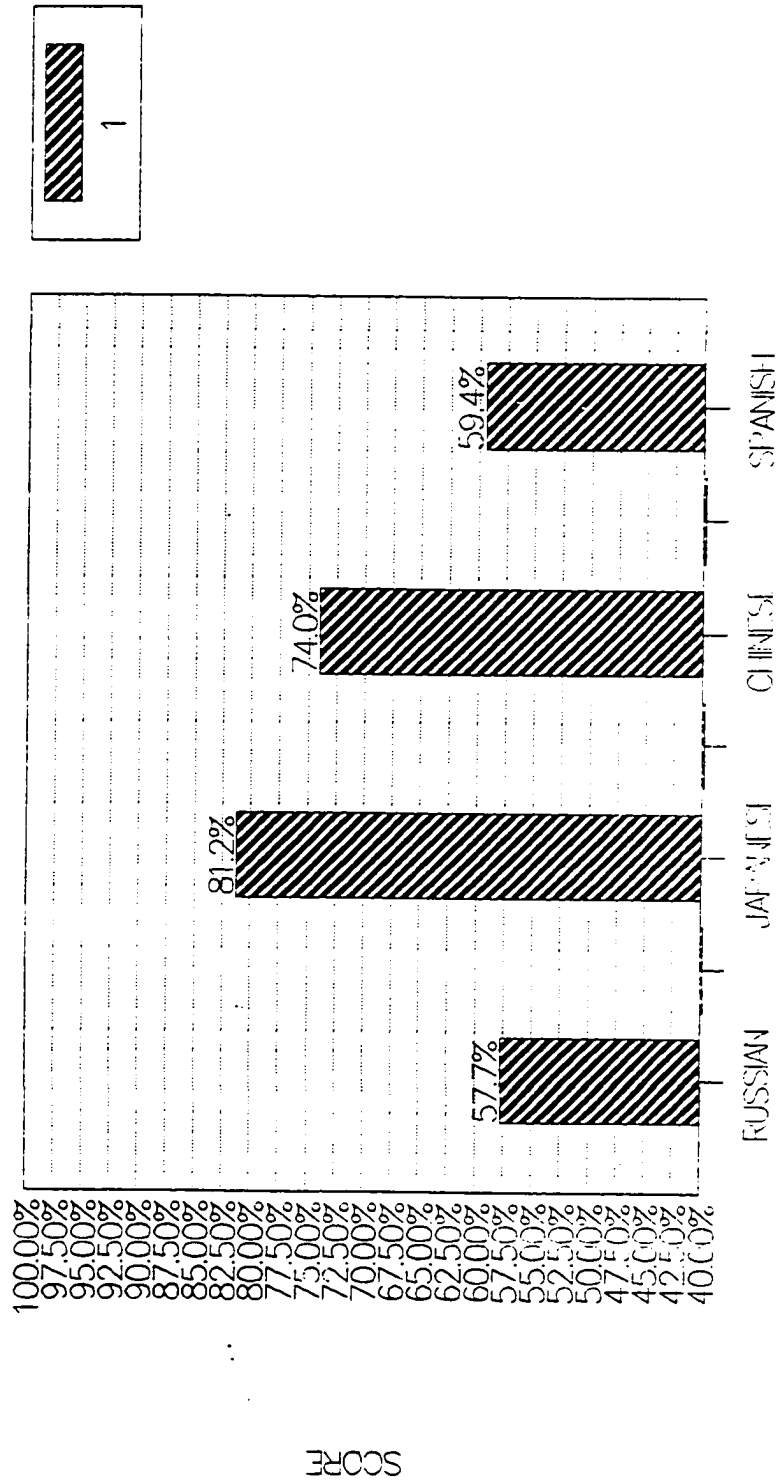
LEVEL A

ENVIRONMENT 6



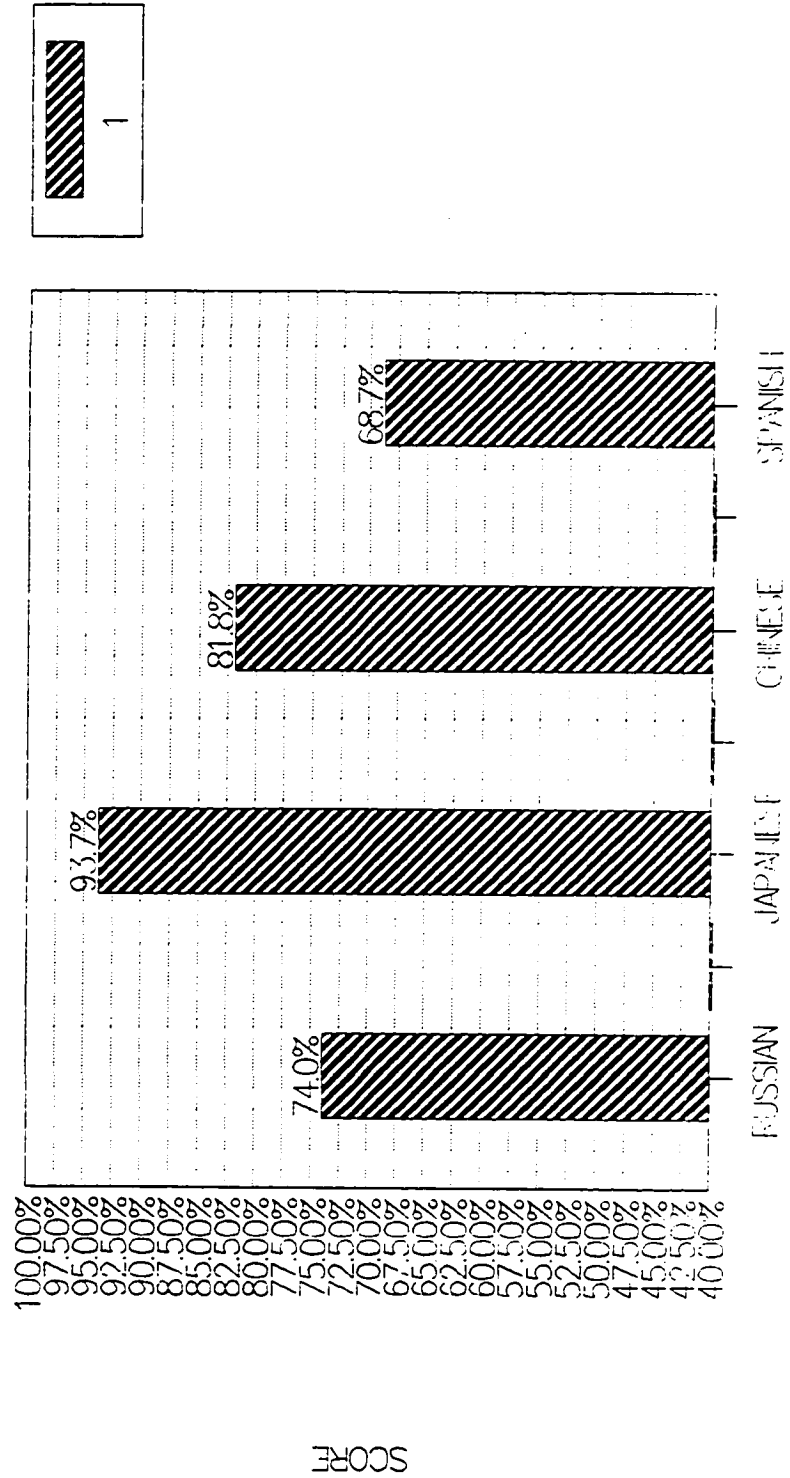
LEVEL A

ENVIRONMENT 7



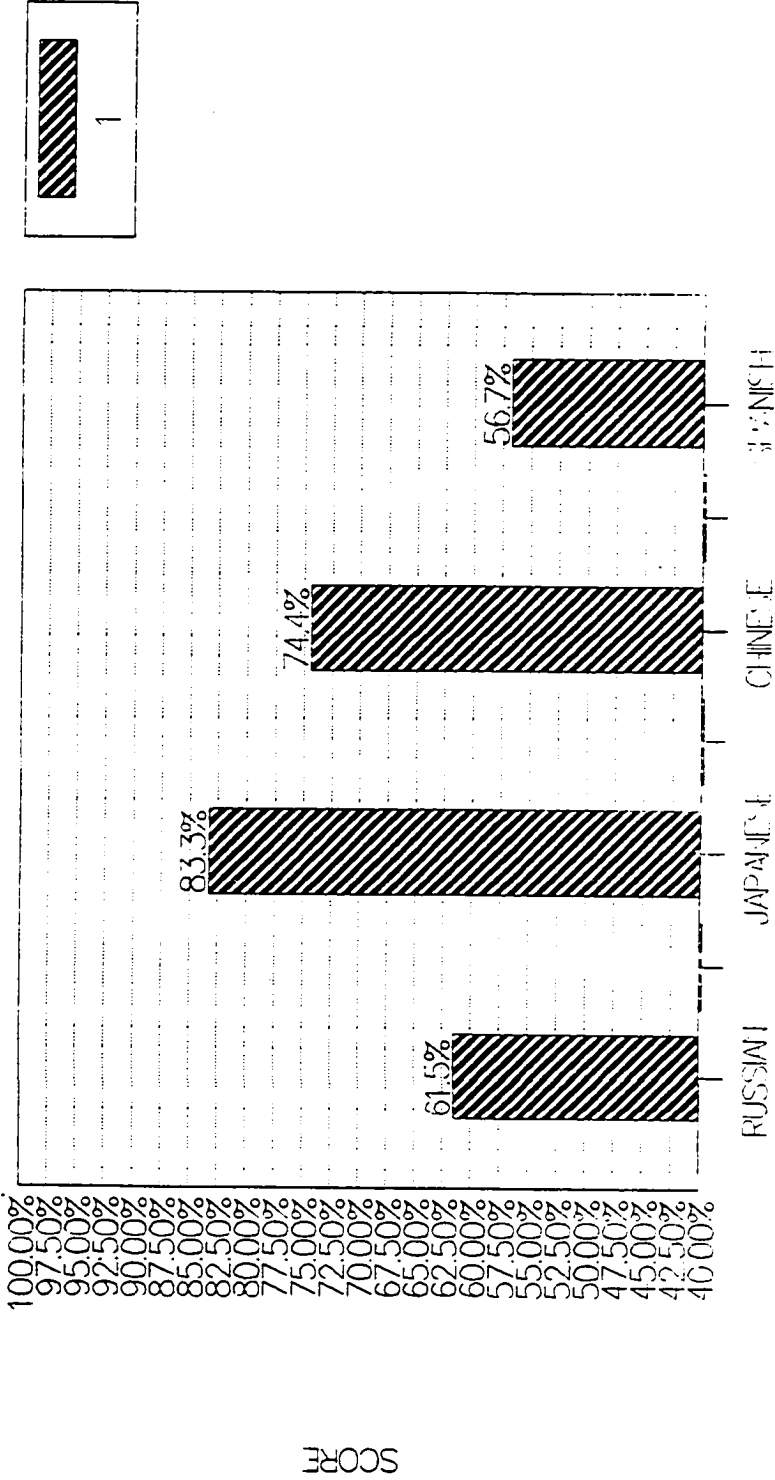
LEVEL A

ENVIRONMENT 8

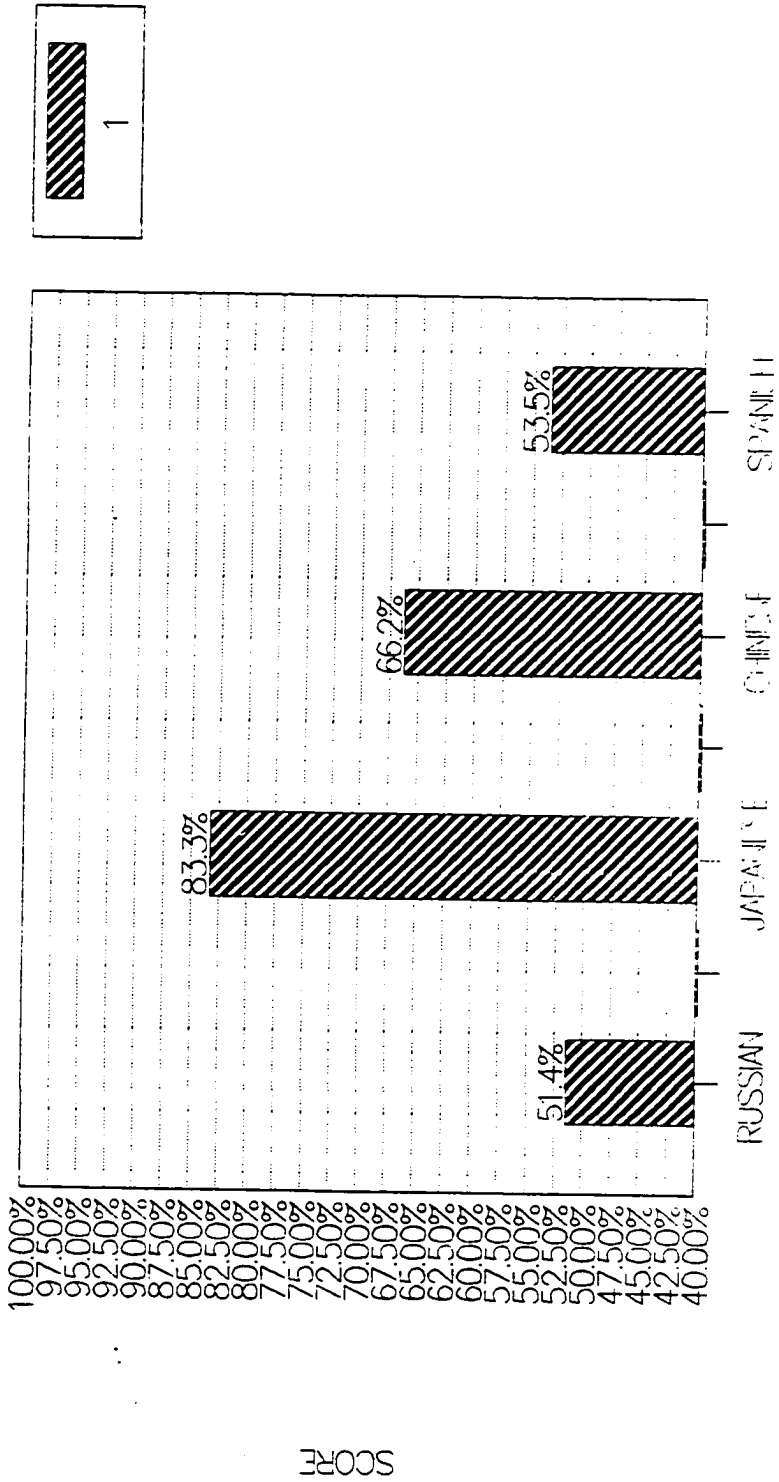


LEVEL A

ENVIRONMENT 9

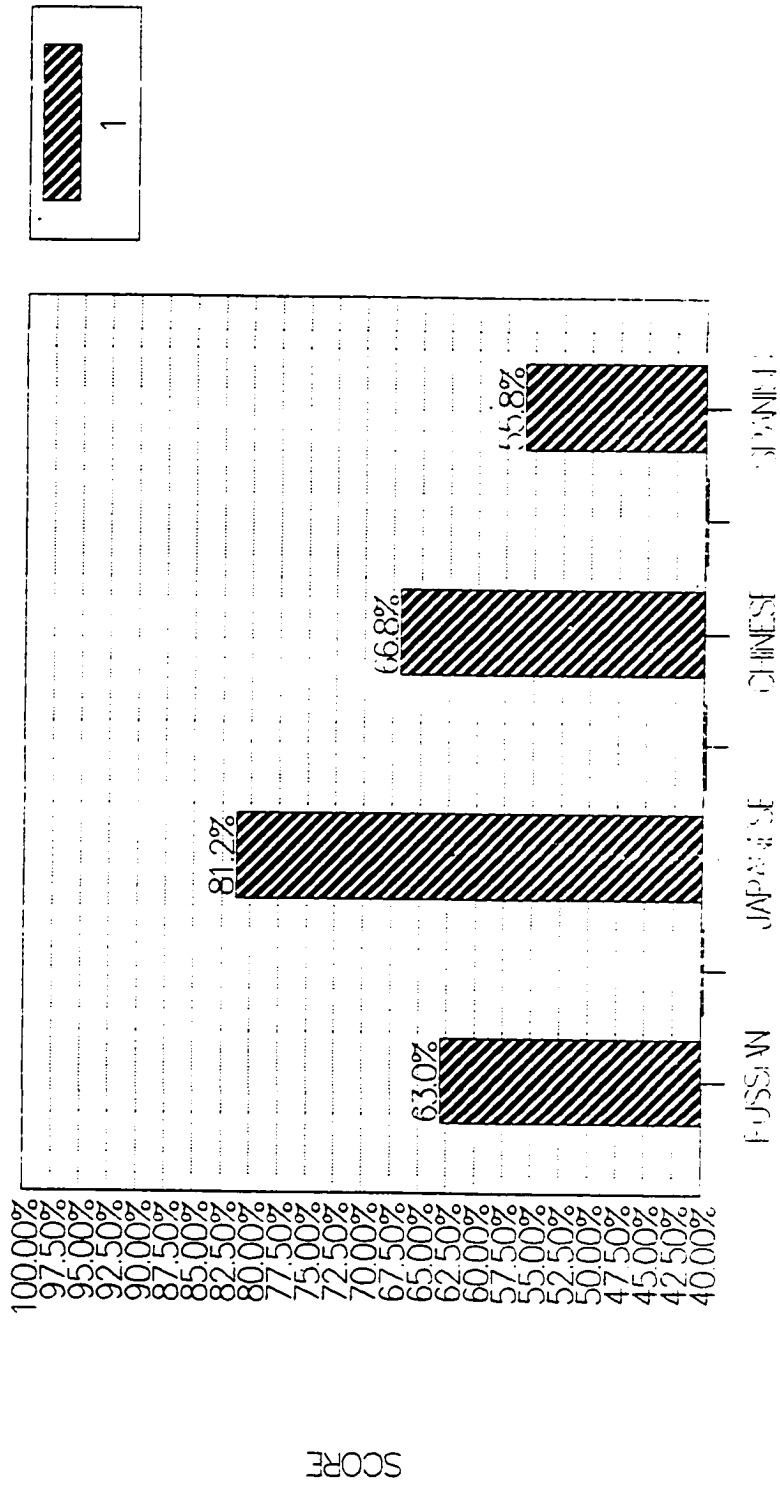


LEVEL A
ENVIRONMENT 10

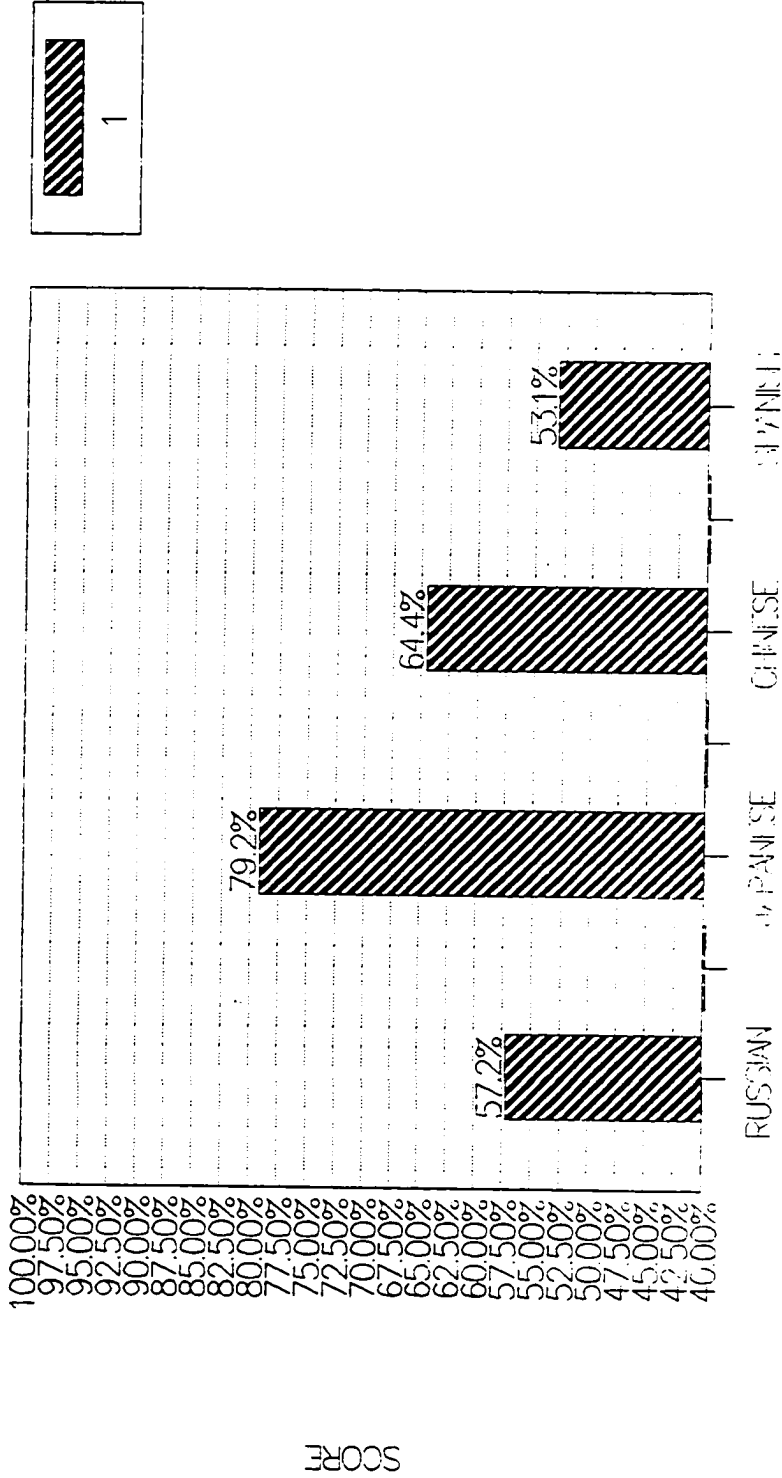


LEVEL A

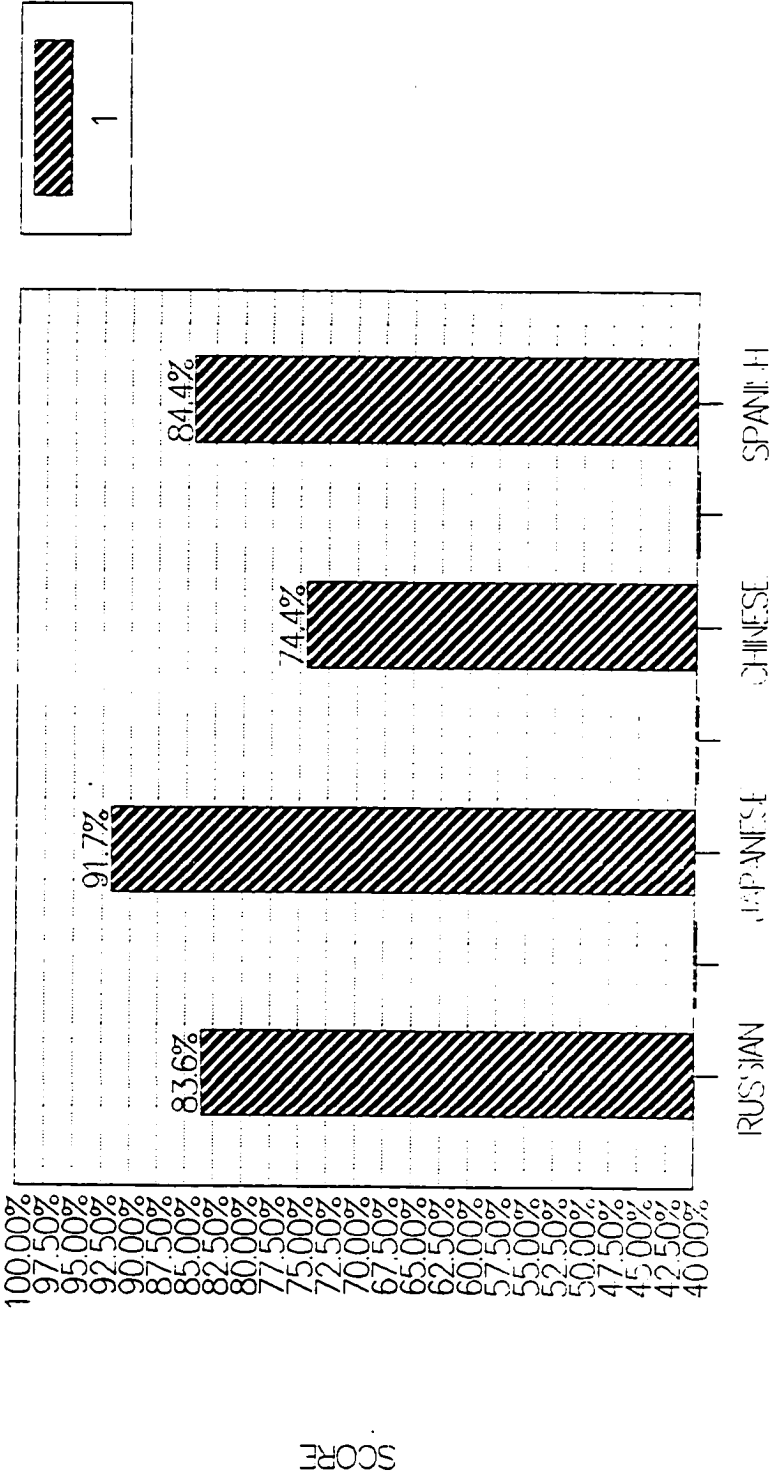
ENVIRONMENT 11



LEVEL A
ENVIRONMENT 12

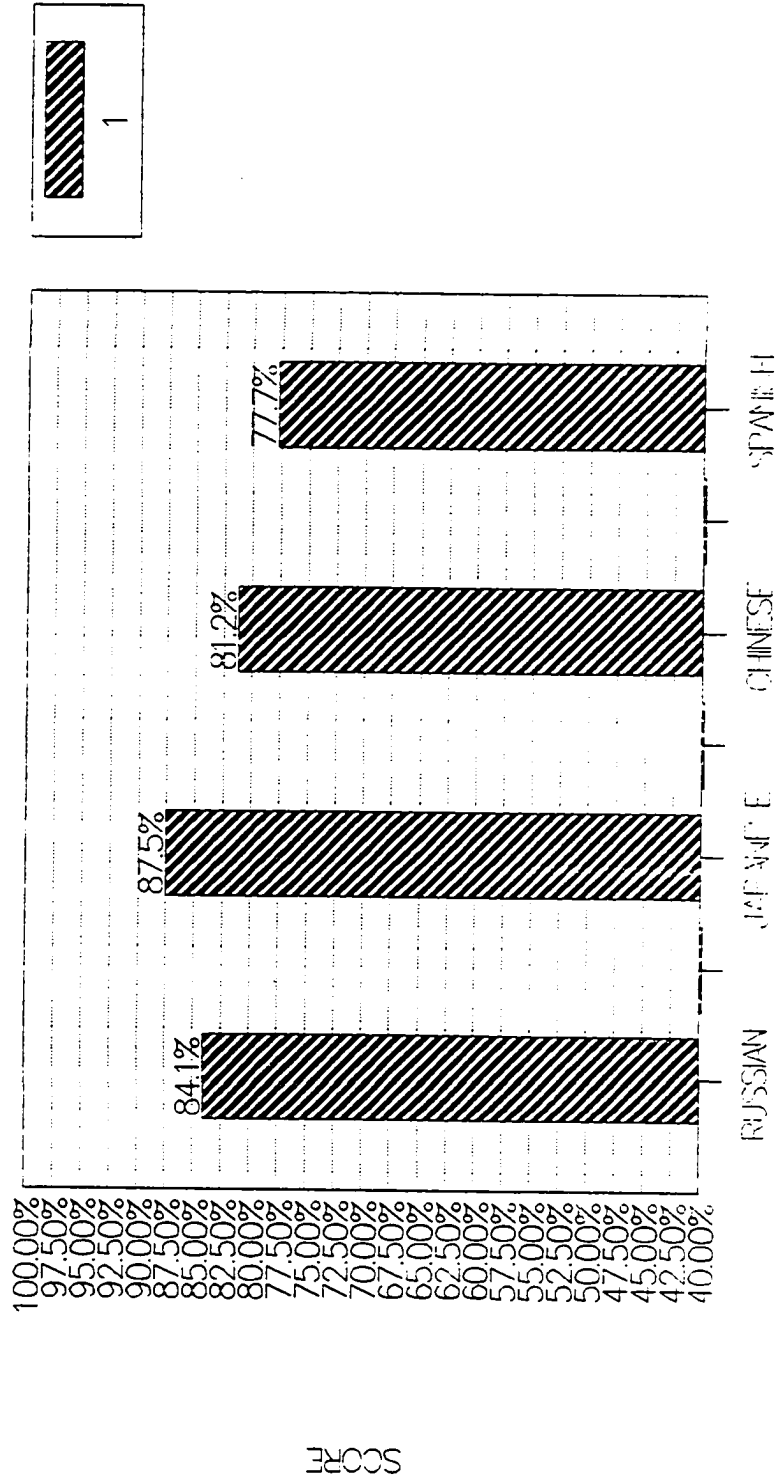


LEVEL A
ENVIRONMENT 13



LEVEL A

ENVIRONMENT 14



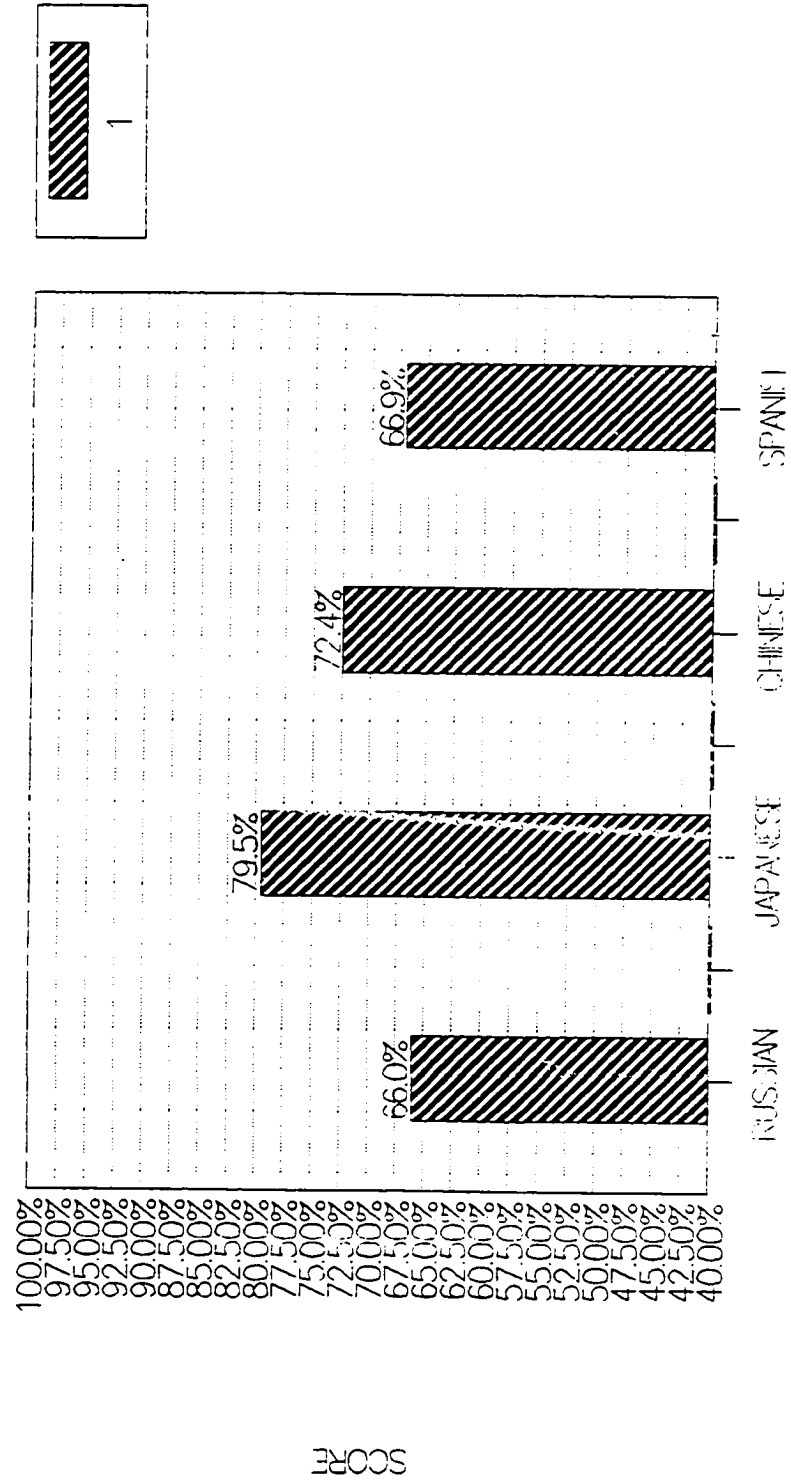
LEVEL A

ENVIRONMENT 15

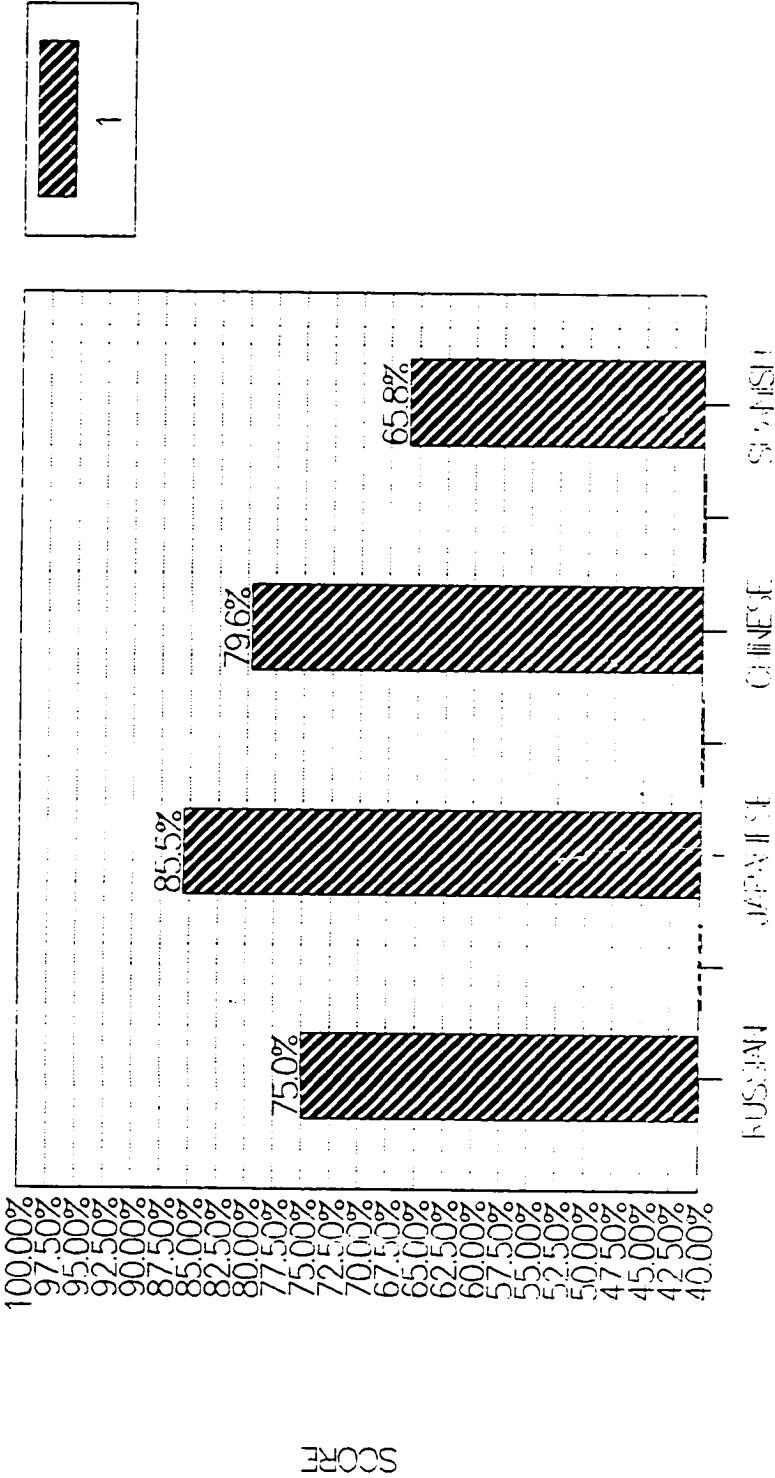


LEVEL B

ENVIRONMENT 1



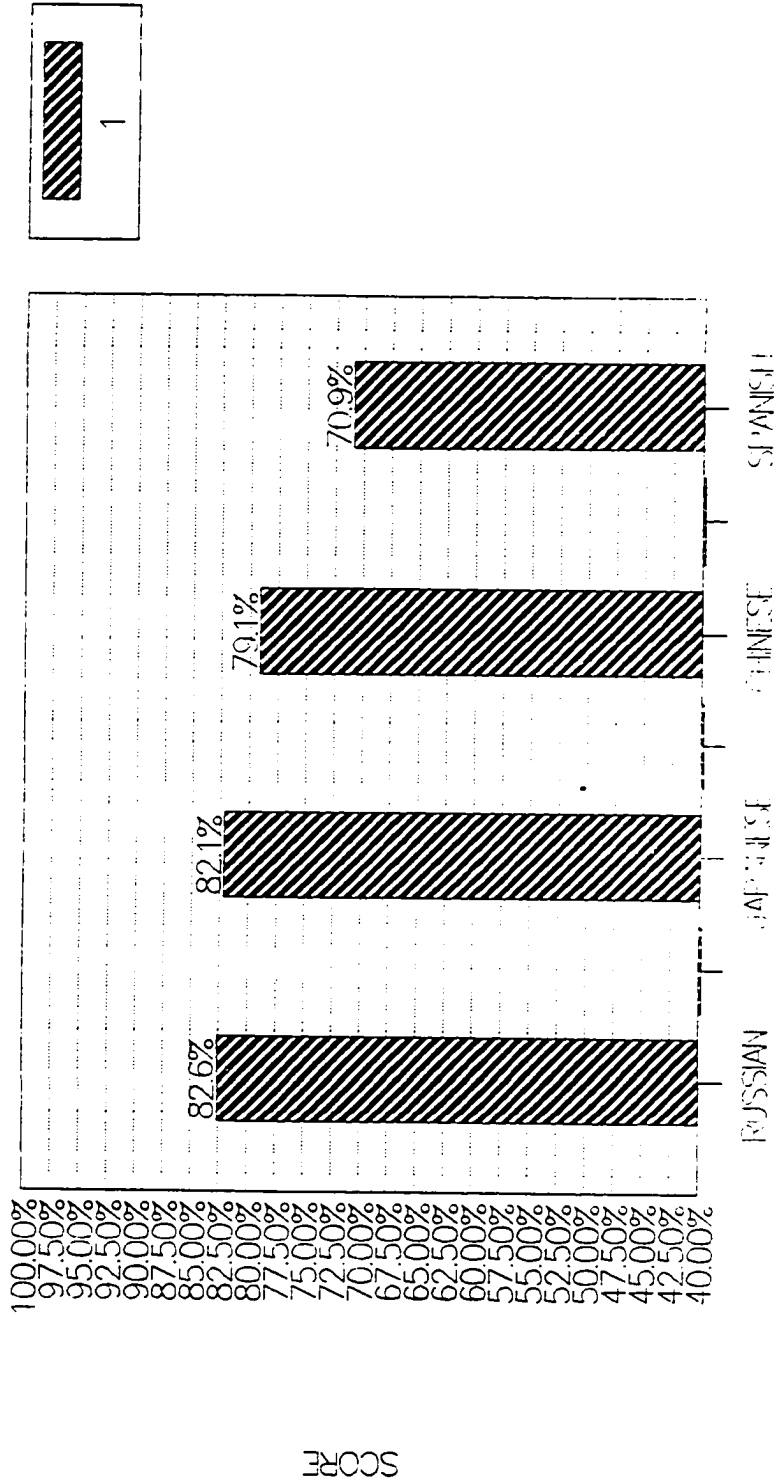
LEVEL B
ENVIRONMENT 2



LEVEL B
ENVIRONMENT 3

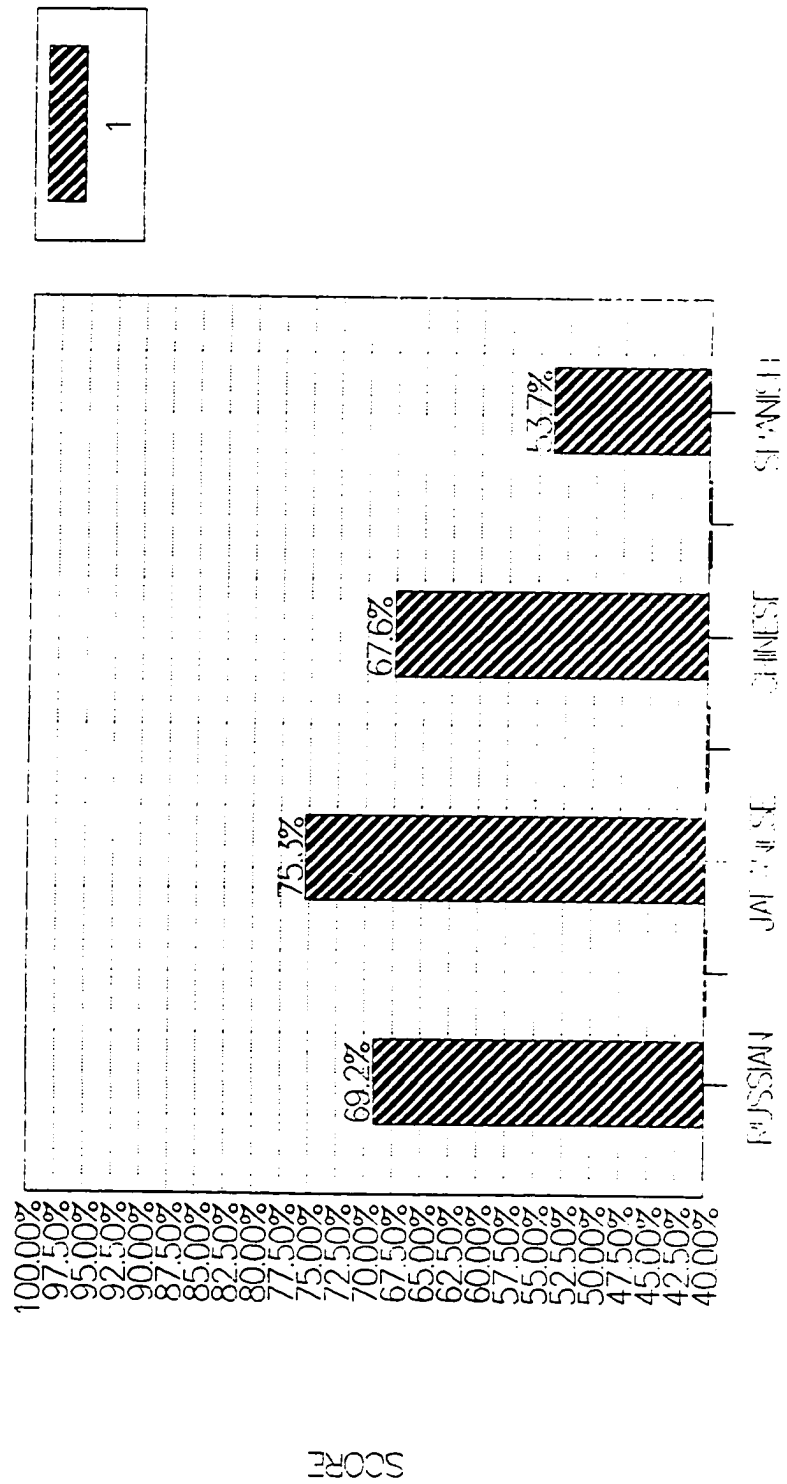


LEVEL B
ENVIRONMENT 4



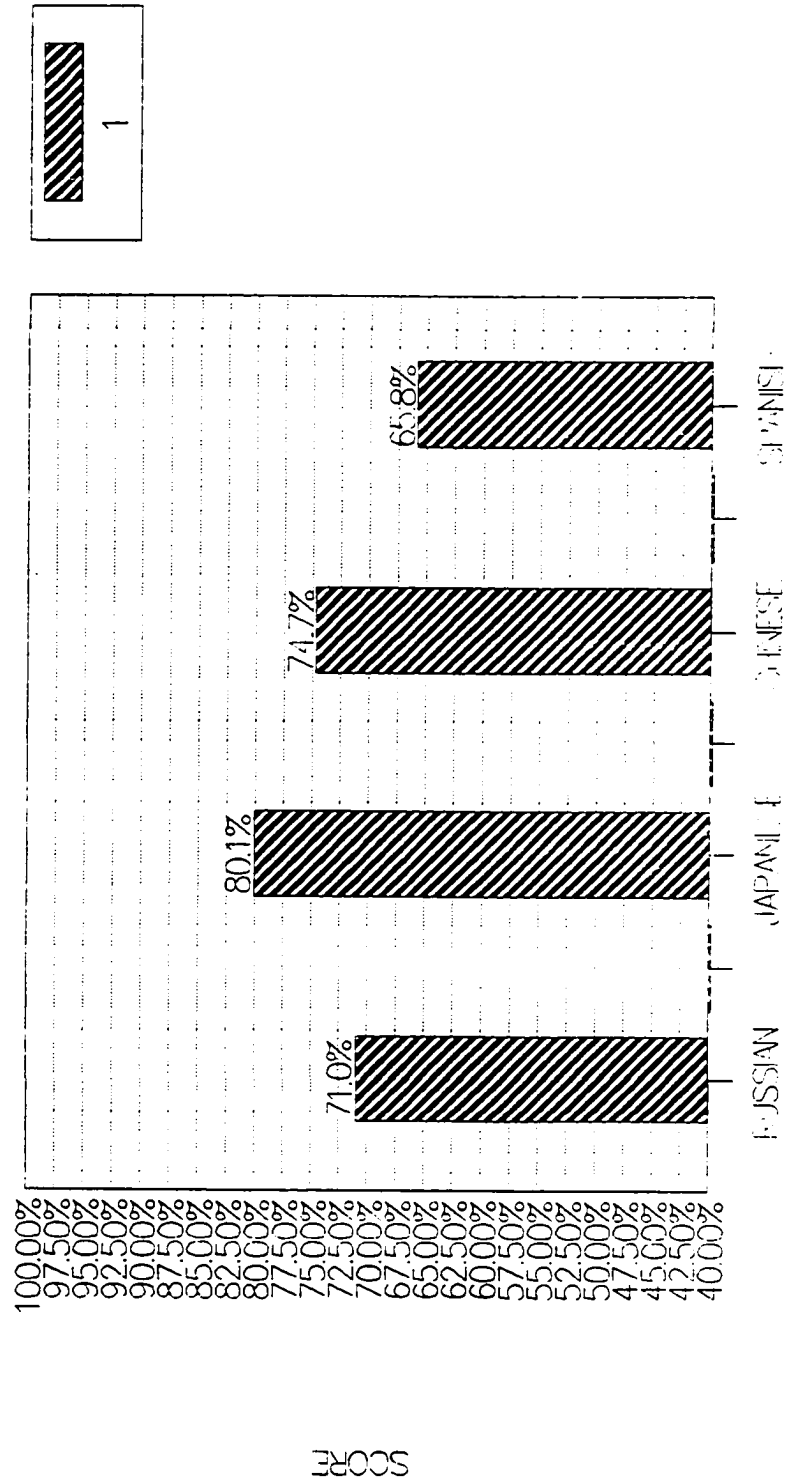
LEVEL B

ENVIRONMENT 5

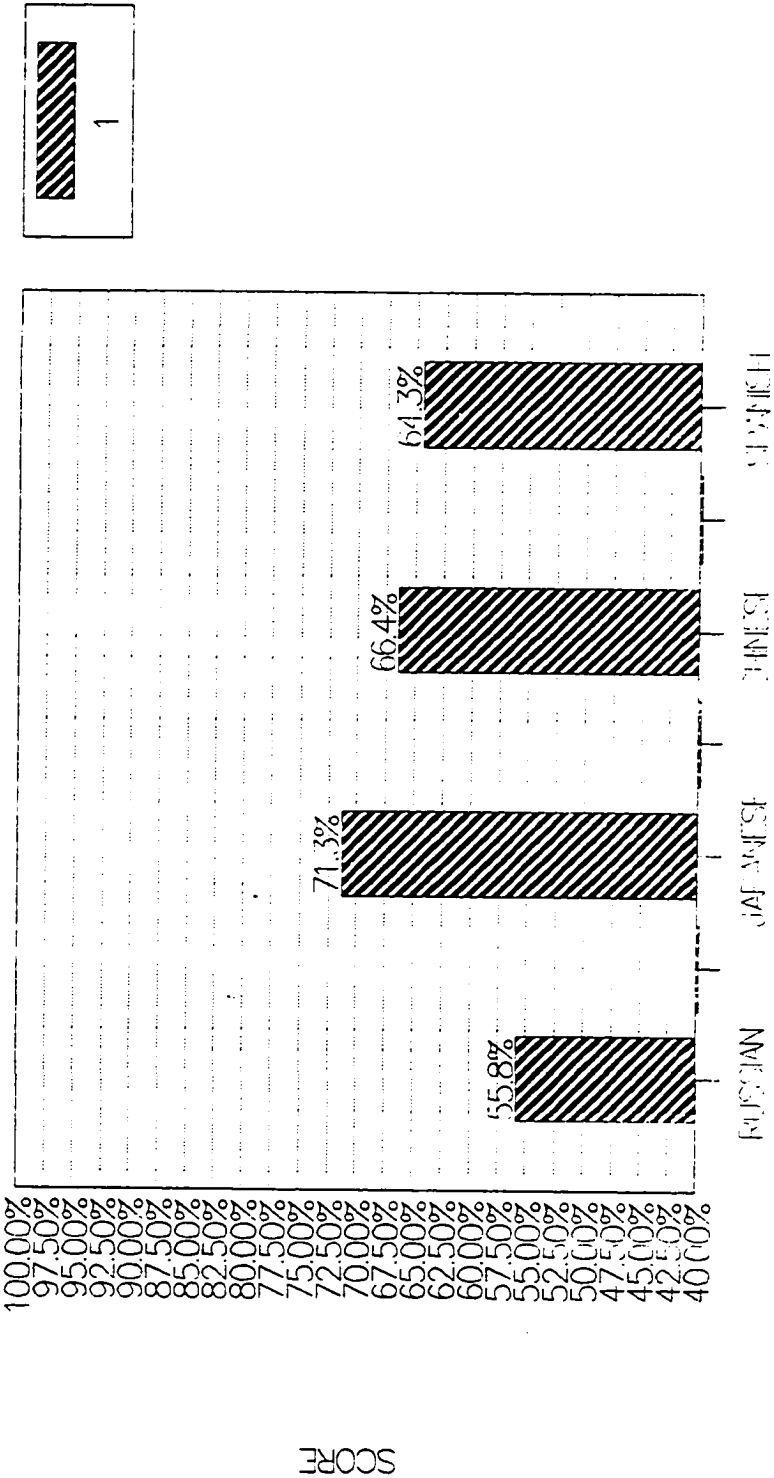


LEVEL B

ENVIRONMENT 6



LEVEL B
ENVIRONMENT 7

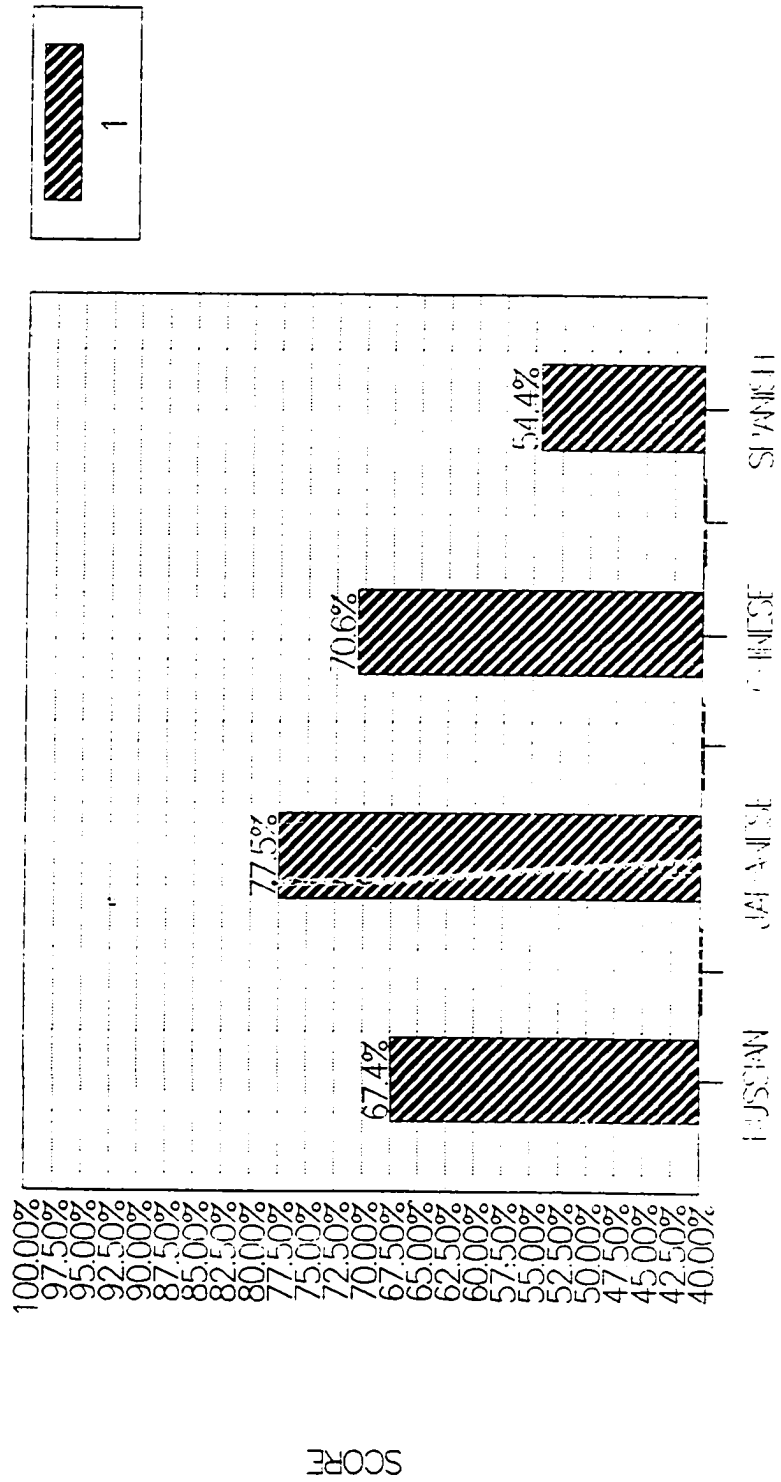


LEVEL B
ENVIRONMENT 8



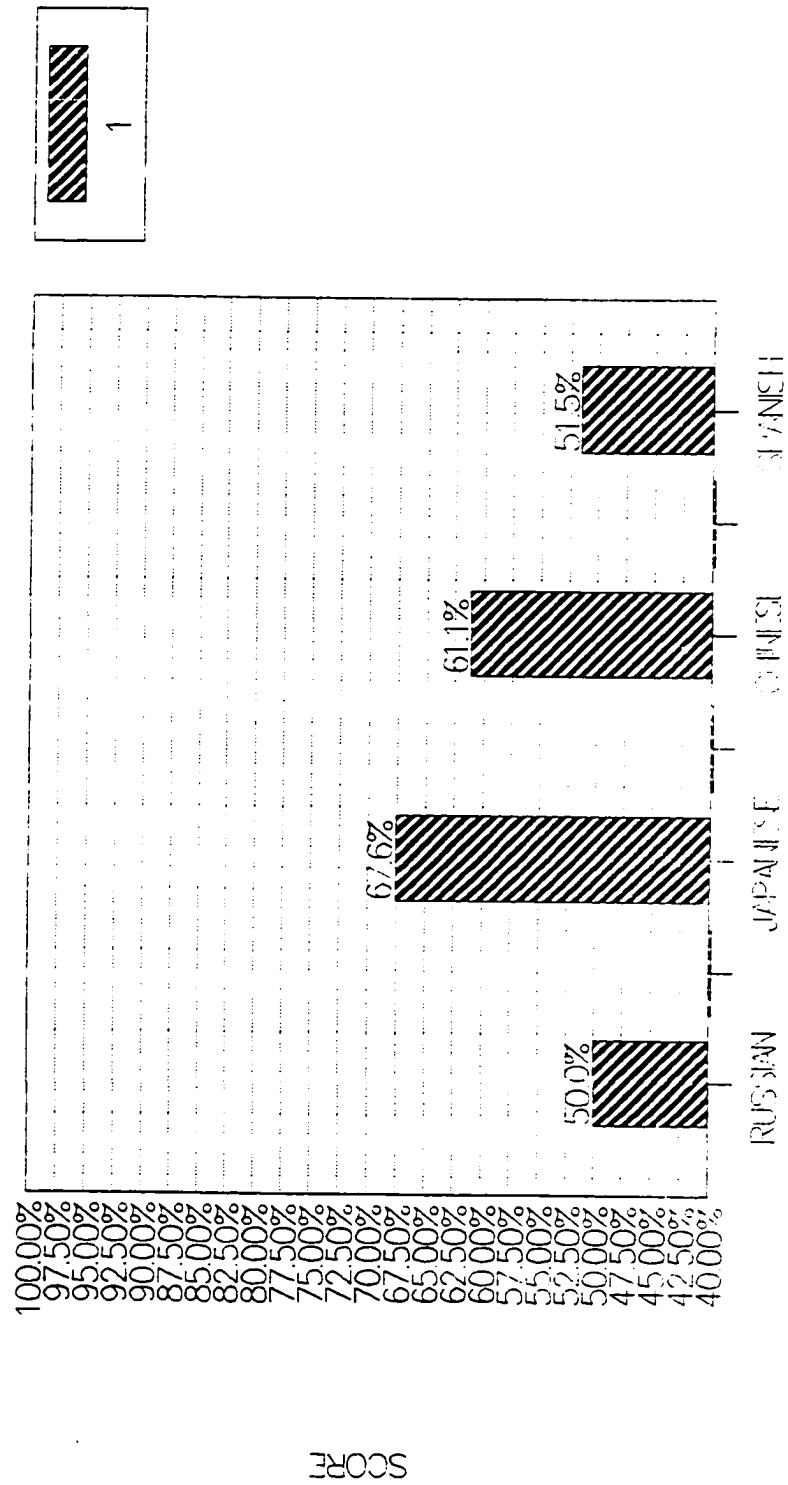
LEVEL B

ENVIRONMENT 9

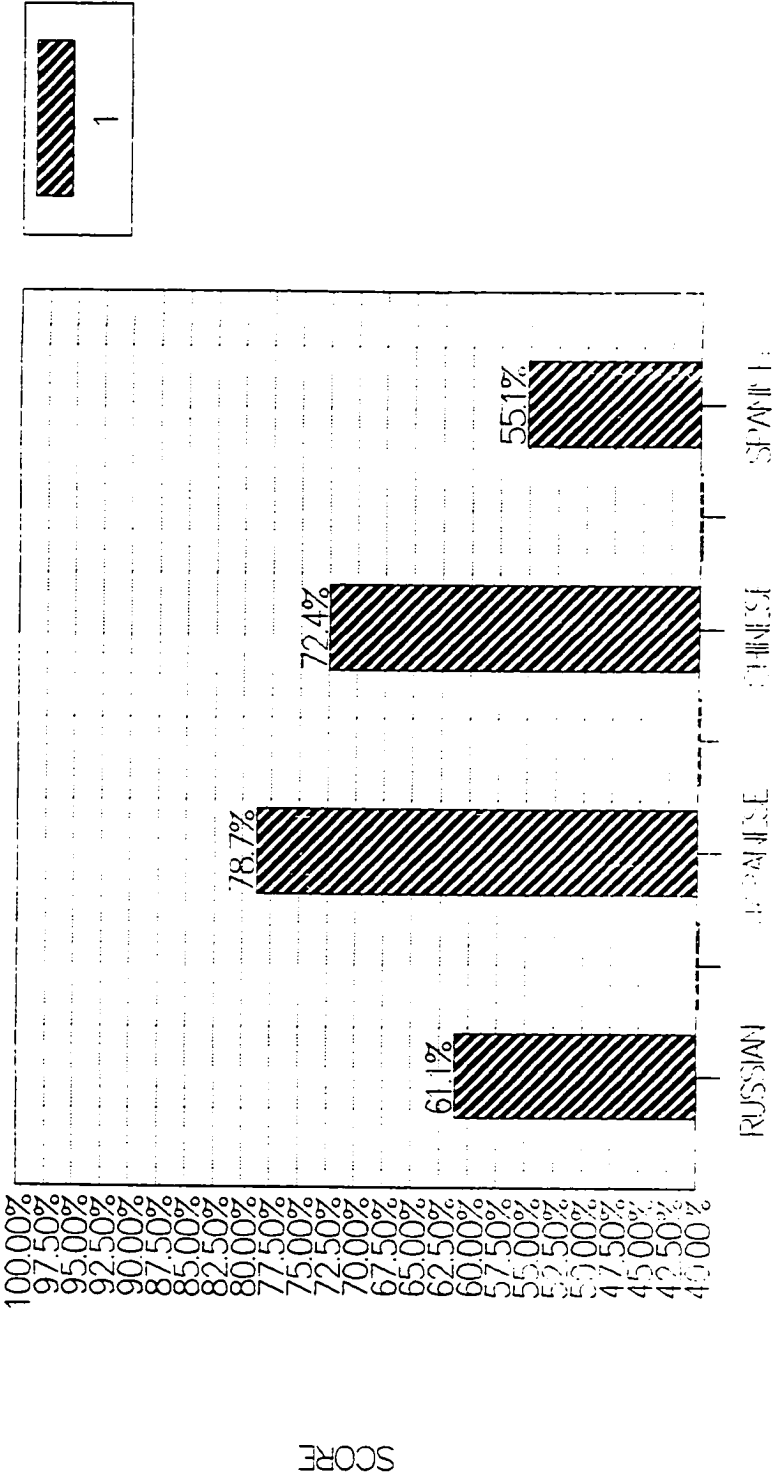


LEVEL B

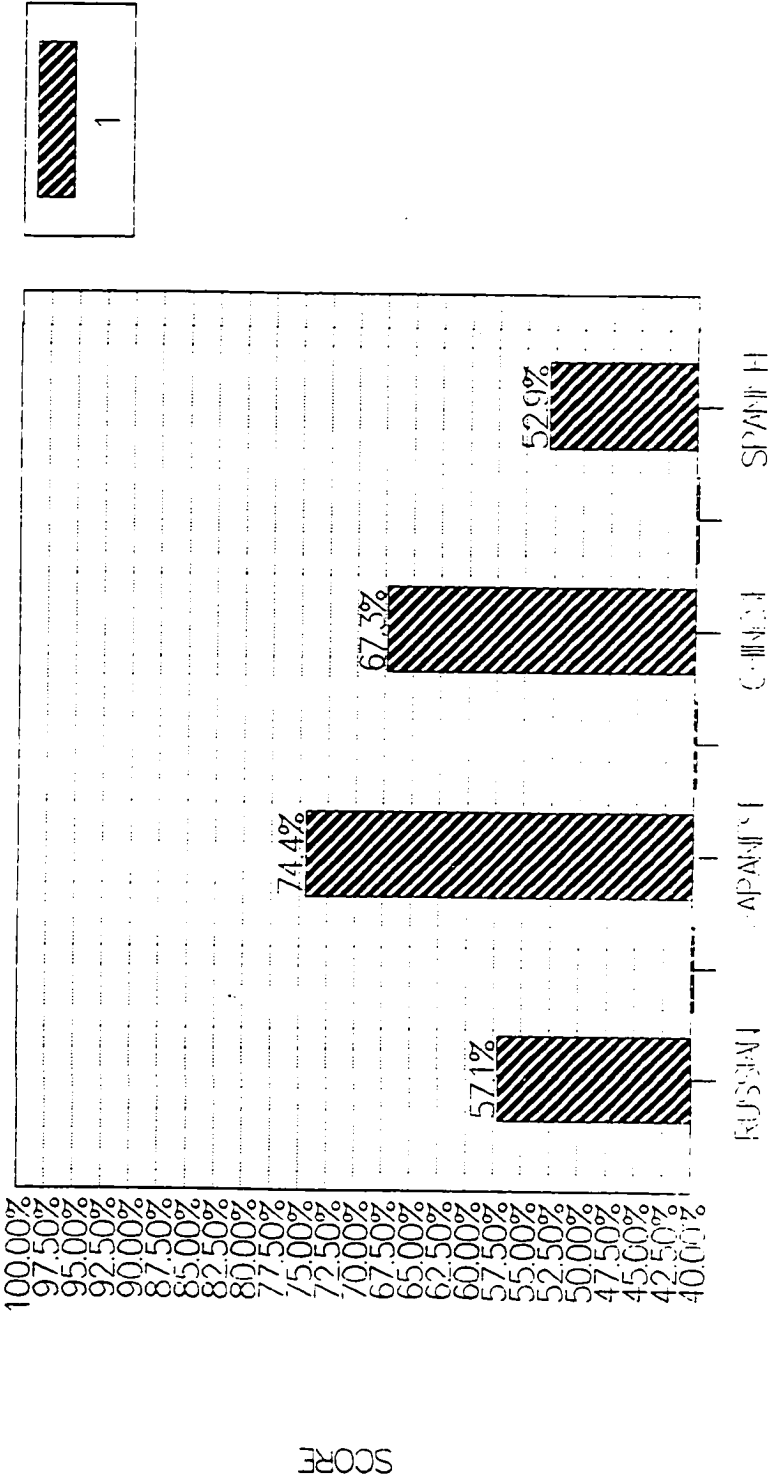
ENVIRONMENT 10



LEVEL B
ENVIRONMENT 11

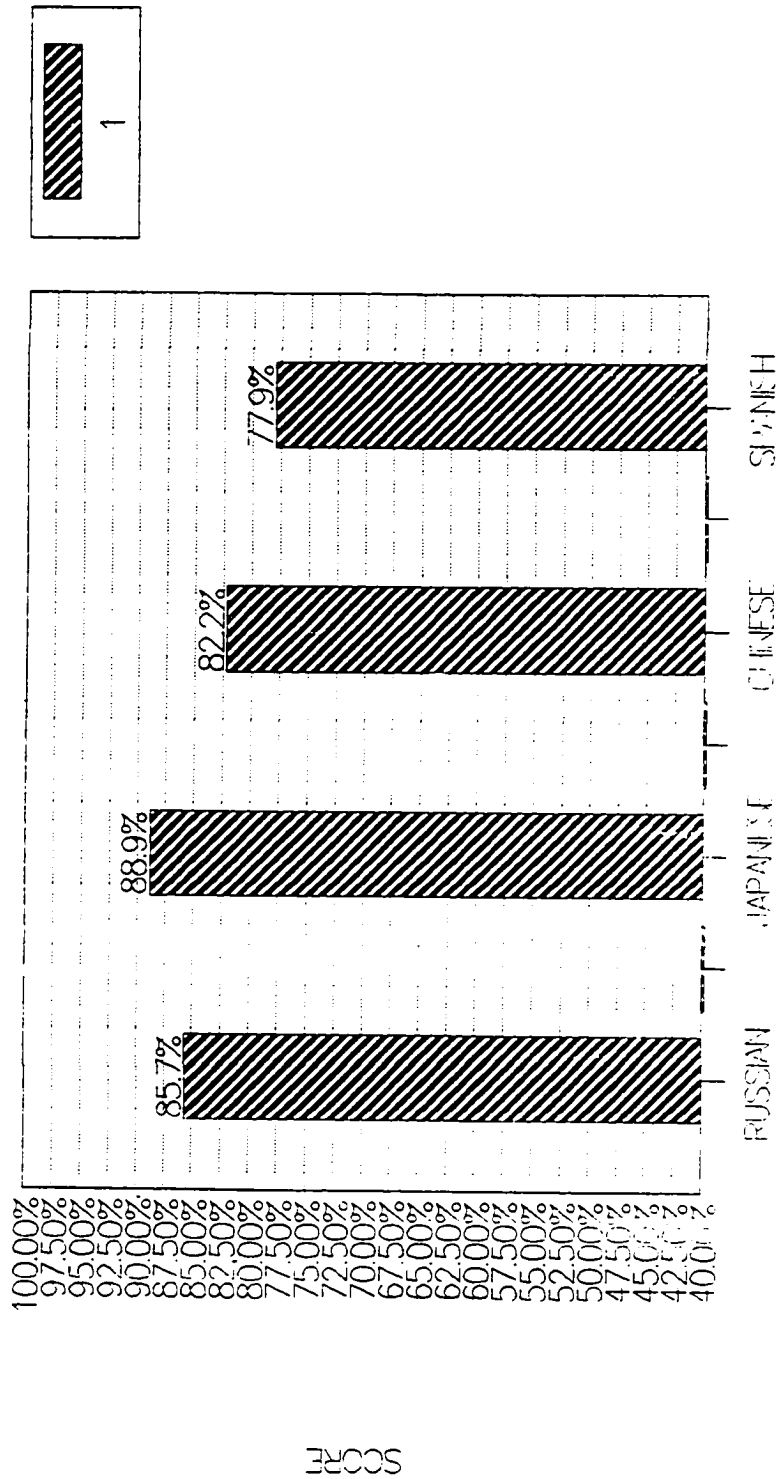


LEVEL B
ENVIRONMENT 12



LEVEL B

ENVIRONMENT 13

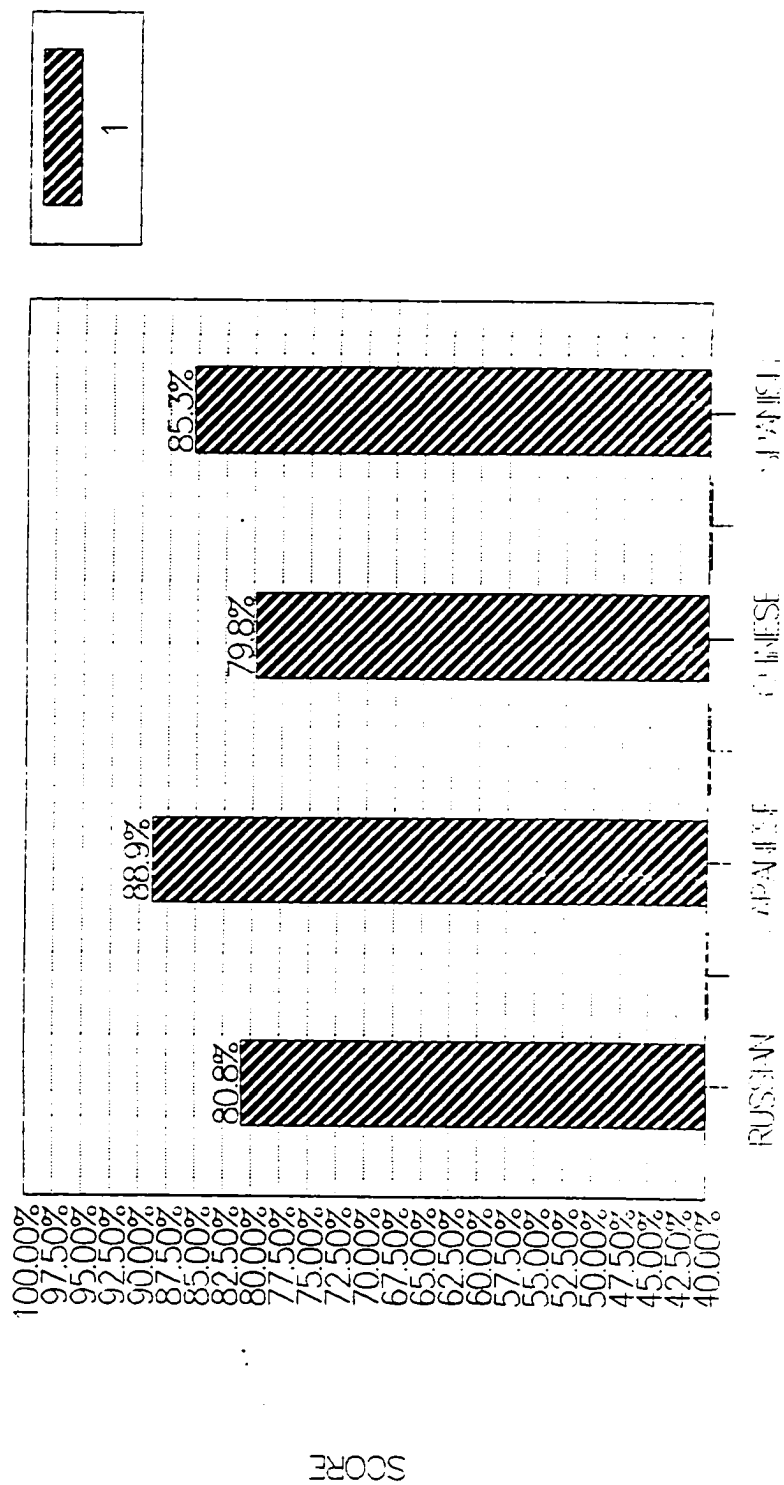


SCORE

1

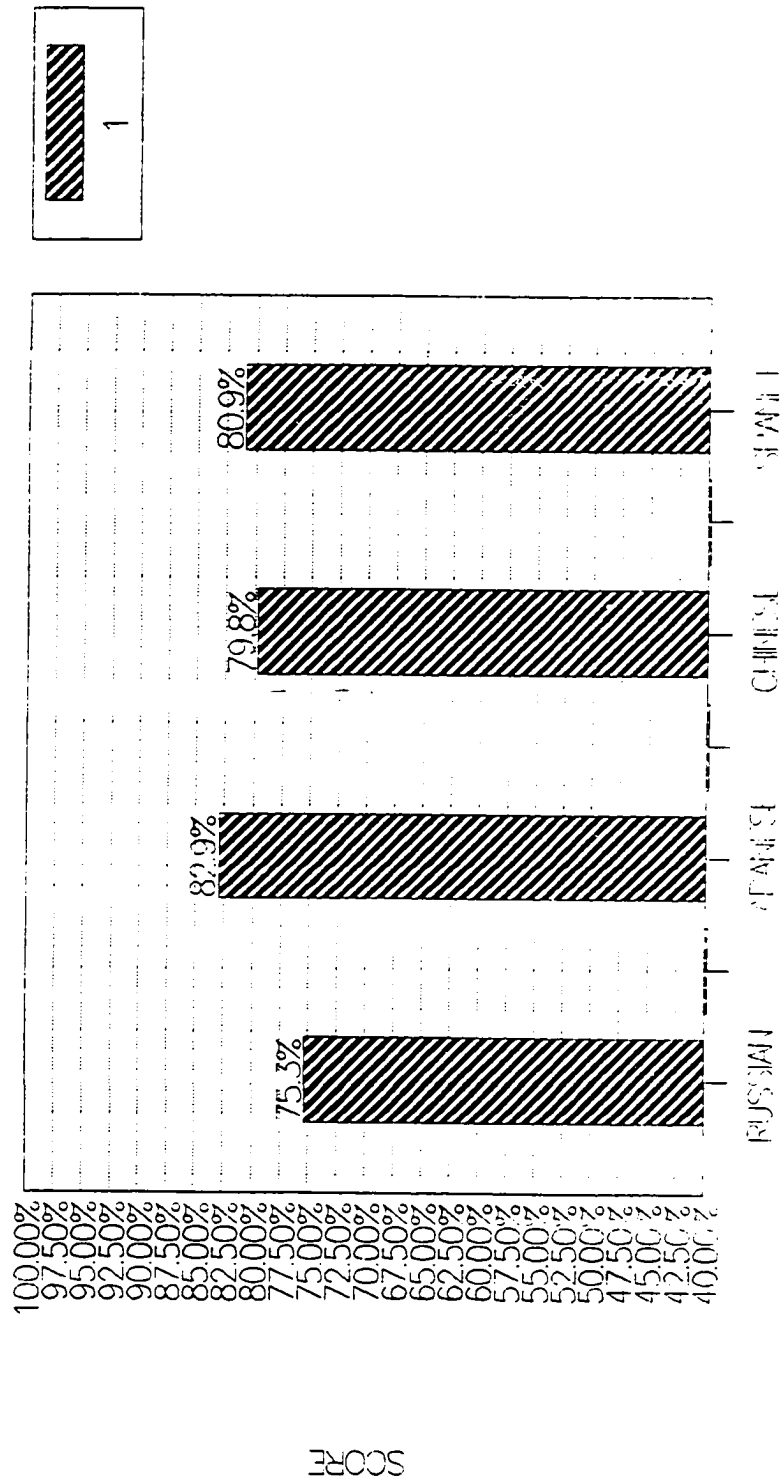
LEVEL B

ENVIORNMENT 14



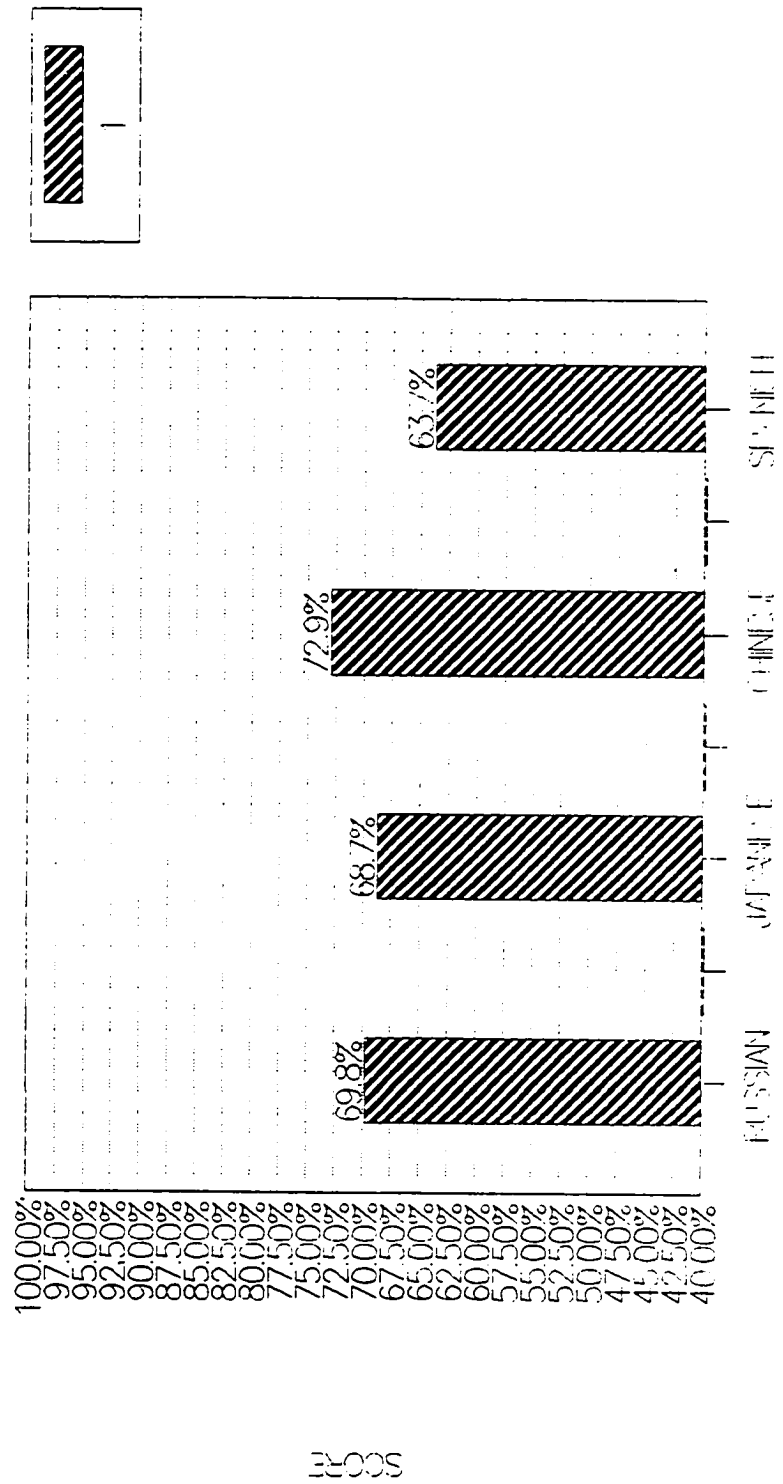
LEVEL B

ENVIRONMENT 15



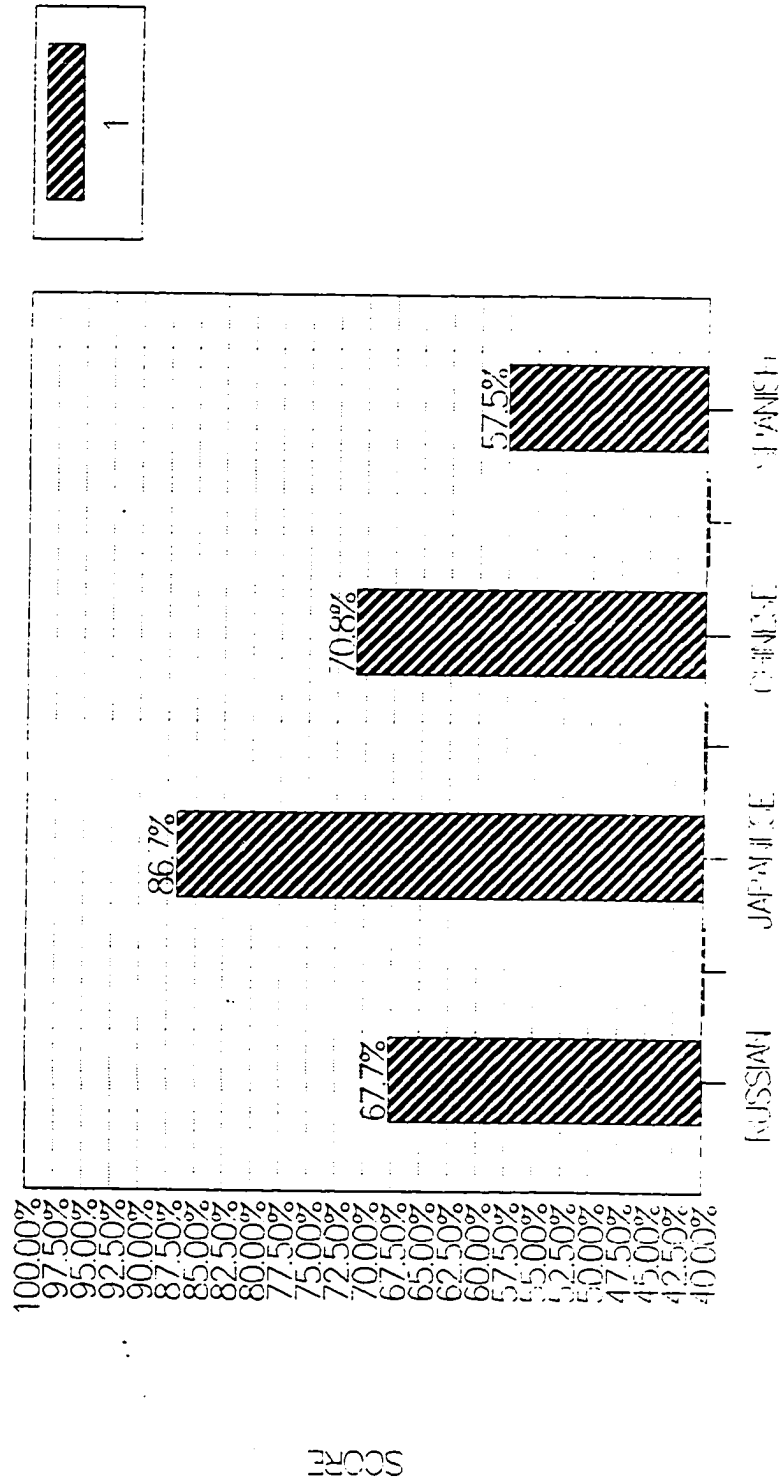
LEVEL C

ENVIRONMENT 1

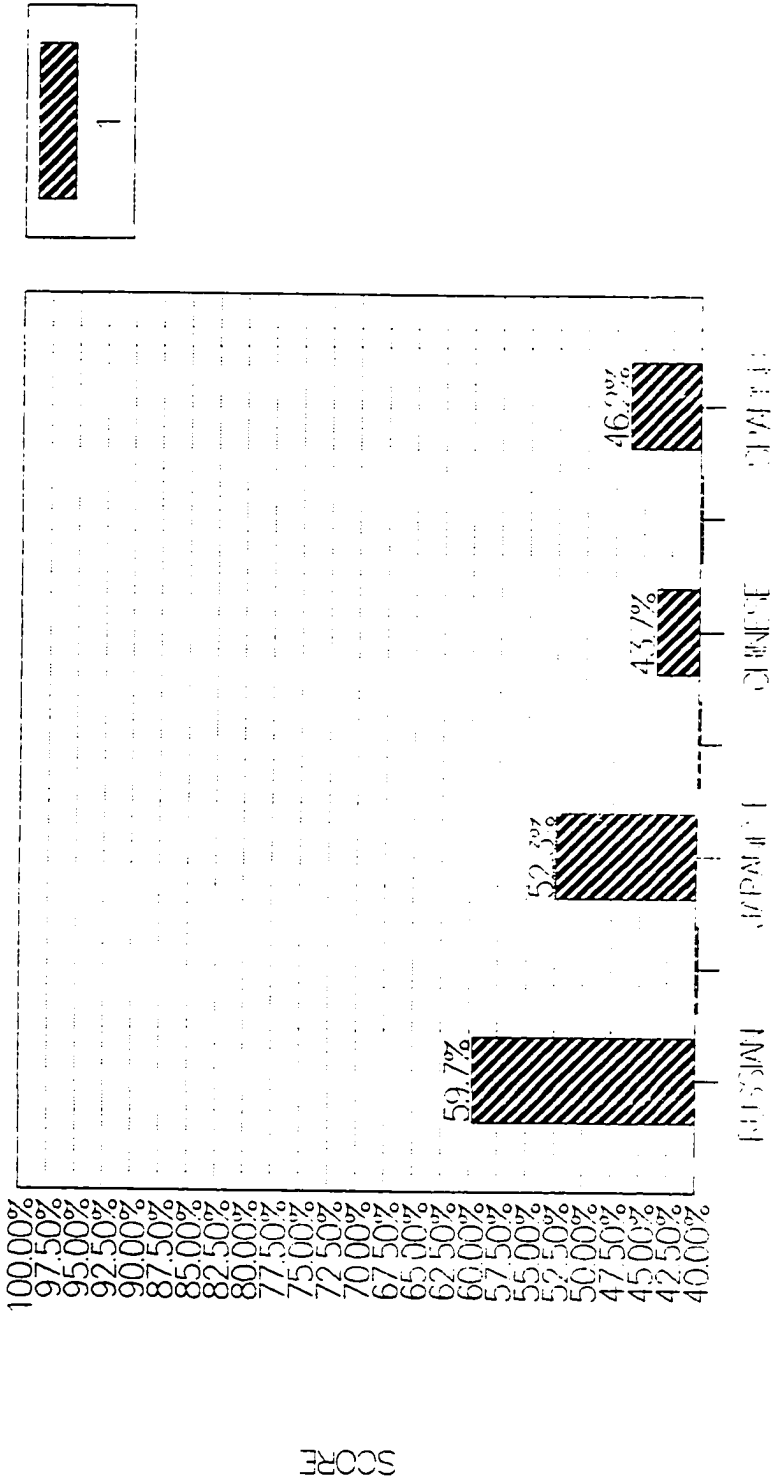


LEVEL C

ENVIRONMENT 2

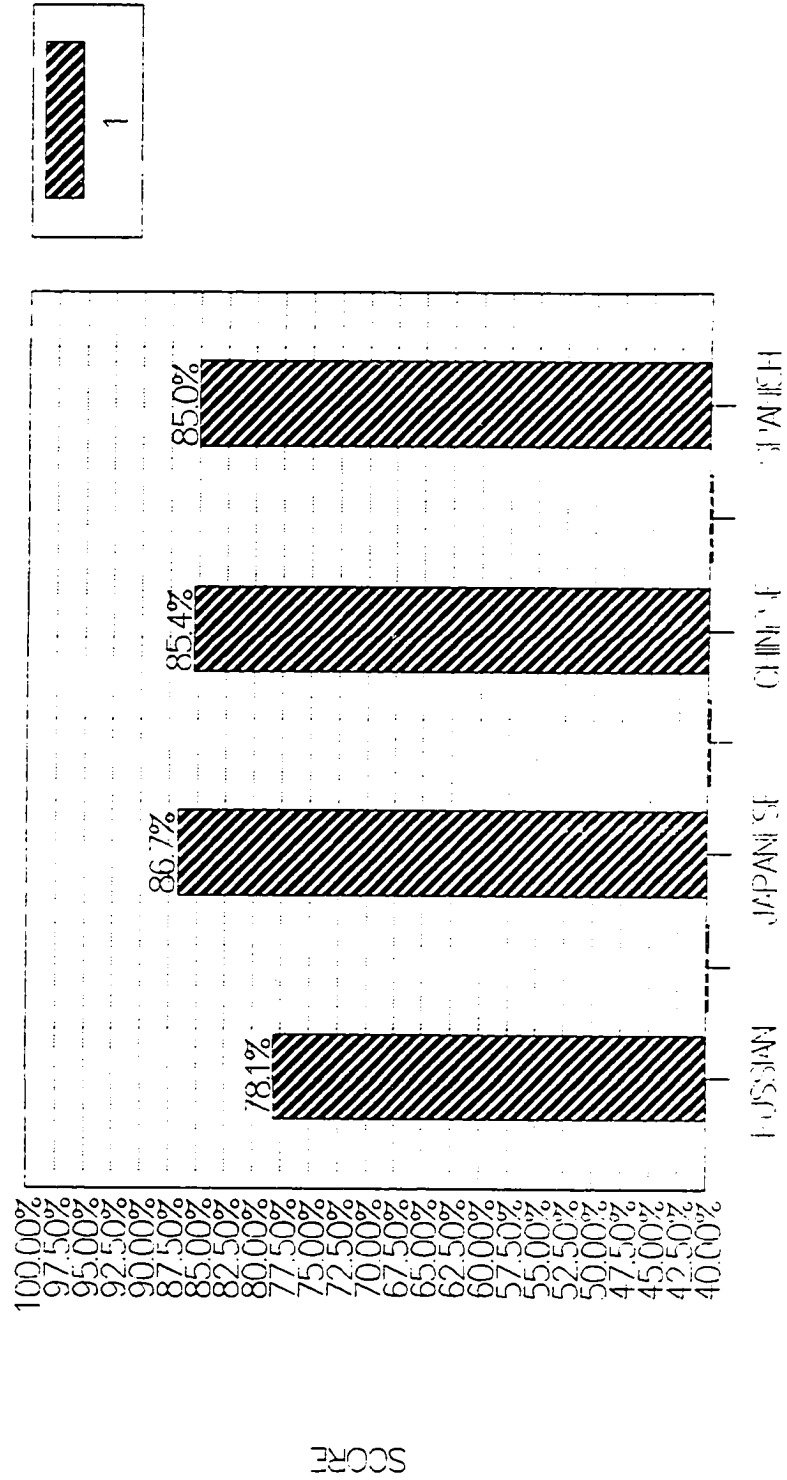


LEVEL C
ENVIRONMENT 3

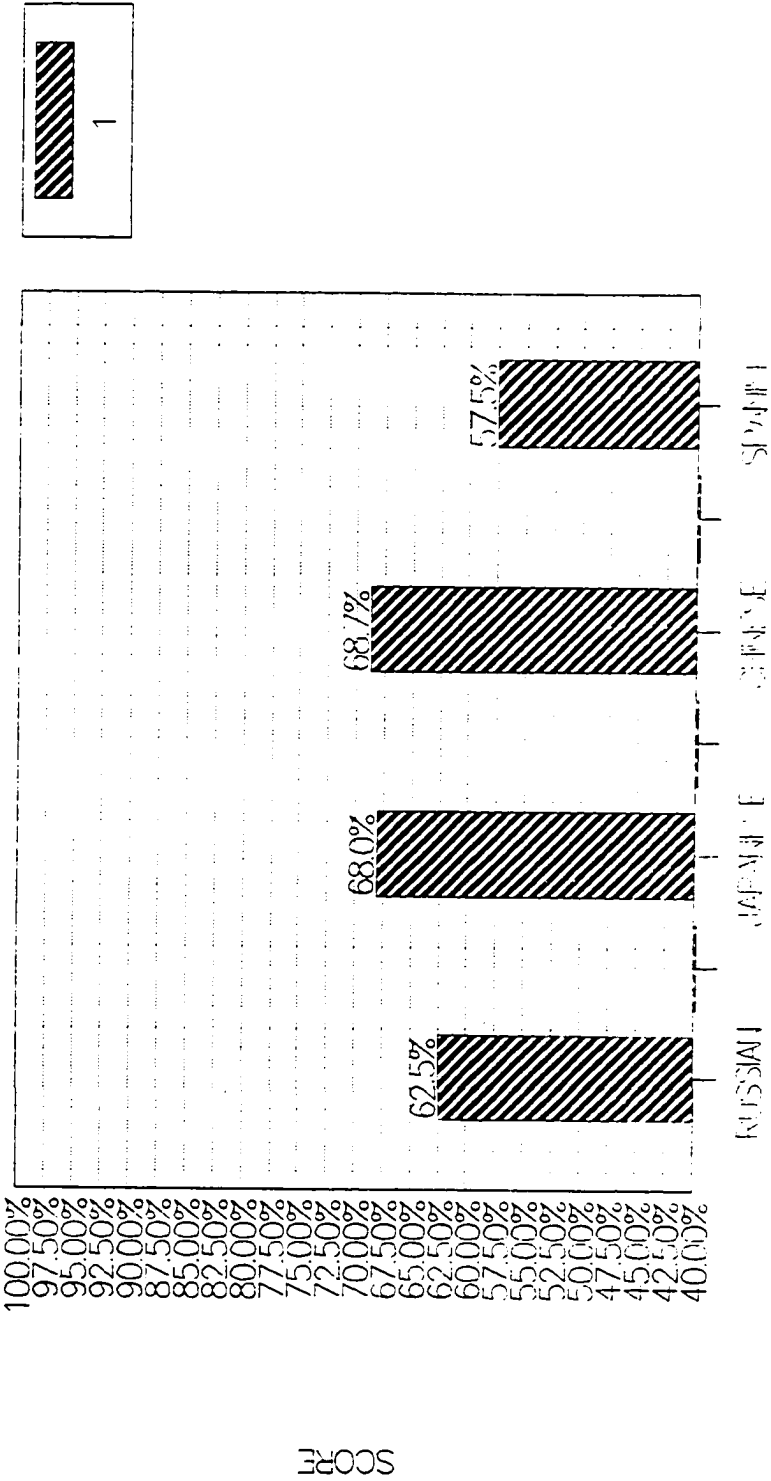


LEVEL C

ENVIRONMENT 4



LEVEL C
ENVIRONMENT 5

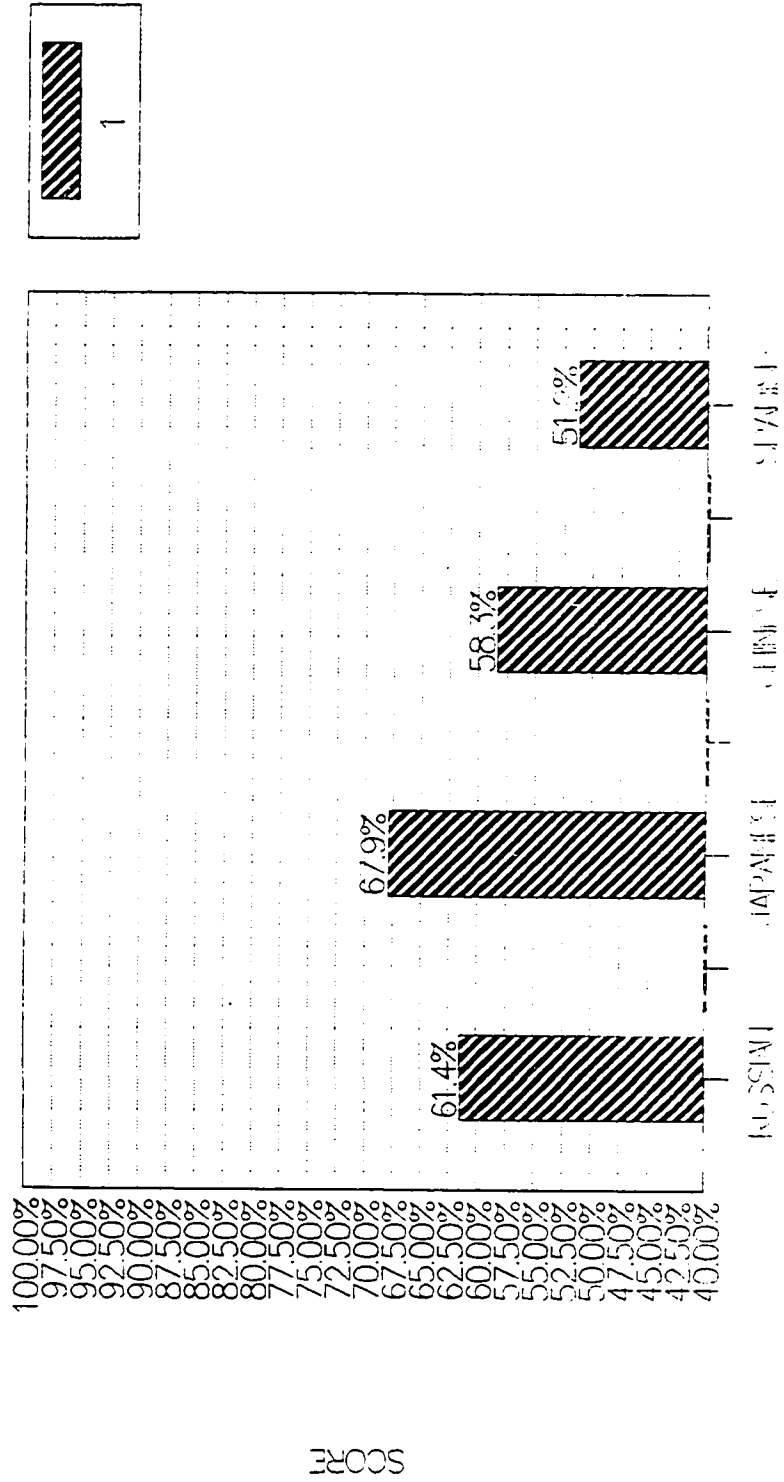


LEVEL C
ENVIRONMENT 6



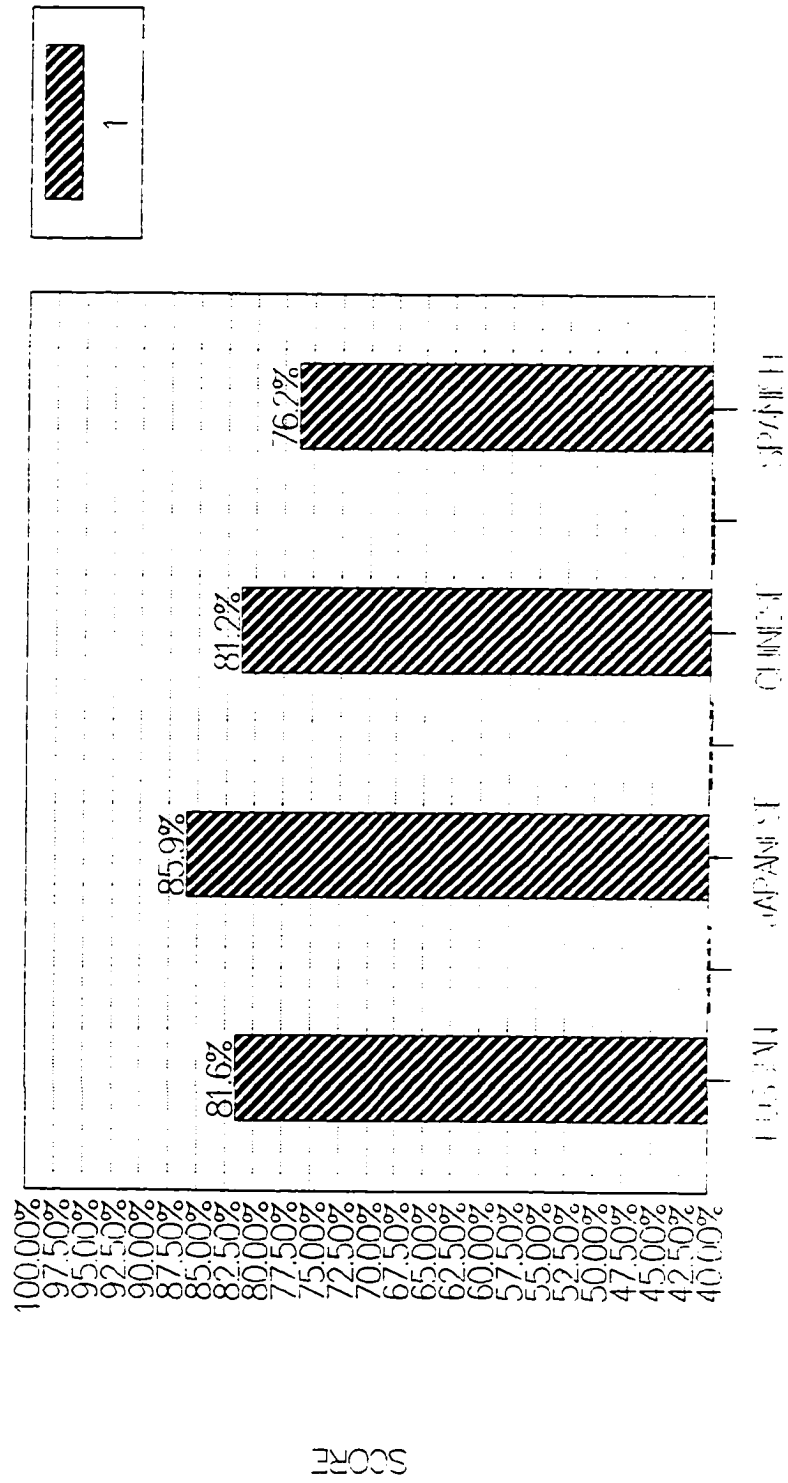
LEVEL C

ENVIRONMENT 7



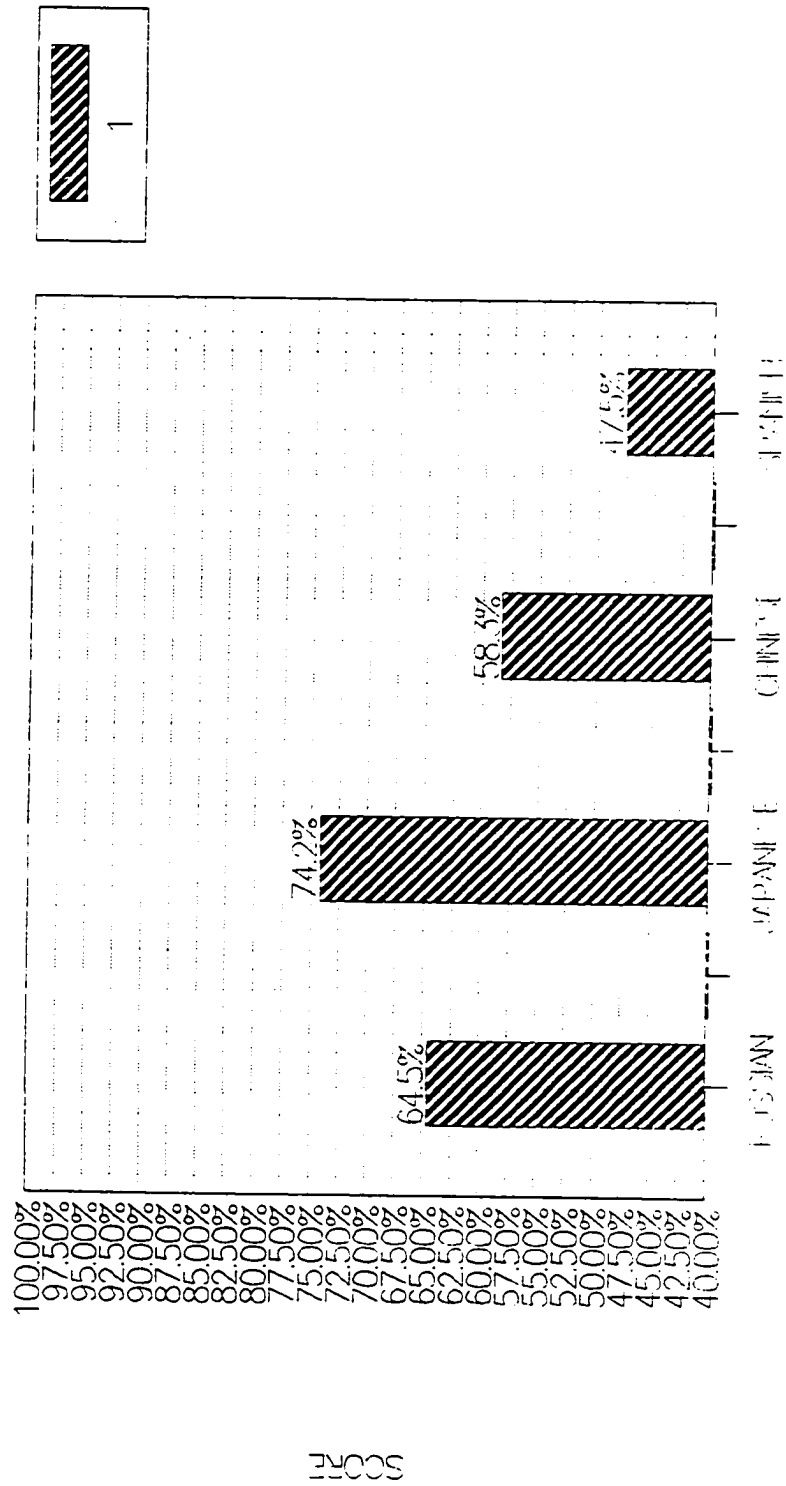
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ENVIRONMENT 8



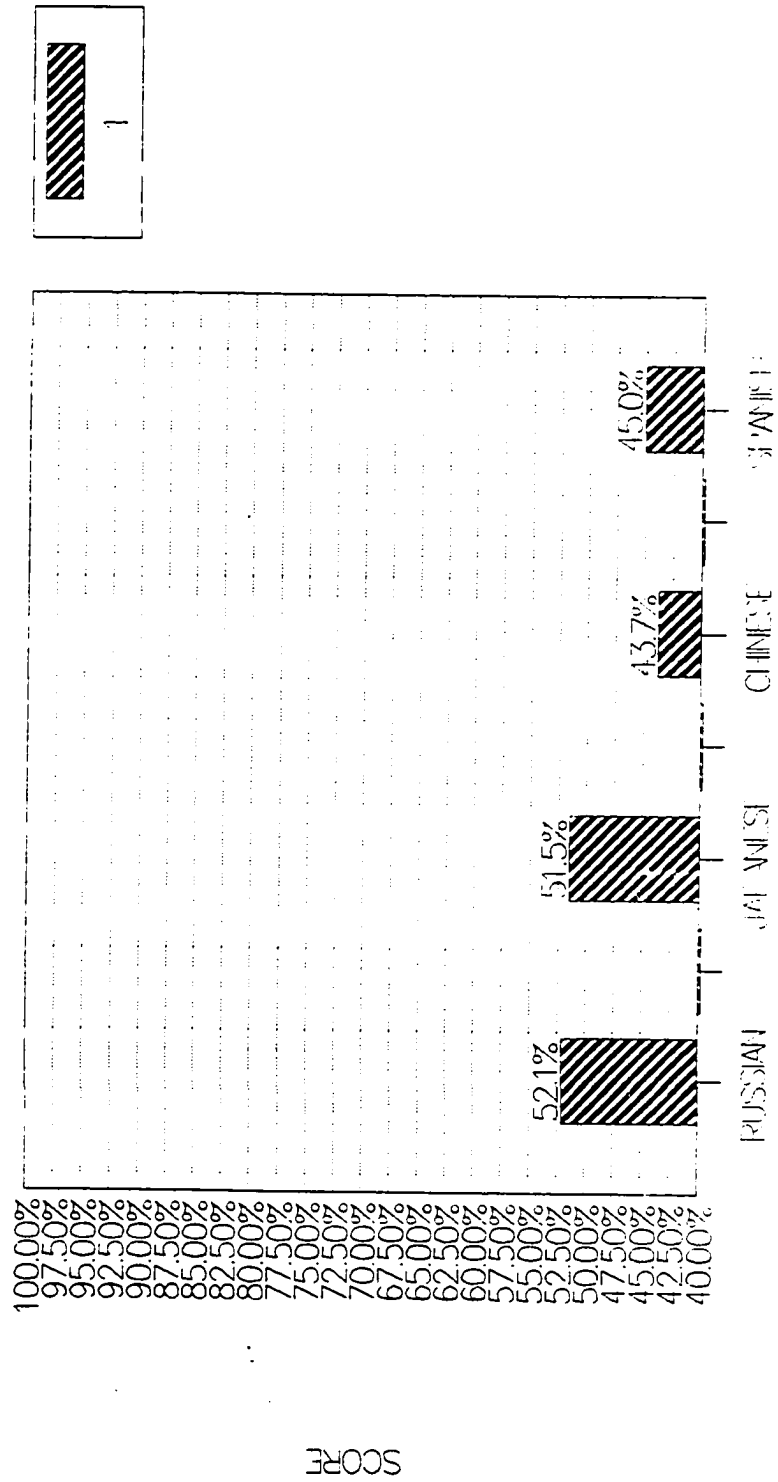
LEVEL C

ENVIRONMENT 9



LEVEL C

ENVIRONMENT 10



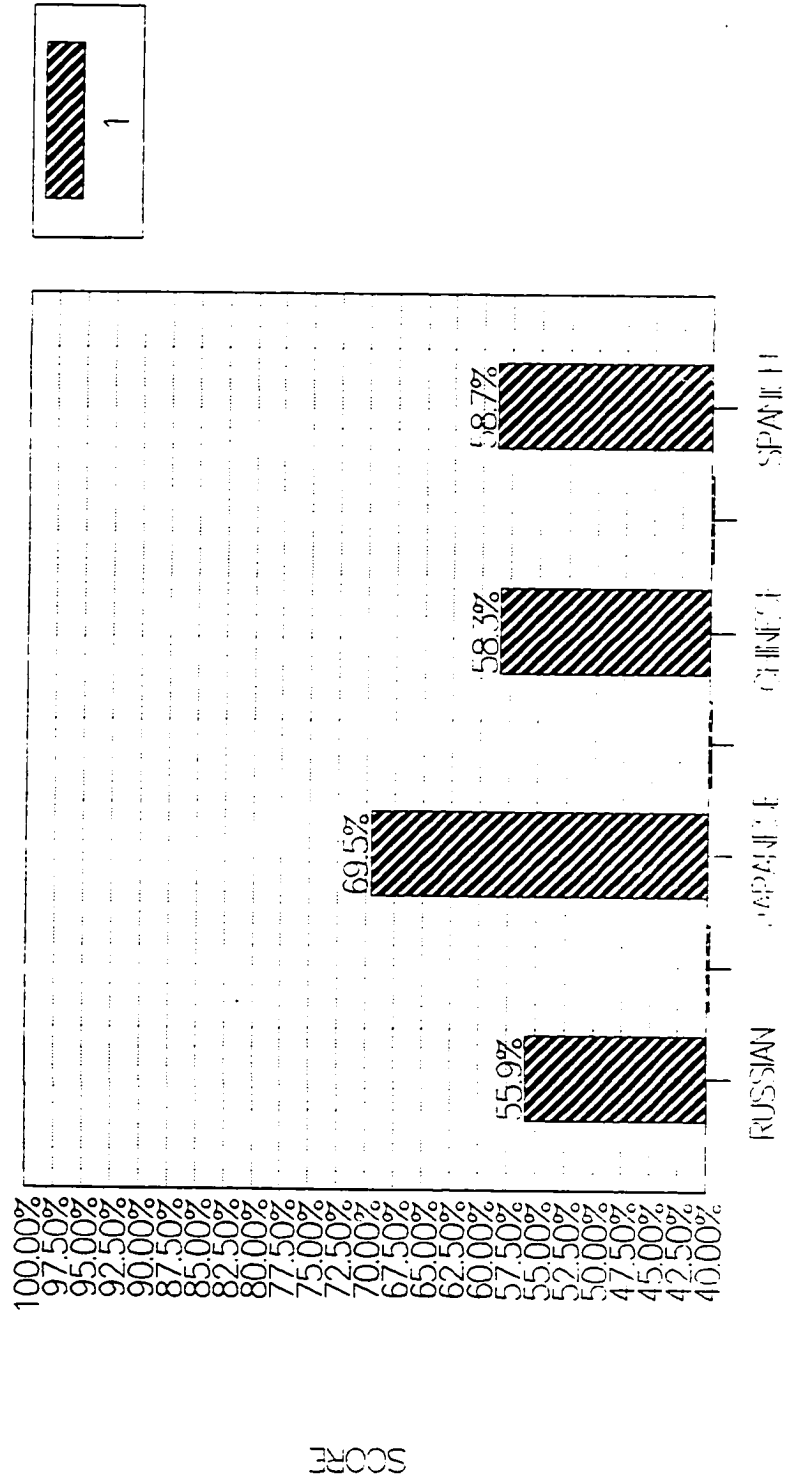
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ENVIRONMENT 11



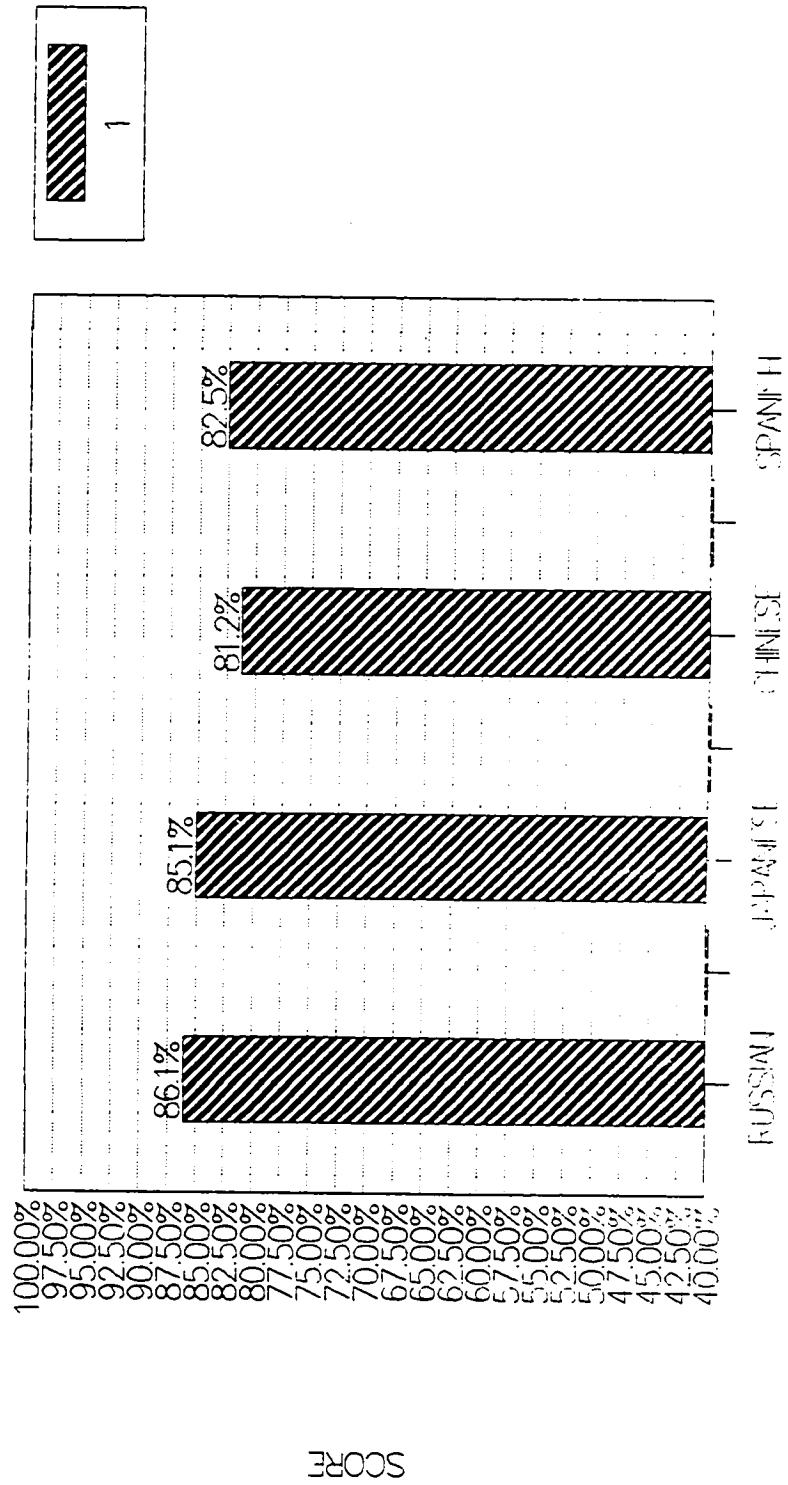
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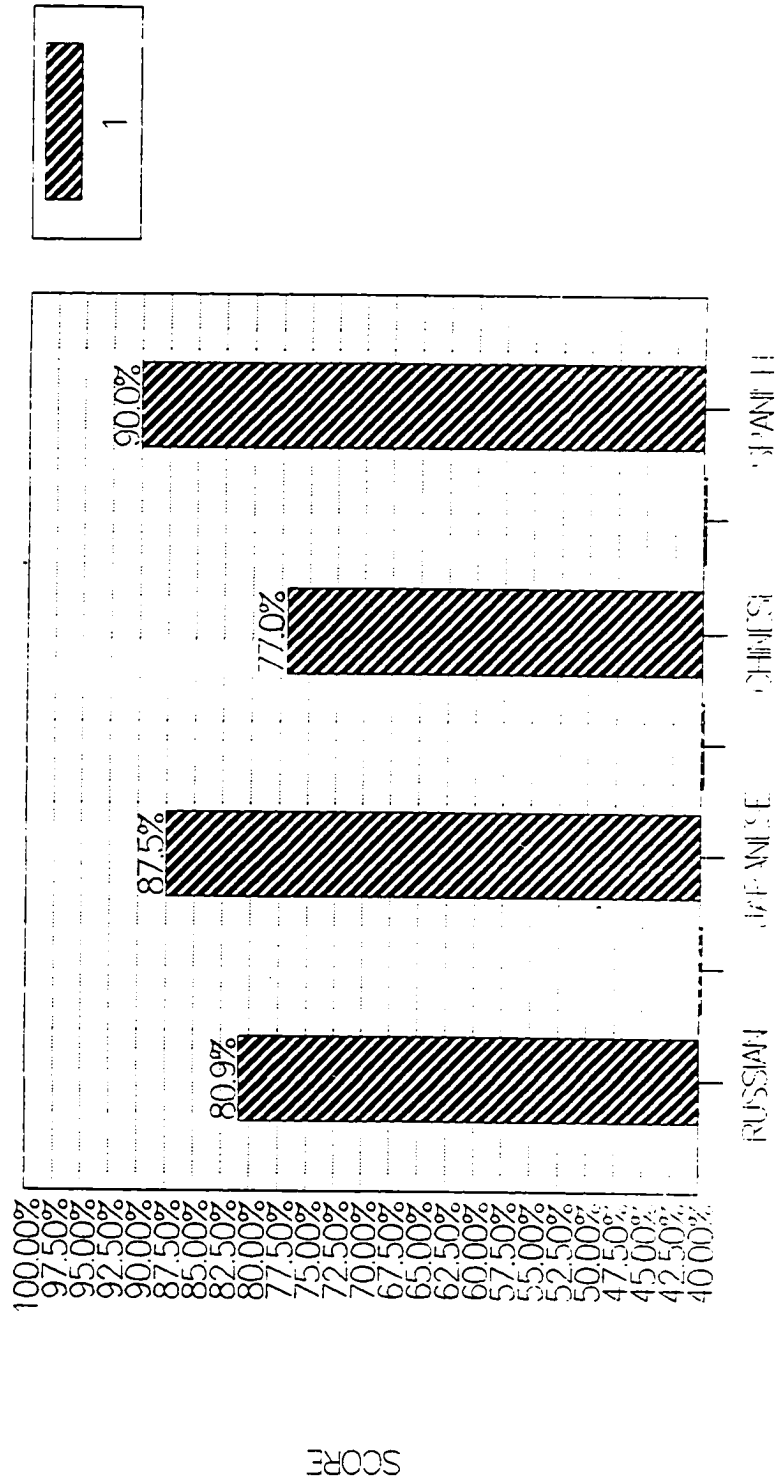
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ENVIRONMENT 13



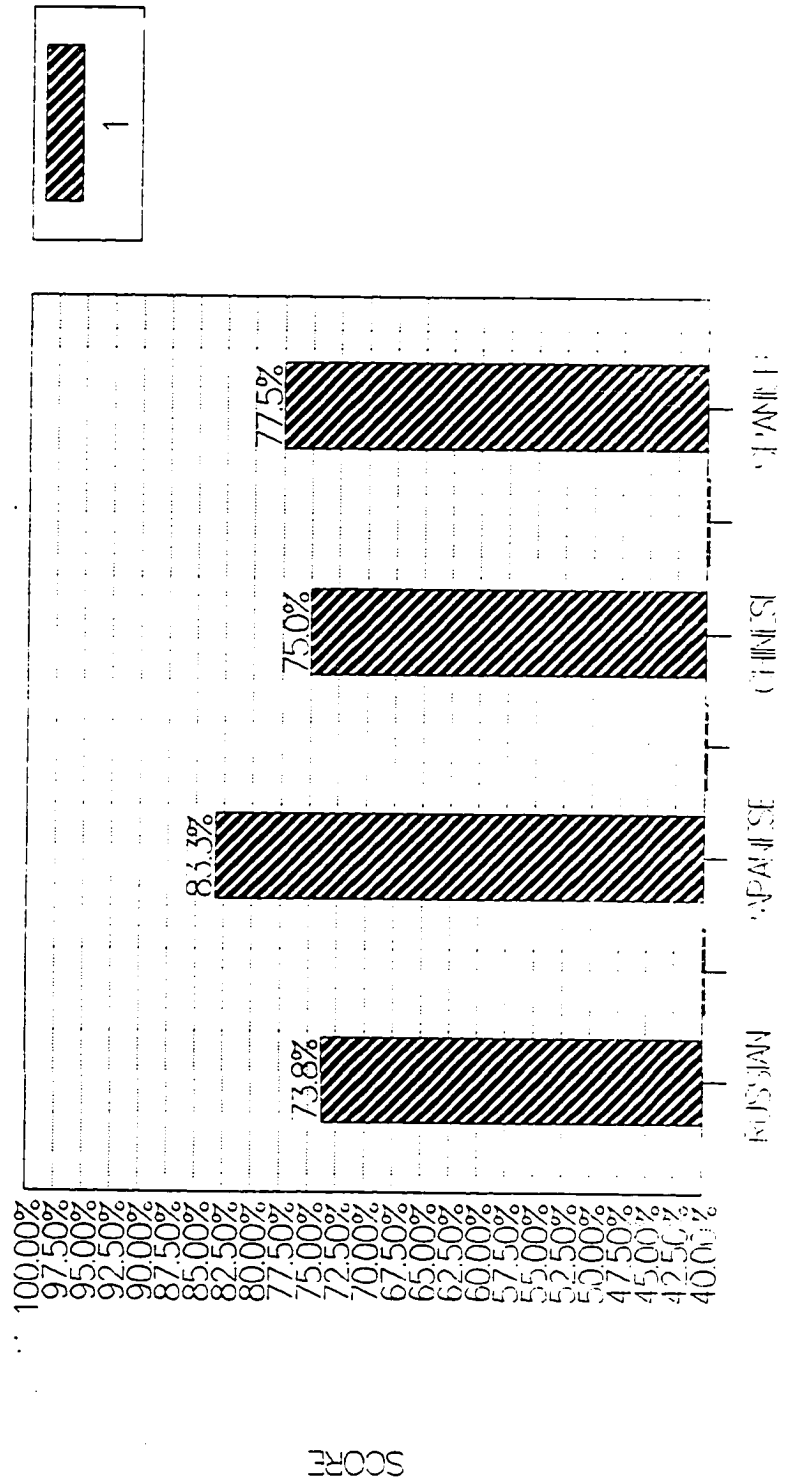
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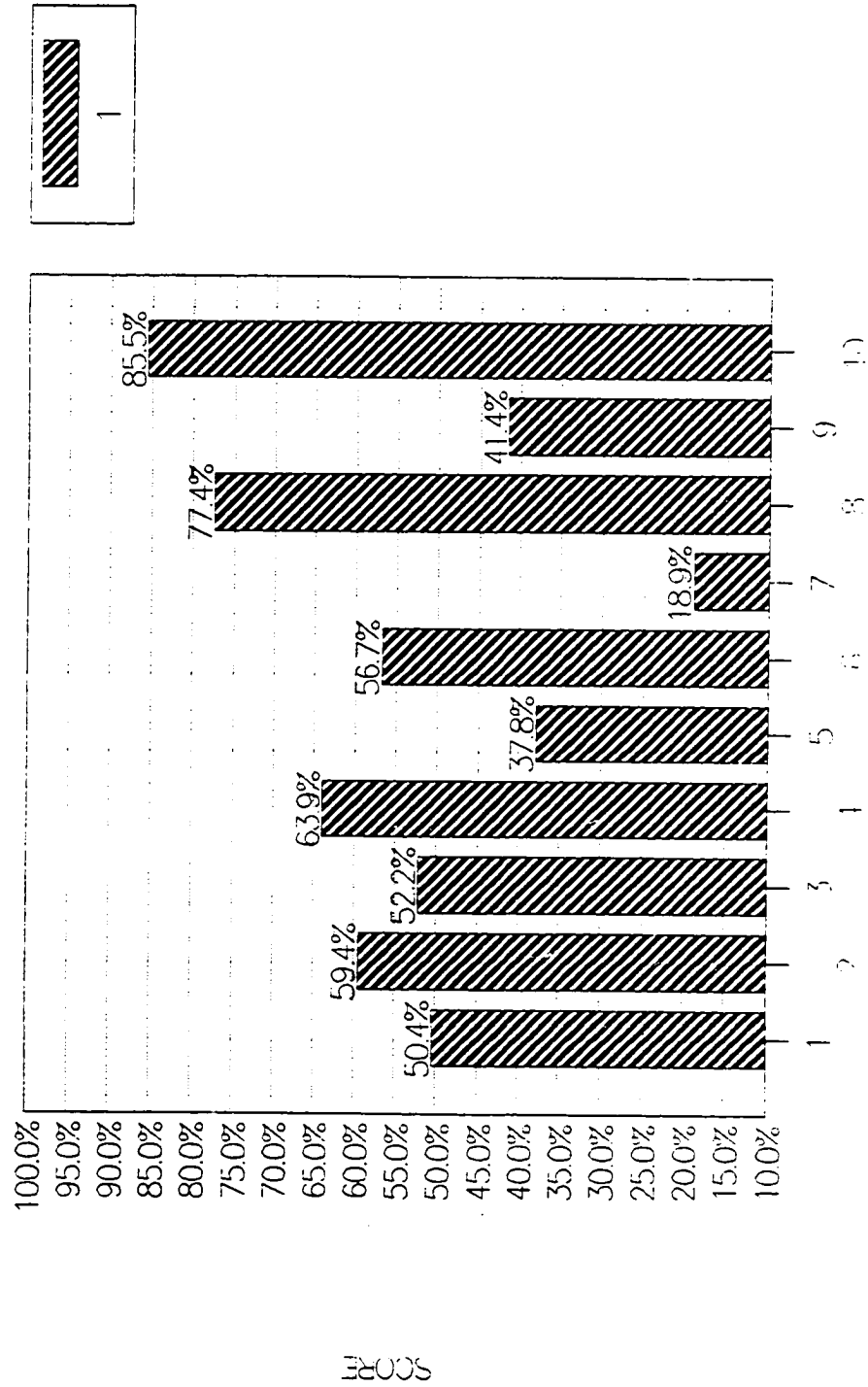


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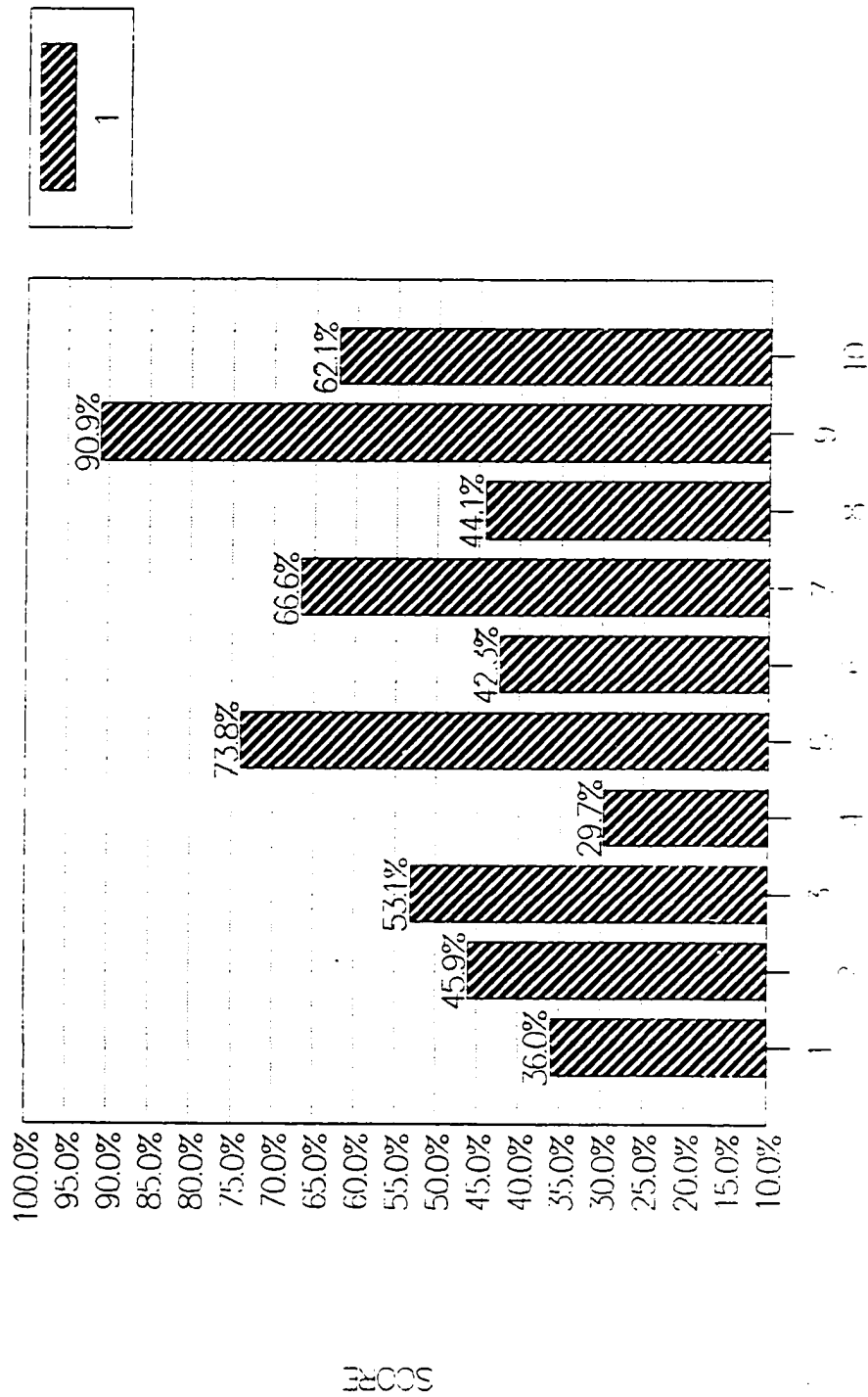
ENVIRONMENT 15



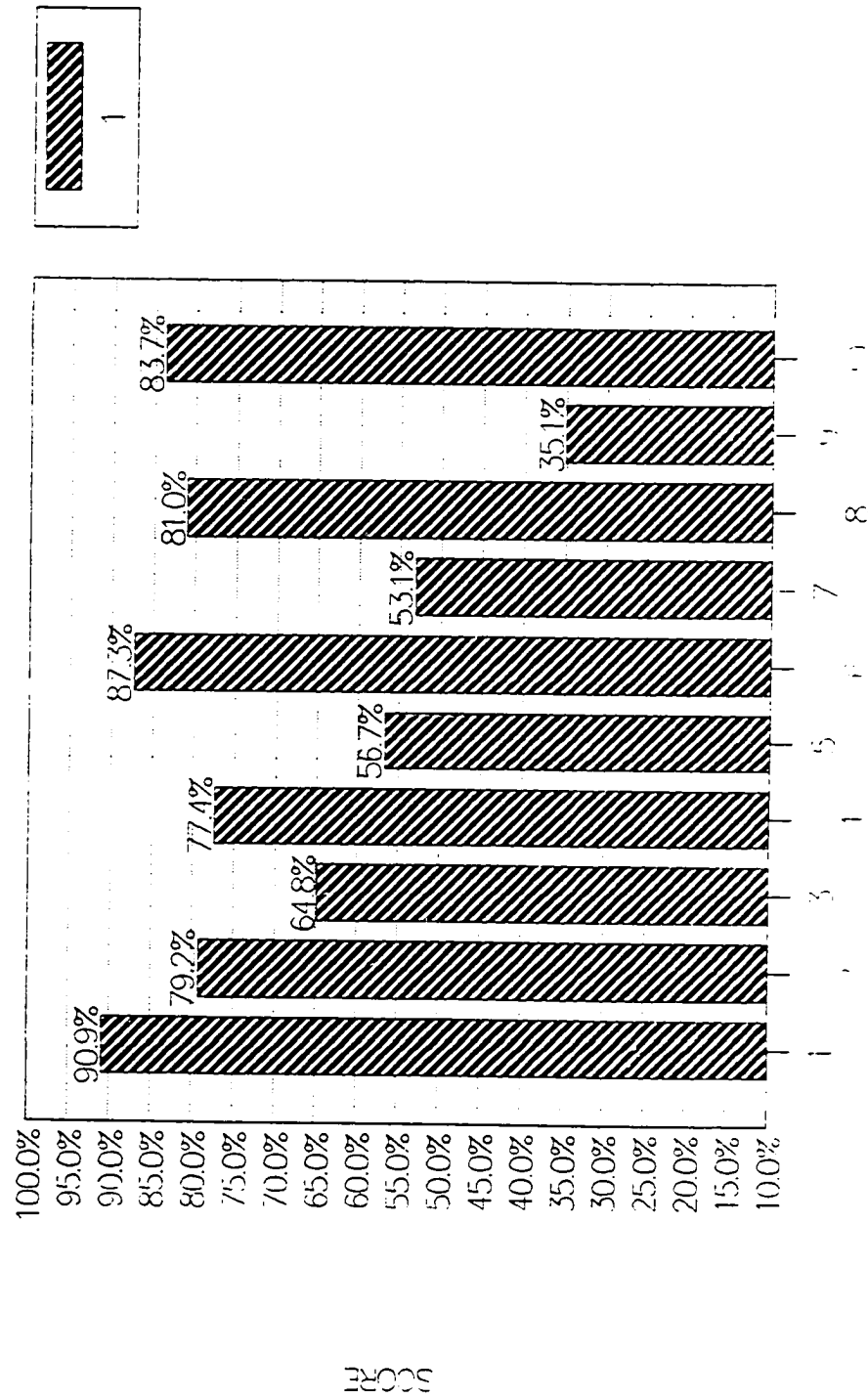
CONTEXT #1



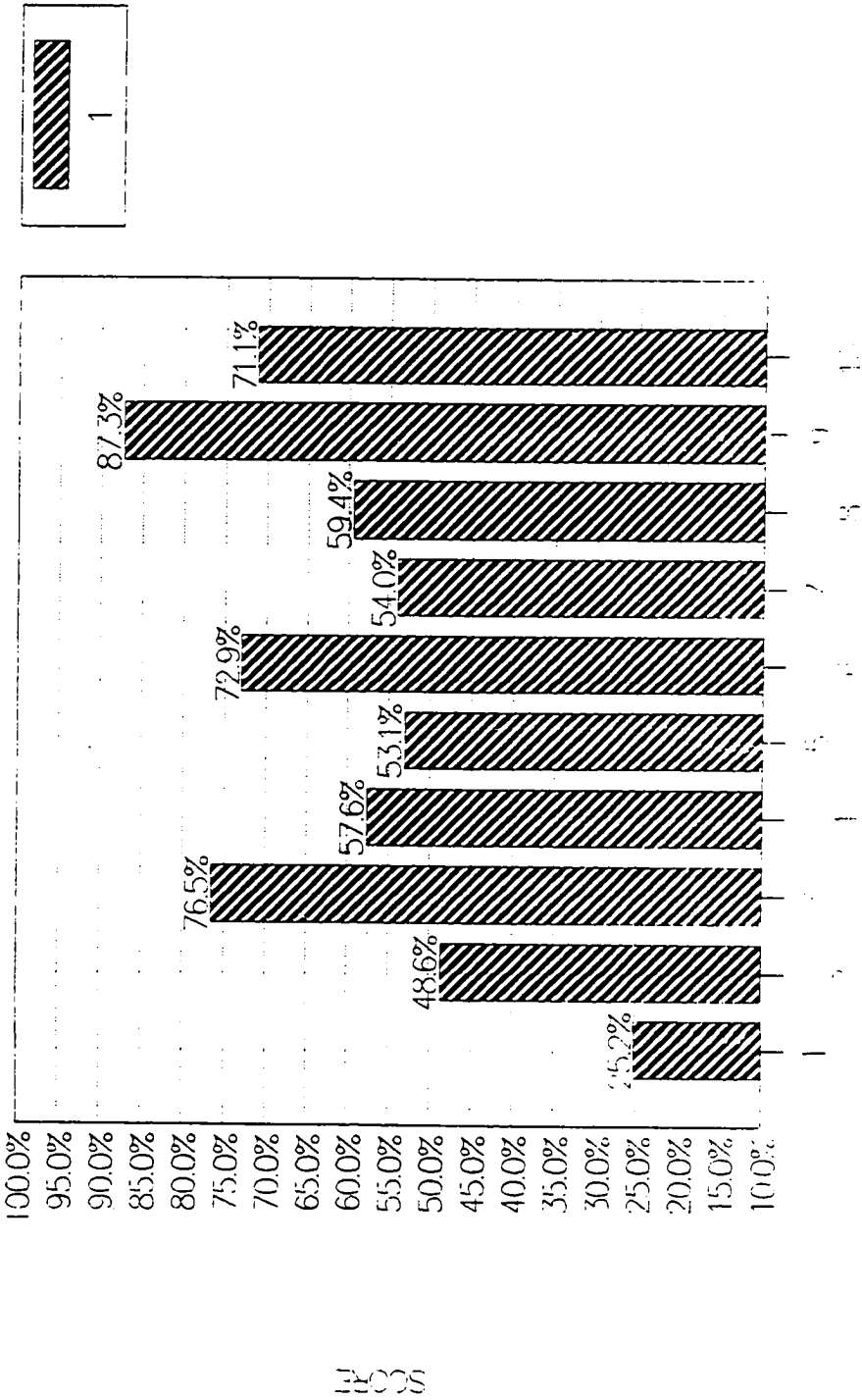
CONTEXT #2



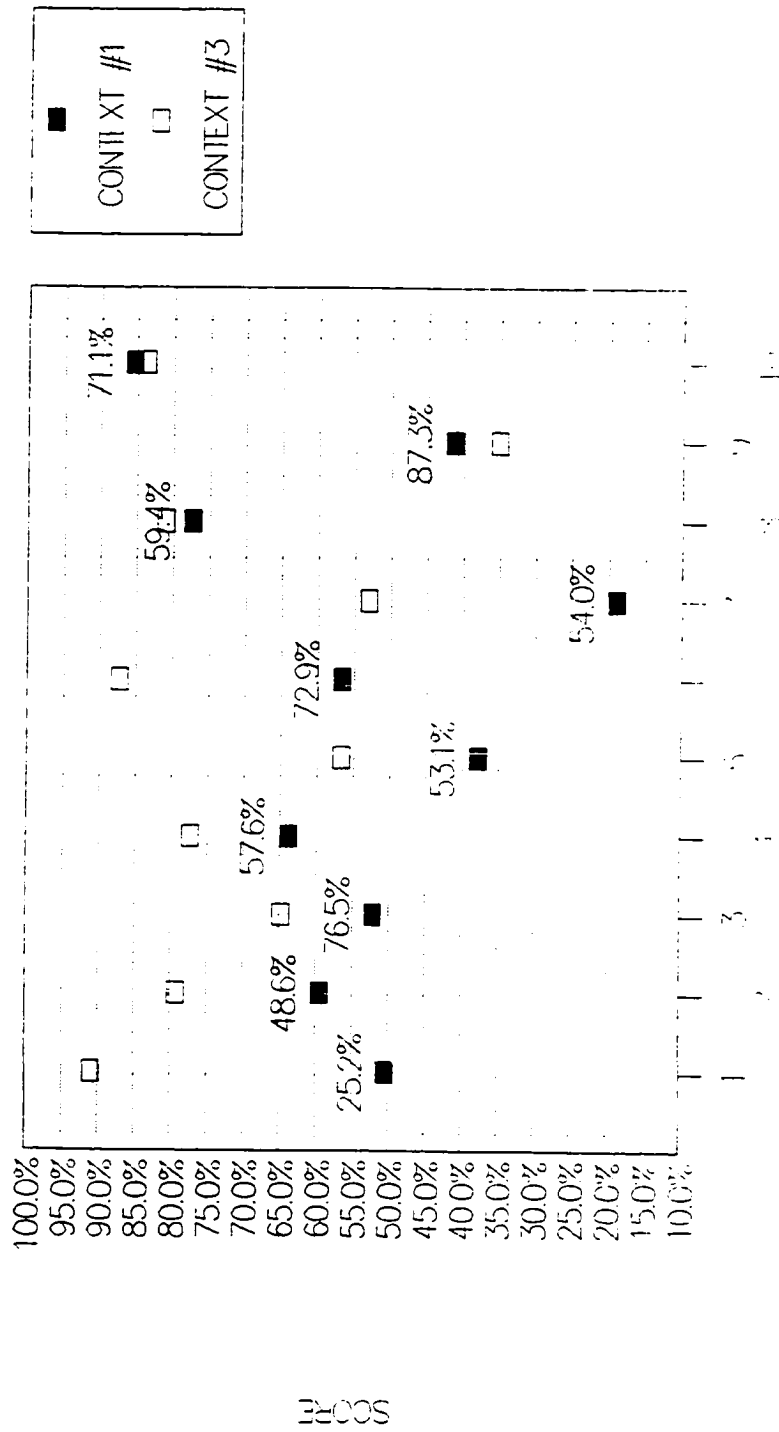
CONTEXT #3



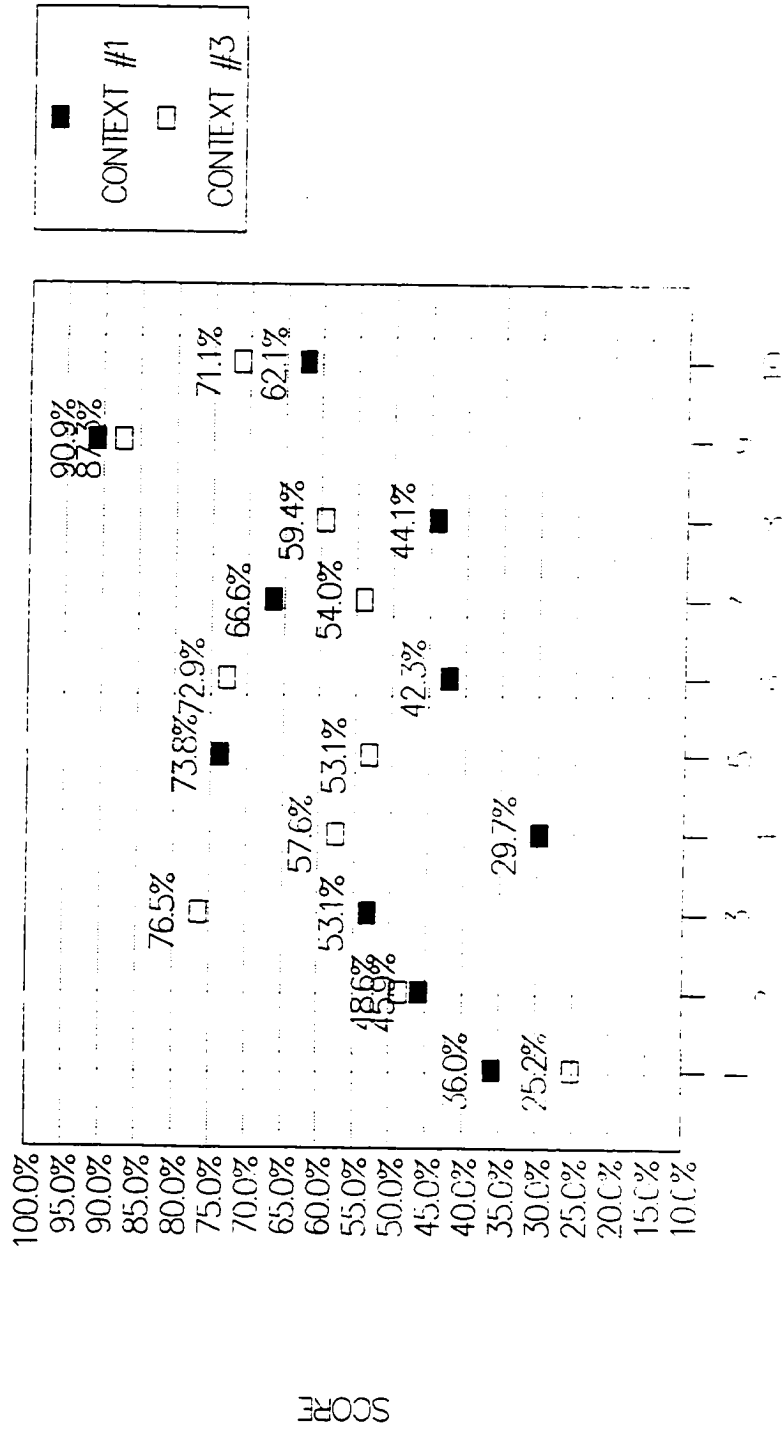
CONTEXT #4



CONTEXT #1 & CONTEXT #3

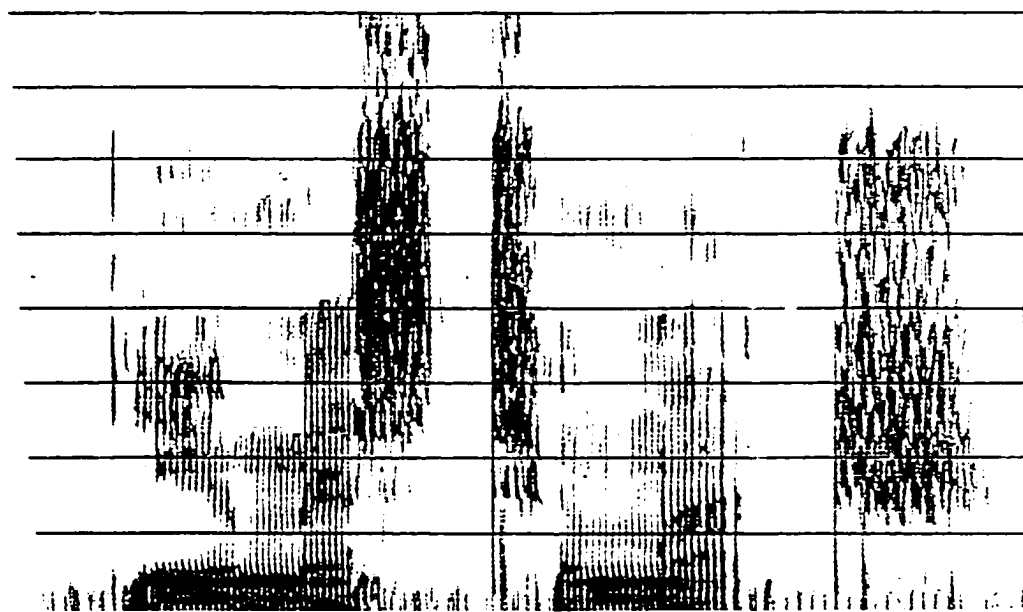
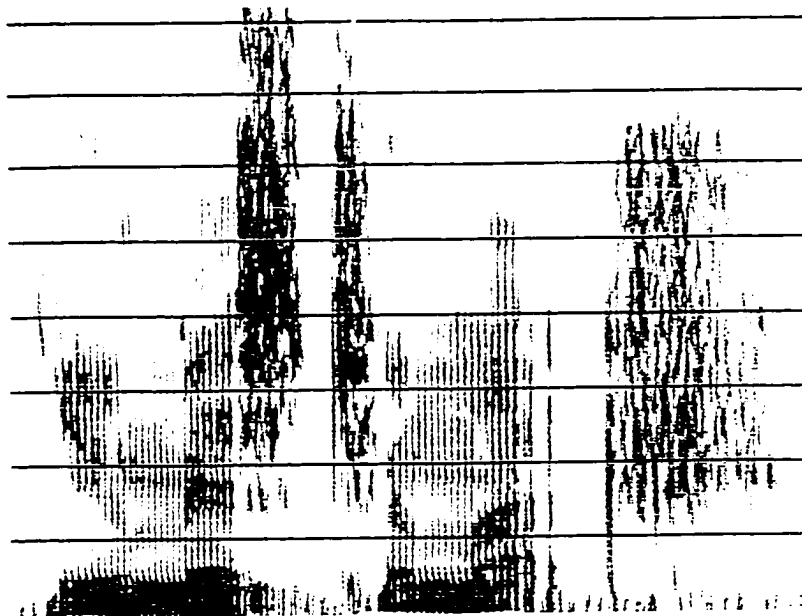


CONTEXT #2 & CONTEXT #4



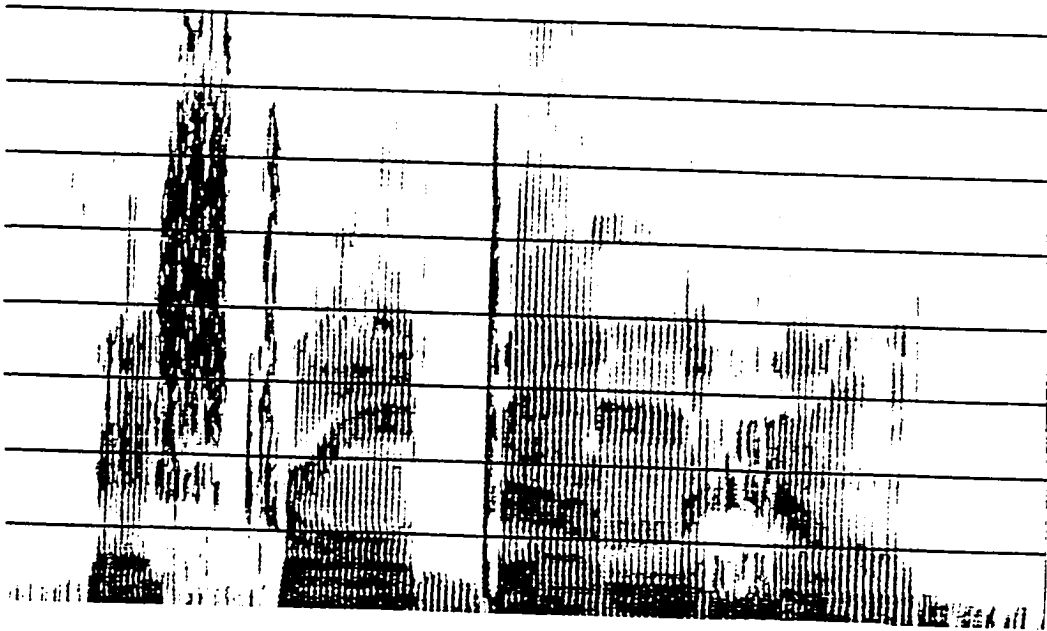
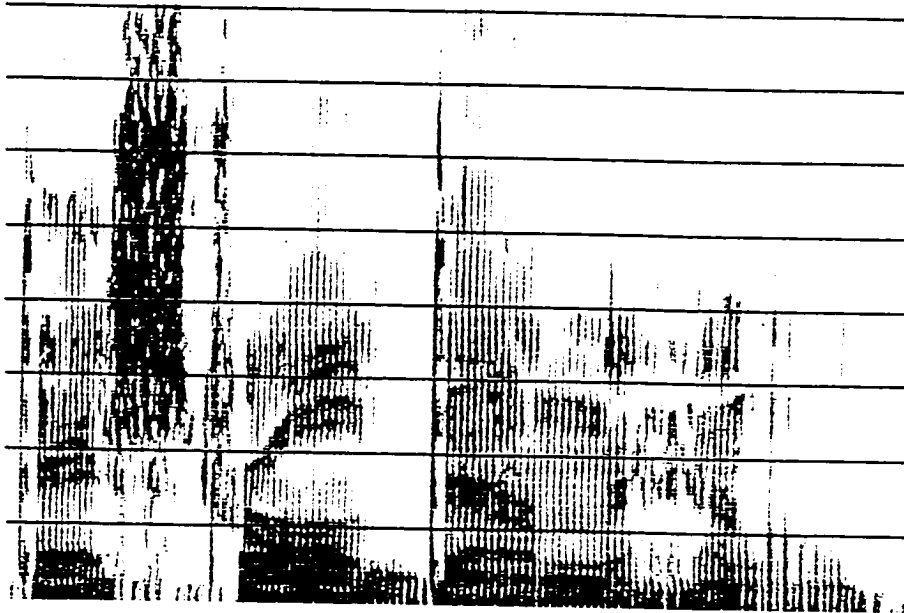
316
Appendix Fifteen
Spectrograms

You miss too much



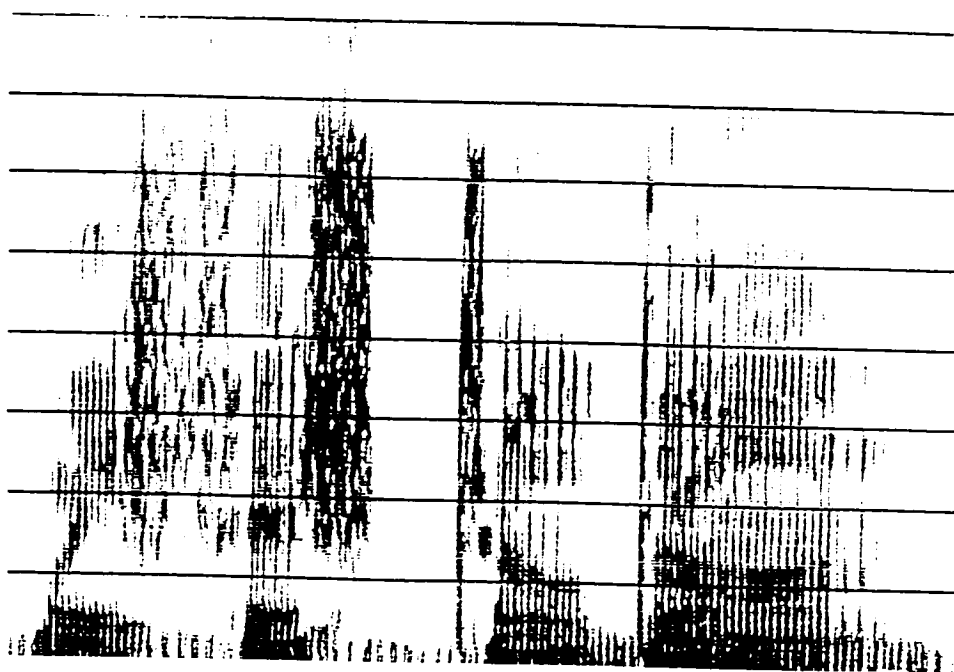
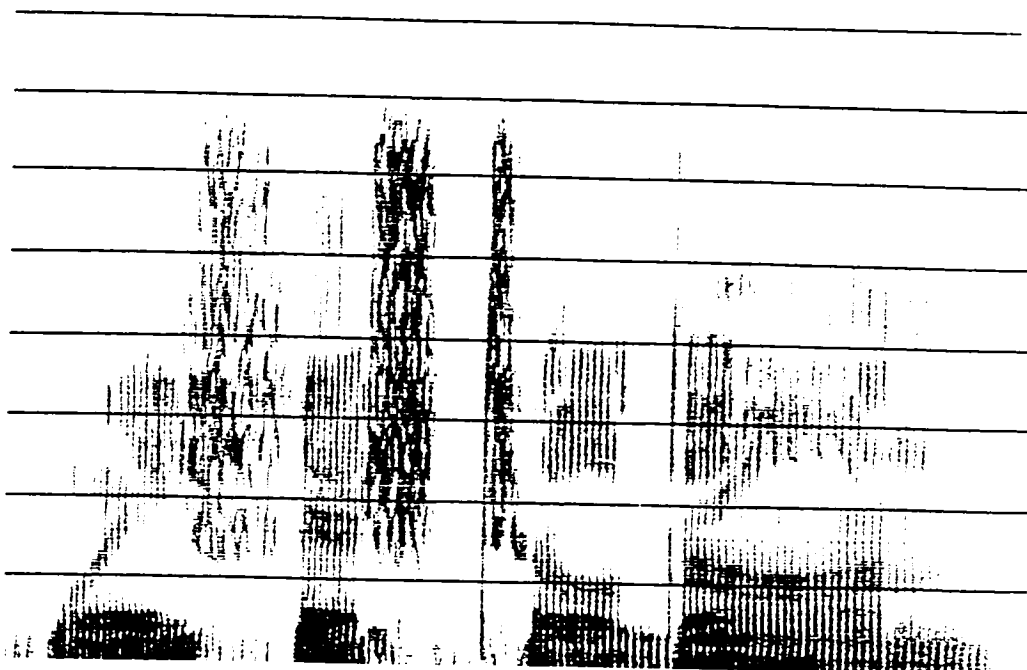
You missed too much

They stroll down hill



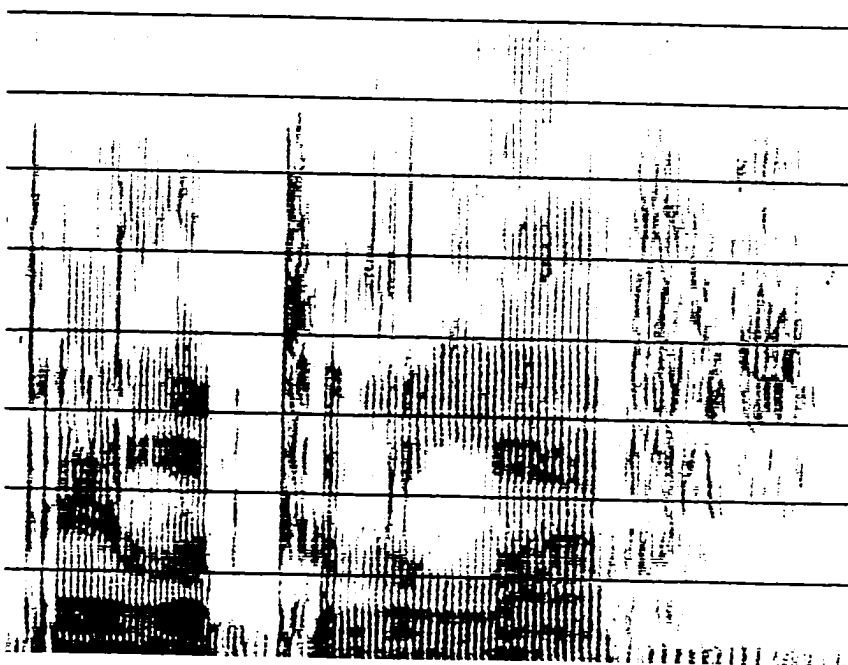
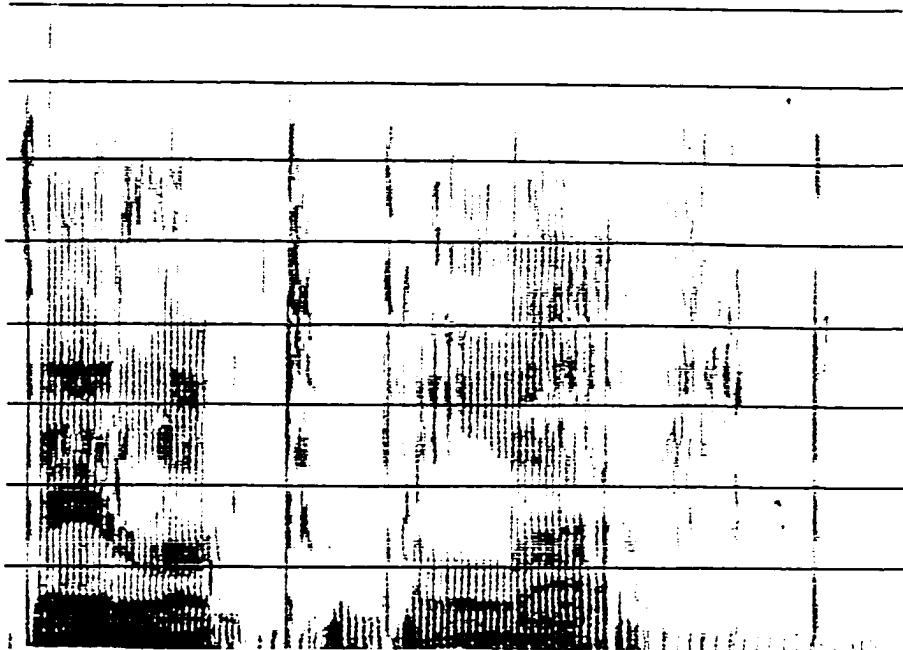
They strolled down hill

We fish till dawn



We fished till dawn

They look to the left



They looked to the left

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