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FOREWORD

The Department of Linguistics of the University of Victoria is pleased to present Volume 14 of the *Working Papers of the Linguistics Circle of the University of Victoria (WPLC)*. The articles in this issue represent current research on language and linguistics at the University of Victoria. It is the editorial policy of *WPLC* to include an even representation of work by graduate students and established scholars.

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PHARYNGEAL APPROXIMANTS, FRICATIVES, TRILLS AND STOPS

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1. Introduction

Recent laryngoscopic observations suggest that renewed discussion of pharyngeal articulations is warranted. The discussion involves the issues of place of articulation -- the nature of the category "epiglottal" -- and of manner of articulation -- whether pharyngeal manners of articulation go beyond approximant and fricative to include trill and stop. In essence, it remains to be resolved how those sounds that are labelled auditorily as "pharyngeal" are actually articulated. The observations reported here suggest that "epiglottal" articulations can be treated as a category of pharyngeal manners of articulation; and that manners of pharyngeal articulation are more closely parallel to their uvular counterparts than previously assumed. The nature of pharyngeal approximants and pharyngeal fricatives is reexamined, evidence of trilling accompanying friction is presented, and the nature of the pharyngeal (epiglottal) stop is described. It is suggested that all four of these categories share a common place of articulation, and that they can best be described as differing in manner of articulation. The motivation for elaborating the phonetic detail of these distinctions is to facilitate a more precise description of phonemes that have been identified as pharyngeal in the languages of the world, and to provide a clearer explanation of phonetic and phonological processes that may be related to pharyngeal articulations.

The objectives of this paper are (1) to elaborate on the phonetic description of the "epiglottal" consonants, (2) to describe a new (previously unformulated) value for the epiglottal fricatives (trilling), (3) to propose that these sounds constitute a regular series of pharyngeal approximant, fricative, trills and stop, and (4) to propose that a secondary component influencing the production and perception of pharyngeal sounds is the height of the larynx (raised or lowered) accompanying pharyngeal stricture.

2. Background: Descriptions of pharyngeals

Hockett (1958) considered that pharyngeal articulations are produced by narrowing the pharynx from front to back. "As in the larynx, a complete closure can be made in the lower pharyngeal region, by drawing the root of the tongue back against the back wall of the passage. This produces a *pharyngeal catch*, which occurs as a speech sound in some dialects of Arabic" (p. 66). Although it is accepted in the present analysis that stop closure as identified auditorily by Hockett does indeed occur in the pharyngeal region, it is not by the mechanism which he implied.

Another account of pharyngeals is provided by Catford. In his 1968 review of articulatory possibilities, Catford advanced the term "epiglottopharyngeal" to characterize "extreme retraction of the tongue, so that the epiglottis approximates to the back wall of the pharynx" (p. 326), but doubted whether a stop articulation could be performed at this location "since it seems to be impossible to make a perfect hermetic closure between epiglottis and pharynx wall -- stop-like sounds produced in this way appear to involve glottal closure as well as epiglottopharyngeal close approximation. However, epiglottopharyngeal *fricative*, *approximant* and possibly *trill* can be produced" (p. 326). Again, the present analysis agrees that an auditory classification of pharyngeal sounds includes "stop-like" sounds as well as fricative, approximant and trill categories. It should be pointed out that Catford's extensive table of articulatory categories (p. 327) holds open the possibility of epiglottopharyngeal stop and trill (signalled by question marks) in articulatory parallel with fricative and approximant. What is needed is to decipher the nature of what is meant by "epiglottopharyngeal."

There is a second component associated with pharyngeal articulatory postures which has been identified auditorily, but which needs to be explained physiologically. Catford (1977a) has dealt extensively with these secondary auditory distinctions, positing such articulatory explanations as "ventricular" and "anterior" glottal. References to similar auditory qualities appear in various phonetic and phonological analyses of Semitic, Salish and Wakashan, and Caucasian consonants, and of Mon-Khmer languages, to account for movements of the larynx that accompany the production of tone. The articulatory explanation that will be put forward in the present analysis involves the raising or lowering of the larynx, which can be observed laryngoscopically and which may accompany the primary mechanism of pharyngeal stricture described below.

Delattre (1968) identified the acoustic characteristics of pharyngealization, and in 1971 described a number of sounds in Arabic, German, Spanish, French, and American English which can be classified as involving pharyngeal constriction -- in the upper pharynx for uvulars and in the lower pharynx for pharyngeals proper. This interpretation is interesting because it introduces the notions that constriction in the pharyngeal region can accompany a variety of "backed" sounds (even in languages that do not have "pharyngeals" per se), that this constriction can be observed to some extent cross-sectionally using x-ray technology, and that different areas of the pharynx may be involved in the production of pharyngeals.

Using fiberoptic laryngoscopy, Fujimura and Sawashima (1971) reported that final /t/ in American English can involve adduction of the ventricular folds, suggesting that the term "glottalization" involves a complex set of phenomena. The articulation observed by Fujimura and Sawashima evidently follows after glottal adduction or glottal stop, as in [t̚]. The tempting question is to ask how much more constricted this closure mechanism could be. If it starts with simple medial and interarytenoidal adduction of the vocal folds and progresses to ventricular fold closure, could it progress further to what has been called a "massive glottal stop" (J. Anthony, personal communication), i.e., to complete closure of the laryngeal (laryngeal-pharyngeal) valve as in a "choking" posture, and what articulatory movements are involved? The present analysis will examine the nature of this continuum of closure in detail, using auditory categories as a basis for the visual examination of sounds labelled as "pharyngeal."

Catford's (1977a) comprehensive treatment divides both pharyngeals and laryngeals into two categories each. The principal bases for these distinctions are assumed to be auditory (based on sound qualities used in various languages), supported by articulatory observations. The less extreme of the pharyngeals, as in Danish /r/, is termed "linguo-pharyngeal" where "the root of the tongue, carrying with it the epiglottis, moves backwards to narrow the pharynx in a front-back dimension" (p. 163). Presumably, this is also the kind of quality and posture that Delattre described as upper pharynx constriction concomitant with German or French /r/. The more extreme pharyngeal articulation, as in [h] and [ʕ], is termed "faucal or transverse pharyngeal" by Catford where "the part of the pharynx immediately behind the mouth is laterally compressed, so that the faucal pillars move towards each other. At the same time the larynx may be somewhat raised. ... It is largely a sphincteric semi-closure of the oro-pharynx, and it can be learned by tickling the back of the throat, provoking retching" (p. 163). These auditory and articulatory observations provide the rationale for at least a two-way distinction, but it remains unclear (1) what occurs beneath the visible faucal pillars during [h] and [ʕ], (2) whether the difference is one of degree, i.e., of manner of articulation, and (3) whether the simultaneous larynx raising is an inherent trait of lingual retraction or a second parameter under independent control.

Catford's (1977a) further characterization of laryngeals adds considerably to the understanding of pharyngeal activity. Simple "glottal" articulations, such as [ʔ], are as represented on the chart of the IPA. "Ventricular" articulations, on the other hand, occur when "the ventricular bands are brought together ..., plus some generalized constriction of the upper larynx and pharynx." In contrast with [ʔ], "this ventricular or strong glottal stop may be represented by [ʕ̚]." Gaprindashvili (1966), as Catford observes, describes this same articulation as a "pharyngealized glottal stop" (p. 163). The strong glottal stop occurs in the Nakh languages and in some Dagestanian languages, and is sometimes termed a "pharyngeal stop" in the Georgian literature (Catford 1977b: 289). Since then, the IPA has incorporated a symbol for an "epiglottal plosive" into its inventory. To isolate what seems from the auditory descriptions to be the same sound, seven terms have been used thus far: "epiglottopharyngeal" stop, "massive glottal stop," "strong glottal stop," "ventricular stop," "pharyngeal stop," "pharyngealized glottal stop" and "epiglottal" stop. That the sound exists, and occurs in phonological contrast, is not controversial. An attempt will be made here to reconcile the articulatory descriptions.

An additional apparent complexity, pointed out by Catford, is the occurrence of the "breathy-voiced (or whispery-voiced) ventricular fricative trill [ʕ̤]" (1977a: 163). In contrast to Arabic [h] or [ʕ] which he regards as "upper pharyngeal or faucal," [ʕ̤] is described by Catford as being "produced much deeper in the throat, with occasionally 'bleat-like' ventricular trill plus ventricular turbulence." Thus, a second sound is distinguished on auditory and phonological grounds from the first, and termed a "glottal plus ventricular 'bleat'" (1977a: 163). The present analysis will endeavour to clarify these articulatory possibilities and identify the gestures that are responsible for the production of both [ʕ̚] and [ʕ̤], and to simplify the categories of phonetic reference used to describe them. This description will treat uvulars as a separate category, so that a transcription such as the following involves a primary uvular articulation and a secondary pharyngeal articulation: "Pharyngealized [χ] and [χʷ] occur in the Bzyb dialect of Abkhaz, in contrast with both plain uvulars and plain pharyngeals" (Catford 1977a: 193). The secondary pharyngeal component of these uvular articulations is considered here to be identical to the mechanism for primary pharyngeal articulations.

In 1979, Laufer and Condax used laryngoscopy to observe the activity of the epiglottis in the production of Semitic pharyngeals. They present convincing evidence in favour of their argument that /h/ and /ʕ/ in Arabic and Hebrew involve constriction that is localized at (or around) the epiglottis. They also cite and confirm, under certain circumstances, the findings of Al-Ani (1970, 1978) that "Arabic /ʕ/ is produced... as a glide, as a voiced fricative and as a voiceless stop" (Laufer and Condax 1981: 55). Without addressing the issue of whether the epiglottis moves independently of the tongue root, it is nevertheless important to point out that Laufer and Condax make an insightful conjecture about /ʕ/ "where we cannot see a complete closure between the epiglottis and the pharyngeal wall, but where spectrograms show the sound to be either a voiceless stop or, sometimes, to consist of creaky (glottalized) voice. In these cases we assume (as with /h/) that the articulation is between the base of the epiglottis and the top of the arytenoids" (1979: 52). In their landmark article, Laufer and Baer (1988) demonstrate that the Semitic emphatics are pharyngealized and not velarized; and that the primary pharyngeal articulation of /h/ and /ʕ/ (involving the epiglottis and the root of the tongue in a constriction in the lower part of the pharynx) appears qualitatively the same as for secondary pharyngealization -- the difference being one of degree of constriction. Their results suggest that lateral compression of the pharynx plays little role in pharyngealization, and is at least not independent of tongue/epiglottis retraction.

Ladefoged and Maddieson (1996: 37) discuss the many observations of what have been called either "pharyngeal stops" or "epiglottal stops" in languages of the world. They cite Catford (1983) who suggests that the "pharyngeal stop" of Chechen may be produced by the epiglottis as the active articulator folding back and down to meet the arytenoids, and Laufer and Condax (1981) who have identified stop closure occurring in the epiglottal region as one way to produce the Arabic and Hebrew pharyngeals. Butcher and Ahmad's (1987) examination of an Iraqi dialect provides a thorough review of studies on pharyngeals and supports the view that the voiceless pharyngeal in Arabic is a fricative and that the voiced pharyngeal can be regarded as an approximant, sometimes accompanied by a stop. They report further that variable ("20 to 160 ms") voicing striations appear in spectrograms often for /ʕ/ and sometimes for /h/ (1987: 166). These observations imply some form of what is usually called "laryngealization," but which may also be accounted for by trilling occurring at the pharyngeal place of articulation.

Interesting but still unresolved comments by Ladefoged and Maddieson are that "it may be that, instead of two distinct regions, pharyngeal and epiglottal, there is actually a range of possible gestures made in this one general area" (1996: 169); and that in certain vowels in Khoisan languages, vibration appears to be occurring around the epiglottis so that these sounds might be called "epiglottal fricative trills" (1996: 170). Their description of the general area, however, is still divided into distinct places of articulation, whereas Laufer and Baer's (1988) finding of differences in degree of constriction might be taken to imply distinct manners of articulation. The question of what structures are moving under conditions of extreme turbulence in the pharynx also needs further clarification. X-ray tracings often show approximate changes in position of the tongue and/or epiglottis, but the larynx and aryepiglottic folds (in the critical area behind the epiglottis intimated by Laufer and Condax in 1979) are not usually represented.

Recent x-ray photographs of "strident" vowels in Khoisan (Traill 1986: 126), also published in Ladefoged and Maddieson (1996: 311), very clearly illustrate a simultaneous narrowing of the pharynx behind the epiglottis, raising of the larynx, approximation of the arytenoid cartilages to the base of the epiglottis, and (reportedly) vibration of the arytenoids and of the epiglottis. Traill identifies this "laryngeal sphincter" as a phonatory mechanism, occurring in !Xóð Bushman as a contrast between "plain voiced," "murmured" and "sphincteric" vowels, [a, a̠, a̠̠] (1986: 125). Fibreoptic laryngoscopic photographs support this description, showing very clearly a voicing mode and a breathy voicing mode at the glottis in contrast with the laryngeal sphincter in pharyngealized mode (1986: 124), which the photographs in the present analysis confirm. The detailed account presented by Traill (1985: 78-79), in which he comments on the balance between constricted aryepiglottic folds at the same time as an apparently abducted glottis and open supraglottal lumen, resembles most closely the configuration for the voiceless pharyngeal trill illustrated here.

The relevant questions for the present study are (1) whether there appear to be two distinct places of articulation in the pharynx, i.e., a "pharyngeal stop" and an "epiglottal stop," (2) whether the epiglottis or some other structure is the active articulator, and (3) how the fricative, approximant and stop manners of articulation relate to this articulator.

As argued earlier by Catford (1968), the epiglottis does not generally compress fully against the back wall of the pharynx. The structures between the epiglottis and the glottis, however, play a major role in deglutition and have been described in the clinical phonetic literature. In their pioneering applications of laryngoscopic technology, Williams, Farquharson and Anthony observed a progression of constrictions consisting of "narrowing of the whole laryngeal vestibule from sphincteric action of the aryepiglottic folds, epiglottis and even the lateral pharyngeal walls"

(1975: 310). The implication of this sequencing for articulatory phonetics is that lateral pharynx compression is the least likely available mechanism for producing pharyngeal quality; that epiglottal (front-back lingual) compression is more likely; and that the aryepiglottic sphincter is the most likely available mechanism for producing pharyngeal quality. Roach has already observed that "glottal closure" for certain glottalized consonants "is in fact made with closure not only of the true vocal folds but also of the false vocal folds and the aryepiglottic folds" (1979: 2). Gauffin notes that the protective closure of the larynx is performed by all the sphincter muscles of the larynx to constrict "larynx tube opening," characterizing a glottal stop as a "reduced protective closure" (1977: 308). This very clear reference to a primary anatomical mechanism implies that "full" protective closure would be associated with a "strong" glottal stop, i.e., a pharyngeal stop.

Painter describes this sphincter mechanism in detail as part of the swallowing process, where initially "approximating the cuneiform cartilages and aryepiglottic folds" means that "the epiglottis is drawn backwards over an already closed airway" (1986: 330). Thus, given that Catford explains that the typical Arabic "pharyngealized sounds involve some degree of contraction of the pharynx either by a retraction of the root of the tongue, or by lateral compression of the faucal pillars and some raising of the larynx, or a combination of these" (1977a: 193), it is likely from a physiological point of view that the aryepiglottic sphincter plays a major role in the process. The articulatory phonetic issue then, is to identify the dependence relationships between these different physiological gestures. Painter describes the components of the basic "effort and swallowing gestures" as a sequence of vocal fold adduction, ventricular fold adduction, cuneiform cartilage and aryepiglottic fold approximation, and epiglottis retraction (in conjunction with general tongue retraction). Catford's observation that the larynx raises during this general retraction gesture should also be taken into account. Painter then lays out several linguistic phonetic realizations of this sequence of gestures: laryngeal configurations for some consonants in European languages (viz. Delattre 1971), Semitic pharyngeals, pharyngeals in Caucasian languages, glottalization in North American languages (cf. Salish and Wakashan below), laryngealization in West African languages, implosives and ejectives, a feature of tone in Vietnamese and of segmental articulation in Danish, and one of the vowel harmony series in West African languages (1986: 330). This elaboration of auditory phonetic categories for pharyngealization can be related to the various adjustments of the mechanism bounding the "laryngeal vestibule" or supraglottal lumen.

A significant contribution to the understanding of the role of aryepiglottic postures in the production of distinctive voice qualities in singing is the finding of Yanagisawa, Estill, Kmucha and Leder (1989) that some widely recognized and even classical singing styles involve a tightened aryepiglottic sphincter. Their laryngoscopic photographs demonstrate that a range of auditory targets can be correlated with contrasting degrees of aryepiglottic fold closure, as well as with varying heights of the larynx for some of the target qualities. The auditory descriptions of the vocal styles which they investigated imply clear auditory parallels with pharyngealization in the labelling of voice quality and of segmental categories in speech. It is equally apparent that the sphincter mechanism represented in their photographs is the major physiological mechanism in the pharynx which differentiates the singing qualities which they studied. They also argue that aryepiglottic constriction is not necessarily a detrimental posture for the health of the voice. It can be interpreted from these findings that spoken qualities probably utilize the same mechanism of pharyngeal stricture when speech sounds that involve a "narrowing" of the pharynx are produced. The photographic evidence invites a direct comparison of the singing styles with the laryngoscopic data obtained in the present study. Both are indicative of a posture where the laryngeal valve is so narrowly constricted that it is about to be "shut off" as in the so-called "strong glottal stop."

A further comment by Pierrehumbert in Honda, Hirai, Estill and Tohkura (1995: 37) suggesting that the pharyngeal consonants of Semitic and Salish involve a glottalized voice quality prompts an elaboration on the auditory quality resulting from aryepiglottic constriction. Honda et al. (1995: 36) identify a "tightening of the larynx tube, or the aryepiglottic space [for Opera, as] an effective gesture for producing a ringing voice quality used for producing loud and bright sounds." In conjunction with "a forward shift of the hyoid bone while maintaining a low larynx position for Opera quality," they identify "a bending and a stricture of the aryepiglottic space" (p. 36).

3. Method of observation

Laryngoscopic images of the pharynx and larynx were obtained using a Kay Elemetrics Rhino-Laryngeal Stroboscope 9100 -- a computer-controlled system including a dual halogen (fixed) and xenon (strobe) light source, a Panasonic KS152 camera, a Mitsubishi S-VHS video cassette recorder BV-2000 (running at 30 frames/sec) and printer. This system comes equipped with a rigid, oral endoscope; but the view obtained with the rigid scope does not extend beyond the apex of the epiglottis during activities involving pharyngeal constriction. In fact, it is difficult to see beyond the apex of the epiglottis even using a flexible fiberoptic laryngoscope during anything but a close front vowel. This was the case in the extensive laryngoscopic observations of Semitic pharyngeal articulations

carried out by Laufer and Condax (1981) and Laufer and Baer (1988) with native-speaker subjects. In order to investigate the extent of view possible of the laryngeal and pharyngeal mechanisms behind the apex of the epiglottis during pharyngeal articulations, an Olympus ENF-P3 flexible fibreoptic laryngoscope was attached to the Kay system, for nasal insertion and using a 28mm lens for wide-angle view. The subject in all nasendoscopic observations was the author, producing maximally contrastive phonetically controlled speech data. The view from the naso-pharynx was adjusted to peer behind the apex of the epiglottis as far as possible, to view the glottis, pyriform recesses, arytenoids, and aryepiglottic folds. The pharyngeal/laryngeal view in the photographic images presented here is taken from above the larynx, at about the level of the uvula or lower, and slightly from the right of centre (the left of the picture). The image is not perfectly vertical but rotated about 20° (notch at the top), in order to eliminate Moiré effects -- striated interference patterns produced by the interaction of fibrescopic and camera optics (Yanagisawa and Yanagisawa 1993: 262).

The original purpose of laryngoscopic filming was to contrast tongue and larynx position for the auditorily specified long-term voice quality settings raised larynx voice and lowered larynx voice. It soon became apparent that a raised larynx quality invokes the same tongue and epiglottal posture as a pharyngealized quality, and that a number of degrees along a "pharyngealization continuum" are possible which cannot be accounted for by observing the position of the tongue alone. It was therefore decided to examine pharyngeal options at the segmental level in more detail, in the context of larynx raising and lowering, before pursuing the long-term effects of these settings.

In this initial collection of baseline data on pharyngeal postures, videotape films were collected of a matrix of phonetic productions: glottal stop and glottal fricative in contrast with pharyngeal stop, trill, fricative and approximant, the latter set in both raised and lowered larynx positions. Articulations were performed with a carrier phrase and, to expose maximum pharyngeal area, in the environment of the close front vowel [i _ i]. This resembles a technique followed in earlier work, using similar equipment (Williams et al. 1975; Esling 1984). Frames of each articulation were then exported to a Macintosh computer for analysis in still-frame sequence and in animation. Frames of some key sequences are presented here in Figures 1-7. Visual interpretations are offered using standard landmark reference.

4. Results of observations

In pharyngeal articulations with varying degrees of friction and closure, the epiglottis is seen to retract towards the posterior pharyngeal wall as described by Laufer and Baer (1988). This creates a narrowed or constricted space at the back of the oral tract, where the distance between the apex of the epiglottis and the posterior pharyngeal wall narrows to almost nothing during an open vowel. What is observed in these laryngoscopic images that has not been described in phonetic terms previously is the role of the aryepiglottic mechanism in the process of pharyngeal constriction. The phonetic articulations that we are describing involve essentially the same mechanism as in the physiological processes of gagging and swallowing (Logemann 1986: 49).

Pharyngeal stop closure is identified as a function of the laryngeal sphincter mechanism whereby the aryepiglottic folds approximate the tubercle of the epiglottis. While simple glottal stop articulation involves, at the very least, a slowing of the vibratory pattern of the vocal folds without significant deformation of the structures of the laryngeal vestibule, the most extreme pharyngeal stop articulation involves a close approximation of the cuneiform cartilages of Wrisberg in an anterior motion which has the effect of a pursing or pinching off of the laryngeal vestibule as described above anatomically. Glottal articulations are observed to retain a typically open laryngeal vestibule. Glottal fricatives, illustrated in Figure 1, are characterized by a brief abduction of the vocal folds within a still open laryngeal vestibule, while glottal stops, illustrated in Figure 2, have either a momentary slowing or full adduction of the still visible vocal folds, and/or an initiation of the sphincter mechanism which just obscures the vocal folds.

Full pharyngeal occlusion of the airway is illustrated in Figure 3, where the close front vowel environment allows a continuous view of the aryepiglottic pursing of the vestibule. This articulatory posture is the same mechanism described by Painter (1986) and by Yanagisawa et al. (1989), taken to extreme closure, and matches the auditory phonetic quality found in Caucasian languages referred to by Catford as a "strong glottal stop" or "[ʔ]" (1977a: 163). In comparison with Figure 1, Figure 3 easily justifies Gaprindashvili's (1966) description of this sound as a "pharyngealized glottal stop." This sound, which has been termed "epiglottal," can be regarded as more properly aryepiglottic in origin and as pharyngeal in general place of articulation, but is still represented unambiguously by the stop symbol [ʔ] introduced by the IPA in 1989.

A pharyngeal approximant (necessarily voiced for audibility) resembles pharyngeal stop closure. As shown in Figure 4, the vibrating vocal folds are not visible during [ʕ], but the constricted posture of the aryepiglottic folds is clearly the principal mechanism that can be associated with the dominant auditory feature of pharyngealization. The challenge for research has been and will continue to be how to analyze the glottal vibratory pattern beneath the pharyngeal stricture and how to determine the influence of increasing pharyngeal stricture on glottal vibration.

The voiceless pharyngeal fricative retains aryepiglottic fold constriction but with a narrow triangular space remaining open between the arytenoids as they press against the epiglottal tubercle. This space presumably generates the friction accompanying voicelessness. Figure 5 illustrates the maintained interarytenoid gap, as well as the familiar aryepiglottic posture that we take to account for the pharyngeal component of [ħ].

Increasingly forced articulations of the approximant and the fricative yield additional activity between the constricted aryepiglottic folds and the base of the epiglottis -- that of trilling. This is the vibration described by Traill (1985, 1986) as the "sphincteric" phonation observed in "strident" vowels. The voiced trill resembles the configuration of an approximant, with the addition of rapidly vibrating aryepiglottic folds; while the voiceless trill maintains the same interarytenoid opening as the voiceless fricative, with the addition of rapidly vibrating aryepiglottic folds. It is unclear whether the epiglottis mirrors this vibration, but the posterior pharyngeal walls do appear to be "flapping" in response to the airflow as the trilled airstream passes through the pharynx. Figure 6 shows the more open configuration for the voiceless trill, resembling the medial openness of Figure 5, and Figure 7 shows the configuration for the intervocalic voiced trill. Auditory comparisons with the Caucasian sounds identified by Catford suggest that the voiceless trill is the same sound (and mechanism of articulation) as his "ventricular fricative trill [ħʕ]" (1977a: 163). As in the case of uvulars, increasing friction is taken to instigate trilling. Since the trilling in the pharynx is aryepiglottic, the sounds which have been labelled epiglottal fricatives can logically be ascribed to these trills, taking trilling to represent an enhanced degree of friction. The trilled counterpart of [ħ] is thus labelled [ħ̤], and the trilled counterpart of [ʕ] is labelled [ʕ̤]. The IPA symbols for the epiglottal fricatives have been taken to indicate that the articulation involves greater constriction than for their pharyngeal counterparts. In the interpretation presented here, this greater degree of stricture involves the aryepiglottic folds pressing against the base of the epiglottis to effect trilling of the aryepiglottic folds, presumably when the velocity of airflow is sufficient.

If an active articulator is considered to be moving against a passive articulator, in the case of pharyngeal articulations, the aryepiglottic folds should be considered the active articulator, and the epiglottis and tongue, once fully retracted, the passive articulator. From this perspective, instead of viewing the epiglottis as being pulled down to effect the laryngeal sphincter, the larynx and aryepiglottic folds are viewed as being pulled up (by the aryepiglottic muscles and thyroepiglottic muscles) towards the epiglottis.

5. Discussion

Laryngoscopic observations associate the tightening of the aryepiglottic space referred to by Honda et al. (1995) or of the laryngeal vestibule referred to by Painter (1986) with the sound qualities labelled by Laver (1980) as "pharyngealized voice" and "raised larynx voice." It has been shown that these two qualities are not auditorily distinguishable from each other at a given pitch but that, given the same intended target, "pharyngealized voice" is the quality identified in a voice with low pitch and that "raised larynx voice" is the quality identified in a voice with higher pitch (Esling, Heap, Snell and Dickson 1994; Esling 1995). As auditory voice quality labels, they are complementary, and pitch-dependent.

Pharyngealization has been associated primarily with tongue retraction, as in the case of vowels. "Pharyngealized vowels involve a compression of the pharynx simultaneously with the primary vowel articulation. This is usually effected by a backward thrust of the root of the tongue, tending to narrow the pharynx in a front-to-back dimension" (Catford, 1977a: 182). This occurs in several Caucasian languages, and Catford reports that "pharyngealization adds a slightly 'squeezed' quality to the auditory impression of vowels in these languages and tends to impart a somewhat 'fronted' (advanced) quality to back vowels, both in terms auditory impression and formant-shifts in spectrograms" (p. 182). Remembering that Catford also associates pharyngealization with raising of the larynx, the most likely explanation for this auditory impression, as Laver (1994: 330) speculates, is the acoustic effect of vocal-tract shortening caused by larynx raising. Since Catford does not use the term "raised larynx voice," it is a plausible candidate for the "squeezed, fronted" quality he identifies.

Nolan (1983: 182-187), investigating the relationship between larynx height and pharyngealization in long-term postures of the vocal tract, cites acoustic, radiographic and physiological evidence to associate pharyngealization with elevation of the larynx. Nolan's x-ray tracings (1983: 183) show clearly that the posture for raised larynx voice

both alters the angle and constriction of the larynx tube and involves the tongue (and epiglottis) filling more of the lower pharyngeal space. Using laryngoscopic observation in the present study, it became quickly apparent with the rigid scope that the same mechanism was being used in retracting the tongue to the pharyngeal wall as in producing the auditory effect of a shortened vocal tract associated with raised larynx voice. With the fiberoptic scope, the source of constriction at the aryepiglottic sphincter mechanism is clear to see. It is also apparent that the larynx cannot raise for aryepiglottic closure, tucking itself up under the epiglottis as it does in pharyngeal stop mode during swallowing, for instance, without the tongue and the epiglottis also retracting. Thus, when the tongue retracts and the aryepiglottic folds constrict in a pharyngeal articulation, the natural, unmarked position of the larynx is raised. Nevertheless, the larynx as a whole can be raised or lowered during pharyngeal stricture. The interdependencies of these articulatory setting parameters could explain the conflicting acoustic effects observed by Nolan, where pharyngealization sometimes appeared to be affected by variable larynx heights.

Under laryngoscopic observation, it became quickly apparent with the rigid scope that the same mechanism was being used in retracting the tongue to the pharyngeal wall as in producing the auditory effect of a shortened vocal tract associated with raised larynx voice. With the fiberoptic scope, the source of constriction at the aryepiglottic sphincter mechanism is clear to see. It is also apparent that the larynx cannot raise for aryepiglottic closure, tucking itself up under the epiglottis as it does in pharyngeal stop mode during swallowing, for instance, without the tongue and the epiglottis also retracting. Thus, when the tongue retracts and the aryepiglottic folds constrict in a pharyngeal articulation, the natural, unmarked position of the larynx is raised. Nevertheless, the larynx as a whole can be raised or lowered during pharyngeal stricture.

A lowered-larynx setting of the larynx concurrent with pharyngealization would constitute a marked deviation from natural anatomical tendencies, and presumably be a more difficult muscular relationship to maintain. This second, vertical dimension, however, can be added to the first, horizontal or front-back dimension of pharyngealization to achieve a varied set of auditory effects. In combination with four possible adjustments in manner of articulation at the aryepiglottic sphincter place of articulation -- approximation, frication, trilling and stop -- a number of complex auditory effects can be accounted for. As these vertical movements are also related to pitch changes, however, further research to investigate and quantify the relationship of pharyngealization (tongue retraction and aryepiglottic-fold constriction) to vertical larynx-height adjustments will also need to control pitch independently.

Both horizontal (antero-posterior) and vertical adjustments are relevant in the description of pharyngeal features associated with tone. A number of languages in Southeast Asia use tones that may involve raised settings of the larynx, i.e., a degree of pharyngealization, as their distinctive feature. One of the six Vietnamese tones (Hanoi dialect) illustrates this quality (Esling in press). It is low in pitch with a pharyngealized (raised-larynx) component usually finishing in a stop, in contrast to another whisperier (lowered-larynx) low tone. The auditory similarity to pharyngeal approximant and stop consonants in other languages suggests that the aryepiglottic mechanism deserves further investigation in studies of Mon-Khmer tone. In Bruu, a Mon-Khmer language in the UCLA HyperCard database, *Sounds of the World's Languages*, tones described as having stiff vocal cords and tense vocal tract walls are a likely result of aryepiglottic constriction and larynx raising, judging by their auditory contrast to the non-stiff series. Mpi, a Tibeto-Burman language investigated by Jimmy G. Harris, also in the UCLA database (Ladefoged and Maddieson 1996: 315-317), has a "laryngealized" series which is auditorily similar to the pharyngeal qualities described here and probably due to aryepiglottic constriction, i.e., actually pharyngealized. Ladefoged and Maddieson refer to the Mpi series as less creaky than the laryngealized vowels of some other languages, hinting that the explanation might not be glottal. As explained below, the relationship of the pharyngeal articulator to pitch control and to phonation type may function as a secondary phonatory source.

West African languages with tongue root contrasts also deserve further clarification with respect to the pharyngeal articulator. What is not clear in the x-ray data on retracted tongue root [-ATR] vowels to date is the role of the laryngeal sphincter, as the larynx presumably raises, when the tongue retracts. The hypothesis that suggests itself here is that the retracted tongue root vowels in Igbo and in Akan (Ladefoged and Maddieson 1996: 300-302) are produced by tongue backing and larynx raising due to pharyngeal constriction at the aryepiglottic sphincter. In this interpretation, based on an auditory classification using Laver's taxonomy, [+ATR] vowels have lowered larynx and are not pharyngealized, while [-ATR] vowels have raised larynx and are pharyngealized. The articulatory parallel to pharyngeal manners of articulation is worth pursuing for all of these tonal and vocalic register phenomena.

It has been pointed out (viz. Delattre 1971) that pharyngeals may occur in European languages, for example, for Danish /r/. The /r/ of Parisian French dialect can also be realized as [ʕ], which is also used as a paralinguistic feature independently of the /r/ environment. An avenue for phonological research would involve the relationship between

uvulars, including /r/, and the development of pharyngeals, as well as the relationship between long-term pharyngeal colouring and neighbouring segmental articulations. The idea of a uvular genesis of pharyngeals has already been broached in the historical linguistic literature (Jacobsen 1969).

Northwest Coast languages of North America illustrate a series of sounds with a secondary articulation variably termed "glottal," "laryngeal" or "pharyngeal" (Carlson 1989). The qualities of /h,ʕ/, as in Semitic, are taken to be a function of the aryepiglottic sphincter. The two voiced pharyngeals of Spokane /ʕ,ʕʷ/ also have "glottalized" counterparts /ʕ',ʕʷ'/, which are interpreted here as adding a stop component -- i.e., being pharyngeal stops in the same way that Catford's [ʕ̥] represents a pharyngeal stop. The Caucasian language, Agul, described by Ladefoged and Maddieson (1996: 38, 167-170) and illustrated in the UCLA HyperCard database, offers a good example of this sound, represented as [ʔ]. Two voiceless pharyngeal continuants are also distinguished in Agul. The one labelled pharyngeal [h] can be described using the terminology proposed here as a voiceless pharyngeal fricative with lowered larynx, i.e., expanded lower cavity resonance. The one sounding more constricted and labelled epiglottal [ɬ] can be described as a voiceless pharyngeal (aryepiglottic) fricative with raised larynx, essentially a voiceless pharyngeal trill. The voiced pharyngeal [ʕ] of Agul sounds slightly trilled in one example, but [ʕ'] is not represented. Catford's impression that [ɬ] and [ʕ] are more "genuinely fricative" than [h] and [ʕ] (1990: 26) is supported by the present interpretation that they are fricatives with the addition of trilling.

Ahousaht (sometimes called Nootka), a Wakashan language of the Northwest Coast, uses /h,ʕ/ phonologically (Jacobsen 1969), but has been observed to modify these sounds paralinguistically to more constricted versions which resemble the equivalent series in Caucasian languages. In the story of Sea Lion as narrated by George Louie in the Department of Linguistics at the University of Victoria, a person who is transformed into a sea lion tends to pronounce [h] as a sustained [ɬ], and [ʕ] as a sustained [ʕ̥], where [ɬ] and [ʕ̥] are trills (Esling 1996a, 1996b).

"Strident" vowels in Khoisan (Traill 1986) are interpreted here to be produced similarly to the [-ATR] vowel series in West African languages (Ladefoged and Maddieson 1996: 300-302), and to be equivalent to pharyngealized vowels with respect to the place of the mechanism of production. This mechanism is the same phenomenon of a tightened aryepiglottic sphincter recognized by Yanagisawa et al. (1989) and Honda et al. (1995) in a number of singing styles, although details of manner of articulation or of larynx height may differ across these categories. The manner of articulation of the !Xóõ vowels, considering auditory quality and the laryngoscopic and x-ray evidence, is secondary voiceless pharyngeal trilling.

The perhaps confusing nature of the sounds produced at this place of articulation is their quasi-phonatory nature. As suggested by Traill (1986), it is possible in phonological terms to view the longer-than-usual sustained action of the laryngeal sphincter as a phonation type, in parallel to modal and breathy glottal phonation. In the same way, sustained pharyngeal approximation can function as a long-term voice quality or register (as in Ahousaht), underlying segmental articulations at other places of articulation for which it is the background. A degree of friction in the pharyngeal sphincter would contribute to the whisperiness or breathiness factor in the identification of long-term voice quality. As in the case of the "strident" Khoisan vowel series, sustained trilling of the aryepiglottic mechanism can be perceived as a quasi-phonatory component of background voice quality. Such is the case in the jazz singing style of Louis Armstrong, where voiced aryepiglottic trilling is the dominant feature of his phonatory voice quality; or in some of the speaking/singing voices in Cab Calloway's band referred to by Catford (1977a: 104). In these cases, pharyngeal (aryepiglottic) approximation, friction or trilling can function extralinguistically or even paralinguistically as a secondary phonatory process, integrating with features of glottal phonation in the perception of long-term voice quality. Another question to be deferred for further research is whether a pharyngeal stop can be imploded (viz. Catford 1977a: 74-75).

6. Conclusions

The present analysis demonstrates: (1) that Catford's epiglottopharyngeal category involves the aryepiglottic folds behind the epiglottis, (2) that stop closure is possible at the aryepiglottic location, (3) that extreme retraction of the tongue towards the back wall of the pharynx accounts for only the orally visible component of pharyngeal articulation, (4) that not only stop closure is possible aryepiglottically but also trilling, and (5) that the pharyngeal fricative and approximant are also produced at the same location, i.e., that the "pharyngeal articulator" is essentially aryepiglottic. It is proposed that the IPA symbols for "epiglottal" articulations be applied to the basic manners of pharyngeal articulation as outlined in Table 1.

Table 1. Pharyngeal Consonantal Distinctions (Place/Manner/Voiceless-Voiced)

[ʔ]	Glottal plosive
[h]	Voiceless glottal fricative
[ʕ]	Pharyngeal (aryepiglottic) plosive ("strong" or "massive" glottal stop)
[ħ]	Voiceless pharyngeal (aryepiglottic) fricative
[ʁ]	Voiceless pharyngeal fricative with aryepiglottic trilling
[ʕ̣]	Voiced pharyngeal (aryepiglottic) fricative/approximant
[ʕ̣̌]	Voiced pharyngeal fricative/approximant with aryepiglottic trilling

These findings imply that there are more possibilities of articulation in the pharynx than previously expected, that a number of phonologically varied phenomena may use adjustments of the pharyngeal articulator in their production, and that manners of pharyngeal articulation are more similar to their uvular counterparts than previously assumed. The vertical setting of the larynx tends to be raised as in "raised larynx voice" when pharyngeal constriction occurs, but the larynx as a whole can be lowered while the aryepiglottic sphincter mechanism is narrowed or closed. In this scheme, two dimensions or planes of movement, antero-posterior and raised-lowered larynx, are adequate to account for the auditory categories that have been used to label pharyngeal sounds.

Animations -- Web Site

Animated images of some of the articulations shown here in still photographs can be viewed on the world wide web at the University of Victoria Phonetics Laboratory research site. To load and view the images, go to <http://web.uvic.ca/ling> and look for Phonetics Laboratory Research. Synchronized audio is absent in the animations, but text descriptions and parallel audio files are provided for reference.

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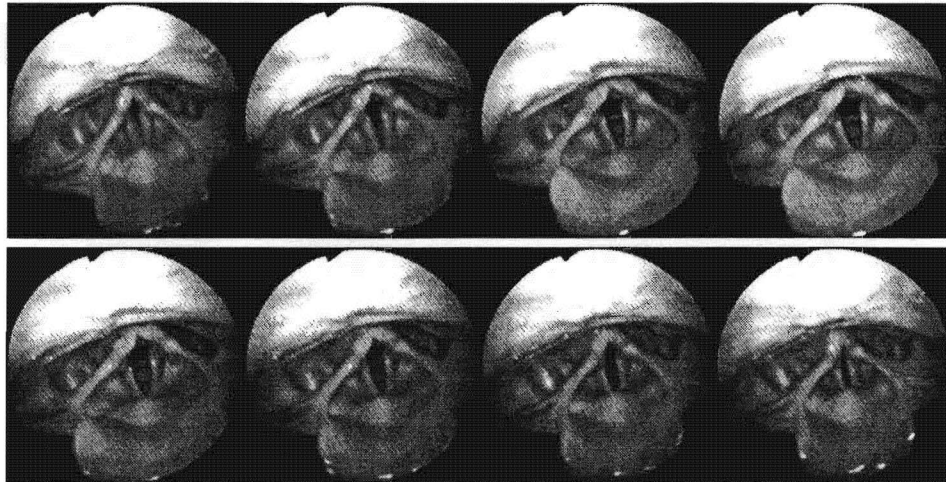


Figure 1. Rhino-laryngoscopic view of the lower pharynx: supraglottal lumen containing the glottis, bounded by the epiglottis, aryepiglottic folds and arytenoids; with the posterior pharyngeal wall behind and the pyriform recesses beneath. An intervocalic [h] of about 266 msec duration is shown. This "laryngeal vestibule" is fully open (not constricted) with the glottis free to abduct.

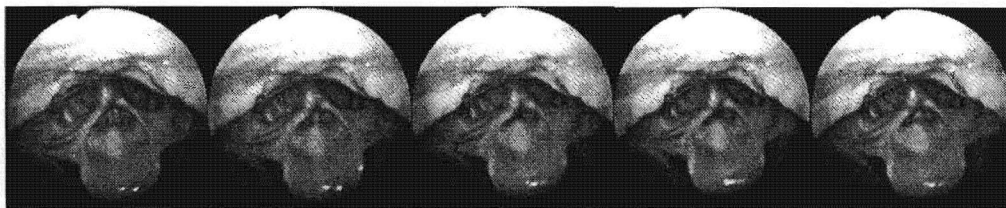


Figure 2. This 5-frame, 166-msec [iʔi] sequence shows the partial narrowing of the sphincter mechanism for a moderate glottal stop [ʔ]. The [i] articulation in the first frame represents the neutral posture for modal phonation. The larynx is neither raised nor lowered.

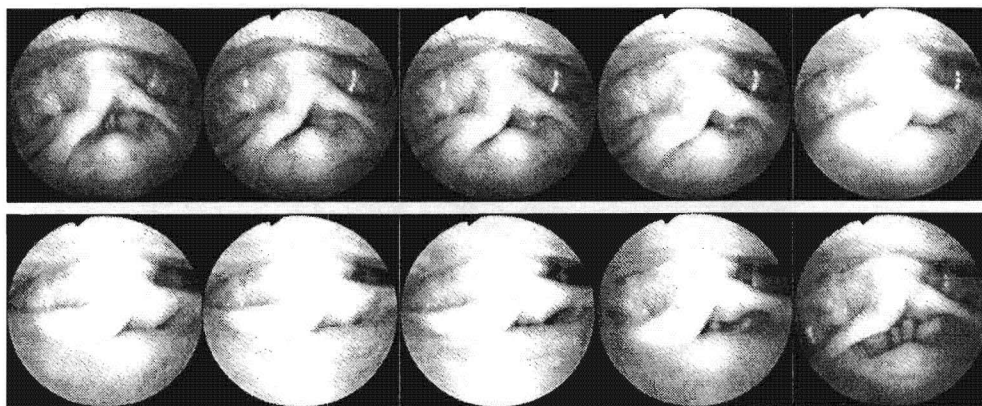


Figure 3. Full pharyngeal occlusion in an [iʔi] sequence, with the larynx raising as the tongue backs and the aryepiglottic folds squeeze against the base of the epiglottis. In this close-up shot of 1/3 sec of stop articulation, the supraglottal lumen is compressed, then released.

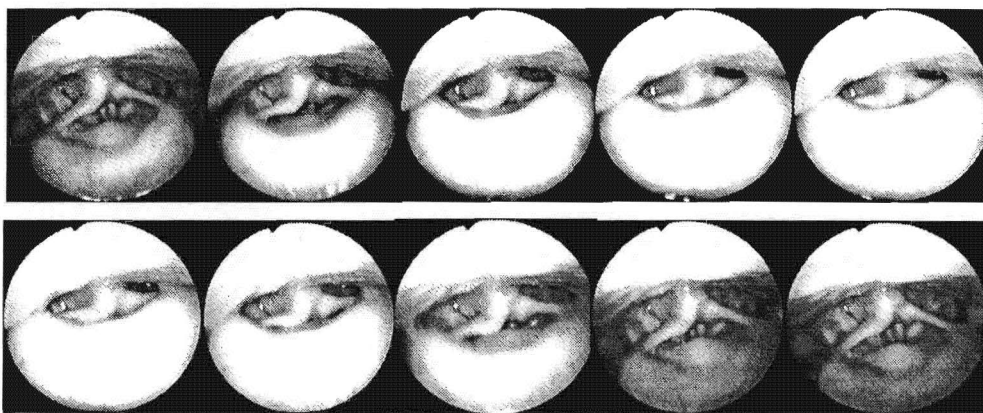


Figure 4. Voiced pharyngeal approximant in an [iʕi] sequence. These shots are further from the larynx than in Figure 3, but the larynx raising that accompanies antero-posterior compression is similar. The posture of the aryepiglottic folds resembles that for [ʕ], and voicing continues throughout, although this is difficult to distinguish visually.

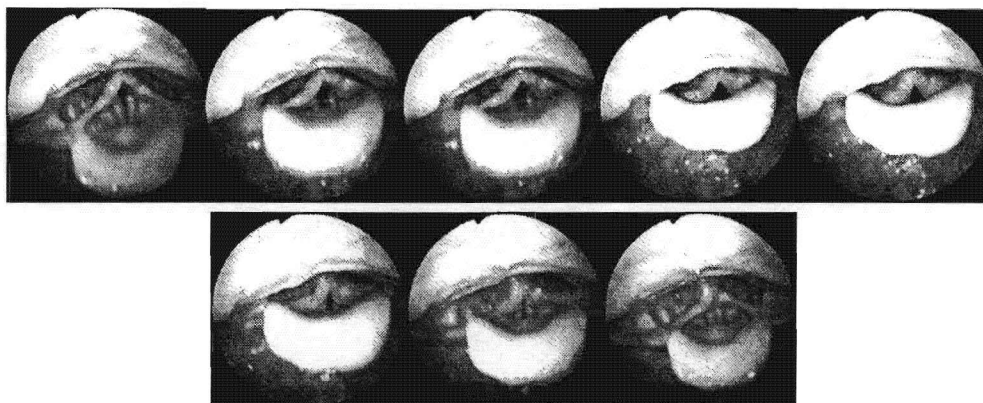


Figure 5. Voiceless pharyngeal fricative in a brief [ihi] sequence. In contrast to the glottal fricative in Figure 1, the supraglottal lumen is constricted into a funnel-shaped sphincter between the aryepiglottic folds as the tongue and epiglottis retract. The larynx raises for the consonantal articulation, and descends again for [i]. The first frame of the sequence is [h], anticipatory to [h].

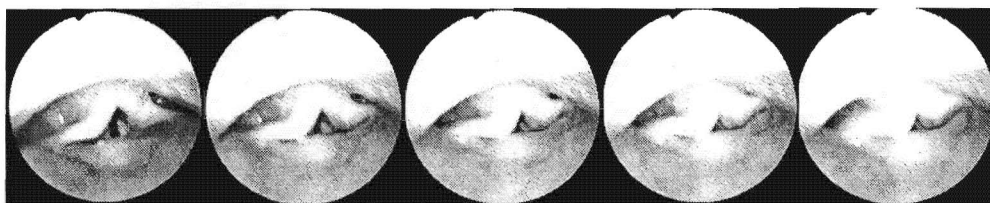


Figure 6. Voiceless pharyngeal trill [Ḥ] from an intervocalic sequence. First frame: [h]. Remaining frames: medial interarytenoid gap with vigorous aryepiglottic fold trilling [Ḥ]. The unmarked vertical laryngeal setting for trilling is raised larynx.

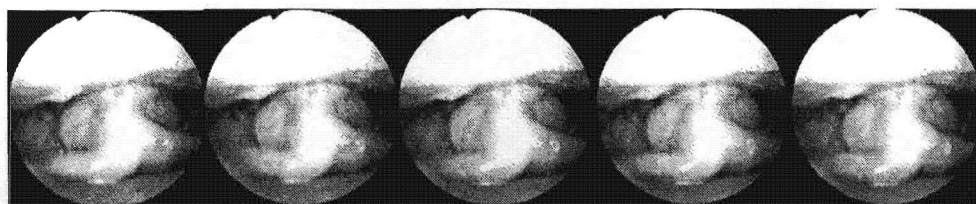


Figure 7. Voiced pharyngeal trill [ʕ̤] from an intervocalic sequence. These frames isolate sustained aryepiglottic approximation and trilling. Aryepiglottic fold motion is blurred because film speed (30 frames/sec) is too slow to capture single periods of movement.

ACOUSTIC ANALYSIS OF PHARYNGEAL APPROXIMANTS, FRICATIVES, TRILLS AND STOPS

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Introduction

The pharyngeal consonants have been problematic phonetically and phonologically. This paper is an attempt to use acoustical data and language data to support the notion of four manners of articulation in the region of the pharynx. Since this area of the vocal tract is difficult to see it is difficult to understand how structures in the larynx and pharynx move with respect to each other. This causes problems with phonological theories in determining the features that are associated with pharyngeal segments and that are involved in phonological processes. The goal of this research is to clarify the confusing and imprecise terminology used to describe behaviour in the pharynx.

This investigation illustrates the importance of considering phonological phenomena when developing a good phonetic taxonomy. It is important to note the phonetic and acoustic qualities of a sound but ultimately, the sound needs to be relevant to language in order to be included in a phonetic taxonomy, such as the International Phonetic Association (IPA). This investigation shows acoustically and physiologically that the pharyngeal area of the vocal tract can produce plosive, trill, fricative and approximant manners. The references to language data suggest languages that use pharyngeal articulations may treat them as varying manners. Data from one language suggests there is more than one place of articulation in the region of the pharynx. Re-considering these language examples as varying manners of articulations may provide a plausible alternative.

Traditionally, consonants are described with respect to 'place' and 'manner' of articulation. For instance, sounds produced by the lips are classed as *labial*. At this place it is possible to produce four manners of articulation:

1. A stop [b] that involves complete closure of the lips.
2. A trill [ʙ] that involves rapid stops in succession.
3. A fricative [β] that requires the lips to be close enough to cause passing air to be turbulent.
4. An approximant [w] that involves the lips approximating, or coming together but not close enough to cause turbulence in the airstream.

Based on auditory assessments of pharyngeal and epiglottal productions it is hypothesized, that the same manners mentioned above for the labial place can be produced at the pharyngeal place. This assertion is based mainly on the auditory descriptions of pharyngeal sounds such as those described in Krauss (1979) and Esling (personal communication) as well as personal observations. It appears, that varying manners are described phonologically (Bessell 1992, 1993, Rose 1976, Krauss 1979). Varying manners in the pharynx implies the use of characteristics that define manners in all places of articulation. That is, stops imply complete closure, trills rapid stops, fricatives a noise component, and approximants involve the least amount of constriction.

The places of articulation, according to the International Phonetic Alphabet (IPA), are shown in Figure 1. The thyroid and cricoid cartilages have been drawn in to illustrate the orientation of the larynx, note that the oral cavity contains nearly all places of articulation. This is largely because the tongue is more agile in the oral region and the tongue is the primary articulator for most speech sounds. Esling (1996) argues that the aryepiglottic folds are the main articulator in the pharynx. This interpretation differs slightly from Laufer's (1979) description that the epiglottis is the main articulator

in the pharynx. The issue of specifying the articulator in the pharynx will not be challenged here, the goal here it is a clarify 'place' and manner of articulation. The articulator does not require consideration here since the manner of articulation in any region is defined by stoppages or friction as mentioned above and not fine tuned adjustments that might distinguish variations on a manner of articulation, such as comparing an apical-alveolar fricative with a laminal alveolar fricative.

Figure 1 shows the pharynx as one region. The IPA chart, however, also postulates an epiglottal place (under 'other symbols' on the chart), in order to distinguish between consonants produced in the pharynx (see IPA chart in appendix). The acoustical and phonological data presented here will show that the consonants classified as epiglottal are not distinct in place of articulation from what have been called pharyngeal articulations.

The advantage of looking at pharyngeal segments phonologically is that their classification is determined by their use in the language. In most cases a certain class of sounds will behave similarly throughout a particular language. In the case of pharyngeal consonants, they are produced in the throat where it is not possible to see the articulation. This may cause difficulty for listeners since it is important to have visual cues in speech. This is known as the McGurk effect and is illustrated by the difficulty in watching dubbed foreign films; dubbed words do not match the speaker's movements, which confuses the viewer. However, in the case of pharyngeal consonants, the phonology, i.e. how the sound is used in the language, helps to eliminate confusion. Phonological consistencies are noted cross-linguistically which contributes to producing a taxonomy like the IPA chart.

This paper considers the general acoustic, auditory and physiological plausibility of manners of pharyngeal articulations. As well, languages that use sounds produced in the pharynx are examined in an attempt to support the pharyngeal region as a place of articulation that is capable of producing varying manners of articulation. The phonetic facts will be considered along with reference to aspects of their phonological role in the language.

The paper is organized as follows: First, a short section covering background information will be presented, followed by sections dealing with each proposed manner of articulation in the pharynx. Each section will consider one manner of articulation starting with the proposed pharyngeal *plosive*, *trill*, *fricative* and *approximant*. In each section, the videolaryngoscopic data collected from a one phonetician will be described acoustically. The last part of each section will discuss languages that make use of the proposed manners of articulation phonologically. Following the manners of articulation, section 5 will discuss an interpretation of the Agul consonant inventory. Agul is a Nako-Dagestanian language spoken in the northeast Caucasus that contains both pharyngeal consonants as represented on the IPA chart and the epiglottal consonants. The different manners of articulation discussed in this paper will provide an alternate interpretation of the Agul consonant inventory.

Background

In order to observe movements in the pharynx, a flexible fiberoptic nasendoscope is inserted through the nose and is positioned just behind the velum (see Figure 1). This gives the view seen in Figure 2. The pertinent structures are labeled and discussed with respect to the manners in which they participate. In general, Figure 2 represents the vocal tract at rest, as in quiet breathing. The *epiglottis* is attached to the base of the tongue, and the *pharyngeal wall* extends down the back of the throat. It may be useful to examine this figure along with Figure 1 in order to better understand the position of structures within the larynx and pharynx.

The acoustic output that correlates with the video is analyzed using the Computerized Speech Laboratory (CSL) 4300A and Analysis by Synthesis Laboratory (ASL) from Kay Elemetrics Corp. Two software packages were necessary in order to describe the varying manners of articulation. For examples, the most notable characteristics of a pharyngeal plosive appear to be in the acoustic waveform. This was confirmed by creating, or synthesizing a pharyngeal plosive from a glottal plosive. The spectrogram alone of a plosive does not show any obvious difference between glottal

stop and the pharyngeal stop. The qualities of a trill can be seen in the acoustic waveform because of spacing of low amplitude sections. The fricative and approximant formant relationships are seen using a spectrographic analysis of a VCV sequence. These techniques are covered in more detail within the sections. The language data are taken from the Phonetic Database (PDB) from the University of Victoria and from Sounds of the Worlds Languages (SOWL) from UCLA.

1. The Pharyngeal Plosive [ʔ]

Viewing a pharyngeal plosive through a nasendoscope shows the larynx, the structure that contains the vocal folds, raising up to meet the epiglottis (see Esling Figure 3, this issue). This is different from a glottal stop where the larynx is closer to its rest position (as in Figure 2) and only the vocal folds close.

Stops in the oral region are distinguished acoustically according to their formant transition to the following segment. These transitions are visible in the spectrogram and used in synthesizing oral stops. However, the spectrogram for both the pharyngeal and glottal stop, in the environment of [ɑ], show no formant transitions. Theoretically, the first formant frequency should increase from the stop to the vowel since vocal tract constriction generally is associated with a low first formant and, since a stop involves complete constriction (Kent 1992 p.116). F2 and F3 are considered cues for place of articulation which would predict no formant transition since the vowel [ɑ] is used and involves constriction in the pharynx. The fact that no transitions are visible provides evidence for the fact that [ɑ] is articulated in the pharynx. Butcher and Ahmad (1987) illustrate spectrographic evidence of formant transitions with an [i] vowel that show F1 lowering from the stop to the following vowel and F2 and F3 raising. This is consistent with formant behaviour from [i] to [ɑ], the pertinent information for the pharyngeal stop in the environment of [ɑ] appears in the waveform.

The top waveform of Figure 3 is the glottal stop; the first part of the waveform corresponds to the vowel [ɑ] and the straight horizontal line portion is the stop. The bottom waveform is the pharyngeal plosive with the same [ɑ] vowel. In the acoustic waveform the vowel preceding the stop is shorter and the closure, or stop portion, is longer than the glottal stop. This is similar to a lenis/fortis type distinction as described in Ladefoged and Maddieson (1996) where, in this case, the pharyngeal stop requires more articulatory force. The implications of a pharyngeal component in the lenis/fortis description of stops in languages, such as Korean, is not expanded here but is certainly worth investigating, since the results could better define the fortis stops as pharyngeal rather than the less precise terminology of lenis/fortis.

The pitch of the vowels preceding and following the pharyngeal consonant is also higher. Increasing pitch is sometimes achieved by raising the larynx (Esling, Heap, Snell and Dickson, 1994). Therefore, it is reasonable to assume that raising of the larynx observed in the video data would correlate with an increase in pitch. The characteristics of vowel shortening, stop closure lengthening and increased pitch in the pharyngeal plosive are confirmed by taking the glottal stop and changing these parameters using synthesis software to create a pharyngeal stop. The adjustments result in a sound, judged by the phonetician and a Farsi¹ speaker, to be similar to the original production of a pharyngeal stop.

This plosive-type behaviour is described in Arabic by al-Ani (1970) as the more common allophone of the voiced pharyngeal fricative in Arabic. Butcher and Ahmad (1987) state alternatives in Iraqi Arabic to the pharyngeal fricative as either a pharyngeal approximant or stop articulation. In Agul, the Caucasian language mentioned earlier, an epiglottal plosive is noted by Ladefoged and Maddieson (1996). Examining the pitch and amplitude of this Agul example reveals an increase in pitch of the vowel preceding the stop but not following. Unfortunately, there are no examples of glottal stops provided in the SOWL database, and attempts to change the pharyngeal stop into a more

¹Farsi is an Indo-European language that contains pharyngeal consonants.

glottal sounding stop were not successful. This failure to synthesize is likely due to the poor quality of the original recording which is difficult for the synthesis algorithm to accommodate.

With respect to the phonological evidence for the use of pharyngeal plosives in language, Rose (1976) describes a plosive in the Ahousaht dialect of Nuuchahnulth (Nootka), a Native North American language. The /ʕ/ appears to alternate with /q/, the uvular stop, providing evidence for /ʕ/ as a plosive. Also, Jacobsen (1969) argues proto-Nootkan uvular stops merged to /ʕ/. Massett Haida also contains a pharyngeal that seems to pattern similarly to Ahousaht and exhibit, acoustically, pharyngeal stop-like articulation, i.e. complete closure, or stoppage in the waveform (Bessel 1992).

The languages discussed above appear to make use of a stop that is more massive than a glottal stop but that can sometimes be confused auditorily with fricative-like behaviour. Since articulation in this area of the vocal tract is not as precise as in the front oral region it is likely there may be some confusion in production. Moreover, there are no visual cues to aid the listener as with more fronted articulations making perception and production difficult. It is important then, to consider how the language uses the segment in the phonology in order to determine the status of manner of articulation.

2. Pharyngeal trills [ɮ, ʕ]

Trilling in the pharynx has not been considered within the formal framework of the IPA. However, using the laryngoscope it is possible to view, in certain situations, the aryepiglottic folds approximating medially and anteriorly and trilling. Esling's Figures 6 and 7 (this issue) show this as well as any still photo can. The film speed (30 frames per second) is slower than the rate of trilling therefore, the pictures do not show all phases of movement. The arrow points to the aryepiglottic fold that is slackened and trilling due to the larynx raising toward the epiglottis.

These pharyngeal segments could be thought of as 'strong' fricatives since the trilling is often not as clearly audible as lingual trills. Visual evidence in the phonetician's production of the epiglottal fricative however, support trilling as a distinguishing factor rather than degree of friction.

Trills described in other places of the vocal tract, (i.e. the alveolar or uvular regions), are described acoustically by low amplitude segments in the waveform occurring about 25 times per second. The waveform in Figure 4 illustrates these quick stops. These low amplitude segments occur about 50 times a second which is faster than the lingual trills. It is plausible that the aryepiglottic folds would vibrate faster than the tongue since they are considerably less massive and dense. However, this vibration may not rely solely on the mass of the aryepiglottic folds. It may be more complex and involve activity of the vocal folds, at least in the voiced trill. This trilling is also visible in the phonetician's voiceless trill, except that trilling is about 40 Hz. While consideration of vocal fold involvement in aryepiglottic trilling is beyond the scope of this investigation, the fact remains that trilling activity is produced in the region of the pharynx by the aryepiglottic folds.

Trilling-like qualities in the pharynx have been described in Hydaburg Haida (Krauss 1979, in Bessell 1992), !Xóõ (Traill 1986) and in this investigation with respect to Agul². The Hydaburg Haida description is an auditory description and not supported by an acoustic description to date. Bessell (1992) has suggested that this segment behaves more like an affricate phonologically.

In !Xóõ, Traill (1986) provides a video and acoustic description similar to this investigation, however, the trilling Traill describes is a quality applied to vowels rather than the [ɮ] consonant referred to here and in Agul. He measured trilling like qualities that occur about 50 times per second, similar to the author's observation. Traill's account also describes the aperiodic, or irregular nature of

²Hydaburg Haida is a language isolate belonging to the Na-Dene phylum, !Xóõ is a Khoisan language of the San subgroup and Agul is a Nako-Dagestanian language of the north east Caucasus.

trilling that is observed here. The trill produced by the phonetician in Figure 4 does not show much irregularity, likely because the trill is produced in a controlled manner, and is produced in isolation. A speaker of !Xóõ may show more regular trilling if asked to produce the trilled vowel in isolation.

The use of trilling in !Xóõ is not as a consonant segment but more like a phonation type superimposed onto a vowel. This phonation type is used distinctively in the language. This poses a problem for phonological theory since the feature [voice] is no longer adequate with such phenomena. For this investigation, the evidence of trilling capabilities in the pharynx is pertinent, leaving the phonological problem open for discussion.

According to the SOWL database, Agul has a distinction between pharyngeal and epiglottal segments. This implies there are two regions in the pharynx that can act as places of articulation. The assumption here is that the pharynx acts as one place of articulation with varying manners. Auditorily, the Agul epiglottal fricative and the phonetician's example of a voiceless pharyngeal trill are very similar. The Agul language example from SOWL contains background noise in the recording which makes instrumental analysis difficult, nevertheless, the example could be argued to have trilling like qualities in the spectrogram as seen in Figure 5. The existence of broadly spaced striations is visible during the consonant production.

From this data, it appears at least two languages make use of trilling behaviour in the pharynx. One language uses the segment as a consonant the other uses the behaviour as a voice quality applied to a vowel. This is both interesting and problematic for theoretical linguistics, but phonetically, it provides evidence for the manner of trilling in the pharynx.

3. The Voiceless Pharyngeal Fricative [h]

The voiceless pharyngeal fricative is the least controversial of the pharyngeal articulations since it has been observed acoustically in Semitic languages by investigators such as in Butcher and Ahmad (1987).

Laryngoscopically, the pharyngeal fricative involves the epiglottis approximating the pharyngeal wall and the larynx raising as in Esling's Figure 5 (this issue). The spectrographic data illustrate the fricative well. Fricatives are characterized by noise or aperiodic behaviour in the spectrogram, as shown in Figure 7(a) for the pharyngeal fricative. The vowel portions of the spectrogram show clear vertical striations that are equally spaced and correlate with glottal pulse periods, but the consonant section shows irregular behaviour that is associated with frication. The formants in the spectrogram are significant and will be discussed along with the pharyngeal approximant in Section 4.

The pharyngeal fricative is common in Semitic languages. However, as mentioned earlier, Butcher and Ahmad (1987) and Laufer (1996) suggest that the voiced pharyngeal segment can also appear as an approximant and a stop, illustrating phonetically, the variable nature of these phonological units.

4. The Voiced Pharyngeal Fricative as an Approximant [ʕ]

As mentioned in Section 3, Laufer (1996) suggests that the voiced pharyngeal approximant is a segment in Arabic, and Bessell (1993) suggests that a pharyngeal approximant is a legitimate segment in Native North American languages. Laryngoscopically, the [ʕ] looks similar to the voiceless pharyngeal fricative but the acoustic data show that it is an approximant rather than a fricative. Figure 7(b), shows approximant characteristics in that, there is no stop portion between the vowels and no trilling or fricative qualities. In a sense, the approximant is unique because it looks almost vowel-like spectrographically. In fact, if only the bottom half of the spectrogram were visible, one would likely confuse the spectrogram with a very long vowel. However, auditorily there is a

definite change between the beginning and end of the utterance. This change is visible in the spectrogram above the third formant. The behaviour of the formants above the first three seem to distinguish the consonant from the vowel spectrographically.

This formant behaviour is also seen in the fricative in Figure 7(a). Though this consonant is voiceless, formants occur because the constriction that causes the noise for the pharyngeal fricative is near the vocal folds, which is near the 'normal' source of sound into the vocal tract. Since the noise produced for the fricative has the opportunity to resonate in the whole vocal tract, consequently formants appear in the spectrogram.

What is noteworthy with the formants in Figures 7(a) and (b) is that the fricative and the approximant formants appear to be identical. This suggests that the posture of the vocal tract for both the fricative and the approximant are the same. That is, the vocal tract is in the same position for both the fricative and the approximant, the only difference being the manner of production.

Considering the voiced pharyngeal fricative as an approximant is associated with Semitic languages, as suggested by Laufer (1996), but is argued for acoustically and phonologically by Bessell (1993) in Interior Salish. Bessell promotes ʕ , ħ as fricatives in Arabic since a voiced/voiceless distinction is preserved in nearly all languages that contain pharyngeal fricatives. Phonologically, in Interior Salish, the ʕ is a voiced segment, and the process of glottalization applies to this pharyngeal in a way that is noted for the rest of the resonant series. These two phonological facts from Interior Salish provide the most compelling evidence for this segment as a pharyngeal approximant according to at least one language. The pharyngeal approximant appears phonetically in Arabic but phonologically there is a need for a voiced pharyngeal fricative. Interior Salish provides both phonetic and phonological evidence for the pharyngeal approximant as a segment.

5. Agul

From the acoustic analysis and phonological evidence presented in the previous sections, it can be argued that the pharynx can produce varying manners of articulation. However, one language seems to provide evidence against this. Agul has a range of pharyngeal articulations that, as described in Ladefoged and Maddieson (1996), have both voiced and voiceless pharyngeal fricatives ʕ and ħ respectively, a voiceless epiglottal fricative ħ and an epiglottal plosive ʔ . The fact that there are two fricatives produced past the velum seems to indicate that there is a need for more than one place of articulation past the velum. Although the ʕ is classed as a fricative here, it may be an approximant acoustically, similar to the Arabic ʕ , or it may be a voiced fricative phonologically, if the language requires the segment. However, if the ʕ behaves as an approximant the full range of manners, according to the model proposed here, would be represented. That is, there would be a pharyngeal plosive ʔ , a pharyngeal trill ʕ , a pharyngeal fricative ħ and a pharyngeal approximant ʕ .

It is not possible to compare the formants spectrographically with the pharyngeal fricative and the epiglottal fricative from the Agul examples in SOWL since the pharyngeal fricative in the ʕ example, is produced after the vowel /u/ that causes the formants to start low for the /u/ vowel, and then change during the course of the consonant to the target position of the following /a/ vowel. This problem refers to an assumption of the IPA, that says "it is possible to describe speech in terms of a sequence of segments, and . . . that each segment can be characterized by an articulatory target" (JIPA 1995, p.5). In the case of the pharyngeal fricative in the Agul ʕ example, the articulatory target of the pharyngeal consonant is much farther from /u/ than /a/ , therefore, the actual consonant timing slot can be described as the transition between /u/ and /a/ , however, phonologically the position is used as a pharyngeal consonant. The fact that the acoustic output does not resemble 'ideal' acoustic description of the articulation, illustrates the importance of phonology in classifying acoustic phonetic segments.

Upon investigation of the Agul epiglottal fricative as mentioned in Section 2, it may be more accurate to consider this consonant a pharyngeal trill rather than a fricative. Based on X-ray data, Ladefoged and Maddieson (1996 p.169) suggest that the distinction between epiglottal and pharyngeal may involve constriction at different heights in the pharynx. However, X-ray data rarely show the larynx. It may be that larynx raising, rather than constriction in more than one region in the pharynx, contributes to the trilling and stop qualities described here.

While the X-ray data provide a good illustration of behaviour of the epiglottis itself, the laryngoscope shows how the larynx and aryepiglottic folds can articulate with the epiglottis. Trilling qualities of the aryepiglottic folds would be impossible to see in X-ray examinations but the laryngoscope clearly shows the ability of these folds to trill. However, Traill (1986) notes vibration of the epiglottis in the X-ray data since the epiglottis is blurred during the production of trilled vowels. Although Agul appears to provide evidence for two places of articulation in the pharynx, reconsidering these consonants as varying manners appears more consistent with capabilities of other areas of the vocal tract. More support for this claim may be found by examining the phonological use of these segments in Agul, similar to how Bessell (1992) uses phonological evidence for manners in Native North American languages. In other languages that use pharyngeal consonants, such as Salish and Arabic, it appears that varying manners are adequate.

Conclusion

If the hypothesis of this investigation is accurate, then the epiglottal consonants found under the 'other symbols' on the IPA chart would find a new home under the pharyngeal column of the chart. The epiglottal plosive is really a pharyngeal plosive, the epiglottal fricatives would fit in the 'trill' row and the approximant would require a new symbol to be added to the chart.

From the visual and acoustical facts presented, structures within the pharynx can produce varying manners of articulation and Semitic, Native North American and Caucasian languages, make use of these manners. Bessell (1993) notes the discrepancy in the classification of Arabic pharyngeals that are described acoustically as stops, fricatives and approximants. In this case it is necessary to rely on the phonology to determine the segment's status in the language. This variation in production is reasonable since it is likely that agile and articulate production of speech segments in the pharynx would be difficult and also, there are no visual cues for the listener. This implies that these segments are acquired auditorily and thus subject to more variation. Whether the language uses these pharyngeal segments as a stop, fricative or approximant phonologically may be the best way to determine the status of the segment in the language.

Bessell suggests the need for epiglottals to be "pressed into service" for Native North American languages. However, the phonologies do not seem to suggest the need for an epiglottal region as well as a pharyngeal region. The phonological evidence in Bessell (1992, 1993) suggests a pharyngeal region with varying manners would be adequate and phonetic evidence corroborates this hypothesis.

Moreover, there does not appear to be much evidence to suggest the need for more than one place of articulation in the pharynx. Most phonetic descriptions of the vocal tract do not include epiglottal as a distinct region. Two important points follow from this investigation: First, it is humanly possible to produce varying manners of articulation in the pharynx and second, it is necessary to consider phonological evidence in order to clarify further the use of the pharyngeal segments in the language.

Questions that remain are largely phonological: How does a phonological theory treat the !Xóõ) use of pharyngeal trilling on vowels? How does Agul phonology treat the pharyngeal and epiglottal segments; are they treated as fricatives by the language, or does the epiglottal segment pattern like a trill? Phonetic questions include, what is the active articulator in the pharyngeal region of the vocal tract? How much do the vocal folds affect the aryepiglottic trilling, or vice versa? Also,

of importance is the extent to which pharyngeal articulations contribute to the lenis/fortis type of distinction in other languages.

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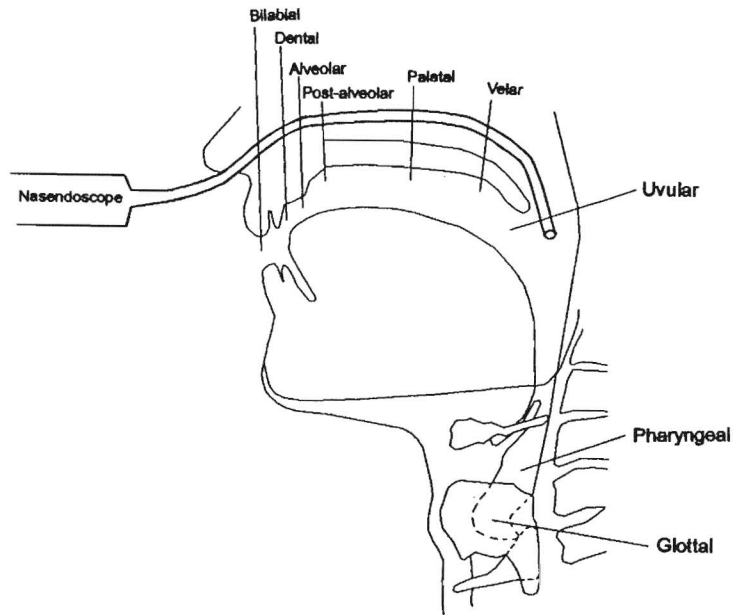


Figure 1. Places of articulation in the vocal tract and the route the nasendoscope takes in order to view the larynx is also shown.

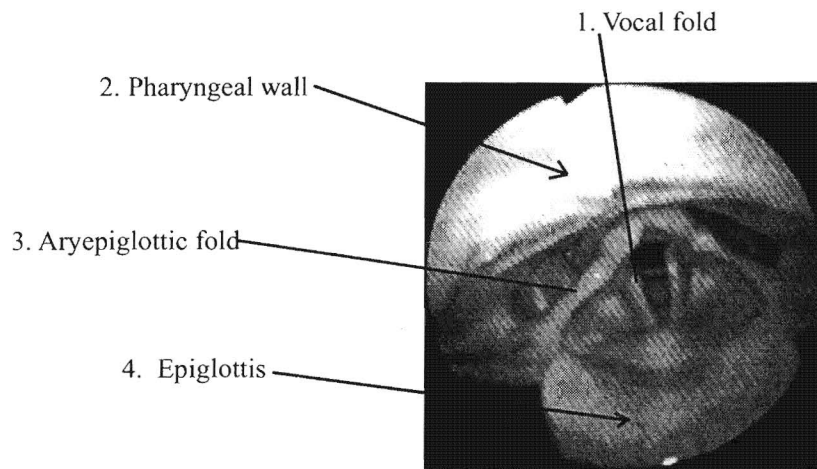


Figure 2. View from the nasendoscope positioned behind the velum shown in Figure 1.

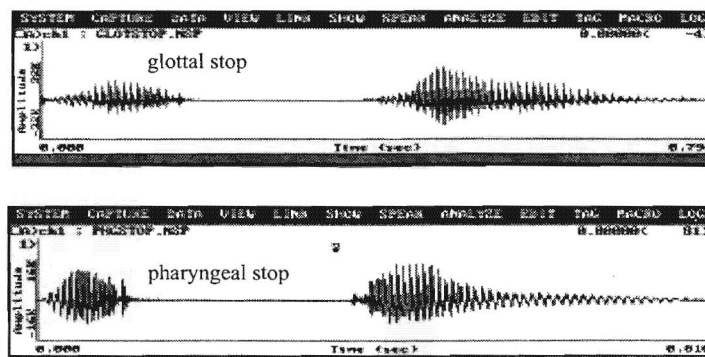


Figure 3. The vowel preceding the stop in the waveform is shorter in the pharyngeal stop and the stop portion is longer.

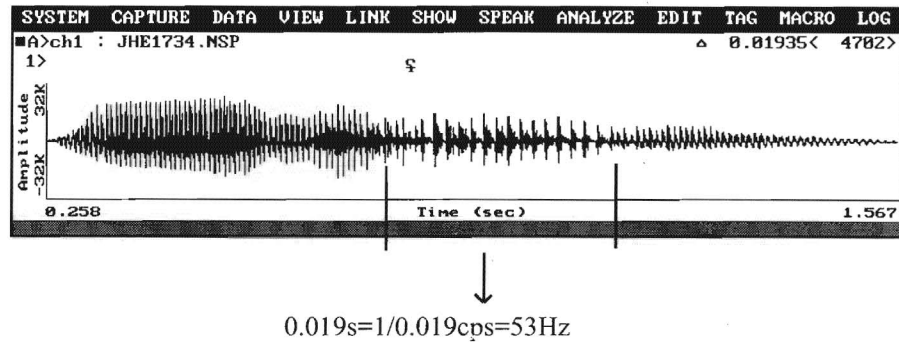


Figure 4. Low amplitude segments of the waveform between the marks are measured to show the speed of trilling.

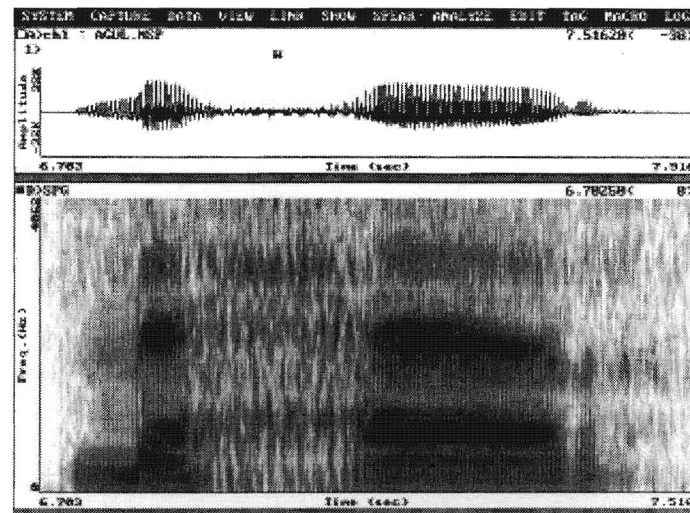


Figure 5. Agul waveform and spectrogram of /mäHär/ that contains a pharyngeal trill. Trilling qualities are seen by the more broad vertical spacing of striations in the spectrogram.

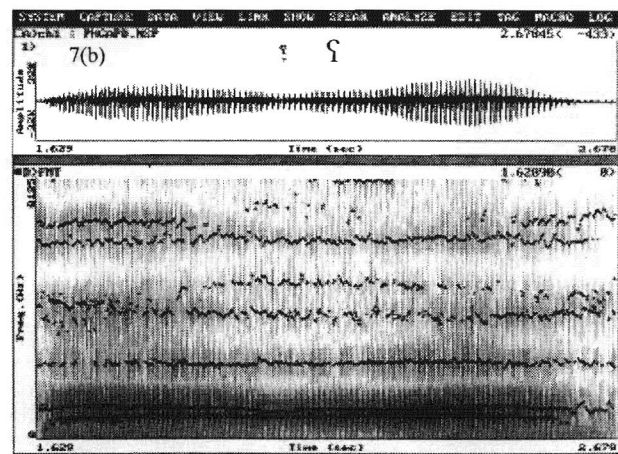
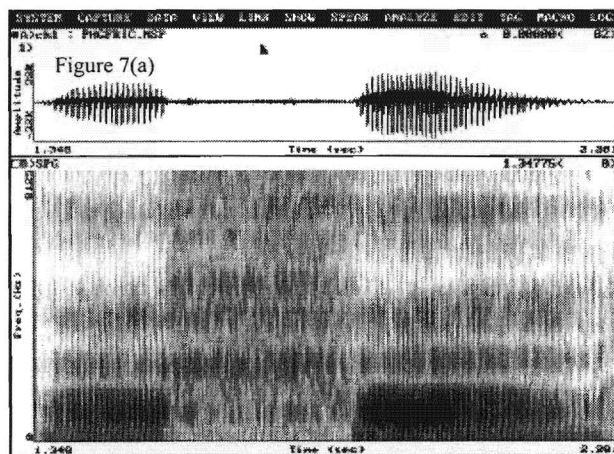


Figure 7(a). The lack of vertical striations in the spectrogram under the consonant symbol, illustrate fricative behaviour. (b) The pharyngeal approximant lacks friction or stop-like behaviour in the spectrogram and waveform.

DEPICTIONS OF THE GENDER ROLES IN ELEMENTARY LANGUAGE ARTS AND MATHEMATICS TEXTBOOKS IN 1940'S ~ 1950'S AND THE PRESENT.

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Introduction

For children, school textbooks are among their first cultural encounters. Since textbooks present an occupational and social picture of the outside world to children, representation of gender roles in elementary textbooks plays an important role to establish children's gender awareness and self-esteem.

In this paper, depictions of the gender roles in elementary textbooks were examined and discussed. Two academic subjects, language arts and mathematics were chosen. In each subject, the textbooks, used in around 1940's to 1950's were contrasted with the textbook used in the present. In order to demonstrate depictions of the gender roles in elementary textbooks, the following procedures were taken: (1) summary of three contemporary education texts on the subject of gender roles in the elementary textbooks; (2) description of my own research project; (3) presentation and analysis of research findings from elementary language arts textbooks; (4) presentation and analysis of research findings from elementary math textbooks; and (5) discussion of depictions of gender roles in textbooks. Throughout this paper, the following questions are discussed: (1) Are any distorted or stereotyped gender roles presented in the textbooks? (2) If so, are there any improvement in stereotyped depiction of gender roles through time? (3) How do stereotyped depictions of gender roles in the textbooks affect elementary school children? (4) How can textbooks be improved?

Summary Of Research Findings From Contemporary Education Texts On The Subject Of Gender Roles In The Elementary Textbook

Pottker's (1977) research on elementary language arts textbook analyzed 20 third-grade readers (1969-70 school year), which contained approximately 2000 stories, for personality and occupational stereotypes of females (111). Pottker found that the female characters in the textbooks reflect the characteristics of the most feminine woman imagined by being appreciative, affectionate, charming, attractive, understanding and considerate. As Pottker calls "Little sister syndrome" (113), females were helped out of tough situations and many problems by "big brothers" in the stories, since males were portrayed as smarter and with greater achievement. In family context, the mother was shown to be weak and passive, who was dependent upon her husband's aid, whereas the father was portrayed as a firm figure and a master of his house.

In 20 textbooks, only sixteen different jobs for women existed, and not one married women worked, while men were portrayed in over 90 different jobs (118). Pottker compared occupations of women in the textbooks with the occupations of American women in the labour force. The comparison clearly reveals sex stereotyped job descriptions of women in the textbooks. About 57% of the women in the textbooks were homemakers, which is about 20% more than there were in the real US labour force in the 1970 (116). Among working women in the textbooks, 42% of them were elementary school teachers, while only 6.1% of working women in the US were elementary school teachers (116). Pottker claims that the occupational status of women in elementary school reading textbooks does not accurately reflect the real occupational status of women in the United States.

Winifred's (1977) research on elementary math textbook analyzed sex stereotyped descriptions from 12 elementary math textbooks for Grades 2, 4, and 6, and obtained similar findings to Pottker's research. Winifred found stereotypical activities among boys, girls, men, and women. For example, boys play with cars, boats, and

rockets, and they also take part in baseball and football games. Fathers earn money and enjoy outdoor activities, such as fishing and camping. In contrast, girls play with dolls, jump rope, practice piano, and help their mothers with the grocery shopping, cooking, baking, and sewing (145). Girls and their mothers serve meals for their father/husband and brothers/sons.

As for occupation status in the textbooks, 86 occupations for males and only 18 for females were found in the textbooks. For men, the jobs "literally ranged from A to Z, from acrobat to zoo keeper" (144). In between, there were "the astronaut, doctor, inventor, lawyer, mathematician, president, scientist, weatherman, and men who perform services in the community" (144). In contrast, none of above male occupations appeared on the list of occupations for females, which includes "a buyer, cafeteria manager, cook, dressmaker, doughnut maker, journalist, librarian, nurse, queen, and ticket seller" (144). Therefore, Winifred concludes that even in math textbooks, sex bias and sex stereotypes are presented through pictures and story questions.

Willis' (1995) research on elementary math textbook was done much more recently than Winifred's, however, boys, girls, men, and women were still portrayed with stereotypical distortions. Willis examined how males and females were presented in Grade 3 math textbooks in Australia. She found that roughly equal numbers of boys and girls appeared as main characters in the stories and activities; however, there were 49 male characters as presenters, but only 25 female presenters (270).

As for occupational status, men in the textbooks were "computer operator, postman, mountaineer, greengrocer, farmer, news agent, teacher, grocer, gardener, fruitier, bank teller, ports store proprietor, wood cutter, car salesperson, service station proprietor, and father" (270). Although men were occasionally called 'Dad,' they were mostly named and described in terms of their jobs. On the other hand, women in the textbooks were "shop assistant, cook, confectioner's shop worker, greengrocer, farmer, news agent, teacher, florist, mother, grandmother" (270). Unlike men, women were referred to as, 'Mom,' 'Grandma' or someone's wife, and they were rarely named. Thus, Willis claims that even very contemporary math textbooks provide distorted images of men and women.

Description of my research project

Two Grade 4 academic subjects of textbooks, language arts and mathematics were examined. In each subject, the textbooks used around 1940's to 1950's were contrasted with the textbook used in the present. In order to demonstrate the gender roles in these textbooks, the following four factors were looked at in both texts and illustrations: (1) number of boys, girls, men, and women in the textbooks; (2) number of occupations for men and women that appeared in the textbooks; (3) types of occupations for men and women; and (4) activities that boys and girls were engaged in the textbooks.

Language Arts

With regard to the number of boys, girls, men and women portrayed in both old and current language arts textbooks, Table 1 shows no significant difference.

	1940's ~ 1950's		Present	
Title of the textbooks (year)	<i>Friends and Neighbours</i> (1946)	<i>Language Journeys</i> (1952)	<i>A Lizard to Start with</i> (1979)	<i>Tickle the Sun</i> (1988)
Boys	8	36	13	22
Girls	11	33	8	17
Men	9	14	16	17
Women	4	16	13	17 25

Table 1. Number of boys, girls, men and women in the textbooks

There is, however, a remarkable difference in the number of occupations for men and women in the old textbooks. Although there is some improvement in the present textbooks, where the number of occupations for women has increased, men's occupations appeared far more than women's.

	1940 ~ 1950's		Present	
Title of the textbooks (year)	<i>Friends and Neighbours</i> (1946)	<i>Language Journeys</i> (1952)	<i>A Lizard to Start with</i> (1979)	<i>Tickle the Sun</i> (1988)
Men	6	6	8	9
Women	3	2	4	4

Table 2. Number of occupations for men and women that appeared in the textbooks

Also striking were the types of occupations for men and women found in the old textbooks. The majority of women were either stay-at-home housewives or unmarried elementary school teachers. These findings imply that girls have only two choices: motherhood or a career woman who remains single.

In the current textbooks, some improvement is shown in terms of women's occupations. Women in the textbooks were engaged in various professional jobs, such as a scientist and a veterinarian. The textbook, *Tickle the Sun* (1988), contains a chapter that deals with an interview with a female veterinarian. As well, *A Lizard to Start with* (1979) contains an illustration of a female engineer with the sentence, "Engineers work with numbers when they build a bridge or design a jet . . ." (164). On the other hand, in the same textbook, the sentence "Mother tried

to cheer Benjy with an apple pie" (54) shows that the role of mother as a server still persists. Furthermore, no working mothers were found in any textbooks.

Title of the textbooks (year)	<u>1940 ~ 1950's</u> <i>Friends and Neighbours</i> (1946) & <i>Language Journeys</i> (1952)		<u>Present</u> <i>A Lizard to Start with</i> (1979) & <i>Tickle the Sun</i> (1988)	
	Occupation	Number	Occupation	Number
Men	farmer	3	mayor	3
	principal	2	farmer	2
	fireman	1	fortune teller	1
	postman	1	shop owner	2
	secretary of PTA	1	Judo instructor	1
	clown	1	TV commercial maker	1
	street car driver	1	artist	1
	elephant trainer	1	police man	1
	potato seller	1	scientist	1
	construction worker	1	professor	1
			sea captain	1
			crossing guard	1
Women	teacher "Miss"	4	teacher "Miss"	1
	housewife	many	principal	1
	candy shop owner	1	artist	1
			engineer	1
			housing inspector	1
			scientist	1
			vet	1

Table 3. Types of occupations for men and women

With regard to the type of activities that boys and girls are engaged in, stereotypical activities were found in the old textbooks; boys were engaged in sports and active games, whereas girls were engaged in quiet activities. Furthermore, most of the time boys and girls did their activities separately from each other. In the current textbooks, however, girls were engaged in more active activities with boys.

Title of the textbooks (year)	1940's ~ 1950's <i>Friends and Neighbours</i> (1946) & <i>Language Journeys</i> (1952)	Present <i>A Lizard to Start with</i> (1979) & <i>Tickle the Sun</i> (1988)
Boys	sports: softball, hockey, baseball, skating, watching a hockey game outdoor: fishing, <i>making snowman</i> playing with a model airplane building a sail boat playing with fire	sports: Judo, fishing with his dad, <i>basketball</i> outdoor: camping, <i>playing on the beach</i> playing as a detective indoor: <i>making pancakes</i>
Girls	outdoor: picnic, <i>making snowman</i> playing with a doll	sports: <i>playing basketball</i> outdoor: playing as a detective <i>playing on the beach</i> indoor: <i>making pancakes</i>

Table 4. Activities that boys and girls were engaged in (activities that are written in italics indicate that boys and girls play together)

Mathematics

Results that were obtained from the old and the present math textbooks were significantly similar to the ones from the language arts textbooks, discussed above, in terms of the number of boys, girls, men and women in the textbooks (Table 5) and the number of occupations for men and women that appeared in the textbooks (Table 6).

	1940 ~ 1950's		Present	
Title of the textbooks (year)	<i>Study Arithmetics 4</i> (1940~1950's)	<i>Study Arithmetics 6</i> (1940~1950's)	<i>Math Quest 4</i> (1986)	<i>Journey in Math 4</i> (1987)
Boys	38	30	79	149
Girls	29	26	66	152
Men	43	46	28	19
Women	37	19	12	13

Table 5.

	1940 ~ 1950's		Present	
Title of the textbooks (year)	<i>Study Arithmetics 4</i> (1940~1950's)	<i>Study Arithmetics 6</i> (1940~1950's)	<i>Math Quest 4</i> (1986)	<i>Journey in Math 4</i> (1987)
Men	8	11	26	12
Women	2	2	8	6

Table 6.

In *Study Arithmetics Book 6* (1940's ~ 1950's), men's and women's roles were clearly contrasted by displaying a man's picture and a woman's close to each other. For example, a picture of a boy and his father in the textbook was described as "During the winter Ray helped his father make plans for spring on their farm . . ." (145). In contrast, a picture of a girl and her mother was described as "Mrs. Wilson saved the fat from meat she cooked . . ." (147).

In the current textbooks, two types of strategies are found. First, the various types of women's jobs were introduced in the textbooks. For example, in *Journeys in Math 4* (1987), the illustration of a female carpenter was provided for the following math question: "A carpenter is making benches and 3-legged stools. *She* has 31 legs that can be screwed into seats. How many stools and benches can she make?" (317). The other strategy is to avoid using human characters. In *Math Quest 4* (1986), various kinds of animals, from Garfield to dinosaurs, were illustrated.

Title of the textbooks (year)	1940 ~ 1950's <i>Study Arithmetics 4 & 6</i> (1940~1950's)		Present <i>Math Quest 4</i> (1986) & <i>Journey in Math 4</i> (1987)	
	Occupation	Number	Occupation	Number
Men	farmer	8	teacher	3
	store owner	6	sports player	3
	sales clerk	4	astronaut	2
	engineer	2	shop owner	2
	driver	1	photographer	2
	surveyor	1	farmer	2
	meteorologist	1	cook	2
	apartment manager	1	baker	2
	forester	1	painter	2
	company owner	1	detective	2
	freight agent	1	magician	2
	bank teller	1	forester	2
	bus driver	1	driver	1
	milk seller	1	librarian	1
	baker	1	fireman	1
Women	teacher "Miss"	7	teacher "Ms/Mrs."	3
	housewife	many	carpenter	2
			professor	1
			cashier	1
			ticket seller	1
			office worker	1
			pharmacist	1
			guitarist	1

Table 7. Types of occupations for men and women

In *Study Arithmetics Book 6* (1940's ~ 1950's), boy's and girl's activities were clearly contrasted again, by displaying a boys' picture and a girls' picture close to each other. For example, a picture of boys in the textbook was described as "The boys who were making boats in the school shop had to be careful not to waste any nails . . ." (125). In contrast, a picture of girls was described as "While the boys worked in the school shop, the girls learned how to sew . . ." (131).

In the present textbooks, boy's and girl's activities are more mixed. Boys were sometimes involved in baking and helping mother, while girls were sometimes actively involved in sports.

	1940's ~ 1950's <i>Study Arithmetics 4 & 6 (1940~1950's)</i>	Present <i>Math Quest 4 (1986) & Journey in Math 4 (1987)</i>
Boys	sports: softball, hockey, baseball, roller skating, swimming, soccer outdoor: horseback riding, cycling, fishing playing with a model airplane wood work: making a boat, building a house painting, farming: tree planting	sports: baseball, hockey, <i>cycling, table tennis, swimming</i> outdoor: camping, <i>playing marble, making a sand castle</i> , playing with a model car fishing, <i>snow sleigh</i> indoor: <i>baking</i> house chore: washing dishes, grocery shopping indoor: computer
Girls	outdoor: picnic, <i>making snowman</i> playing with a doll house chore: baking, grocery shopping, sewing, making candy, knitting, preparing dinner, baby-sitting practicing the piano	sports: baseball, <i>table tennis, swimming, gymnastics, cycling, snow sleigh</i> outdoor: water sliding playing as a detective <i>playing marble, making a sand castle</i> , horseback riding house chore: baking indoor: playing with a doll. <i>making pancakes</i>

Table 8. Activities that boys and girls were engaged in (activities that are written in *Italic* mean boys and girls play together)

Discussion and Conclusion

The findings from this project are not significantly different from those of Pottker, Winifred, and Willis. In both language arts and math textbooks used around the 1940 to the 1950, the depictions of gender roles were distorted and stereotyped. Men were portrayed as breadwinners engaged in limitless kinds of jobs. On the other hand, the majority of women were described solely in terms of their roles as housewives in a family context. The only occupations that they held were typically 'female,' such as elementary school teachers.

In the current textbooks, there has been a great improvement in terms of girls' activities and women's occupations. Girls are more involved in sports, and women are more engaged in a variety of jobs. However, stereotyped images of males and females still persist in virtually all of the current textbooks. For example, most of the professional jobs are still undertaken by men and women's occupations are still quite limited. None of the working mothers is presented in any textbooks.

How do these distorted images of males and females in the textbooks affect elementary school children? According to Serbin (1983), children prefer to read about characters of their own sex and are more likely to want to try out activities modeled by characters of their own sex. Her findings indicate that children are aware of, and sensitive to, gender roles in the textbooks. Similarly, Stockard (1980) finds that children tend to copy the attitudes of characters in textbooks. Therefore, if the textbooks provide symbolic stereotyped representations of males and females, they help children define what is expected of them to do. For example, if women are only depicted in a few occupations and men are shown in many more, this suggests sex segregation in occupation. Stockard presents the following anecdote to show how negatively textbooks affect children's self-esteem:

A sixth-grade girl once was doing her math homework which consisted of ten story problems. Suddenly, she threw her book down in disgust. When asked what was wrong, she reported, "I'm not supposed to be able to do these problems. Of ten problems, eight of them are about boys and the two girls are stupid!" None of the characters in her math text were people with whom she wanted to identify. (70)

Furthermore, textbooks are the major source of instruction in schools (Pottker 1977); approximately 75% of classroom time and 95% of homework time are spent with textbooks (118). Thus, it is extremely important to consider the impact of biased and inaccurate portrayals of males and females on children as a serious problem.

Finally, the question of how to eliminate stereotyped gender roles is not easily solved. However, a concerted effort should be made to create textbooks that will enable children of both sexes to develop their full potential and self-esteem. There are two ways in which this could be accomplished. First, textbooks could equally distribute roles between males and females. For example, Michel (1986) suggests that "the mother and father should be portrayed as parents on equal footing, with the same responsibilities and household chores should be done by anyone in the family" (59). Second, textbooks could introduce more possible and enhancing images of girls and women who exist in the real society. For example, textbooks should present those women who raise their children and also go out to work and those who have professional responsibilities.

In conclusion, elementary school textbooks have greatly improved in terms of stereotyped depictions of gender roles for the past 45 years. These sex stereotype, however, have not completely been eliminated. Since textbooks have a great influence on children's development of self-esteem, it is extremely important to make textbooks free from stereotypical and inaccurate images of males and females. Sex-bias free textbooks can be effective in helping to develop attitudes in children that will contribute to equality and mutual respect between boys and girls, and men and women.

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THREE PERSPECTIVES OF DETERMINER AGREEMENT IN GERMAN

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1. Introduction

In German, the constituents of a simple noun phrase are articles, possessive pronouns, adjectives and nouns. The noun phrase must be comprised of at least one of these elements and most combinations of them are possible. Most constituents of noun phrases are inflected for the features case, number, gender and declension. Case, number and gender features are common to all constituents (although gender is, in most cases, inherent in nouns) while it is only adjectives and nouns that inflect for declension. However, when an adjective follows a noun the adjective occurs in an uninflected or stem form.

Agreement between the noun phrase's constituents can be quite complex. Gender¹ and number are characteristics of the noun and any constituents, which attach to it, must agree with the noun's gender and number features. In the case of possessive pronouns the inherent feature values are suppressed in favour of the noun's feature values. Case features are the characteristic of the noun phrase as case in German accounts for grammatical functions and are, therefore, integral to syntactic agreement. The noun phrase is feature marked for case by its role within the phrase and this feature must be shared between all the noun phrase's elements (although only a few nouns actually inflect for this feature). The complexity of agreement lies in the distribution of the declension feature.

The values of the declension features are weak, strong and mixed. The strong value occurs in cases where a noun phrase consists of only an inflected noun or substantival adjective, an articleless or uninflected indefinite article² noun phrase in which all constituents must share this feature or in the case of post-demonstrative possessives, which can be marked both strong and weak. The weak declension value is evident in all constituents following an inflected definite article.

This distribution of features creates quite a challenge for theories attempting to provide a generalisation of German noun phrase internal agreement. In this paper I examine three variations of the theory Head-Driven Phrase Structure Grammar which attempt to account for the distribution of agreement features in German. Klaus Netter (1994) discusses noun phrase internal agreement under the assumption of a functional head in his paper 'Towards a Theory of Functional Heads in German Nominal Phrases'. In contrast to this assumption, Carl Pollard and Ivan Sag (1994) and Andreas Kathol (1994) attempt to generalise these phenomena in terms of a noun as the head of a nominal phrase in *Head-Driven Phrase Structure Grammar* and 'On Agreement in HPSG' respectively.

The organisation of the paper will be as follows: I will first present a sample of the data discussed followed by a brief discussion of the three author's interpretations of such. Considering how their analyses account for simple determiner phrases I will attempt to provide as much of a comparison as possible between their respective approaches. The conclusion will comprise of a critique of how well these data are accounted for and a brief discussion of areas of further research.

2. German Noun Phrases

Although adjectives, pronouns, possessive pronouns and possessives can be elements of a noun phrase, in this paper I will be primarily concerned with the simple German noun phrase consisting of a determiner (including

¹ German is a grammatical gender language.

² This includes numerals such as *zwei* 'two'.

numerals), and noun. As I have mentioned previously these elements are optional with the restriction of at least one must be present to comprise a noun phrase.

The article, which precedes the noun in these constructions, can be either a definite article or an indefinite or numeral type article. Both articles exhibit morphological inflection for case, gender, and number, see Appendix A. Specific numerals such as *zwei* 'two' do not inflect. The noun with which the article combines has inherent gender and can inflect for number and case, see Appendix B. It has been noted by Pollard and Sag (1994:372 ref.: Kathol-personal communication 1991) and Netter (1994:325) however, that there are a handful of nouns that also inflect for declension. They suggest that these nouns inflect similarly to adjectives. However, in most dictionaries these nouns³ such as *Verwandte* have a double lexical entry: one, which is a standard noun, showing inflection for the case and plurality (Messinger 1973:585):

<i>Verwandte</i> (+n genitive), (+en plural)	'(fem.) relative'
<i>Verwander</i> (+n genitive), (+en plural)	'(masc.) relative'

and another which is an adjective: *verwandt* 'related to'.

I propose that these few nouns are actually members of a large class of nominals called substantival adjectives. According to Hammer (1983:54) "all adjectives ... can be used as nouns". In addition, it is noted that for the most part substantival adjectives are capitalised indicating a noun in German orthography and are inflected as if they were followed by *Mann* 'man', *Frau* 'woman' or *Element* 'element' (neuter) depending on their respective referent. A feature that sets the substantival adjective apart from a standard noun is the fact that it shows inflection for declension (see Appendix C). Given this fact, the inventory of these select few nouns that inflect for declension has increased by the total adjective inventory in the lexicon.

When combining an article with a noun the three features, case, gender and number must agree between the two constituents, see for example the following:

1	<i>des</i> (gen) <i>Buches</i> (gen)	'of the book'	* <i>des</i> (gen) <i>Buch</i> (nom/acc/dat)
2	<i>die</i> (fem) <i>Frau</i> (fem)	'the woman'	* <i>der</i> (masc) <i>Frau</i> (fem)
3	<i>die</i> (plur) <i>Bäume</i> (plur)	'the trees'	* <i>der</i> (sing) <i>Bäume</i> (plur)

However, declension being either weak, strong or mixed is not considered an agreement feature of an article. Instead, the form of declension of a following constituent is determined by the article preceding it, therefore a governing relation exists. Indefinite articles govern the mixed declension class. This class assumes a strong declension value for all nominative and feminine and neuter accusative forms; all other forms show a weak declension value. In efforts of simplification, all three authors dispense with this third declension feature opting instead for a binary approach of either weak or strong declension values (Pollard & Sag 1994:66, Netter 1994:324 and Kathol 1994:24,25). I will then present the data in this binary manner. Note that standard nouns (*Buch*) fail to show the inflection for declension:

1	<i>ein Buch</i> (strong,nom)	'a book'	* <i>ein Buch</i> (weak,nom)
2	<i>ein Kluges</i> (strong,nom)	'a clever (one)'	* <i>ein Kluge</i> (weak,nom)
3	<i>eine Kluge</i> (strong,nom)	'a clever (woman)'	* <i>eine Kluge</i> (weak,nom)
4	<i>ein Kluger</i> (strong,nom)	'a clever (man)'	* <i>ein Kluge</i> (weak,nom)
5	<i>einem Buch</i> (weak,dat)	'to a book'	* <i>einem Buch</i> (strong,dat)
6	<i>einem Klugen</i> (weak,dat)	'to a clever (one)'	* <i>einem Klugen</i> (strong,dat)
7	<i>einer Klugen</i> (weak,dat)	'to a clever (woman)'	* <i>einer Kluger</i> (strong,dat)
8	<i>einem Klugen</i> (weak,dat)	'to a clever (man)'	* <i>einem Klugen</i> (strong,dat)

³ This is with the exception of the noun *Beamter*_{masc} (*Beamtin*_{fem}) 'official' which has only a standard noun listing. However, as a standard noun it exhibits only a genitive and plural inflection according to Messinger (1973:85).

Cardinal numbers (with the exception of *ein* 'one'), such as *zwei* 'two' can also act as an article⁴ which governs for a strong constituent, for example: *zwei Kluge*(strong) 'two clever (women)'. Definite articles govern the weak declension class:

1	<i>das Buch</i> (weak)	'the book'	* <i>das Buch</i> (strong)
2	<i>das Kluge</i> (weak)	'the clever (one)'	* <i>das Kluges</i> (strong)
3	<i>die Kluge</i> (weak)	'the clever (woman)'	* <i>die Kluge</i> (strong)
4	<i>der Kluge</i> (weak)	'the clever (man)'	* <i>der Kluger</i> (strong)

As we have seen in the examples, the constituents that can follow a determiner in a simple determiner construction can either be a standard noun, such as *Buch* or a substantive adjective, such as *Kluger*. These nouns will be marked for either strong or weak declension dependent on the article preceding.

These data bring forward some key agreement issues in German: the features, case, gender and number must agree between all constituents of the noun phrase which bear inflectional morphology. The agreement features of the adjective and the noun must be identical including the declension value. Perhaps, the most challenging aspect brought to light is accounting for the distribution of the declension feature, particularly in the absence of a governing article.

3. Three Perspectives

In this section we will consider the three approaches to the previously discussed agreement issues within the German noun phrase. While the basic agreement tools of HPSG, such as structure sharing are employed in each account, they differ in the basic assumptions of what constituent is the head of the noun phrase and also, in the principles and constraints they employ. These distinctions have interesting effects on their ability to account for the data.

The two key issues in accounting for agreement in a determiner phrase are first, that the agreement features case, gender and number agree between the determiner and the noun and second, that articles showing strong inflection (definite articles and non-nominative, and non-feminine/neuter accusative indefinite articles) choose a weakly declined noun and the remainder of indefinite articles and cardinals (with the exception of *ein*) which are weakly inflected choose a noun with strong declension.

3.1 The Noun as Head

Pollard and Sag and Kathol both assume that the head of the noun phrase in German is the noun and the noun in this role selects the appropriate article for itself. However, both approaches rely on a reciprocal selection of the noun by the article to ensure agreement

3.1.1 Pollard & Sag's Account

On Pollard and Sag's account articles do not bear a value for declension, rather they exhibit a head feature called DTYPE which describes either a strongly or weakly inflected article (1994:66). The strongly inflected article, such as *das* specifies for the weak declension value in constituents to follow and the weakly inflected one, such as

⁴ One could suggest that the cardinal number, *zwei* is acting like an article. However, if this were the case it would govern for the strong declension class in the constituents following which generates an ungrammatical phrase as we have seen previously: **die zwei letzte*(strong) *Kluge*(strong). Therefore, it seems reasonable to assume that cardinals modifying nouns act like uninflected adjectives which may either bear agreement features or transfer the declension feature to the constituents which follow.

ein selects the strong declension value. The lexical entry of the noun identifies the article with which it can adjoin by means of this DTYPE feature, as for example in the truncated lexical entry for *Kluge* which governs a strongly inflected determiner.

Figure 1

$$[\text{SYNSEM}_{\text{Kluge}} [\text{LOC} | \text{CAT} [\text{SPR} \langle \text{DETP}_{\text{strong}} \rangle]]]$$

The identification of the strong article occurs *viz.* specification of a valence feature SPR, the value of which stipulates what other signs this noun's lexical entry must combine with in order to be considered saturated, ensured by the Valence Principle (1994:348). The actual selection of the determiner by the noun is guaranteed by the Head Specifier Schema which accounts for the local selection of a non-head specifier phrase by the noun head (1994:362). In addition, this selection is considered obligatory in the case of weakly inflected attributive adjectives to prevent them from forming an ungrammatical noun phrase (1994:373), i.e. **Kluge* (weak).

Resembling a head of the phrase, the article, like a marker, selects the type of noun that it marks by means of the head feature SPEC. This identifies the correct form of the noun required through SPEC's value. The SPEC Principle maintains that this specified value is token-identical to the SYNSEM value of the noun (1994:51). The obvious value for SPEC to ensure the appropriate declension distribution for the noun *Kluge* would be a strong declension value. However, the feature DECL [ension] was not available in Pollard and Sag's earlier account of German internal noun phrase agreement. It arose from the realisation that declension is a property of the noun and consequently, the article governs this value (1994:373). Therefore, the SPEC feature of articles is marked for the appropriately governed declension value either weak or strong (1994:372). Therefore, the correct article for the noun *Kluge* would need to bear the feature DECL strong as in the following truncated lexical entry of the article *das*.

Figure 2

$$[\text{SYNSEM}_{\text{das}} [\text{LOC} | \text{CAT} [\text{HEAD} [\text{SPEC} : \text{N}' [\text{DECL}_{\text{strong}}]]]]]$$

The result of this reciprocal specification of the article and the noun is the appropriate combination of a show inflection) such as *Buch*, it is not clear on Pollard and Sag's account how these nouns are specified for by the article. They acknowledge that these nouns exhibit an unspecified value for declension (1994:373). To ensure that these nouns are available for reciprocal selection by the article, the article's SPEC value would need to be disjunctively marked for the correct declension value or an unspecified value, as in figure (3).

Figure 3

$$[\text{SYNSEM}_{\text{das}} [\text{LOC} | \text{CAT} [\text{HEAD} [\text{SPEC} : \text{N}' [\text{DECL}_{\text{strong}} \vee []]]]]]$$

Therefore, an unspecified noun will correctly combine with its article.

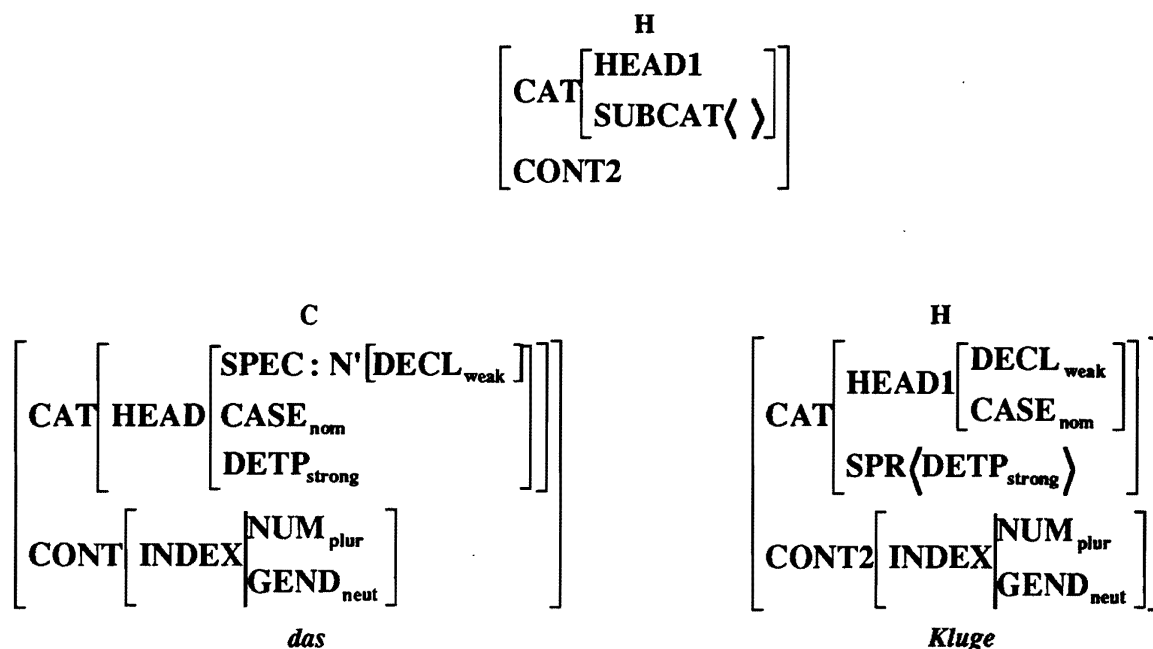
In addition to correct government of the article and the correct selection of the declension value, the agreement values gender, case and number must agree between the article and the noun in the determiner phrase. Pollard and Sag divide these features into two categories, syntactic which includes CASE as a HEAD feature and semantic which includes GEND [er]⁵ and NUM [ber] as CONTENT features (1994:88).

⁵ As German is a grammatical gender language, there are no anchoring restrictions on this feature (Pollard & Sag 1994:88)

Case concord is a form of syntactic agreement which Pollard and Sag distinguish from index agreement. Language-specific constraints require structure sharing between a noun's CASE value and that of a determiner or adjective that is dependent on the noun. Given that agreement occurs between co-indexed elements with differing case values (antecedent pronoun relationships for example) index agreement and case concord are distinct (1994:88).

On Pollard and Sag's account, case concord is a consequence of lexically specified identities. Considering a noun such as *Kluge*, the CASE value would be nominative in a nominative noun phrase by virtue of the Head Feature Principle which ensures that the SYNSEM values of the phrase and its head daughter are token-identical (1994:34). The CASE value for the article is co-indexed with the CASE value of the noun thereby ensuring case agreement between them through structure sharing. Number and gender are properties of the noun whose attribute INDEX specifies the values for NUM singular and GEND neuter which are in turn co-indexed with the article to ensure agreement of number and gender between the noun and the article. These values are percolated up to the phrase level by means of the Semantics Principle which maintains that the CONTENT values of the phrase and its head daughter are identical (1994:48). Structure sharing, then, ensures that only an article and a noun with identical values for case, gender and number will combine, such as in the following example of *das Kluge*.

Figure 4



Pollard and Sag do not address the issue of cardinals acting as either articles or adjectives. However, Netter (1994:335) suggests that their account could not explain this distribution without assuming that in both cases the cardinal carries some form of weak declension value. His argument rests on considering that a cardinal such as *zwei* in a determiner position takes the declension value as unspecified or strong (1994:334). However, there appears to be no evidence for this assumption. As we have seen previously, an adjective and/or noun following the cardinal must be strongly declined, the cardinal then acts more like a weakly inflected article, i.e. *zwei letzte* (strong) *Kluge* (strong). If it were strongly declined it would govern for a weak adjective and noun, i.e. *zwei letzten* (weak) *Klugen* (weak). Therefore, as an article *zwei* appears to carry some type of marker for weak declension. In adjectival usage the cardinal will always be within a weakly declined N', as it will always be preceded by a strongly inflected article.

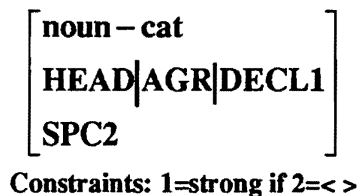
It appears, then, that it is reasonable to assume that the cardinal as both an article and an adjective does carry some form of weak declension value. Therefore, Pollard and Sag's approach is able to account for this distribution with the addition of a dual lexical entry for *zwei*, one as an article and another as an adjective. In both the article's and the adjective's lexical entry the head feature would have a weak value, DETP weak and MOD weak respectively.

Pollard and Sag's approach can account for government and correct nominal declension within determiner phrases by means of reciprocal specification of constituents through the marking for the article being a DETP type and the noun being a declension value. However, disjunctive specification of the noun may be necessary to ensure that undeclined nouns are available for selection. The phrase itself is licensed by the Valence Principle and the Head Specifier Schema, while the SPEC principle ensures declension agreement between the constituents as does structure sharing of syntactic and semantic agreement features.

3.1.2 Kathol's Account

Much of Kathol's account of determiner phrases is based upon Pollard and Sag's approach. The noun as head of the phrase selects its article by means of a feature for specification; here SPC is the equivalent of SPR in Pollard and Sag's approach. The declension value of the noun, which is applicable to all nouns including substantival adjectives, is identified as a head feature, AGR in the lexical entry. However, in the case of nouns such as *Buch* which do not inflect for declension, the declension information in their HEAD|AGR feature would need to be disjunctive as the noun can either be strongly inflected such as in *ein Buch* (strong) or weakly inflected as in *das Buch* (weak). Kathol states that absence of these declension values is due to the morphology and does not offer any further account (1994:27). A constraint applies to all nouns, which defines weak as the default declension value if the noun has value for SPC (including both definite articles and indefinite articles), as illustrated in the following figure (1994:25).

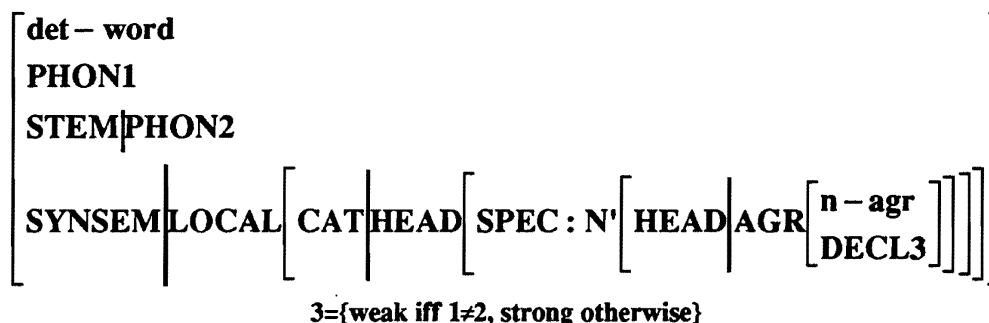
Figure 5



Therefore, in the case of the substantival adjective, *Kluge* the SPC value would be a determiner, which could be either a definite or indefinite article, and the declension value of the noun weak satisfying the constraint. The Valence Principle and the Head Specifier Schema ensure that the noun can combine with its chosen article.

As in Pollard and Sag's account, the article selects its noun and does not bear a declension value. However, it is not typed as being strong or weak as we have seen in their account. Instead, Kathol appeals to the morphology of the article to ensure appropriate government by the noun. The article's PHON value is compared with the value of the article's STEM|PHON value to determine the declension value of the governed noun. A strongly inflected article will exhibit a difference in values, such as *einem* in which *-em* is the distinction between the stem and the realised article. On the other hand, *ein* shows no distinction between the two values just as the cardinal *zwei*, which Kathol considers a determiner variant (1994:26). A constraint is placed on all articles such that distinction between the stem and the article will ensure the article selects a weakly declined noun and no distinction between them will trigger a strong selection, i.e. as in figure (6) (1994:26).

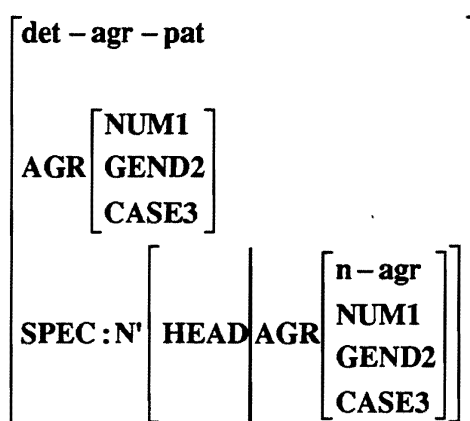
Figure 6



Given *das* as the article, the noun SPEC specifies for would be bear a weak DECL value as it is considered to have a full inflectional paradigm (1994:24) and consequently reflects a distinction from its stem, thereby satisfying the condition on the article constraint. Conversely, an indefinite article such as *ein* or the cardinal *zwei* being identical to its stem form would require a strongly declined noun.

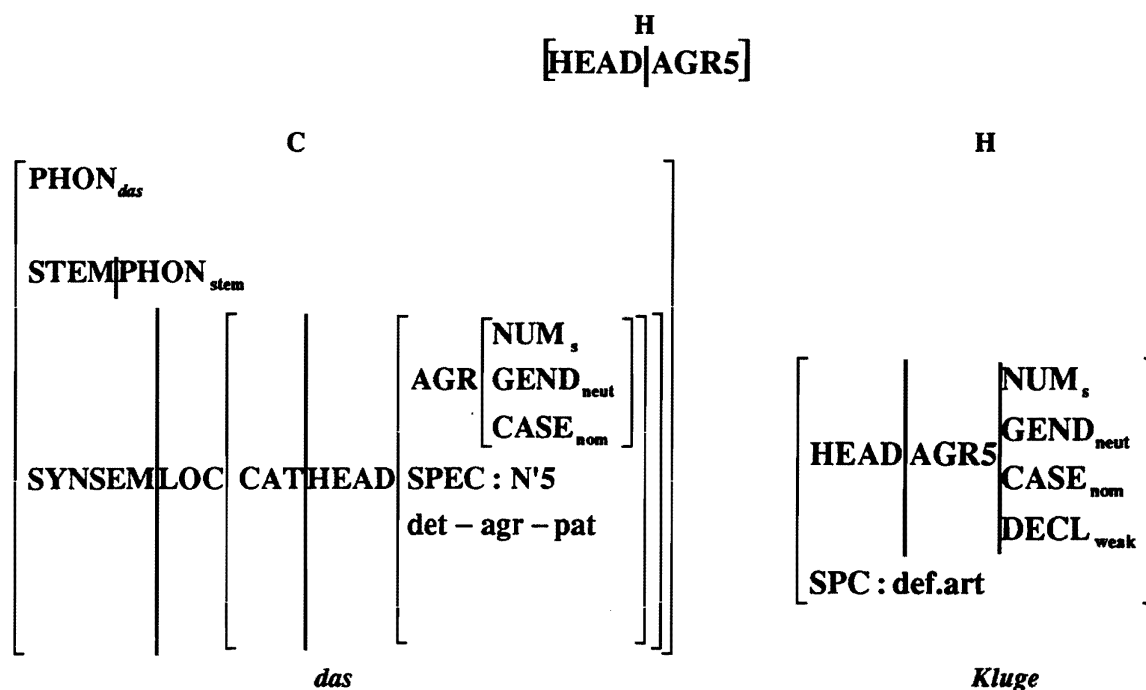
The reciprocal selection between the article and the noun results in the proper government for declension. It is assumed that Pollard and Sag's SPEC Principle ensures agreement between the specified declension value of the article and the noun's declension value while the agreement of case, gender and number do not rely on direct structure sharing and their Semantics Principle. Kathol does not make a distinction between INDEX agreement features, gender and number and the syntactic HEAD feature, case. Case, gender and number are syntactic in that they are all considered values of the HEAD feature AGR like the DECL feature. Agreement of these features is a result of the satisfaction of agreement constraints that are considered head feature values of the article's SPEC N' (or MOD N' in the case of an adjective). For determiner phrases, the constraint would be det-agr-pat as in figure (7) (1994:24).

Figure 7



Agreement of case, gender and number rely on token-identity within this constraint. The agreement values of the determiner must be identical to those of the specified noun and to ensure that the specified agreement values are identical to those of the noun the SPEC Principle would be required. An illustration of Kathol's account of a grammatical determiner phrase showing proper government and agreement is as follows.

Figure 8



Given the distinction in phonology between the stem and the definite article, the weak declension of the noun satisfies the determiner constraint and the noun specifies for a definite article allowing a weak declension value *viz.* the noun constraint. Both the specified declension value and the noun's actual declension value are identical ensured by the SPEC Principle. Therefore, proper government is achieved and the phrase is licensed by the Valence Principle and the Head Specifier Schema. Agreement of case, gender and number are ensured by means of the det-agr-pat constraint being satisfied and these head features are shared by the phrase and its daughter by means of the Head Feature Principle.

Clearly then, Kathol's approach can account for government and agreement in the determiner phrase given that a caveat be made to allow for disjunctive declension values for undeclined nouns as was the case with Pollard and Sag's account. However, Kathol provides a link between morphology and government through describing the government of the noun in terms of the phonological form of the article, which was not available in the previous account.

3.2 Determiner and the Noun as Head

In the previous analyses, we have seen that the noun governs its determiner. A problem inherent in such an approach is apparent in the necessity of the disjunctive specification of an article by the noun (as undeclined nouns bear dual declension marking). In answer to this, Netter proposes an approach, in which the determiner is responsible for selecting the noun.

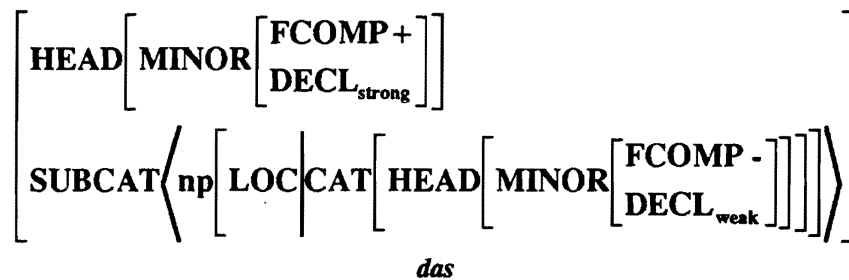
On Netter's account, a simple determiner phrase is comprised of two categories a major being either a noun or an adjective and a minor such as an article which acts as the functional head. This head subcategorises for a major, or substantive, category, however it is optional through an unspecified value for the major category to select a functional head (1994:310). MAJOR and MINOR are the crucial head features of this analysis. A binary MINOR feature, FCOMPL, tags the major category for the requirement of a functional head to create a maximal projection (-), a DP (fully saturated) which is marked as complete (+) given the Functional Completeness Constraint (1994:312). In addition, the functional head carries a (+) value. This ensures that a functional category can only occur once in a phrase and that the major category will not occur on its own.

Unlike in the previous approaches, here Netter assumes that declension is a feature of both nouns and articles. It is considered a MINOR feature (1994:326) which allows determiners and nouns to have differing declension values, as MINOR features are not required to be shared by both the functional heads and the substantive categories.

Declension values distinguish between inflected and uninflected articles (including cardinals). An inflected article specifies for the head of its complement to be weakly declined and an uninflected article is left unmarked for this value and is forced to share what value it might acquire with its complements. In addition, the maximal projection DP is always marked for a strong declension value (1994:326).

In the case of the determiner phrase, *das Kluge* the inflected article bears the MINOR features FCOMP+ and DECL strong. Through subcategorisation, *das* defines its weakly declined complement, *Kluge*, as in the following figure.

Figure 9



The selection of the *das*' complement is licensed by a head complement schema, which allows the functional head to select locally a non-head (Pollard and Sag 1994:362). The subcategorisation value of the head is satiated by the CAT|HEAD|MINOR values of *Kluge* resulting in the phrase having a saturated SUBCAT value ensured by the SUBCAT Principle. In addition, there is no violation of the Head Feature Principle in that the head values of the mother agree with those of the functional head, FCOMP+ and DECL strong.

This account of a determiner phrase with a definite article exhibits lateral governance between the head and its complements as did Pollard and Sag's and Kathol's approaches. However, in contrast to these other accounts, there is no reciprocal selection in this approach; the burden of selection is the sole responsibility of the article. Another major difference evident in Netter's account emerges with his account of indefinite or uninflected articles. This account exhibits horizontal governance.

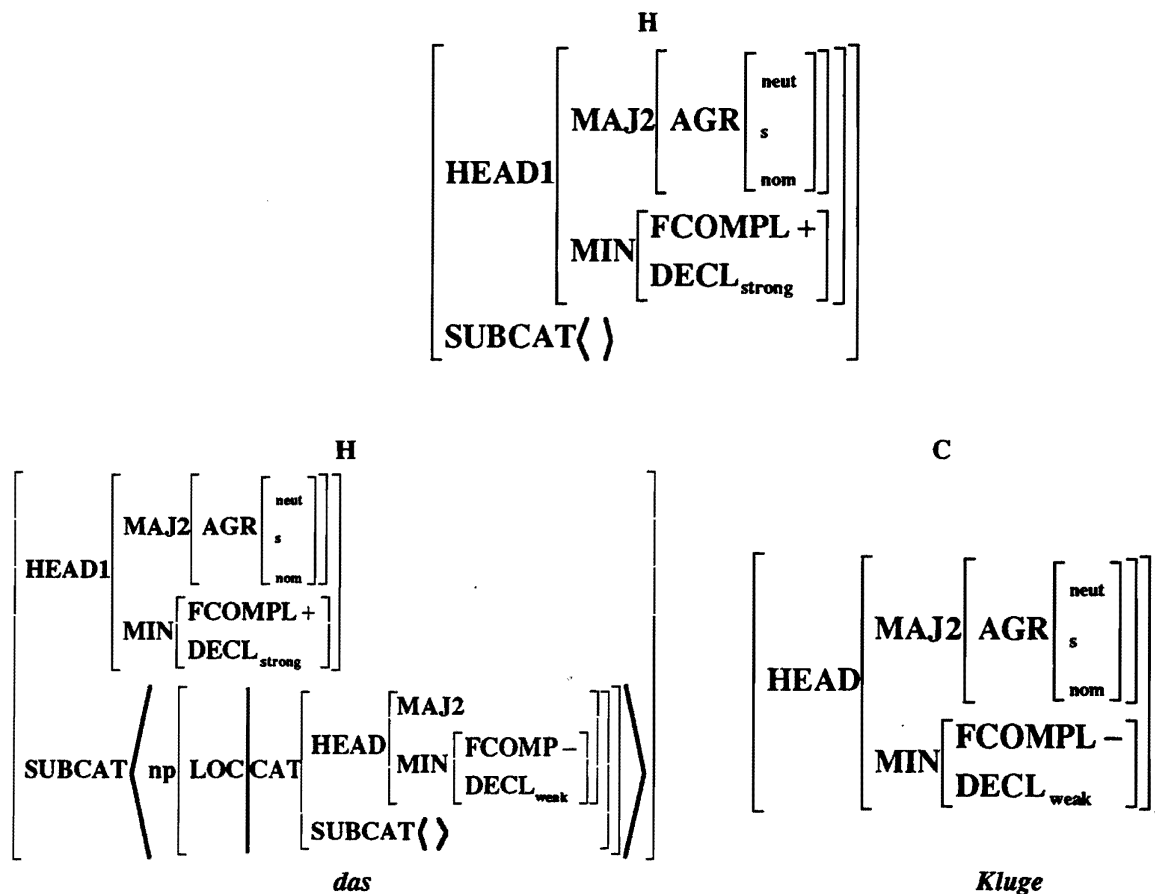
Consider the determiner phrase *ein Kluges*. The article does not have an inflectional ending and is therefore unspecified for a declension value. It is not until the phrase qualifies as a DP that the functional head receives this value. As we have seen DP is restricted to bearing a strong value and this value must agree with that of the head by virtue of the Head Feature Principle. Therefore, *ein* is no longer unspecified for declension and now bears a strong inflection value, which it is required to share with its complement. Consequently, *Kluges* is chosen as the appropriate complement owing to its strong declension value.

However, Netter does not discuss why the strong declension value of uninflected articles is not expressed. In addition, it is not clear, why an inflected determiner such as *das*, which is also strongly declined, governs a weak declension value for its complement. Therefore, there must exist some inherent difference between an uninflected article such as *ein* or *zwei* and the inflected *das* to trigger the government of different declension values. Clearly, this issue warrants further attention.

The issue still remains of how the features case, gender and number agree within the determiner phrase. Following Kathol's treatment of agreement features, these features are considered head features. However, they are not MINOR features as was declension, but are of the MAJOR sort. MAJOR features are required to be shared between the functional head and its complement (1994:310). This is accomplished through structure sharing: the

agreement features of the functional head are shared with those of its subcategorised complement. The SUBCAT Principle guarantees that these values are satiated in the noun before a saturated maximal projection can result. The agreement features are evident in the phrase by means of the Head Feature Principle, which percolates these features up from the functional head. Given that agreement is then accounted for, we have a properly governed determiner phrase, *das Kluge* that exhibits feature agreement, as illustrated in the figure (10).

Figure 10



A determiner phrase on Netter's account can be accounted for by assuming a functional head which selects its complement viz. the Head Complement Schema and subcategorises for it according to the criteria set out by its inflectional type. The Subcat Principle ensures saturation of these requirements and also those of the agreement features shared with the head. The Head Feature Principle then maintains that the agreement features are evident at the phrase level, which is specified as a functionally complete category requiring no further specification. However, as with the other approaches this one still must assume that the uninflected nouns have disjunctive declension values to enable the article to govern for the required values. In addition, while this approach can in fact account for determiner phrases comprised of uninflected articles, the assumption that these and the inflected variety have the same declension value while exhibiting different government patterns is somewhat problematic.

As we have seen, all three approaches can account for determiner phrases in German. Each relies on some form of structure sharing to ensure that all the phrase's constituents agree in case, gender and number. Regardless of a noun-head or an article-head approach, proper government of the declension value can be attained; Kathol offers the additional advantage of linking this government to the morphology of the article. However, the declension value for all three approaches must be disjunctively specified in uninflected nouns to ensure correct specification and

government. In addition, the applicable cardinals that are acting as an article can be accounted for on all three accounts if they are assumed as either a weak or an uninflected determiner.

4. Conclusion

In conclusion, the approaches of Pollard and Sag, Kathol, and Netter are able to provide a basic account of agreement in the German noun phrase provided some additional proposals are assumed. However, each approach carries with it inherent difficulties.

In order to account for all noun phrases, an assumption must be made by all four authors that being that substantive adjectives are a subclass of nouns. In addition, this subclass and the uninflected variety must be disjunctively specified for by the article to make them available for selection. Although the definitions of agreement features differ between approaches, agreement within the noun phrase is guaranteed by all through principles that maintain identity of case, gender, number and declension between constituents, such as the SPEC principle, Schema 5 or specific constraints.

Although the government of declension within the noun phrase differs in terms of origination, i.e. noun or determiner, the results are much the same for these accounts. Either by lateral government in reciprocal selection on Pollard and Sag and Kathol's accounts or by lateral government where the article subcategorises for appropriate values or horizontal where they are percolated down from the phrase, a weakly inflected article selects a strongly declined N' and a strongly inflected one chooses a N' that has weak declension. However, an additional benefit emerges from Kathol's approach that links government with the morphology of the language.

With or without an article, a modifier selects its noun. The phrase is licensed by Schema 5 on all three accounts. However, Netter offers the most promising approach by preventing the occurrence of a weakly declined N' and the modification of a determiner phrase given that the SPEC feature is extended to the noun class.

However, while Netter offers definite benefits in this regard, his approach has drawbacks when considering the case of cardinals in German. The other authors can easily account for the determiner-like and adjectival roles these forms play if a dual lexical entry for them is assumed. However, on Netter's account these forms are considered functional heads regardless of their varying roles. In the instance of a cardinal as an adjective, an applicable form as a functional head prohibits further specification by virtue of its positive value for functional completeness. In addition, his assumption that cardinals and all other uninflected forms bear a strong value is problematic considering that this removes an apparent distinction that seems linked to the government of declension.

In sum, while the approaches posited to account for German internal noun phrase agreement could, for the most part, account for these issues, a little fine-tuning is still in order. In addition, many other issues have not been addressed that require attention. The issue of post-positioned adjectives which fail to exhibit any form of inflection, such as in *das Kluge, letzt* and that of possessive pronouns that follow a demonstrative article in a noun phrase, such as *dieses unseres Landes/dieses unseren Landes*, which bear dual declension values are just a few examples which require further research.

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Appendix A

German Determiners

The determiners of German decline according to grammatical gender, number and case. The following paradigms represent their declension:

Definite

	SING.			PLUR.		
	<u>Masc</u>	<u>Fem</u>	<u>Neut</u>	<u>Masc</u>	<u>Fem</u>	<u>Neut</u>
NOM	der	die	das	die	die	die
ACC	den	die	das	die	die	die
GEN	des	der	des	der	der	der
DAT	dem	der	dem	den	den	den

Indefinite

	<u>Indefinite only</u>	<u>Masc</u>	<u>Fem</u>	<u>Neut</u>
NOM		ein	eine	ein
ACC		einen	eine	ein
GEN		eines	einer	eines
DAT		einem	einer	einem

Appendix B

Standard Nouns

German nouns have inherent gender and inflect for number and case. The inflection paradigm follows for the noun *Buch* 'book (neuter gender)':

Buch

	<u>SING.</u>	<u>PLUR.</u>
nom	Buch	Bücher
acc	Buch	Bücher
gen	Buches	Bücher
dat	Buch(e)	Büchern

Appendix C

Substantival Adjectives

All attributive adjectives can be used as nouns. Their status as a noun is indicated by the capitalization of the initial letter in most instances. While standard nouns inflect for plurality and the genitive case, attributive adjectives differ in that they exhibit declension features. These declension features are distributed as follows:

Weak Forms of Klein +

	SING.			PLUR.		
	<u>MASC</u>	<u>NEUT</u>	<u>FEM</u>	<u>MASC</u>	<u>NEUT</u>	<u>FEM</u>
NOM	-e	-e	-e	-en	-en	-en
GEN	-en	-en	-en	-en	-en	-en
DAT	-en	-en	-en	-en	-en	-en
ACC	-en	-e	-e	-en	-en	-en

Strong Forms of Klein +

	SING.			PLUR.		
	<u>MASC</u>	<u>NEUT</u>	<u>FEM</u>	<u>MASC</u>	<u>NEUT</u>	<u>FEM</u>
NOM	-er	-es	-e	-e	-e	-e
GEN	-en/NA	-en/NA	-er	-er	-er	-er
DAT	-em/-en	-em/-en	-er	-en	-en	-en
ACC	-en	-es	-e	-e	-e	-e

Mixed Forms of Klein +

	SING.			PLUR.		
	<u>MASC</u>	<u>NEUT</u>	<u>FEM</u>	<u>MASC</u>	<u>NEUT</u>	<u>FEM</u>
NOM	-er	-es/-e	-e	-en	-en	-en
GEN	-en	-en	-er	-en	-en	-en
DAT	-en	-en	-en	-en	-en	-en
ACC	-en	-es/-e	-e	-en	-en	-en

MANDARIN DIMINUTIVE FORMATION: AN OPTIMALITY ANALYSIS

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Introduction

This paper presents an analysis of Mandarin diminutive formation in terms of Optimality Theory (OT) (Prince and Smolensky 1993, McCarthy and Prince 1993a&b, 1994 a&b). The diminutive suffix /-ər/ surfaces in many Mandarin dialects. It brings about prosodic and segmental alternations through interaction with the stem. The suffixation process eventually merges two syllables, resulting in the phonological phenomena of syncope, coda deletion, gliding, spreading and stability. A number of linguists have addressed this issue in different ways, for example Chao (1968) uses a structuralist approach; Cheng (1973), Yin (1989), Lin (1989) and Duanmu (1990), among others follow a generative framework. However, all these studies fall into a derivational account. Unlike previous studies, this paper will offer a constraint-based, nonderivational study of the issue along the lines of Prince & Smolensky (1993) and McCarthy & Prince (1993a,b; 1994a,b).

I argue that the constraint-based Optimality Theory plays a role in the interface between prosodic categories and morphological categories in Mandarin. I adopt the view of Prince and Smolensky (1993), and assume constraints are ranked and violable. Given an input form, the optimal output form is the one which satisfies all constraints, or at least the more highly ranked constraints. The grammatical wellformedness of any phonological output is thus achieved by satisfying certain constraints rather than following phonological rules.

The paper is organized as follows: Section 1 consists of a description of Mandarin diminutive formation; Section 2 lays out some problems in the previous studies; Section 3 provides an overview of the theoretical framework; Section 4 deals with the analysis and Section 5 is the conclusion.

1. Diminutive Formation in Mandarin

In order to provide basic background information essential to the examination of Mandarin diminutive formation, I will first give a brief account of the Mandarin consonant and vowel inventory and the prosodic structure.

1.1. Mandarin Consonants and Vowels

(1) Mandarin Consonants:

p	t	ts	<u>ts</u>	tɕ	k	(_ = retroflex)
p'	t'	ts'	<u>ts'</u>	tɕ'	k'	
f		s	<u>s</u>	ɕ		
m		n			ŋ	
	l	ɭ				
y		w	ɥ		x	

(2) Mandarin Vowels:

	Front	Central	Back
High	i ü	ɨ	u
Mid	e	ə	
Low		a	

1.2. Mandarin Syllable Structure

The Mandarin syllable has a canonical structure: (C) (G) V { (G) , (N) }, which allows the following representations:

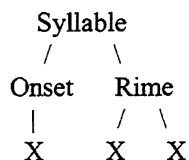
(3) Mandarin Syllable Shapes:

ó shape	V	VG(lide)	VN(asal/[r])	GV	CV	GVN	GVG
example	ə	ay	an	ya	xə	wan	way
gloss	goose	love	bank	duck	drink	finish	out

ó shape	CVG	CVN	CGV	CGVN	CGVG
example	t'ay	p'an	kwa	t'yan	xwey
gloss	very	plate	melon	heaven	meeting

Duanmu (1990) proposes that all Chinese languages have a uniform syllable structure of three timing slots: one in the onset and two in the rime, schematized as follows:

(4) The Uniform Syllable Structure of Chinese (Duanmu, 1990)



I assume that Mandarin, a dialect of Chinese, has the same syllable structure. Thus, the canonical representation can be reduced to CV(C). There are three assumptions associated with this proposal. First, onset is obligatory in the CV (C) structure. According to Chao (1948:2, 1968: 20), Mandarin syllables that are not written with an onset, such as 'e' (goose) in (3), are actually always filled by a consonant, depending on what the nucleus is. However, this practice is phonetic in nature. When the nucleus is a high vowel, i.e. [i, u, ü], the seemingly empty onset is filled by one of the glides [y, w, ʏ] homorganic with the following vowel. When the nuclear vowel is [-high], the onset has four variants: glottal stop [ʔ], [ŋ], velar or uvular unaspirated fricative [ɣ], and glottal unaspirated continuant [H].

Second, in the canonical structure and in (4) as well, Mandarin allows a pre-nucleus glide [y, w, ʏ] in the syllable structure: CGV(C) (see (3)). According to Duanmu (1990), this G is assigned to the onset as a secondary articulation of the C, e.g. C^G. Thus, C^G realized as either a palatalized consonant or a labialized consonant, is a single segment occupying only one template slot. Since the distribution of glides is predictable, this solution does not increase the underlying inventory of Mandarin consonants. For example, /ty/ in 'tyan' (heaven) is actually /tʲ/, with /y/ linked to the onset. The reason is that there is only one nuclear slot. If two elements compete for this nuclear position, priority is often given to a more sonorant vowel. In this case, it is the more sonorant /a/ that takes the nuclear

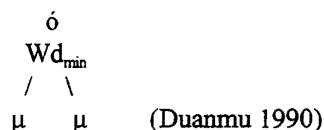
position, and /y/ is forced into the onset, becoming the secondary articulation. Then, C^G best satisfies the well-formedness of the prosodic structure. Post-nuclear glides occupy the coda in VG, GVG, CVG and CGVG syllables as expected.

Third, the rime has two fixed slots as in (4). This means that: (I) diphthongs do not occur in closed syllables; (ii) when there is no coda in the syllable, [CV] is actually [CV:], with the nuclear vowel occupying two template slots; (iii) there is no complex coda in Chinese.

1.3. Mandarin Minimal Word

The notion of minimal word is important in this task. In the previous section, we have examined Mandarin syllable, which has a constant template structure. This proposal is further expanded to link to other prosodic units. According to Duanmu (1990, 1993), each slot in the rime is equivalent to one mora position, one for the nucleus and the other for the coda. Furthermore, a minimal word in Mandarin is comprised of a bi-moraic syllable.

(5) Mandarin Minimal Word



1.4. Mandarin Data

I assume that the lexical representation of the diminutive can be either /-ər/ or /-r/. While both representations are feasible in this proposal, /-ər/ is preferred in view of the general claim of OT: prosodic constraints dominate morphological constraints. When /-ər/ is used as a suffix, the [ə] in the nucleus is often dropped as in (6a-f). The deletion of [ə] is mainly constrained by the prosodic well-formedness of the output of the language. Use of the suffix /-r/ requires an account of [ə] insertion for cases such as (6g & h). The prosodic constraints do not play a significant role in this account. Therefore, the choice of /-ər/ is independently motivated, carrying more weight.

Unlike general processes of suffixation in many other languages, in which suffixes are directly adjoined to the base morphemes, the diminutive suffixation in Mandarin merges two syllables into one. The result is a Minimal Word with exactly one syllable, consisting of two fixed moras. The process triggers deletion in the base syllable and in the suffix syllable as well, depending on the base syllable shape. There are roughly four types of diminutive formation as follows. The data mainly come from Yin (1989).

- (6) a. l an 'basket' → lar 'small basket'
 b. laŋ¹ 'wolf' → lār 'small wolf'
 c. p'ay 'signboard' → p'ar 'small signboard'
 d. t'ow² 'head' → t'or^w 'small head'
 e. taw 'knife' → tar^w 'small knife'
 f. k^wən 'club' → k^wər 'small club'
 g. ɕin 'heart' → ɕ^yər 'heart'

¹ Duanmu (1990) suggests that in anticipation of the velar closure in [ŋ], the soft palate is lowered earlier. In other words, the nuclear vowel is nasalized before [ŋ] is drooped from the coda. Therefore, the input form is 'lāŋ' rather than 'laŋ'. This treatment is formulated to agree with his proposal on Chinese syllable structure. To me, this pre-suffixation nasalization is phonetic. Therefore, I treat the stem form as 'laŋ' rather than 'lāŋ'.

² Based on Duanmu (1990), the round feature is construed as spreading to the coda of the prosodic word.

In (6), all the codas in the root syllables are dropped and, in turn, the empty second mora position is filled by [r]. In (6a-f), [ə] in the suffix is also dropped. In (6c & d), the new coda is labialized, becoming [r^w]. In (6g), the original nucleus is replaced by the suffix [ə], and the [i] in (6g) becomes the secondary articulation of the onset. (6) shows that introducing the suffix to the stem syllable only causes some changes in the structure of the segments, but not in the structure of the syllable; the prosodic structure of the syllable is still preserved.

The roots with [CV] syllable structures constitute the second type of suffixation. In this case, the suffix [r] directly adjoins to the stem.

- (7) a. p'a 'rake' → p'ar
 kə 'song' → kər
 ya 'duck' → yar
 b. p'i 'skin' → p'yər
 tɕi 'chicken' → tɕ'yər
 tɕ'ü 'song' → tɕ'yər

In (7a), there is no change in the stem nucleus; while in the suffix, [ə] is deleted. In (7b), the high vowels [i, ü] are desyllabified (becoming glides) and relinked to the onsets as a secondary articulation. In turn, the rime is substituted by [-ər].

Stems with initial dental or retroflex sibilants followed by a high central vowel [ɨ] form the third type of diminutive formation. In this case, [ɨ] is replaced by [ə] in the suffixed form as shown in (8). According to Chao (1968), the motivation for this replacement is the incompatible articulation of [ɨ] and retroflex [r]. My explanation for this phenomenon is that the result best satisfies the constraints, especially NUCLEUS/V CONSTRAINT (see Section 4 for details).

- (8) a. tsɨ 'paper' → tsə r
 b. tsɨ 'word' → tsə r
 c. sɨ 'silk' → sə r
 d. ts'ɨ 'lyrics' → ts'ə r
 e. ʂɨ 'things' → ʂə r

Now let us examine the last type. Consider the following (from Duanmu 1990):

- (9) a. hu 'lake' → hur^w
 b. kow 'hook' → kor^w
 c. taw 'knife' → tar^w

In (9), there is no diphthong in the suffixed forms. The coda is replaced by [r^w], with the feature [labial] spreading from the original [u]/[w] to the new coda. Furthermore, [ə] is dropped in all the suffixed forms.

2. Problems

The underlying form of the Mandarin diminutive is controversial. Some scholars take /-r/ to be the underlying

suffix form (Chao 1968, Duanmu 1990), while others prefer /-ər/ (Cheng 1973, Yin 1989). None of the explanations is satisfactory. The former fail to account for the fact that [ə], rather than other vowels, is inserted as shown in (7b) and (8); the latter cannot explain why [ə] in the suffix is dropped throughout (7a) and (9). Moreover, it is not clear why final [w] and nuclear [u] behave differently from other final consonants and vowels as in (9) (see Duanmu 1990 and Yin 1989). In addition, there is no convincing explanation for the asymmetrical behaviour of the final nasals: /n/ -ə without [nasal] relinking as in (6a); in contrast, /ŋ/ -ə with [nasal] relinked to the nucleus as in (6b).

This paper offers a solution in terms of OT (see Section 4 for details). For the convenience of the analysis, I assume that the underlying suffix form is /-ər/. The deletion of [ə] in certain cases can be accounted for by satisfying prosodic constraints. The difficulty brought about by the odd behaviour of [w]/[u], [i]/[ü] and final nasals can be circumvented in terms of the Correspondence Theory (McCarthy and Prince 1995). In the following section, I will give a brief review of two analyses with regard to these issues.

2.1. Duanmu's Analysis (1990)

Duanmu (1990) provides a formal study of Mandarin diminutive formation. In this study, the Mandarin diminutive morpheme is treated as a retroflex vowel [r]. In the process of the suffixation, [r] replaces the coda of the root rime. Since the syllable structure is claimed to have three fixed slots, as in (4), the deletion occurring in the coda position is driven by the syllable template. On the whole, the three slot syllable structure theory renders the account simple and plausible. However, it is not clear why this retroflex vowel [r] always occupies the coda position rather than the nucleus. Furthermore, the study ignores the changes happened in the nucleus. In addition, the account of the asymmetrical behaviour of the final nasals is not very convincing.

2.2. Yin's Analysis (1989)

Yin (1989) gives a different account. In this analysis, the diminutive suffix form is treated as [-ər]. And a four slot syllable structure, i.e. C G V G/N is proposed to describe the derivation of the suffixation. Yin suggests that the process is a merger of two syllables, involving de-linking and re-association of certain segments. The re-association is involved with certain vowels, guided by the *Vowel Association Principle*. It requires that association of vocalic melody to the nucleus proceed according to the sonority hierarchy: a > o > e > ə > [+high] (Yin, 1989: 48). This study explains why the nuclear vowels change sometimes. However, it does not give any account of the final [u]/[w] behaviour. Based on the Vowel Association Principle, the high vowel [u] should be dropped from the nucleus, and [ə] should shift in. But the result is contrary to the prediction: 'hu' (lake) → 'hur'/*'hər'. Further, it is not clear why [w] and [u] spread [labial] onto the new coda, i.e. 'taw' (knife) → 'tar', while [y] does not, i.e. 'kay' (cover) → 'kar'/*'kar'.

3. Theoretical Prerequisites

The spirit of Optimality Theory can be captured by the interplay of two functional components: Generator (Gen) and Evaluator (Eval). Gen is responsible for generating possible candidates to Eval. Eval is a system of constraints that assesses the various candidate forms provided by Gen. The constraints are ranked and violable. The optimal candidate chosen by Eval is the one that minimally violates the constraints. OT departs from the traditional derivational grammar to a nonderivational grammar, shifting 'the burden of linguistic theory from input-based rewrite rules to output-based constraints' (MacCarthy and Prince, 1993a).

The grammar also lays out three principles underlying the theory of Gen:

- (I) Freedom of Analysis. Any amount of structure may be posited.
- (II) Containment. No element may be literally moved from the input form.

- (III) Consistency of Exponence. No changes in the exponence of a phonologically specified morpheme are permitted.

Freedom of Analysis requires that Gen provide any amount of structure to an underlying representation so as to generate a range of possible surface candidates for Eval. Consistency of Exponence says that the lexical specifications of a morpheme can never be changed by Gen. Containment maintains that the underlying representation must be contained in any legitimate candidate. It literally will not allow anything to be deleted from the input. Deletion is treated as unparse. This principle disallows nonidentical correspondents. Regarding 'laŋ 'wolf' → lār 'small wolf', a stability phenomenon preserves the feature [nasal] when the input coda /ŋ/ is deleted and relinks [nasal] to /a/. In the sense of PARSE, this [nasal] already satisfies PARSE [nasal] through the linkage to the unparsed [ŋ]. Therefore, it cannot be relinked to /a/.

Since Containment is empirically problematic, it has been abandoned by McCarthy and Prince (1994a). Instead, McCarthy and Prince (1994a) propose the correspondence theory that gives license to potential input-output non-identical pairs.

(10) Correspondence (McCarthy and Prince 1995)

Given two strings S_1 and S_2 , *Correspondence* is a relation R from the elements of S_1 to those of S_2 . Segments $\acute{a} \in S_1$ and $\hat{a} \in S_2$ are referred to as correspondents of one another when $\acute{a} R \hat{a}$.

All correspondent constraints in this proposal are faithfulness constraints. Faithfulness of input to output is achieved by segment to segment correspondence. Therefore, this proposal is not supposed to license segment to feature input-output pairs.

In view of the stability phenomenon occurring in the deletion of /ŋ/, I propose the following CORR, which permits segment to segment or segment to feature correspondence.

(11) CORR(string₁, string₂, X)

- a. X is a constituent \in string₁;
- b. X is a set of feature specifications: $X = \{F_1, F_2, \dots, F_i\}$;

At least one node of every X in string₁ must be coindexed with a node of the same type in string₂.

The proposed correspondence is similar to Orgun's (1995) proposal:

(12) CORR(string₁, string₂, X) (Orgun 1995)

X is a constituent with any amount of information (e.g. features) specified. The **TOP NODE** in every X in string₁ has to be coindexed with a node of the **same type** in string₂.

Orgun's CORR constraints require a correspondent only for the TOP NODE (root node), rather than identity of all the structures specified in X, making it possible to have nonidentical correspondents. Nevertheless, this proposal is not clear enough to allow segment to feature correspondence, since each of the correspondents has to have a root node of its own. In contrast, my proposal requires a correspondent for any node having some generic relations with the input X. It follows that if the top node of X in string₁ is coindexed with a node of the same type in string₂, segment to segment correspondence is expected to occur. If a node of X in string₁ other than the top node is coindexed with a node of the same type in string₂, segment to feature correspondence is expected. If no node of X in string₁ is coindexed with a node of the same type in string₂, X is construed as deleted. The proposed CORR in (11) can handle deletion, segment to segment correspondence and segment to feature correspondence.

Together with the proposed CORR, I will use Orgun's MATCH, which encourages agreement between correspondents.

(13) MATCH(string₁, string₂, X) (Orgun 1995)

For any pair $\langle X_1 \in \text{string}_1, Y_1 \in \text{string}_2 \rangle$, Y contains all the information in X. That is, elements of string₂ contain all specifications of their string₁ correspondents.

MATCH constraints do not require correspondents to be identical, but do require string₂ to contain at least all the information in its string₁ correspondent. As it stands, violations of MATCH are assessed only in cases of absent or differing specifications, but not when the output correspondent is more specified than the input. I also assume 'elements' in this definition as referring to string₂ correspondents, either segments or features.

3.1. Constraints

In the standard conception, the constraints are provided by Universal Grammar and claimed to be language Universal. Only the ranking of the constraints is language-specific. The constraints active in our task are as follows:

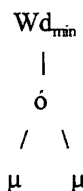
(14) NUCLEUS/V CONSTRAINT (NUCL/V)

'A higher sonority nucleus is more harmonic than one of lower sonority' (Prince and Smolensky 1993:16). This constraint can be construed as follows:

If two vowels compete for one nuclear slot, the more sonorant wins.

Sonority Hierarchy: $a > o > e > \emptyset > [\text{+high}]$. (Yin 1989: 48)

MINIMAL WORD CONSTRAINT (MIN-WD)



The result of diminutive formation is a minimal word. A minimal word is comprised of a syllable, which has three slots. One is in the onset; the other two in the rime, equal to two moras.

ALIGN-RIGHT (Suffix, R, PrWd, R)

$]_{\text{PrWd}}]_{\text{Suffix}}$: The right edge of the suffix coincides with the right edge of every prosodic word. (This constraint is an absolute wellformedness constraint: alignment is either satisfied or not.)

IDENT (i, o, /back V/): Every input back vowel has an identical output correspondent.

SPREAD [labial]: [labial] must spread to a nearby consonant: front vowel to onset; back vowel to coda.

CORR (i, o, /high, front V/): Every input high front vowel has an output correspondent.

CORR(i, o, /ŋ/): Every input /ŋ/ has an output correspondent.

MAX - IO: Every segment of the input has a correspondent in the output.

MATCH -OI: Every output correspondent of an input segment contains all specifications of the input.
(Output correspondents refer to both segments and features.)

4. Analysis

In the following, I will demonstrate how these proposed constraints work to account for our data.

4.1. Syncope and Final Consonant Deletion

As high ranking constraints, ALIGN-R and MIN-Wd are seldom violated. An optimal output must satisfy both of these constraints. Since ALIGN-R and MIN-Wd do not conflict with each other, they are on the same level of the constraint hierarchy. Each plays an independent role in this task. (15) shows how ALIGN-R works to serve this purpose.

(15) Input /lan; ər/ 'basket'

Candidates	ALIGN-R	MAX-IO
>lar		**n,ə
lan	*	**r,ə
ran	*	**l,ə

In view that all the candidates in (15) makes equal violation of MAX, we now consider the other constraint ALIGN-R. ALIGN-R is required in the theory to assure the occurrence of the suffix boundary [-r] at the right side of every prosodic word. Both 'lan' and 'ran' in (15) are ruled out by ALIGN-R because of misalignment or failure of alignment. Without ALIGN-R, 'lar' would not be the winning candidate.

(16) shows that MIN-Wd plays a role in regulating the prosodic structure of the optimal candidate.

(16) Input /lan; ər/ 'basket'

Candidates	ALIGN-R	MIN-Wd	MAX-IO
>lar			**
lanr		*	*
lanər		*	

'lanər' in (16) satisfies ALIGN-R and MAX, but violates MIN-Wd, because it has two syllables and thus is not a minimal word. 'lanr' violates MIN-Wd by having a complex coda. 'lar' wins this competition by having minimal

violation. MIN-Wd is crucial for this work, since without it, 'lanər' would be the winner. The ranking of the constraints so far is: ALIGN-R, MIN-Wd >> MAX.

I will now demonstrate how the segmental structure constraints interact with faithfulness constraints to account for the syncope phenomenon occurring in either the stem or in the suffix. (7a) can be dealt with by the following tableau. It shows when the stem vowel and the suffix [ə] compete for the single nucleus position in the output form, the winning candidate is more sonorant. This fact justifies NUCLEUS/V CONSTRAINT.

(17) Input /p'a; -ər/ 'rake'

Candidates	NUCL/V	MAX
> p'ar		*
p'ər	*	*

In (17), both candidates violate MAX, but 'p'ər' also violates NUCL/V, a higher ranking constraint dominating MAX. This ranking of the constraint picks out 'p'ar' as the winner. (17) indicates when two vowels compete for a single nucleus slot, i.e. [a] and [ə] in this case, the winner is the more sonorant [a] in comply with NUCL/V.

Since NUCL/V is violable (see below), it is lower than ALIGN-R and MIN-Wd, but higher than MAX in the hierarchy. The constraint ranking is thus revised to:

ALIGN-R, MIN-Wd >> NUCL/V >> MAX-IO

4.2. High Front Vowel Gliding

(7b) differs from (7a) in that the high front vowels in the stem become the corresponding glides, which attach to the onset. The constraints: CORR (input, output, /high, front V/) and MATCH, are called for.

(18) Input /p'i; -ər/ 'skin'

Candidates	MIN-Wd	CORR(i,o,/high, front V/)	NUCL/V	MATCH	MAX
p'ir			*		* ə
p'ər		*			* i
p'iər	*		*		
ɿ'ər				**	
>p'yər				*	

CORR(input, output, / high, front V/) requires that every input high front vowel have an output correspondent. In other words, CORR prevents the input [i] or [ü] from being deleted. However, NUCL/V forces the high front vowels out of the nucleus. The contradiction is reconciled by gliding, in which the vowels in question are represented as a secondary articulation of the onset. In (19), all the candidates except 'p'ər' satisfy CORR, since only 'p'ər' has no [i] correspondent. 'p'iər' violates MIN-Wd by its nucleus weight, and violates NUCL/V by its nucleus [i]. 'ɿ'ər' is the strongest rival to 'p'yər'. Nevertheless, [ɿ] has two violations of MATCH in the sense that [ɿ] has different specifications from the input [p'], and so is [y] from [i]. Without MATCH, 'ɿ'ər' would tie with 'p'yər'.

Some discussion should be given to the assessment of the violation in 'p'yər'. Forced by MIN-Wd, [i] in 'p'iər' changes to [y], and is attached to the onset. [y] as a palatal feature has different specifications from the input full segment [i]. [y] is [-syllabic], while [i] is [+syllabic]. The feature changing from [+syllabic] to [-syllabic] constitutes

a violation of MATCH. Thus [y] is construed as a nonidentical correspondent to the input [i]. Since [y] does not carry all the specifications of the input [i], it violates MATCH, but satisfies a higher ranking constraint CORR. In contrast, based on the definition of MATCH, the onset [pʸ] as a single segment is not a violation of MATCH despite its added vocalic glide, since its underlying feature specifications are the same. Therefore, 'pʸər' is the winner. This tableau shows that CORR must rank higher than NUCL/V, MATCH and MAX in order to eliminate 'pʸər'. In turn, NULC/V is higher than MATCH to reject 'pʸir'. The ranking of the constraints is now:

ALIGN-R, MIN-Wd >> CORR (i,o, /high, front V/) >> NUCL/V >> MATCH, MAX

In contrast, the treatment of [ɨ] in (8) is different from [i] as shown in (19).

(19) Input /ts'ɨ; -ər/ 'lyrics'

Candidates	MIN-WD	CORR(/high, front V/)	NUCL/V	MATCH	MAX
ts'ɨ r			*		*
> ts'ər					*
ts'ʸ ər				*	

CORR (i,o, /high, front V/) is irrelevant in this piece of work, because [ɨ] is not a high front vowel. As a high central vowel, [ɨ] should not occur in the nucleus as required by NUCL/V. Therefore, 'ts'ɨr' violates NUCL/V. I now focus on the last two candidates. 'ts'ʸər' violates MATCH by the segmental alternation from [ɨ] to [y]³. [y] is a hypothetical glide correspondent to [ɨ]. 'ts'ər' violates MAX by the deletion of [ɨ]. Each candidate makes a violation of MAX. Nevertheless, by ranking MATCH higher than MAX, we get the ideal result: 'ts'ər' is the optimal candidate.

CORR (i,o, /high, front V/) is also employed to account for the behaviour of [ü] in the same manner, which I do not discuss in detail. (19) gives rise to the following ranking of the constraints:

ALIGN-R, MIN-Wd >> CORR (i,o, /high, front V/) >> NUCL/V >> MATCH >> MAX

4.3. [labial] Spreading

The behaviours of final [w]/[u] are different from other segments as shown in (9). First, both spread a [labial] feature to the new coda: hu 'lake' – hur^w; kow 'hook' – kor^w. Second, in 'hur^w' (lake), [u] remains in the nucleus, which is a violation of NUCL/V. This fact calls for additional constraints. IDENT (i,o, /back V/) and SPREAD [labial] are thus introduced to the analysis. IDENT(/back V/) ranks higher than NUCL/V in order to force [u] to stay in the nucleus. SPREAD [labial] is responsible for [labial] spreading.

(20) Input /lu; -ər/ 'deer'

Candidates	IDENT(/back V/)	NUCL/V	SPR[Lab]	MATCH	MAX
> lur ^w		*		*	*
lur		*	*		*
lə ^w r	*			*	*

³ Unlike [i], there is not a corresponding glide for central high vowel [ɨ]. According to a glide formation rule, Mandarin glides are specified for [-Approximant], while [ɨ] is [+Approximant]. [y] is the glide counterpart for [i], not for [ɨ].

[u] is specified for [high], therefore it should not be kept in the nucleus in accordance with the sonority hierarchy: $a > o > e > \emptyset > [+high]$. However, IDENT(/back V/) requires every input back vowel have an identical output correspondent. The contradiction is resolved by ranking IDENT higher than NUCL/V. Then, [u] is kept intact in the nucleus as the faithful correspondent to the input counterpart. Since 'lør^w' violates IDENT, it is eliminated earlier. 'lur' has an equal score with 'lur^w' in terms of IDENT (/back V/) and NUCL/V, but violates SPREAD [labial]. SPREAD [labial] is crucial to rule out the undesirable candidate 'lur'.

Some discussion is necessary to be given to [r^w]. Based on the definition of MATCH, [r^w] as a single segment does not violate MATCH. However, the [Lab] on [r] as a feature output correspondent does not carry all the specifications of the input [u], and thus constitutes a violation of MATCH. MATCH in a way blocks spreading, therefore SPREAD [labial] must rank higher than MATCH to force the spreading.

Since IDENT(i,o,/back V/) does not conflict with CORR (i,o,/high, front V/), they are parallel with each other in the constraint hierarchy. In addition, NUCL/V parallels SPREAD [Lab]. Now the ranking of the constraints is:

ALIGN-R, MIN-Wd >> CORR (i,o,/high, front/), IDENT(i,o,/back V/) >> NUCL/V,
SPREAD [labial] >> MATCH >> MAX

4.4. [nasal] Stability

In this section, I will deal with the interesting phenomenon of stability (Goldsmith 1976), where features of a deleted segment are saved by relinking to another anchor.

(21) laŋ 'wolf' – lār 'young wolf'

The output form in (21) shows velar nasal /ŋ/ is deleted, but its feature [nasal] is relinked to the nucleus vowel. In contrast, the deletion of coronal nasal /n/ never incurs [nasal] relinking. This asymmetrical behaviour between two nasals complicates the analysis and requires the introduction of CORR (i,o,/ŋ/). In previous analysis, I have shown that MIN-Wd forces stem coda deletion. Similarly, the fate of /ŋ/ is subject to this constraint. Nevertheless, CORR (i,o,/ŋ/) plays a role in preventing total deletion of the nasal velar. The result is that feature [nasal] is saved and relinked to another anchor.

(22) Input /laŋ; -ər/ 'young wolf'

Candidate	MIN-Wd	CORR(i,o,/ŋ/)	MATCH	MAX
laŋr	*			* _ə
> lār			*	* _ə
lar		*		** _{ŋ,e}

'laŋ r' is a faithful input /ŋ/ output correspondent, but unfortunately, 'laŋ r' has a complex coda, thus violating MIN-Wd. Otherwise, it would be the winner. 'lar' is beaten by 'lār' by the total deletion of /ŋ/, a violation of CORR (i,o,/ŋ/). 'lār' satisfies CORR (i,o,/ŋ/) because the [nasal] on [a] is construed as the output correspondent of the input /ŋ/. This unfaithful correspondence is licensed by the definition of CORR in (11). CORR (i,o,/ŋ/) forces [nasal] to relink to the nucleus. Since 'lār' makes the least violation, it is the optimal candidate.

In contrast, there is no correspondent constraint preventing the deletion of /n/. Therefore, /lār/ is doomed as expected. Compare (22) with (23).

(23) Input /lan; -ər/ 'small basket'

Candidates	MIN-Wd	MATCH	MAX
lanr	*		*ə
>lar			* _n *ə
lār		*	*ə

'lār' violates MATCH by having an unfaithful correspondent, i.e. [Nasal], and thus runs out of the competition.

5. Conclusion

In this paper I have proposed a segment to segment and segment to feature correspondence in the analysis of Mandarin diminutive formation. Controversial problems in this topic arising from derivational analyses have been circumvented or resolved by general constraints. The proposed analysis constitutes an argument for the two-level Optimality Theory, which abandons Containment, and permits non-identical input and output pairs. I have demonstrated alternations occurring in the optimal representations are motivated by the well-formedness of the grammar and licensed by the faithfulness constraints. The proposed framework requires refining, especially in MATCH. I leave the issue for further study.

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PSYCHOLINGUISTIC DIMENSIONS OF THE MENTAL DICTIONARY IN CHINESE VS. JAPANESE

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1. Introduction

This paper contrasts one of the central issues in psycholinguistic models of lexical access and word recognition in Chinese, Japanese, and English. The relationship between phonology and orthography differs across languages, with some languages boasting a close relationship between the two and others not. We know that different orthographies are based on different aspects of language, namely, phonemes, syllables, and morphemes, or the interstices of these features (like morphophonemes), and that these orthographies can present such linguistic information in different ways. But we are not always sure of what cognitive processes handle these orthographic representations and how the human processor takes information out of these various orthographic shapes. While Chinese has been held out to exhibit an opaque relationship between phonology and orthographic type and English a closer relationship, these assumptions do not always find themselves reflected in the facts. For example, Chinese has phonetic radicals; and English has oblique spellings for familiar words which are read at processing glance, instead of through phonological decoding. Moreover, English is not such a simple phonemically-based writing system; rather, graphemic units are often tied to an intermediate morphophonemic level before they are related to sound (see Venezky, 1967). And although Chinese is morphemically-based, Chinese allows, and sometimes requires, phonological information to be accessed during its word recognition procedures. The fact is that the phonemically-based orthography of English is more morphophonemic than we give it credit for. In turn, Chinese has many phonetic elements which can be and are used in reading hanji¹ (see Leong, 1986, for an excellent outline of just such processing hints).

A central psycholinguistic question in respect to Chinese hanji processing focusses on the degree to which phonological and semantic processing interact when the mental dictionary is consulted. Do they interact in parallel or sequential modes? From a psycholinguistic viewpoint, there have been two opposing explanations for how fluent Chinese readers access the mental lexicon as they cognitively process hanji characters for recognition and their semantic properties. One view, the speech recoding view, claims that hanji processing does not require an orthography-specific processing mechanism. This means essentially that lexical access goes from the written form of the word through the speech coding for the word to the semantic representation for the word. Although Chinese orthography is logographic in nature, the processing mechanisms it employs are claimed to resemble the processing mechanisms employed by languages which use alphabetic scripts. The opposing view, the direct access view, instead claims that lexical access is achieved directly, with the written image of the word allowing direct access to the semantic representation of the word. This view, as applied to Chinese orthography, maintains that hanji processing is unique, employing processing mechanisms which inherently differ from those used for dealing with other script types (see Chen, 1996, for an overview which draws this conclusion). Not surprisingly, there is evidence for both views on

¹ Hanji are the logographic written symbols used in the Chinese orthography, common known as Chinese characters. Kanji are those logographic written symbols imported into Japanese orthography from Chinese in four separate and distinct historical periods. In Chinese, their use constitutes the only writing system, but in Japanese, the use of Chinese characters is complemented by three other types of orthographic symbols, two of which are syllabic in origin and one alphabetic.

whether speech recoding is essential or even helpful to readers of other languages, and the situation with Chinese is no different. The evidence can be equivocal, and we will make an attempt to survey those differences and resolve their apparent differences.

Perhaps a better test of the characteristics of logographic systems is a comparison between Japanese and Chinese, two completely unrelated languages which, through the vagaries of history, have come to employ the logographically-based Chinese characters in somewhat different ways. An interesting way to make this comparison is through examination of what is considered to be one of the central psycholinguistic issues in the study of the mental lexicon in each of the two languages, and how recent psycholinguistic research has addressed these issues and with what results. Actually, such inquiry has a much wider interest, for it not only tells us about possible universalistic vs. orthography-specific processes that correlate with their various writing systems, but it also lays the foundations for a general theory of lexical access and word recognition.

The Japanese system of orthographic scripts provides an informative counterpoint in its use of several different systems. The most important of these are the two kana syllabaries, which match the simple syllabic structure of the language, and a large inventory of logographic kanji which can have varying pronunciations derived from either borrowed Chinese readings or native Japanese readings. The issue in Japanese is similar to the debate in Chinese lexical access: Can meanings of Japanese words written in kanji be understood even when their phonetic codes are not retrieved from the written transcriptions? However, unlike Chinese, Japanese kanji characters can have two possible types of reading for a given kanji; *on* Chinese readings, derived from one of four periods of historical borrowing from China, can compete with *kun* Japanese readings of the same kanji.

This paper first explores psycholinguistic dimensions of hanji processing and word recognition in Chinese. In passing, we survey relevant psycholinguistic literature on Chinese hanji processing, and attempt to chart issues related to phonological activation in research on Chinese lexical access, word recognition, and the architecture of the Chinese mental lexicon. We then explore similar psycholinguistic issues for kanji processing in Japanese, attempting to contrast relevant findings in this structurally unrelated language which also employs some of the same principles in its orthographic system. Finally, we attempt to provide a synthesis of the research findings and posit a word recognition model which accounts for how both Japanese and Chinese employ phonological activation in lexical access procedures.

2. Lexical Access in Chinese

2.1. Introduction

As is well-known, Chinese employs both the *pictograph* and the *phonograph* types of hanji. Pictographs comprise a small percentage of Chinese logographs, but the majority of Chinese logographs are phonographs (Wang, 1981). It is this type of logograph that draws our attention in matters of lexical access and word recognition, because phonographs exhibit two possible constituent parts: a radical or *signific*, which refers to meaning, and a *phonetic*, which refers to pronunciation (see Chen and Yuen, 1991). The figures vary, and some put the number of Chinese characters that use phonetic compounds as high as 90% (see Tan, Hoosain, and Peng, 1995). Even so, the pronunciation of many of these phonetic compounds are not identical to their phonetic radicals.

A central issue in Chinese hanji processing is related to this dichotomy, and reflects research into whether the phonological properties of a given hanji character must be invoked before its meaning can be accessed. One possibility that has been suggested is that hanji processing does not require an orthography-specific processing mechanism. This is the same as saying that, logographic script type notwithstanding, the processing mechanism that Chinese employs is the same as the processing mechanism employed by other languages. In other words, languages like English that use alphabetic scripts, as well as languages like Chinese that use logographic scripts, ultimately use the same cognitive mechanisms to deal with those scripts. Another possibility is that hanji processing is instead unique. This has, of course, been the commonly held belief in the general literature, namely, that the processing

mechanism which Chinese uses in dealing with logographic script is inherently different from the processing mechanisms used for dealing with alphabetic scripts. This view maintains that hanji achieve access to meaning without the mediating step of decoding phonological properties. There are in fact two variations on this basic theme, a weaker version and a stronger version. The strong version of this view posits a simple, single-step processing explanation, wherein phonology is secondary to meaning. The cognitive routing in this view proceeds directly from Orthography to Semantics, accessing Phonology only as required. A weaker version argues that hanji can access meaning without activating the phonological identity of the word, but that this processing step is highly grapheme-dependent and in this way differs from alphabetic processing.

2.2. Orthography-independent Hypothesis

The first explanation in respect to hanji processing, the Orthography-independent Processing Hypothesis, holds that the meaning for hanji cannot be accessed without first accessing the phonological identity of that hanji. Thus, the cognitive route goes from Orthography through Phonology and then on to Semantics. This is, of course, exactly the same route as the sound-mediated path that reading in alphabetic and syllabic scripts entails. In theory, then, the properties of all scripts are such that the processing demands they make on the cognitive architecture in the symbolic decoding of language-based written materials are essentially the same.

An early pair of experiments by Tzeng, Hung, and Wang (1977) on short-term retention first suggested phonological activation. Their first experiment visually presented target lists of four Chinese characters which differed in syllable structure from each other. This was followed by an oral interference task which contained items that were either phonemically similar or dissimilar to the target list of characters. Immediately after visual presentation of the target list, subjects had to say aloud the interference words which they had just heard. They were next asked to write down the target characters which they had first seen, and in the order that they had appeared. If speech recoding takes place, one would expect that phonological similarity between the target and the interference characters would disrupt the memory for the items that subjects had to recall. The results demonstrated that phonological similarity did have a significant effect; in particular, it was vowel similarity in the pronunciation of the characters that elicited interference on recall abilities.

The second experiment tested grammaticality judgments for sentences, manipulating normal vs. anomalous sentences that contained phonologically similar words vs. phonologically dissimilar words. As in the first experiment, phonological similarity again interfered with subjects' performance, affecting not only their short-term memory for unrelated characters, but even the reading of the normal meaningful sentences. Both experiments were taken as early evidence suggesting that phonological factors have a very real cognitive presence in processing.

Similarly, Tzeng and Hung (1980) found subjects to be more accurate in detecting logographs that contained a target radical with a phonetic value in the pronunciation of the hanji in which it appeared. To put the example into English terms, this would be like reporting where the letter *e* appears; is it easier to notice in words like *red* or in words like *date*. In the word *red*, the letter *e* is directly linked to the pronunciation of *red* and is therefore more readily noticed than the *e* in the word *date*. The 'silent *e*' in *date* is not linked to its pronunciation and might not be reported as having been seen as often. In both experimental reports for Chinese (Tzeng, Hung, and Wang, 1977, and Tzeng and Hung, 1980), the authors concluded that phonetic recoding does take place, but left open to further research the important question of where that speech recoding takes place. Does it take place at the pre-lexical stage before word recognition has been achieved? Or at the post-lexical stage once word recognition has been achieved?

Several recent studies offer direct support for automatic phonological activation in Chinese. Lam, Perfetti, and Bell (1991) took as their working hypothesis the automatic availability of the phonetic code of the first language or first dialect to proficient readers of that dialect or language. They compared subjects who were bidialectal in Cantonese and Mandarin with subjects who were unidialectal in Mandarin. One can expect that, because some hanji have different pronunciations in Cantonese and Mandarin, there will be interference for native Cantonese readers. They suggest that it is the phonetic representation in the first language, Cantonese, that will be indelibly stored in

memory; this will be the one automatically retrieved from memory in reading individual characters. Thus, the inference is that when making judgments about whether pairs of words are pronounced the same or differently in Mandarin, the Cantonese phonetic representations will be automatically recalled, causing the interference. When subjects were given pairs of characters and had to determine whether they had the same pronunciation in a given dialect, Mandarin or Cantonese, this task revealed that judgments were both faster and more accurate in the first dialect. This suggests that phonetic values in the first dialect were automatically recalled and that automatic acoustic activation necessarily takes place.

Perfetti and Zhang (1995) also report supportive results for the notion of phonological activation in two experiments which manipulated synonym judgments. But, in keeping with their *at-lexical* view of the identification event in word recognition, they tested both factors of phonological interference and semantic interference. Giving precedence to neither, they probed whether Chinese readers can suppress phonological activation when a semantic judgment is required, and then probed whether semantic activation can be suppressed when phonological judgments are required. In the first experiment, subjects were asked to judge whether a given pair of hanji was synonymous or homophonic. When the characters were homophones, negative judgments resulted in longer reaction times than when the characters were not. The second experiment used a similar experimental design with synonym judgments to check the time course of such interference, and found that phonological interference took place within 90 msec. of stimulus onset. Semantic interference, on the other hand, was initiated much later, at the 140 msec. boundary. Thus, in a task in which phonological activation has no obvious value, the name (or pronunciation) of the character is activated within 90 msec. of processing. This, of course, does not rule out semantic activation, but simply shows that visual processing of a hanji for a semantic judgment task will nevertheless bring up its phonological characteristics. The one conclusion from the perspective of the issues raised in this paper must be that phonological activation is a necessary component in word recognition, and furthermore, that phonological processing may be activated before semantic processing. It may be that phonological and semantic processing levels are automatically and simultaneously activated, but once again, the implication must be that phonological activation is an integral part of the access path to final word recognition.

2.3. Orthography-dependent Hypothesis

An opposing view to this notion of automatic phonological activation claims that hanji recognition accesses semantic properties directly. Often this is tied to other corollaries about processing Chinese characters, namely, that lexical access is more direct or quicker for hanji than for alphabetic words, that hanji are more distinctive in shape than alphabetic words, and that hanji can facilitate recall through graphic features like semantic radicals to access semantic categories. These premises cannot be taken as proven, however, as a series of ten experiments by Liu, Zhu, and Wu (1992) have shown in their examination of and explanation for the visual superiority effect in Chinese subjects' performance in the immediate free recall and serial paradigms. Rather, their results suggest a multivariate set of factors for reported findings; they demonstrate that Chinese subjects exhibit visual superiority effects for a complex of reasons, not simply because Chinese lexical access is simple, rapid, and direct (see Leong, Cheng, and Mulcahy, 1987, for another multi-variate analysis, as well as Tan, Hoosain, and Peng, 1995).

Semantic categorization tasks have been used to test the possibility of a direct cognitive route from Orthography to Semantics. But these experiments for Chinese report results that are different from the results reported for English. Let us review the results for English first. Van Orden (1987) and Van Orden, Johnston, and Hale (1988) gave English-speaking subjects a category name like *flower*, and then had them decide whether a later target word was a member of that category. But they manipulated target words to include targets like *rows*, which is a homophone with a word like *rose*. *Rose* is obviously a real member of that category. Both experiments found that subjects made more categorization errors with, and spent more time on, the homophone foils than they did on the spelling controls. What this means is that when the category was *flower* and the target word was *rows*, homophone foils like *rose* gave more problems than spelling controls like *snobs*. In fact, such homophonic identity gave rise to problems, even when their spellings were very different. Van Orden, Johnston, and Hale (1988) introduced as targets non-words that were homophones, as for example, *brane*, to be matched with the category entitled *a part of the human body*. The reasoning

is that since non-words such as *brane* are obviously not entries in the mental lexicon, there must be a mandatory phonological activation of such words if categorization errors occur. And indeed, this is just what happens with *brane*, a homophone with *brain*; but it does not happen with *blane*, a non-word spelling control. What we are led to believe from such results is that there is automatic activation of phonological information in lexical access for English words.

But this does not seem to be the case in Chinese. When the experimental paradigm was applied to Chinese word recognition, the situation seems to be quite different. Chen, Flores d'Arcais, and Cheung (1995) applied semantic categorization tasks to their investigation of hanji processing, and report results which differ from the English results. In one experiment, Chinese subjects silently read a category name and then looked at a fixation point. A target character was then presented, and the subjects had to judge whether the target was a member of the category that had just been presented by pressing a response key labelled 'yes' or 'no'. Subjects were relatively accurate at making judgments about semantic categorization, producing the same proportion of false positive categorization errors and showing the same decision latencies on homophone foils as on the non-homophone controls. The confounding factor of phonological information did not seem to affect the semantic task in this instance, and the authors concluded that phonological information associated with a character does not become active in processing the character for semantic decisions.

A second experiment added orthographic similarity as an extra condition to check whether there were possible interference effects arising from orthographic similarity. Such interference would reveal whether the orthographic code is active during the process of coming to a semantic decision. This time subjects made more errors and produced longer response times on graphemically similar foils than they did on the corresponding controls. Such clear effects from visual similarity in the Chinese characters on the semantic categorization task stand in sharp contrast to the absence of phonological effects, and suggest that phonological information is not automatically activated during semantic processing for Chinese characters. The authors did not rule out the possibility of optional phonological activation, but observe that their results cannot support the notion of automatic phonological activation.

Even here, variations on the experimental task defined above might produce conflicting results, as suggested by Chua's results (1995). Adapting the same general semantic task (see Van Orden, 1987, and Van Orden, Johnston, and Hale, 1988) in three experiments, Chua had subjects decide if a target logograph fit a previously presented definition. The results show phonological recoding as obligatory, and not optional; in addition, this recoding was not easily inhibited, and took place before semantic access was completed, thus making it a candidate for pre-lexical automatic activation. As with the van Orden studies in English, Chua's subjects' performance suffered when homophones were introduced; in this condition subjects were less accurate and took longer to make their decisions.

3. Lexical Access in Japanese

The issues in lexical access for Japanese words are complicated by the fact that Japanese does not have a single script type. Instead it has three script types, two of them syllabaries and one of them based on Chinese characters borrowed and adapted over the centuries. Even though Chinese characters are employed in Japanese, these kanji are in many ways quite different from Chinese characters. The early literature entertained the notion that the two types of writing system, kana syllabary vs. kanji logographs, would employ different mechanisms and perhaps even different sides of the brain. The expectation was that kana syllabaries would be processed through phonological decoding, whereas kanji would allow direct access to meaning. In this respect, the two writing system types, one based on a phonological principle and the other based on the same morphological principle as Chinese hanji, would ostensibly rely on different processing principles. The expectation was that the morphologically-based kanji would allow direct whole-word access to meaning direct from the orthography, while the phonologically-based kana would have to go through the step of phonological decoding to get at meaning. This expectation was further enhanced by the fact of extreme regularity in the relationship of the hiragana and katakana syllabaries to their respective syllables. The facts are, as we shall see, otherwise, and in some ways reminiscent of the Chinese findings while in other ways quite different.

The findings are colored by the relationship of kanji to their various readings or pronunciations. Among other things, a kanji character may have a Chinese reading, called the *on*-reading, or a native Japanese reading, called the *kun*-reading. In fact, it can have more than one of either of these readings, *on* or *kun*, and these readings (or pronunciations) are very much tied to context. Moreover, although the characters imported from China often retain their phonetic radicals, these are nowhere as reliable or useful as they are in Chinese. In fact, the percentage of phonetic radicals with reliably correct readings for a given kanji are very limited in Japanese. This basic difference in and of itself makes the discussion of phonological activation different for character recognition in Japanese discussions of lexical access. Nevertheless, the basic findings regarding automatic phonological activation for kanji characters are congruent with the Chinese, as we shall see below.

4. The Issue of Phonological Activation in Japanese

In line with the expectation that kanji meanings could be directly accessed without being mediated by the phonological code, some early experiments demonstrated that the meaning of words presented in kanji could be retrieved directly. This was shown in both the experimental literature (see, for example, Hatano, Kuhara and Akiyama, 1981, and Saito, 1981), and to some degree, in the clinical literature on aphasia (see Yamadori, 1986). Nevertheless, three recent experiments by the same authors (see Kuhara-Kojima, Hatano, Saito & Haebara, 1996) qualify this position somewhat. This qualification rests on the finding that vocalization latencies for fifth graders repeatedly show that vocalization latencies for less skilled readers were longer than skilled readers for both hiragana and kanji words. Vocalization latencies are operationally defined as the elapsed time from the presentation of a word to the subject's initial vocalization, and the task explicitly targets such vocalized responses. On the one hand, this finding corroborates the findings in English that show vocalization latencies to single printed words to be a reliable measure of automaticity in word recognition. Apparently, the same reliability as a metric applies in non-alphabetic writing systems used in languages like Japanese. But for our purposes here, it implies that some speech processing accompanies lexical access in Japanese even for kanji-transcribed words, for the same effect applies across both orthographic types.

The semantic categorization paradigm with homophones we discussed earlier for both English and Chinese has been replicated with similar results for Japanese kanji processing. Like those findings, three experiments reported by Wydell, Patterson, and Humphreys (1993) also found a significant homophone effect. In Japanese, as well as in English and Chinese, homophonic words elicited longer reaction times and more errors than their controls. But Wydell, Patterson, and Humphreys, like Chen, Flores d'Arcais, and Cheung (1995), also found a significant effect which arose from orthographic similarity. That is, incorrect target words that were visually similar to correct exemplars which did fit into the semantic category were also responsible for longer reaction times and higher error rates, although not to the same extent as the results obtained from phonological overlap in homophones. The effects were strongest when both factors intersected, that is, when homophonic targets were also visually similar in orthographic shape to correct exemplars of the semantic category specified. As a result, Wydell, Patterson, and Humphreys (1993) suggest that, in Japanese, lexical access for kanji invokes both orthographic and phonological representations for the appropriate information. In this respect, kanji processing may exhibit some important differences from alphabetic differences in English, and may be somewhat more like hanji processing in Chinese.

But more important than this finding, from the overall perspective of word recognition models, is the finding that the readings for Japanese kanji are likely computed at the word level, not the individual character level. This conclusion comes from two separate paradigms; one is the work on consistency effects arising from word and character segments, and the other is from an application of the priming paradigm to compound words in Japanese.

Research on potential consistency effects confirm that the normal effects of word frequency, character frequency, and familiarity on word naming tasks hold true. But the phonological rendering of the kanji is highly dependent on the intra-word context, and is finalized at the word level, not at the character level. A series of six experiments by Wydell, Butterworth, and Patterson (1995) note that Japanese is different from both English and Chinese in this respect. This result is tied to the fact alluded to earlier, that Japanese can have two types of reading for its kanji, *on* or *kun* readings. And furthermore, recall that these readings can vary for individual kanji according

to the level of intra-word context, and not the individual pieces of the character in respect to phonetic or semantic radicals.

There are some interesting findings for single kanji characters which include more than a single component. Such complex single kanji may include a segment that signals some aspect of meaning or pronunciation, or both. At the left-hand side of the complex character, for example, there may be an additional component that suggests meaning, the radical *hen*. At the right-hand side of the complex character, there may be an additional component which suggests pronunciation, the radical *tsukuri*. Although the positions of these radicals can vary, they generally appear at the left and right sides, respectively, and thus Flores d'Arcais, Saito, and Kawakami (1995) employed them to investigate phonological and semantic activation in a pair of experiments. The semantic radical only gives a vague idea of the general semantic field through which a set of kanji characters might be 'semantically' related. The phonetic radical is not a very reliable indicator of pronunciation for most words in Japanese lexicon. Nevertheless, these shortcomings notwithstanding, a pair of experiments manipulated characters that did encode phonological and semantic information separately in their two radicals. The method was to present such semantic and phonetic radicals with an onset asynchrony, so that either the phonetic or the semantic radical was presented before the whole character. Assuming that both components are activated in the lexical search, this would give a momentary advantage to either the phonological or the semantic information, depending on which radical was presented ahead of the entire character. The results confirm our previous summarization of findings in Chinese and Japanese that both phonological and semantic information are activated, since subjects in these two experiments made use of the information as soon as it was supplied. Phonological information seems to become available more effectively in this naming task, adding another processing task to the list of those in which the automatic retrieval of phonological information is activated.

In closing this section on phonological activation in Japanese, we should note that it has not been as central an issue in Japanese psycholinguistic research as it has been in Chinese psycholinguistic research (see Kess and Miyamoto, 1994, for a complete inventory, as well as Kess and Miyamoto, 1996). There are several reasons for this. One is that Japanese has concentrated more on the possible processing differences between its two orthographic types, syllabary vs. kanji. Secondly, Japanese research has also expended some effort in finding possible processing differences between its two syllabary types, hiragana vs. katakana. In essence, because Japanese has a phonologically-based orthographic type in common use, namely, the syllabaries, the issue of phonological activation has not received the same attention for Japanese that it has for Chinese which has no phonologically-based script at all. Nevertheless, what research has been recorded seems to be congruent with the research reported for Chinese.

5. Conclusions on Chinese Lexical Access and Word Recognition

The picture for Chinese hanji processing is not a simple one; certainly the picture is not so clear as to allow us to choose between one simple, thorough-going explanation which places logographic scripts on one side and alphabetic scripts on the other. There is certainly not enough evidence to support either the Orthography-independent Hypothesis or the Orthography-dependent Hypothesis to the complete exclusion of the other. A better way of looking at this problem might be to suggest that hanji processing can employ either of two processing routes in accessing the specific properties of a lexical item presented in hanji script. In fact, this notion of a double-route is not limited to logographic systems using hanji or kanji, but it can apply to access strategies in alphabetic or syllabic systems which are phonologically based.

Nevertheless, we would hesitate to posit that hanji processing is the same as alphabetic processing, particularly in the earliest stage of processing. It seems reasonable to assume that pattern recognition processes are likely to be different for stimuli of the logographic type and stimuli of the alphabetic type, with logographic stimuli having a greater dependence on visual pattern-matching stimuli. There is a vast array of experimental literature using a variety of experimental tasks which suggests a contributory role of graphemic information (see Miyamoto and Kess, 1995; Kess and Miyamoto, 1996).

But, by the same token, we cannot support the equally simplistic view that hanji processing has a single route, which goes from Orthography to Semantics and ignores the contribution of Phonological information. Indeed, we get some glimmer of the likelihood that not all hanji processing is the same either, especially when we review the results of short-term memory for Chinese characters. Immediate free-recall tasks for characters that differ in frequency and complexity show different characteristics when subjects are probed in short-term recall. Radicals or characters with pronunciations that are well-known are apparently maintained in verbal form in short-term memory, whereas characters that are infrequent, with pronunciations that are not well-known, are apparently maintained in their visual shape in the short-term memory of Chinese subjects (see Hue and Erickson, 1988). Not only that, but the short-term memory for the high-frequency characters is more susceptible to interference from verbal than visual tasks; just the opposite is true for the low-frequency characters.

The most plausible cognitive model may mix the basic tenets of the Orthography-independent and the Orthography-dependent Processing Hypotheses. That is, depending upon the contextual setting for a given hanji, and its specific features of familiarity, frequency, and complexity, one of two processing routes may be taken. Both processing routes ultimately access semantic information, but one route is a sound-mediated route and the other route is a grapheme-mediated route. For many processing tasks that involve natural language, hanji symbols are like alphabet symbols in that they must invoke phonological properties as the decoder searches through the mental lexicon. Tasks that are not simple pattern-matching maneuvers take the decoder from Grapheme through Phonology to Semantics. We suggest that phonological properties are automatically accessed in most analytical tasks that are not pattern-matching or category-matching in nature.

We also posit a cognitive routing that can travel a grapheme-mediated route. This is the only way that we can account for how some tasks access information about, as well as make decisions on, hanji logographs that do not require phonological mediation. Moreover, Chinese hanji will employ a direct route especially in cases where hanji exhibit high frequency and high familiarity. There are, of course, examples in alphabetic systems like English where the cognitive route traveled is a direct route. For example, the English lack of a perfectly transparent sound-letter correspondence is overlooked in cases of morphophonemic identity such as the plural <-s>, the past tense <-ed>, the alternation /haws > hawz-/ in *houses*, and so forth. This is certainly the case in repeated instances of highly idiosyncratic spellings; these quickly become immune to phonological analysis and their spellings are soon ignored. Words like *Ubysey* in British Columbia, *Liliuokalani* in Hawaii, *Thames*, *Gloucester*, and the *admirable Crichton* in Great Britain, and well as common words like *thyme*, are forms of this type. There is experimental support for this. In two experiments using a vocalization task, Seidenberg (1985) has shown that very frequent words in English are recognized visually, without phonological decoding, just as they are in Chinese. Infrequent or newly-coined words were accessed by referring them to the process of phonological decoding, whereas high frequency words and characters were recognized visually without phonological mediation. For the Chinese subjects, phonetic compounds were read more quickly than non-phonetic compounds when the characters were of a low frequency.

Thus, it may not be an all-or-none hypothesis we should entertain. A number of critical factors enter into the question of what will be the most efficient strategy for achieving the task at hand, given the type of stimulus. In Seidenberg's experimental results, the interactive relationship of hanji compounds with low frequency may have exploited phonetic activation as the most effective processing strategy. This is just what Leong, Cheng, and Mulcahy (1987) conclude after analyses of variance underscored the individual contributions of reader ability, frequency of hanji, and complexity of the hanji to vocalization latencies in reading Chinese lexical items.

If our speculation is valid, then, we surmise that the claims for the absolute uniqueness of logographic hanji/kanji systems are considerably weakened. The grapheme-mediated primary route would be unique to neither Chinese nor Japanese, but is a matter of degree, and tied to how often this route is activated as the primary route. This position is congruent with the general theoretical position that has been applied to questions of basic research in both word recognition and reading.

However, the dual route notion, with its suggestion of two possible routes to lexical representation, one a phonological route and the other a direct route, has its shortcomings. Although this position has informed much current research (see Foss, 1988) in alphabetic languages, even there the question of where phonological information is activated is a moot point. The dichotomy of pre-lexical vs. post-lexical is unresolved with respect to whether the phonological representation is addressed following lexical access or before. Maybe it is *at-lexical* (see Perfetti and Zhang, 1995), and as such, is part of the identification event itself. In this view, identifying a word in the culmination of the lexical access approach to it, should include taking account of its phonological name, not just abstracting its semantic values or its general location in the mental dictionary. The address must have a specific name!

There are also arguments that the phonological activation is post-lexical. For example, even in alphabetic languages like English, the assemblage of letter or cluster combinations to phonological representations is not a particularly efficient strategy. After all, just because there are grapheme-to-phoneme conversion rules in alphabetic languages does not mean that these are the processing algorithms that are employed in lexical access to the exclusion of other processing strategies. In turn, Chinese cannot be said to be uniquely opaque in its relationship of orthography to phonology. The number of Chinese logographs that have some phonetic hint carried inside their orthographic shape is far from minimal. Though the figures vary, many characters exhibit a *phonetic* radical with hints as to part or all of the pronunciation. Indeed, a better test case for claims of such exclusivity might have been Egyptian or Mayan hieroglyphs, or even Arabic numerals.

In conclusion, we must recognize that the current philosophy of science inexorably draws our attention to the question of universal constraints on how the mental lexicon is searched. We have noted that there are cognitive mechanisms which respond to considerations of correspondence regularity, frequency, familiarity; and in this light, the analytical task type may drive the choice of the most efficient route for turning lexical access into word recognition. Thus, the two types of orthography, alphabetic and logographic, certainly differ in their representational basis, in being either phonologically based or morphologically based. The two types of orthography, alphabetic and logographic, may not be inherently different in their processing nature, in that graphemic properties and phonological properties will be both processed, but to varying degrees in different tasks. Accessing phonological information may be an optional processing feature, not an obligatory one. It is a crucial processing step, and depending on the task, it may be required in neither Chinese nor English. Then again, depending upon the task, it may be required in both English and Chinese. As we, the decoders, search the mental lexicon for the correct interpretation of a lexical item appearing in its written shape, we will use the phoneme-mediated and the grapheme-mediated routes to varying degrees in English or Chinese. The degree to which we employ these routes may differ across languages, but the fact of their availability will not vary across these languages.

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INTERACTIONAL/ABILITY AUTHENTICITY AND THE DEVELOPMENT OF A CRITERION-REFERENCED PERFORMANCE TEST FOR EVALUATING THE ORAL PROFICIENCY OF TEACHING ASSISTANTS

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1. Introduction

In the field of language testing, the assessment of oral production ability has always been one of the most important aspects. However, many well-established tests either do not have an oral component or if they do, not enough weight is allocated to the oral aspect compared with other components tested in the written mode. This is mainly because--disregarding the elementary level of mimicry and repetition--it is extremely difficult to construct practical, reliable, and valid communicative tests of speaking.

One problem is that questions related to the criteria for measuring the speaking skills and to the weight given to such components as correct pronunciation and sound recognition are still unanswered. It is possible for people to produce practically all the correct sounds but still be unable to communicate their intended meaning effectively. On the other hand, people can clearly express themselves while having numerous errors in both phonology and syntax. Furthermore, as Heaton (1990) states, success in communication depends as much on the listener as on the speaker, a particular listener may have a better ability to decode the foreign speaker's message or may share common ideas with him/her thus making communication simpler.

Many tests of oral production are also fraught with the problem of interrelationship between speaking and listening skills. In normal speech situations, it is impossible to hold a meaningful conversation without understanding what is being said and without making oneself understood at the same time. This interdependency increases the difficulty to analyze precisely what is being tested at any one time. Moreover, due to the transient nature of spoken language, the examiner in an oral test will be under great pressure of making subjective judgments as quickly as possible. Even if samples of speech are recorded during a test, the tape recording itself, apart from the unrealistic situation that it would create for the elicitation of speech, cannot recapture the full context of the actual situation essential to any assessment of the communication that takes place.

Still another difficulty in testing speaking is that of administration. It is almost impossible to test and score large numbers of students during a limited time.

However, particular merits or limitations of different testing instruments cannot be fully appreciated apart from the uses to which they are put. One or the other of the above restrictions can be relaxed depending on the objectives of a particular test, its theoretical basis, the population being tested, and the type of the test (e.g. whether it is an achievement or a placement test). As such no one can pass judgments on a test without having particular group(s) of examinees with definite objectives in mind. A test which is considered as practical for testing a specific population with respect to a particular objective may prove impracticable for testing another group of students with different objectives.

This paper addresses the problem of appropriately assessing the oral proficiency of non-native graduate students working as teaching assistants (TAs) in English-speaking environments. Working from the theoretical standard of "authenticity" for language testing (Bachman, 1990) and the studies so far conducted with the purpose of identifying the features of language use by TAs in instructional contexts, this paper attempts to first formulate the objectives that an appropriate test of oral proficiency of TAs should pursue and second, explore the ways such objectives can be best translated into task types used for testing the oral ability of TAs. Oral tests constructed in this way, I believe,

can have an excellent washback effect on the teaching that takes place in TA programs prior to the test.

2. The Problem

In recent years, several studies have been performed to identify both the nature of the problem facing TAs and the features of language use they need in instructional contexts. Rounds (1987), for example, analyzed the discourse of effective and non-effective TAs teaching mathematics. She found evidence that when elaborating on mathematics in the classroom, the language of effective TAs included such features as: (a) overtly marking the junctures of problems; (b) explicitly organizing and chunking the material and making transitions between topics; (c) using cohesive devices to relate problems and topics discussed in different sessions. Similar results were obtained by Byrd & Constantinides (1992) who observed native-speaker faculty members--teaching mathematics--who used contextualizing strategies for making connections between classes, between courses, between the discussion and the textbook, between the world of mathematics and the outside world, and so forth. They cite evidence that less successful TAs gave minimal narration of the problems or did not talk at all while solving a problem on the board.

In laboratory contexts, Myers and Douglas (1991) note that the less shared context between students and their TA (compared with that of a teacher-fronted classroom) can be the result of the students' use of non-technical vocabulary and their informal register whose interpretation and comprehension is problematic for the non-native TA. Along with the same lines, in an investigation of TA questions in the chemistry lab, Tanner (1991) reports that the lack of teacher evaluative comments in the lab meant that the language in the lab was more like everyday conversation and concluded that the primary role of the TA within the lab was not to evaluate the students' performance but, consisted of assisting them and giving help.

Office hours constitutes another context within which TAs have to function. In a study of the language used by both professors and TAs with their students in office hours, McChesney (1990) found that the functions of talk included expressing interest and encouragement, recalling what the professor said in class, providing information and advice about tests, and influencing decision making. Questions were used for information, clarification, comprehension, and confirmation. McChesney found that in contrast to professors and TAs, students used indirect forms in asking questions that might not be recognized as questions by non-native TAs.

On the whole, this brief survey of studies dealing with the problem of TAs reveals the type of instructional tasks they need to perform in different academic settings. They refer to three major instructional settings as contexts for language use by TAs: (i) classrooms (one-to-large group interaction), (ii) laboratories (one-to-small group interaction), (iii) office hours (one-to-one or small group interaction).

The nature of all the above contexts for language use is "interactive", emphasizing the importance of teacher questions in organizing classroom talk and the importance of listening comprehension (of both formal and informal registers).

Moreover, the language used for teaching in such interactive contexts is complex in nature, that is, TAs should have the ability to process several language tasks simultaneously (e.g., chunk information, organize it, provide transitional cues, and use appropriate means for best transferring it to the students). As Hoekje and Linnell (1994) state, such complexity can be best captured by communicative models of language such as Canale & Swain (1980) or Bachman (1990).

The above considerations imply that tests designed for assessing non-native TAs' oral proficiency should involve them in the appropriate expression and interpretation of utterances in an interactive setting. The question that arises at this point is whether any one of the present standardized instruments--such as Test of Spoken English (TSE), Spoken Proficiency English Assessment Kit (SPEAK), Oral Proficiency Interview (OPI)--which have so far been used in several institutions for assessing the oral proficiency of TAs, really elicit the performance that can be indicative of the TA's ability to employ the interactive complex form of language required by instructional settings.

The next section will focus on this point.

3. Standardized Tests Of Spoken Language

Since its introduction (more than a decade ago), the TSE has proved to be the most commonly used measure of spoken ability. This exam is a tape recorded test in which the examinee's responses are also tape recorded. In an attempt to determine the TSE's validity for testing the language communication skills of non-native TAs, Clark and Swinton (1980) conducted a study using sixty foreign TAs at several large universities in the United States. The study reported a fairly strong correlation not only between TSE and OPI scores (which at the time was assumed to be a valid criterion measure) of the same subjects, but also between the instructors' TSE comprehensibility score and the students' evaluations of the instructors' "ability to handle common situations involving language skills".

Above results, however, contradict Educational Testing Service's (ETS) recommendation that TSE scores should not be considered as the only measures for evaluating TAs and that other available relevant information should also be taken into consideration in addition to TSE scores (ETS, 1990). Moreover, OPI, which consists of a live conversation between the examinee and the interviewer (as opposed to a tape recorder) has recently been strongly criticized by several researchers. For example, Valdman (1988) states:

The total control the OPI interviewers possess is reflected by the parlance of the test methodology . . . In short, the OPI can only inform us of how learners can deal with an artificial imposition rather than enabling us to predict how they would be likely to change authentic linguistic interactions with target language native speakers. (p.125)

Bachman (1988) also questions the validity of OPI on the grounds that it does not distinguish between ability and performance and that its 0-5 rating scale is not theoretically grounded. Furthermore, Hoekje and Linnell (1994) point out that OPI's time-consuming (about 15-25 minutes for each examinee) nature is its greatest limitation.

As for the SPEAK test, it has also been criticized since the type of topics it covers do not adequately assess TA's proficiency as communicators of scientific or technical information (Ponder, 1991). Another area of concern has been the audio-taped format of the test as a means of eliciting language. Students have to talk to a tape recorder about pictures and topics which seem unnatural to them (Gokcora, 1992; Johnson, 1991).

In short, due to the different limitations imposed by these standardized tests, none of the tests can lead to the observation of the examinee's performance in contexts similar to those mentioned at the end of section two. That is why many TA programs nowadays use standardized tests (such as SPEAK) just for initial screening and placement but not for final evaluation. Here is where the test purpose and the actual context of use lead to the requirement of "authenticity" for language tests. Section four elaborates on the concept of "authenticity" as formulated by Bachman(1990).

4. Authenticity: Some Theoretical Considerations

Authenticity has been the topic of major discussions in language testing in the past decade (Language Testing 1985, 2/1) and still continues to be a widely discussed issue in this field. As Bachman (1990) suggests, there are two major approaches to authenticity. The "real life" approach requires tests to mirror the reality of non-test language performance. It is mainly concerned with the appearance of a test and the way it affects the test performance (face validity); and the extent to which test performance predicts future non-test performance (predictive validity).

The "real life" approach--which underlies the Interagency Language Roundtable (ILR) oral interview (OPI),--one of the most widely used approaches to testing speaking--has been criticized on the grounds that the replication of

non-test performance in language tests is not possible and no test situation can exactly resemble its real life counterpart (Spolsky, 1985). For example, there are major differences between a situation in which a lecturer presents information to undergraduates in a regular session during a course and when he presents information to a panel for certification purposes (Hoekje and Linnell, 1994).

The second approach to defining authenticity, called the "interactional/ability" approach, focuses on the distinguishing characteristics of communicative language use; the interaction between the language user, the context, and the discourse. Tests based on this view involve the test taker in the appropriate expression and interpretation of illocutionary acts, and his performance in the test is interpreted as an indication of the extent to which he possesses various communicative language abilities. As opposed to the real life approach which does not distinguish between the behavioral manifestation of an ability and the trait itself, here there is a clear distinction between the abilities to be measured, on the one hand, and the performance we observe and the context in which observations take place, on the other. In the interactive/ability (IA) approach, the role of context and the manner (i.e. test method facets) through which we elicit a sample of performance are, therefore, recognized. This would result in a shift of emphasis from "attempting to sample actual instances of non-test language use to that of determining what combination of test method facets is more likely to promote an appropriate interaction of a particular group of test takers with the testing context" (Bachman 1990, p.317). According to this view, authentic or communicative tests or test tasks should reflect our knowledge of language abilities and language use.

On the whole, Bachman's model of language testing consists of two interrelated theoretical frameworks that affect performance on language tests: "communicative language ability" and "test method facets". In his formulation, communicative language ability consists of language competence, strategic competence, and psychophysiological mechanisms. Test method facets, on the other hand, refers to five main features of a test: (1) the testing environment (e.g., familiarity of place and equipment), (2) the test rubric (e.g., organization, time allocation), (3) the nature of input the test taker receives (format and the nature of the language), (4) the nature of the expected response to that input (format, the nature of language, and restrictions on response), (5) the relationship between input and response (e.g., reciprocal or non-reciprocal).

5. Ia Authentic Tests And Tas Evaluation

Within the "communicative language ability" component of Bachman's framework for language testing, differences in language ability can be attributed to differences in language knowledge and/or in the adoption of communication strategies. Such a notion can also account for the communicative competence necessary for efficient teaching assistants. Their ability to handle complex functions of language in such interactive contexts as instructional settings can thus be tested by making use of a criterion-referenced performance test the activities of which best involve TAs in communicative language use. Specifications for the development of such a test can be characterized on the basis of Bachman's theoretical framework in the following way.

First, with respect to the "communicative language ability", the test should be designed so that it captures:

1. Language competence: the oral test should tap TA's knowledge of vocabulary, grammar and morphology to the extent that these elements interfere with the communication of information. Moreover, TA's performance in the test should involve the employment of elements of conversational language--such as the use of a variety of cohesive devices for organizing the oral discourse--as well as the employment of conversational conventions such as attention getting, topic development, communication maintenance (Hatch, 1978). Besides the above elements of organizational competence, the examinee's pragmatic competence including knowledge of language functions and sociolinguistic rules of appropriateness should be also considered as an important element to be measured by the test.
2. Strategic competence: the degree to which the test taker adopts communication strategies to overcome his/her linguistic gaps in interactional situations is the most important point that the

test should measure in the performance of TAs. Successful communicators try to achieve their communicative goal by resorting to different types of communication strategies (such as paraphrase, circumlocution, repetition, overgeneralization, . . . etc) rather than avoiding communication altogether when there is a gap in their linguistic knowledge.

3. Psychophysiological mechanisms: the implication of this factor for a TA oral assessment test is that the test should involve the test taker not only in productive but also receptive language use. For instance, the TA should use his/her auditory skill to gain access to the information on the tester's questions/instructions, and his/her articulatory skill to pronounce the word correctly.

The second dimension of the model, "test method facets", affects the examinee's performance on language tests and can be adopted for our purpose as follows:

1. Testing environment: Tests should be conducted in a familiar place with familiar equipment (the ones usually used by TAs in their teaching activities such as blackboard, opaque projector, etc). Because of the interactive nature of the test, no tape recorder is used, rather test takers should address live audience.
2. Test rubric: Test takers are instructed to use English during the testing session, no native words are permitted. It is very important that the test taker understands the task that is required of him/her (through aural channel). Timing is relatively fixed regardless of whether the teaching task performed by the test taker is finished or not. Within the specified guidelines, it is the test taker who determines the content area and its organization of parts.
3. Input: The input given to the test taker is in the form of "live" language from several different audience members by making use of the target language (English in this case) through aural channel.
4. Response: The type of the response should be "constructed", i.e., consists of the language sample in response to the input material. Regarding the nature of the language of response, the test should involve the TA in using highly specialized vocabulary associated with technical registers as well as references to figures of speech which often characterize effective language use. As for the topic of the talk, the interactive relationship between input and the response requires that the topic of the discourse be determined jointly by the tester and the test taker so that a topic which is best suited to the candidate's interests and knowledge is chosen. Examinee's talk around this topic takes place in a limited time during which his/her employment of different language functions as well as the listening comprehension are explicitly evaluated.
5. The relationship between input and response: This relationship is reciprocal necessitating the presence of feedback on the part of the examiners. Thus both the test taker and the audience have control over the conversation and turn-taking.

6. Final Remarks

The above detailed specifications reflect how the model proposed by Bachman can be adapted to a criterion-referenced performance test with the specific purpose of assessing the oral proficiency of teaching assistants.

An important consequence of devising a test on the basis of the above procedure, I believe, is the positive washback effect that it can have on instruction by reflecting the skills and abilities that should be focused upon in

any TA preparation course. It is then quite clear that the contents of a language course for TAs with a focus on developing the oral ability should be different from a course in conversation with an oral interview as its final test. The elements of communicative performance that exist in a performance test devised on the basis of the above specifications provide feedback for teaching and learning by bringing particular needs of teaching assistants to the attention of those responsible for material development and course design.

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A DISCUSSION OF ROSEN'S (1989) LEXICAL ANALYSIS OF NOUN INCORPORATION

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Introduction

In her paper, "Two Types of Noun Incorporation: A Lexical Analysis," Sara Thomas Rosen presents an account of noun incorporation (hereafter NI), which is the result of word formation rules in the lexicon, rather than the result of a syntactic process. Her claim is that languages may choose one of two rules which produce noun incorporation and that each rule will have a different set of grammatical properties associated with it. One rule will produce "Classifier NI". When the object is incorporated into the verb, an argument of the verb is not satisfied, and so the verb's transitivity is unaffected. Languages of this type display "doubling" and "stranding". Northern Iroquoian, Caddo, and Rembarnga languages are among those with Classifier NI (Rosen, 1989, p. 296).

The other rule will produce "Compound NI". When the complex verb is formed, one argument of the simple verb is satisfied within the complex verb, and the verb itself becomes intransitive. Polynesian and Micronesian languages are among those with compound NI (Ibid.).

Rosen's goal is to show that a lexical theory, which distinguishes the two types of NI, will predict the grammatical properties associated with these languages, while a syntactic approach to NI will not.

Classifier Noun Incorporation

Classifier NI is so named because the incorporated noun acts like a classifier in that the object noun phrase must be, at least as specific or more so than the incorporated noun. For example, one could say 'I fish-caught a trout' but not 'I trout-caught a fish'. There are three main grammatical properties associated with this type of NI. They are:

1. Stranding of modifiers.
2. Argument structure of the verb is unaffected.
3. Doubling of objects.

In addition, Rosen notes that all classifier incorporating languages allow pro-drop in all positions.

Stranding occurs when a direct object NP is partly null, and the stranded element modifies the null head of that NP. While incorporated nouns can be related to NPs with modifiers but no head noun, stranding is said to be independent of the incorporation process. Rosen attributes stranding to the existence of null-head modifiers but states that NI and null pro-forms are bound to interact, which is what the data shows (p. 298). Three examples, which show the independence of stranding and the existence of null-head modifiers, are given. Example (5) from Mohawk shows that stranded modifiers are possible with or without an incorporated noun. In addition, the adjective "dotted" shows gender agreement with the null head, with or without incorporation, and so provides further support for this position (p. 299).

(5) Mohawk

- a. *Kanekwarúnyu wa? -k-akya? tawi? tsher-ú:ni.*
 3N.dotted.DIST PAST-1sg.3N-dress-make
 'I made a polka-dotted dress.'
- b. *Kanekwarúnyu wa? katkáhtho.*
 3N.dotted.DIST PAST-1sg-3N.see
 'I saw a dotted (one).'

Examples (6) and (7) from Caddo show that demonstratives and quantifiers may be stranded with or without incorporation (Ibid.)

(6) Caddo

- a. *ná: kan-núh- ? a? .*
 that water-run.out-will
 'That water will run out.'
- b. *ná: ? iyúh ? a? .*
 that run.out.will
 'That will run out'

(7) Caddo

- a. *wayah hak-k? uht-? i? -sa ? .*
 a.lot PROG-grass-be.grow-PROG
 'There is a lot of grass.'
- b. *wayah háh-? i? -sa ? .*
 a.lot PROG-be.grow-PROG
 'There is a lot.'

Examples (8) and (9) from Tuscarora and Seneca show that modifier stranding also occurs in NPs not usually associated with NI (p. 300).

(8) Tuscarora

- a. ...*kye:ni:kv: ha? kye? ra-kwatihs Ø yah-wa-hra-kwa? n-*
 thi that that M-you Ø TRS-AOR-M-side-

a0e:- ? kye? Ø-hr-e? ra-kwatihs Ø
 encircle-PUNC that REP-M-go M-young Ø
 'This young (man) who had gone around the other side, came back again as a
 young (man).'

Languages with Classifier NI are predicted to have no change in transitivity of the verb after incorporation, because the incorporated noun does not satisfy an argument of the verb. After NI occurs, transitive verbs remain transitive and intransitive verbs remain intransitive. This is demonstrated by the transitive agreement prefixes which remain on the verbs after incorporation. In example (13) from Seneca, the agreement prefix *shako-*, which indicates agreement with a third person masculine subject and a third person feminine object, remains after incorporation (p. 301-302).

(13) Seneca

- a. *Ta:h o:neh nä:h* *kyō?ō h* *da? -a-shako-kē-?*
 and now CONTRASTIVE QUOTATIVE NEG-AOR-3M.3.F-see-PUNC

katka? hoh, ne:? kyō?ō h kē:s nekē? neh ye-ks-a a:h
 anywhere ASSN QUOTATIVE repeatedly this the F-child-small-STAT
 'And he didn't find the girl anywhere.'

Although transitivity is unaffected, incorporated nouns in Classifier NI do place a selectional restriction on the verb. The object NP must belong to the class of objects described by the incorporated noun root and must be at least as specific as the incorporated noun (p. 297).

The third grammatical property characteristic of Classifier NI is that of doubling. An incorporated noun on the verb is repeated or doubled in the DO position in order to satisfy the argument structure of the transitive verb (p. 302). While the morphological form of the doubled noun need not be the same as the incorporated noun, it is required to meet the selectional restrictions of the incorporated noun. In example (15) from Mohawk, *rabahbót* 'bullhead' is a type of *tsy* 'fish' (p. 303). Tuscarora, Caddo and Rembarnga exhibit doubling in a similar way.

(15) Mohawk

- a. *Tohka niyohserá:ke tsi nahe? sha? té:ku níku:ti rabahbót*
 several so.it.year.numbers so.it.goes eight of.them bullhead

wahu-tsy-ahni:nu ki rake? niha
 3M.3N-fish-bought this my-father
 'Several years ago, my father bought eight bullheads.'

Rosen concludes her discussion of Classifier NI with observations of Southern Tiwa and West Greenlandic Eskimo. She finds that Southern Tiwa is similar to other Classifier NI languages because NI doesn't affect the transitivity of the verb and stranding occurs. West Greenlandic also allows stranding, but the issue of transitivity is uncertain. When incorporation occurs, the verb is always intransitive and stranded elements are marked with instrumental case. One possible explanation is that only definite objects receive agreement on the verb and that all indefinite objects appear in instrumental case. Rosen surmises that definiteness, not incorporation, affects transitivity (p. 304-305).

Southern Tiwa and West Greenlandic Eskimo differ from other Classifier NI languages in that they do not allow doubling. One explanation may be that doubling is not allowed because of selectional restrictions that the incorporated noun places on the verb (p. 307). Rosen speculates that the head of the DO NP may not be permitted to duplicate information in the incorporated noun and, as a result, doubling would be forbidden. In other Classifier NI languages, the incorporated noun has few noun-like features and is more compatible with fully specified NP Direct Objects (Ibid.). By contrast in Southern Tiwa and West Greenlandic, incorporated nouns are fully specified for noun head features. Duplication of these features may not be permitted, thus attributing the lack of doubling to a process independent of NI.

Despite the lack of doubling, Rosen maintains that the lexical account of NI for these two languages is still correct. Her proof is in the existence of null-head modifiers which occur independently of NI, as shown in example (27a) from West Greenlandic in which the noun root for 'dog' is incorporated and the modifier 'big' appears with a null head, and in example (27b) in which the null-headed modifier 'big' is in object position with a null NP head and no noun root in the verb. (p. 308).

(27) West Greenlandic

- a. *Angisuumik qimmeqarpoq*
 big.NM.INST. dog.have.INDIC.3sg
 'He has a big dog.'
- b. *Angisuumik unataavoq.*
 big.NM.INST. beat.APASS.INDIC.3sg
 'He beat a big one.'

Similarly, in Southern Tiwa, numerals and demonstratives can stand alone without a head noun, even when a noun is not incorporated into the verb.

(28) Southern Tiwa

- a. *Yede a-mū-ban.*
 that 2s.A-see-PAST
 'You saw that.'
- b. *Wisi bi-mū-ban.*
 two 1s.B-see-PAST
 'I saw two.'

The stranding facts together with the independent existence of null-head modifiers seems to be enough to justify a lexical account of NI. Rosen concludes that lack of doubling is due to some other factor independent of NI, which is not addressed in this paper (p. 308).

Rosen speculates that a different type of NI occurs in these languages. If this is so, then such a theory would have to explain lack of effect on the transitivity of the verb, stranding, lack of doubling, and existing selectional restrictions on the verb. These grammatical properties would have to be predicted whether the theory is syntactic or lexical.

Compound Noun Incorporation

Compound NI is a process similar to compounding in English where the DO argument of the verb is satisfied, preventing the co-occurrence of a DO with NI (p. 309). When the complex verb is formed, it is intransitive and no stranding or doubling takes place. Some Polynesian and Micronesian languages allow this type of NI.

Case marking in the Polynesian languages provides evidence for the intransitivity which results from NI. In Samoan and Niuean, which have ergative case marking, Rosen finds that after NI, the subjects are marked absolutive, which indicates that the verb is intransitive (p. 310).

Stranding of determiners or modifiers is not expected in languages with Compound NI, since object arguments are not expressed outside the verb. From the examples given in (35) and (36), modification of the incorporated noun is not possible, and thus prohibits stranding as well (p. 311-312).

(35) Kusaiean

- a. *El twem-lah mitmit sahfiht sac.*
 He sharpen-PAST knife dull the
 'He has sharpened the dull knife.'

- b. *El twetwe mitmit-lac.*
 He sharpen knife-PAST
 'He has knife-sharpened.'
- c. **Nga twetwe mitmit sac.*
 I sharpen knife the
 'I knife-sharpen the 0.'
- d. **Nga twetwe mitmit sahfiht sac.*
 I sharpen knife dull the
 'I knife-sharpen the dull 0'

(36) Ponapean

- a. *I pahn perek-I loh-o.*
 I will unroll-TRANS mat-that
 'I will unroll that mat.'
- b. **I pahn perek-0-los-o*
 I will unroll-INTR-mat-that
 'I will unroll that mat.'

As with stranding, doubling also requires an argument outside the verb. Since the complex verb formed by Compound NI has no object argument, doubling is not expected in languages with this type of NI. As predicted, doubling does not occur in Polynesian and Micronesian languages (p. 312).

Syntactic Accounts of Noun Incorporation

Having stated her case for a lexical account of NI, Rosen turns to a discussion of two syntactic accounts of NI. Baker's 1988 movement account describes NI as a process where the head of the DO NP moves from object position into the verb. A trace is left behind in the DO NP. Modifiers and determiners are left behind in the DO NP, which would account for stranding (p. 313). This means that transitivity will be unaffected, and the verb will remain transitive. According to Rosen, this presents two problems for Compound NI languages. It will not predict the intransitive verbs found in these languages, and it will not predict the lack of stranding (p. 313-314).

Rosen also discusses Sadock's 1985 autolexical account of NI which states that morphology and syntax have independent representations that meet at the word level. Morphology has one representation combining the verb and incorporated noun in a single word, and syntax has a different representation with the noun in object position. Morpheme order in the sentence is determined morphologically, so that if a noun root occurs within the verb the sentence will surface with NI (p. 313). This account also allows for compounding as an NI process and therefore treats Compound NI in the same way that Rosen does.

However, Classifier NI languages present a problem for this theory. Rosen explains that there would have to be a condition such that transitivity would be determined by the syntactic representation, not the morphological representation, so that there would be no transitivity change between NI sentences and non-NI sentences. There is no reason that a grammatical property such as transitivity should be determined syntactically. In a lexical account, however, such properties occur as a natural result of NI process (p. 314).

Rosen also finds that neither syntactic account is able to explain two properties of Classifier NI languages; the independent existence of null-head modifiers and the existence of doubling.

One unresolved issue is how to classify what can and cannot incorporate (p. 315). Both types of NI show that it is usually direct objects and only subjects of unaccusative verbs that may incorporate. A syntactic theory is able to explain this asymmetry between subjects and objects. If the verb governs the DO position, then the incorporated noun stem governs its trace, which satisfies the "Empty Category Principle" (p. 315). A lexical account is unable to explain this asymmetry. Rosen suggests other distinctions, such as "subject/non-subject" or "external/internal arguments", as a basis for classification. One fact that any theory will have to explain is that goals and benefactives never incorporate in any language (p. 316).

Finally, Rosen points out that a by-product of her lexical theory is the potential occurrence of four different NI language types based upon the interaction between the two NI rules and the independent existence of null pro-forms. This means that both Compound NI and Classifier NI may occur with or without null pro-forms (p. 316).

Critique

In this paper, Rosen has provided for two types of NI which are the result of word formation rules. Classifier NI results in selectional restrictions being placed on the verb while Compound NI results in argument satisfaction. Her theory also shows that stranding facts are the result of the existence of null arguments and of null NP heads, rather than the process of NI. For many languages, this theory correctly predicts the groupings of grammatical properties that occur.

However, there are three questions that her theory has not been able to clearly explain:

1. Why does Southern Tiwa not pattern like Classifier NI languages and allow doubling?
2. How can the lack of doubling and change of transitivity be explained in West Greenlandic?
3. Is there a way to explain what can and cannot incorporate?

Some solutions to the lack of doubling in Southern Tiwa are discussed. The most promising is that it is possible that the incorporated noun may be fully specified for noun head features. In this case, there may be a selectional restriction that forbids duplication of this sort of information and that doubling may only occur when the features of the head are not so completely specified as they are on the verb (p. 307). There does seem to be a range in the selectional restrictions cross-linguistically. In Rembarnga, the direct object may provide information identical to the incorporated noun. Example (18) illustrates this with "paperbark" repeated as the direct object and incorporated noun. In Iroquoian and Caddoan, the selectional restrictions are more precise and they require that the independent NP be more specific than the incorporated noun (p. 303).

Such selectional restrictions are also seen in languages with Compound NI. In South Slavey (Saxon, 1996a), "*chi*" provides more specific information about the object and may therefore may be incorporated:

- (31) *Nachizheluh*
 chi=stick/stem zhe=3rd person S & DO
 'He is letting it (a wooden object) hang down'

It is reasonable to say that selectional restrictions may be responsible for the lack of doubling at least in Southern Tiwa. The fact that Tiwa clearly patterns with other Classifier NI languages with respect to stranding and transitivity, plus the independent existence of NI and null-head modifiers, lead me to conclude that Rosen's analysis of Southern Tiwa as a Classifier NI language is essentially sound.

The problems with West Greenlandic Eskimo are more complicated than with Southern Tiwa. It is possible that West Greenlandic may be a language that does not have NI. If so, then stranding and the occurrence of nouns within a complex verb will need to be explained.

Rosen has proven that the existence of null-head modifiers is independent of the incorporation process. In Mohawk, adjectives may be stranded independently of incorporation, and so may demonstratives and quantifiers in Caddo. Null-head modifiers may also be responsible for the stranding facts in West Greenlandic. This would explain the existence of the stranded adjective and the instrumental agreement marker in (27) from Sadock (1980):

- (26) *Sapanngamik kusanartumik pisivoq*
 bead - INST. beautiful-NOM.-INST. thing-get-INDIC.-3s

- (27) *Kusanartumik sapangarsivoq*
 beautiful-NOM.-INST. bead-get-INDIC.-3sg.
 'He bought a beautiful bead.'

Example (28) from Sadock (1980) shows the relationship between the stranded element and the noun within the complex verb, indicated by the plural agreement on the modifier:

- (28) *Kusanartunik sapangarsivoq*
 beautiful-NOM.-PL.-INST. bead-get-INDIC.-3sg.
 'He bought beautiful beads.'

Examples (32) and (33) from Sadock shows an instance of a stranded possessor of the noun within the complex verb:

- (32) *Tuttup neqaanik nerivunga*
 reindeer-REL. meat-3sg.-INST. eat-INDIC.-1sg.

- (33) *Tuttup neqitorpunga*
 reindeer-REL. meat-eat-INDIC.-1sg.
 'I ate reindeer meat.'

If we say that null-head modifiers do exist in West Greenlandic and that they do not need to be connected to NI, then there is a plausible explanation for the instances of stranded modifiers and possessors which also show agreement with the noun contained in the complex verb.

The occurrence of nouns within the complex verb is not necessarily a case for NI in West Greenlandic. As Rosen points out, the process in this language is not like NI in the other languages that she discusses (p. 304). In other NI languages, a verb without its incorporated noun remains a well formed verb (Mithun, p. 32). In West Greenlandic, incorporation only applies obligatorily to a restricted set of affixes, since all verbs select whether they take noun roots. These verbs are more like affixes, since they may not stand alone without a noun (p. 304). Since this process is so different from that in NI languages, it is possible that this is a case of denominal verb formation, as suggested by Mithun (1986). This would explain the occurrence of nouns within a complex verb.

The final problem concerns what may or may not incorporate. We see variance across languages both in terms of what entities may incorporate and how they are classified by researchers who study these languages. This is illustrated by the following examples of entities which may incorporate:

Chukchee (Polinsky, p.361-363)

Initial Absolutes	{Intransitive Subject
	{Direct Object
	{Initial DO and final Subject of
	{unaccusative
	{ Initial/final Subject of unergative

Koyukan (Axelrod, p. 183-4)

Nouns -Inanimate noun stems	{ as subject, object, or
	{ adverbial expression of
-areal nouns	{ manner, location, or instrument
-body part terms	{ as object or adverbial
Adjectives	

Dogrib (Saxon, 1996b) Verbs of expression, body parts, features in the natural world, and other unspecified nouns.

In addition to these examples there is attested incorporation of themes, instrumentals, means phrases, and locatives in other NI languages (p. 315). It is difficult to find a common thread in the data. One possibility that Rosen points out is that there is a distinction between external arguments, which never incorporate, and internal arguments, which seem to freely incorporate. This still does not explain why goals and benefactives never incorporate (p. 316).

Another possibility is that the criteria for deciding what may or may not incorporate is decided at a different level of the grammar. It may be that such criteria are a matter of selectional restrictions of the verb. Using Jackendoff's model of the grammar, selectional restrictions "are constructed out of a subvocabulary of conceptual structures." (Jackendoff 1987, p. 385). Lexical primitives and rules in conceptual structure would determine the selectional restrictions such that only certain entities would be allowed to undergo incorporation with certain verbs. The action of a particular verb may only be compatible with certain entities.

There may also be another factor that affects the choice of what may incorporate, or when incorporation is permitted. Discourse context may be relevant to the incorporation process (Mithun, p. 35). Examples (1) a. and (1) b. from Mithun show that in Tewa, a sister language to Southern Tiwa, new topics are introduced by nouns appearing outside of the verb with incorporation of that noun occurring in the discourse that follows. Since most examples in the literature are isolated sentences taken out of context, more data within a discourse context would be needed to formulate a theory.

Rosen's lexical analysis is a thorough and logical explanation of the process of Noun Incorporation. While it is applicable to a number of languages, it remains challenged by languages such as Southern Tiwa and West Greenlandic Eskimo, which do not follow the prototypical pattern, and by difficulties in determining what may or may not be incorporated.

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ON THE CONTROL STRUCTURE OF THE CHINESE VERB *DAYING*

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1. Introduction

Control refers to a relation of referential dependence between the controlled element (an unexpressed subject) and the controller (an expressed or unexpressed constituent). The referential properties of the controlled element are determined by those of the controller (see Bresnan 1982). In Chomsky's (1981) theory of control, it is generalized that (1) only subjects are controlled and (2) only non-finite clauses have controlled subjects. From this generalization, a number of different analyses have been derived. Some suggest that a configurational control theory is constructed on essentially the same notions on which binding theory is constructed in Chomsky (1981) (see Manzini, 1983). Others (e.g., Bresnan 1982) believe that functional and anaphoric control theory covers more data and more adequately than does the simple c-commanding analysis. Still others (e.g., Sag & Pollard 1991) argue that a principled explanation for the grammar of controlled complements in a language like English can be derived from the interaction of semantically based principles of controller assignment and the principles that determine the distribution of anorphors and pronominals. Huang (1987) proposed the Generalized Control Rule which basically follows the GB theory but slightly modifies it to account for the problem of empty categories in pro-drop languages, such as Chinese. All these different theories have one thing in common: they all recognize the fact that different predicates in a sentence may involve different control structures. In other words, the main clause predicate verb in a control sentence may be either subject-control or object-control. This paper intends to show that in Chinese, there exist a type of verbs which possess one phonological and morphological shape, but different semantic contents, and therefore have different control structures. I will first introduce the two types of verbs (subject-control and object-control) that are commonly found in Chinese, show the difference in their control structures, then show the double semantic contents of the type of verbs (represented by the verb *daying* 'promise') that show different control structures. I will provide my own analysis to explain the nature of such structural differences in control.

2. Control in Chinese

Languages, such as English, show distinct structural differences in terms of the relation of referential dependence between the matrix subject and the unexpressed subject of the embedded verb phrase complement. Compare the following sentences.

- (1) a. John tries to come here.
b. John promised (Lee) to come tomorrow.
- (2) a. John persuaded Lee to go.
b. John allowed Lee to come tomorrow.

It is clear that the unexpressed subject of the embedded VP in (1a) and (1b) is actually coreferential with the matrix subject of the sentence (it is *John* who intends to come here in (1a) and is coming tomorrow in (1b)), while the unexpressed subject of the embedded clause is controlled by the object *Lee* of the main clause in (2a) and (2b) (it is *Lee* who is supposed to go in (2a) and to come in (2b)). We can therefore conclude from the above examples that, in English, verbs such as *try* and *promise* are subject-control and verbs such as *persuade* and *allow* are object-control. Similarly, control verbs of different types are also found in Chinese, as shown in the examples below.

- (3) a. Zhang shefa lai zheli.
name try come here
'Zhang tries to come here.'

- b. Zhang daying (Li) lai zheli
 name promise name come here
 'Zhang promised (Li) to come here.'

- (4) a. Zhang shuofu Li lai zheli.
 name persuade name come here
 'Zhang persuaded Li to come here.'

- b. Zhang yunxu Li lai zheli
 name allow name come here
 'Zhang allowed Li to come here.'

Apparently, the examples in (3) and (4) match exactly their English counterparts in (1) and (2) in terms of control structure. There is one interesting point about the Chinese verb *daying*, which is usually interpreted as "to promise" in the literature, in terms of Chinese control structure analysis (see Xu 1986, among others). In fact the verb *daying* has at least 2 related but different readings ("to promise" and "to allow"), each having its own particular structure. That is to say, the two verbs "promise" and "allow", which are different in their control structure, can be represented with one single verb *daying*. In daily speech, the verb *daying* seems to be used so freely that the referential dependence relation runs "out of control". Let us now have a closer look at the structure of *daying* in a sentence such as (5). Following Huang (1984), I use square brackets to mark the embedded clauses and use *e* to stand for the unexpressed subject of the embedded clause (empty category).

- (5) Zhang daying Li [e mingtian lai]
 name promise name tomorrow come
 'Zhang promised Li to come tomorrow'.

The verb *daying* has the usual interpretation as "to promise". But the following examples show two different lexical expressions of the verb *daying* when different clauses are added to the same sentence.

- (6) a. Zhang_i daying Li_j [e mingtian lai],
 name promise name tomorrow come
 keshi ta_{i/j} congbu shou yue
 but he never keep promise
 'Zhang_i promised Li_j to come tomorrow, but he_{i/j}
 never keeps his promise.'

- b. Zhang_i daying Li_j [e mingtian lai],
 name allow name tomorrow come
 keshi ta_{i/j} jianchi yao jintian lai.
 but he insist want today come
 'Zhang_i allowed Li_j to come tomorrow, but he_{i/j}
 insists on coming today.'

The unexpressed subject (*e*) of the embedded clause, namely, the person who is supposed to come in (6a) is the matrix subject *Zhang*, but not the matrix object *Li* when the verb *daying* in the sentence has the reading of "promise". But the opposite is true in (6b) when *daying* has the reading of "allow". It is clear that there is difference between the two interpretations of the verb not only in meaning, but also in control structure. In English, the verb *promise* is subject-control while *allow* is an object-control verb. This is compatible with the two readings of the Chinese verb *daying*. The following discussion will show how the two interpretations of *daying* differ in the control structure.

Unlike English, Chinese does not have tense markers or subject-verb agreement in person and number. The language does not use verb affixes to signal the relation between the time of the occurrence of the situation and the time

the situation is mentioned in speech. Instead, Chinese uses aspectual markers to show different ways of viewing a situation. These aspectual elements include: the perfective *le*, indicating perfective aspect; the durative *zhe*, indicating continuous aspect; and the experiential *guo*, indicating past aspect (see Chao 1968, Li & Thompson 1981). Also, there are no overt markers for finite or non-finite clauses, such as *that* and *to* in English. However, a finite clause in Chinese may contain modal verbs, such as *neng* 'can', *hui* 'will' and *keyi* 'may', while a non-finite clause cannot. The following examples illustrate the two different types of clauses in both English and Chinese.

- (7) a1. John tries to come tomorrow.
 a2. *John tries he can come tomorrow.
- b1. Zhang shefa mingtian lai.
 name try tomorrow come
 'Zhang tries to come tomorrow'
 b2. *Zhang shefa mingtian neng/hui/ keyi lai.
 name try tomorrow can will may come
 'Zhang tries he can/will/may come tomorrow'

- (8) a. John_i thinks that he_{ij}/Lee can come tomorrow.
 b. Zhang_i renwei ta_{ij}/Li mingtian neng/hui/keyi lai.
 name think he name tomorrow can will may come
 'Zhang_i thinks that he_{ij}/Li can/will/may come tomorrow.'

Like English modals *can*, *will*, *may*, Chinese modals *neng*, *hui*, *keyi* can appear only in finite sentences. A further point that deserves our notice is that in a pro-drop language like Chinese, an empty category can appear in the subject position in a finite clause, which is not the case in English.

- (9) a. *John_i thinks that e_{ij} can come tomorrow.
 b. Zhang_i renwei e_{ij} mingtian neng/hui/ keyi lai.
 name think tomorrow can will may come
 'Zhang_i thinks that he_{ij} can/will/may come tomorrow.'

With these structural similarities and differences between English and Chinese in mind, we can now turn to examine the control structural difference between the two readings of the Chinese verb *daying*. I will show that when *daying* has the reading of "promise", the control structure of the verb has similar (as well as different) behaviors to its English counterpart *promise*, and it behaves very much like English *allow* when the verb *daying* has the equivalent reading.

3. Control Structure of *Daying* with the Reading of "Promise"

In many analyses (e.g., Manzini 1983, Radford 1988, Sag & Pollard 1991), the English verb *promise* is believed to be subject-control and take both finite and non-finite clauses as its sentential constituents, as shown in the following.

- (10) a. John promised Lee [IP. e to come tomorrow].
 b. John promised Lee [CP. that he will come tomorrow].

The Chinese verb *daying*, when it has the reading of “promise”, exhibits similar properties as its English counterpart. Consider the following Chinese sentences.

- (11) a. Zhang_i daying Li_j [e_i mingtian lai]
 name promise name tomorrow come
 ‘Zhang promised Li to come tomorrow.’
 b. Zhang_i daying Li_j [ta_i mingtian lai]
 name promise name he tomorrow come
 ‘Zhang promised Li that he will come tomorrow.’

Example (11a) shows that *daying* can take a non-finite clause (or a clause that looks like a non-finite clause because of the lack of complementizers, overt pronominals or modal verbs), and the unexpressed subject of the clause is controlled by the matrix subject. The predicate verb *daying* is, therefore, subject-control. *Daying* can also take an NP object that precedes the embedded clause, as shown in (11b). This NP object, however, cannot be the controller of the unexpressed subject of the embedded clause; when *daying* has the reading of “promise”, it is the matrix subject, the **promiser**, who is making the commitment that he/she is going to fulfill. The matrix object, the person(s) the commitment is made to, has no control over the realization of the commitment, and is therefore not the subject of the embedded “commitment clause”. Note that Chinese is a pro-drop language where a pronoun can be dropped from a clause when its reference is clear. If we drop the pronoun *ta* ‘he/she’ from (11b), the embedded clause will look the same as (11a), which is a typical IP corresponding to the English clause in (10a). Therefore, it is difficult to tell whether the embedded clauses in (11) are non-finite if they are pro-dropped.

It is important to make clear whether a clause is finite or non-finite, because it helps determine whether a NP is the object of the main clause or the subject of the embedded clause. One way to determine the finiteness of a clause is by checking whether it contains what Huang (1989) calls AUX elements. It is generalized in Huang (1989) that if the subject of a clause is obligatorily null, then the clause cannot contain an element of AUX (or INFL status including overt clausal subjects, aspectual markers or modal verbs). Huang further points out that in Chinese, a clause is finite if it contains any AUX. We are now faced with the question of whether clauses like those in (11) involve an obligatorily null subject. Recall that Chinese does not have overt markers for finite clauses, such as the complementizer *that* in English. With the English *that*, we can easily see whether an embedded clause is finite or non-finite. For example, verbs like *hope*, *think*, *believe* can naturally be followed by a finite clause headed by *that* (e.g., “*I hope/think/believe that he can do this*”). But it is not the case with verbs like *force*, *allow*, *forbid* (“**I forced/allowed/forbade (him) that he can do this*”). Many verbs take both finite and non-finite clauses, and *promise* is one (as shown in (10)). In Chinese, on the other hand, although there is no overt marker for finite or non-finite clauses and no overt AGR either, there are still ways to show the INFL features of a clause, such as the possibility of using a modal verb, as indicated in the previous section. If we assume that the addition of a modal verb, such as *neng* ‘can’, can test if a clause is finite or non-finite, we now use it to try the following sentences.

- (12) a1. Zhang_i daying [e_i mingtian lai]
 ‘Zhang promised to come tomorrow.’
 a2. Zhang_i shefa [e_i mingtian lai]
 ‘Zhang tries to come tomorrow.’
 b1. Zhang_i daying [e_i mingtian neng lai]
 ‘Zhang promises that he can come tomorrow.’
 b2. *Zhang_i shefa [e_i mingtian neng lai]
 ‘Zhang tries that he can come tomorrow.’

Examples in (12) show that the acceptability of the modal *neng* ‘can’ indicates that the clause in (a2) is non-finite. The clause in (a1) is ambiguous, in that it looks non-finite but can in fact be finite since a modal verb can be added within

the embedded clause as shown in (b1). The reason why an embedded clause in a Chinese sentence such as (a1) is problematic in terms of its finiteness is that there is no overt complementizer or AGR to distinguish the two types of clauses, and that Chinese allows a zero subject in a clause, which makes it difficult to tell if a clause is finite or non-finite. We shall now examine further examples to see how the two kinds of clauses are identical in Chinese by replacing the empty categories with pronominals or full NPs.

- (13) a. Zhang_i daying [ta_{ij} mingtian neng lai]
'Zhang_i promised that he_{ij} can come tomorrow.'
- b. Zhang_i daying [Li_j mingtian neng lai]
'Zhang_i promised that Li_j can come tomorrow.'

If a finite clause does not have a modal verb, AGR will usually assign case to the clausal subject in an English sentence (e.g., John says that he WILL come everyday vs. John says that he COMES everyday). But if we take the modals away from the above Chinese sentences in (13), the INFL status may not be clear.

- (14) a. Zhang_i daying [ta_{ij} mingtian lai]
'Zhang_i promised that he_{ij} can come tomorrow.'
- b. Zhang_i daying [Li_j mingtian lai]
'Zhang_i promised that Li_j will come tomorrow.'

Note that if we erase the square brackets, (14b) will be exactly the same with (11a).

- (15) Zhang_i daying Li_j mingtian lai
'Zhang_i promised that Li_j will come tomorrow' (=14b)
'Zhang_i promised Li_j to come tomorrow' (=11a)

Up to this point, we see that *daying* and *promise* are identical in that they both take finite or non-finite clauses. But a Chinese sentence like (15) can be very ambiguous as to whether *Li* is part of the matrix clause or part of the embedded clause. I believe that the difference between the two interpretations of the same sentence is clearly marked in the discourse situation, the speaker's phonological variation, as well as the concept of control structure in the speaker or the listener's lexicon. Phonologically, the location of a slight pause in the utterance of a sentence like (15) will help clarify if *Li* is part of the matrix clause or the embedded clause. In other words, a slight pause in normal speech usually separates the embedded clause from the main clause. The sentence would mean "Zhang promised Li to come tomorrow" if the pause is located immediately after *Li*, as in *Zhang daying Li (pause) mingtian lai*. Otherwise, the sentence would mean "Zhang promised that Li will come tomorrow", if the pause is right after *daying*, i.e., *Zhang daying (pause) Li mingtian lai*. From this point of view, I assume that the concept of control structure is deep in the lexicon of a Chinese speaker rather than on the surface structure of a sentence.

We now turn to compare other properties of *daying* and its English counterpart *promise*. In an English sentence like (16), the downstairs clause subject *he* is unbound and can refer freely to either the matrix subject *John*, the matrix object *Lee*, or someone that is not mentioned in the sentence.

- (16) John_i promised Lee_j that he_{ij/k} can come tomorrow.

But in the following Chinese sentence, the subject of the embedded clause is more likely to refer to either the matrix subject *Zhang* or someone not mentioned in the sentence, but is less likely the matrix object, as in (17).

- (17) Zhang_i daying Li_j [ta_{ij/k} mingtian neng lai]
'Zhang_i promised Li_j that he_{ij/k} can come tomorrow'

Sag & Pollard (1991) assume that verbs like *promise* refer to an action of making a commitment, which involves a **committor** and a **commissee**. The action described by the VP in the embedded clause in a promise type sentence is usually completed by the committor or the person the committor has made a promise for, but not the commissee. This seems to be true for the sentences with embedded non-finite clauses in both English and Chinese.

(18) a. John promised Lee to give a reply before Wednesday.

b. Zhang *daying* Li *xingqisan yiqian gei huixin*.
 name promise name Wednesday before give reply
 'Zhang promise Li to give a reply before Wednesday'

In both sentences in (18) it is the matrix subject, the committor, who is going to give a reply, but not the matrix object, the commissee. Xu (1986) argues that in English, the controller of *promise* in sentences like (18a) is typically the matrix subject, but that such an obligatory relation does not hold in Chinese. In other words, the one giving a reply may well be someone other than the committor in a Chinese sentence like (18b). This statement suggests that *daying* and *promise* do not have the same property in terms of subject control. Xu's argument can easily be proven to be incorrect if we bear in mind that a Chinese clause without an overt pronominal in the subject position may be either a finite or a non-finite clause. Consider the following English sentence.

(19) John promised Lee [*e* to build him a house].

If we believe that the subject control relation in sentences like (19) is literally obligatory in English but not in Chinese (according to Xu), the builder of the house would be expected to be the matrix subject *John* only, no one else. This is not necessarily true because the construction activity may well be done by a third party on *John's* behalf. This is exactly the same situation as described in (18b). In this sense, *daying* and *promise* have the same control structure, since in sentences like *John promised Lee to leave early*, the controller is no one but the matrix subject in both English and Chinese. On the other hand, the controller of *e* in sentences like (19) (and its Chinese equivalent) is also the matrix subject, *John*, the representative of the action performer.

One possible difference between the control structures of *daying* and *promise* might rise in sentences with finite clauses. According to Chomsky's (1981) GB theory, the pronominal *ta* 'he/she' in the subject position of the embedded finite clause in (17) should be free in its governing domain. However, it seems that *ta* 'he' has a closer referential relation with the matrix subject *Zhang* than with the matrix object *Li*. A possible explanation to this difference is that the Chinese verb *daying* has more than one lexical expression and one expression may be intertwined with another, both semantically and structurally. As mentioned earlier, *daying* can express the meaning of "promise" and "allow". If the verb *daying* is used in a sentence like "Zhang *daying* Lee mingtan lai", then it can mean both "Zhang promised Li to come tomorrow" or "Zhang allowed Li to come tomorrow". The properties of the verb *daying* with the reading of "allow" will be discussed in a later section.

Another aspect of the comparison between the English verb *promise* and the Chinese verb *daying* involves passivization. In English, *promise* basically does not allow upstairs passivization if the sentence involves a control relation (see Bresnan 1982; Sag & Pollard 1991).

(20) a. John promised Lee to leave.

b. *Lee was promised by John to leave.

In Chinese, *Daying* "promise" does not allow passivization in the matrix clause either. The passive construction in Chinese is generally applied to sentences containing the passive marker *bei* with the following linear arrangement (see Li & Thompson 1981; Li 1990).

- (21) NP1. *bei* (NP2) verb

The following examples show how (21) applies in Chinese passive sentences.

- (22) a. Zhang *bei* pian le.
 name BEI cheat ASP
 ‘Zhang was cheated.’
 b. Li *bei* Zhang da le.
 name BEI name beat ASP
 ‘Li was beaten by Zhang.’

There has been a lot of discussion in the literature about the nature of the Chinese passive marker *bei*. It is argued to be a verb, a co-verb, a passive morpheme, or a preposition (like the English preposition *by*, which I will temporarily use for illustration in the examples). The true syntactic properties of *bei* are not the major concern of this paper. What concerns us here is how the verb *daying* behaves in the passive construction with the reading of “promise”. Consider the following Chinese examples.

- (23) *Li *bei* (Zhang) *daying* [e mingtian lai]
 Li by (Zhang) promise tomorrow come
 ‘Li is promised (by Zhang) to come tomorrow.’

Example (23) shows that upstairs passivization does not form grammatical sentences with subject-control verbs such as *daying*, where the logical subject in the matrix clause cannot control the unexpressed subject of the downstairs clause. This is compatible with its English counterpart.

- (24) *Lee is promised (by John) to come tomorrow.

However, a “promise” sentence with a finite clause allows upstairs passivization in English, but not in Chinese, as shown in the following pair of sentences.

- (25) a. Kim_i was promised (by the doctor) [that he_i would
 be healthy by the game time on Sunday].
 b. *Zhang *bei* Li *daying* [Wang mingtian hui lai].
 Zhang by Li promise Wang tomorrow will come
 ‘Zhang was promised by Li that Wang will come tomorrow.’

This is another contrast between the English *promise* and *daying* with the reading of “promise”. Note here that the active version of (25b) would be grammatically perfect, but it is not the case in the passive form. I believe that this, again, has to do with the intertwining of the two readings of *daying*. “Promise” is usually understood as a volitional behaviour of making a commitment, and the “promiser” is more prominent semantically than the “promisee”, who is usually optional in an active sentence. On the other hand, the action of “allow” is more or less decided by relevant conditions, and the “allowee” is always obligatory while the “allower” is optional (compare: *John is allowed to leave*, but **John is promised to leave*). Since *daying* in Chinese carries the meaning of both “promise” and “allow”, a sentence like (25b) can be easily understood as “Zhang is allowed by Li ...”. Since “allow” does not take finite clause as its complement, hence the ungrammaticality of (25b).

Although the “promise” type of sentences do not allow upstairs passivization if they contain non-finite clauses, as indicated in the above examples, downstairs passivization is often found in both English and Chinese. Note that in such sentences, the controller of the unexpressed downstairs clause subject is “shifted” from the logical subject to the

logical object of the matrix clause. This has been a longstanding problem in many analyses in English (e.g., Sag & Pollard 1991), and the Chinese *daying* seems to have the same problem of “shifts of controller”. Consider the following sentences.

(26) a. Kim promised Sandy to be allowed to come.

b. Kim promised Sandy to be invited by the host.

Although it is still in debate as to whether sentences like those in (26) are subject-control or object-control, or both, the following Chinese sentences with *daying* as “promise” are definitely object-control.

(27) a. Zhang_i daying Li_j [e_{•ij} bu bei jingcha chufa]
 Zhang promise Li not by police punish
 ‘Zhang_i promised Li_j that he_{•ij} will not be punished by police.’

b. *Zhang_i daying Li_j [e_{•ij} bei laoshi piping]
 Zhang promise Li by teacher criticise
 ‘Zhang_i promised Li_j that he_{•ij} will be criticised by the teacher.’

c. *Zhang_i daying Li_j [e_{•ij} bei mama biao yang]
 Zhang promise Li by mother praise
 ‘Zhang_i promised Li_j that he_{•ij} will be praised by the mother.’

d. Zhang_i daying Li_j [ta_{•ij} jiang bei mama biao yang]
 Zhang promise Li he shall by mother praise
 ‘Zhang_i promised Li_j that he_{•ij} will be praised by the mother.’

In these examples, it is interesting to find that passivization is allowed in the embedded non-finite clauses only in the negative form, but not in the positive form. This kind of behavior is not found in English sentences.

(28) a. John is promised (by Lee) to be allowed to leave by the boss.

b. John is promised (by Lee) not to be punished by the police.

I am not quite sure what causes such a difference, but it certainly has to do with the special feature that *daying* has the reading of both “promise” and “allow”.

Let us now turn to look at some other characteristics that *daying* shares with the English *promise*. In English, *promise* selects basically a clause through which to show the content of a commitment. Individual NPs may also be selected.

(29) a. He promised this.

b. John promised (Lee) a quick answer.

c. The father promised the child a gift.

Furthermore, these well-formed sentences can also be passivized.

(30) a. This is promised (by him).

b. A quick answer was promised (Lee) by John.

c. A gift was promised by the father.

d. The child was promised a gift by the father.

In Chinese, however, *daying* allows only a limited number of NPs as its object constituent, as shown in the following.

- (31) a. Zhang daying le (Li) zhejian shi.
 Zhang promise ASP Li this Matter
 'Zhang promised (Li) (to deal with) this matter.'
- b. ?Zhang daying le Li yiliang qiche.
 Zhang promise ASP Li one car
 'Zhang promised Li a car.'
- c. *Zhang daying le Li yiwei hao laoshi.
 Zhang promise ASP Li one good teacher
 'Zhang promised Li a good teacher.'
- d. Zhejian shi bei Zhang daying xiale.
 'This matter is promised by Zhang.'
- e. *Yiliang qiche bei Zhang daying xiale
 'A car is promised by Zhang.'
- f. *Yiwei hao laoshi bei Zhang daying xiale.
 'A good teacher is promised by Zhang.'

These examples suggest that *promise* in English selects a constituent which indicates an action to be taken on the promiser's part, as well as a state. A rare example would be a sentence like, "*I promise you good weather*". On the other hand, *daying* ('promise') selects mainly clauses and a limited number of NPs that usually indicate an event rather than a state. An NP, like *zhejian shi* 'this matter' in (30a), is selected by *daying* because the sentence actually means "Zhang promised TO DEAL WITH this matter". I therefore assume that the NPs selected by *daying* should be eventive in nature.

To summarize the main features of *daying* with the meaning of "promise", the Chinese verb *daying* selects both finite and non-finite clauses, is a subject-control verb, and allows downstairs passivization but not upstairs passivization in a negative context. These features of *daying* are basically compatible with its English counterpart *promise*. However, the two differ slightly in certain ways. The difference between CP and IP is not quite clear in some Chinese sentences because Chinese does not have overt clause markers, such as *to* and *that* in English. Furthermore, Chinese allows a zero pronoun in a clause subject position. This is why a sentence like (15) appears ambiguous. Also, the fact that *daying* has the reading of "allow", which is believed to be an object-control verb, influences the judgment of the real control structure of the verb in a sentence. We now compare the behavior of *daying* and its English equivalent *allow*.

4. Control Structure of *Daying* with the Reading of "Allow/Approve"

As mentioned earlier, apart from "promise", *daying* also has a dictionary interpretation of "to allow/approve" or "to reply". When *daying* has the meaning of "allow/approve", the control structure is different from when it means "promise". In English, *allow*, *persuade* etc. are categorized as object-control verbs for the obvious reason that they require PRO to refer back to the matrix clause object (see Radford 1988). For examples,

- (32) a. John_i persuaded Lee_j [_{*e*_{i,j}} to attend the party].
 b. John_i allowed Lee_j [_{*e*_{i,j}} to leave the party early].
 c. *John allowed [_{*e*} to come].
 d. *John does not allow [_{*e*} to come].

When *daying* has the reading of “allow” the verb demonstrates similar characteristics as its English counterpart.

- (33) a. Zhang_i daying Li_j[e_{ij} mingtian lai]
 Zhang allow Li tomorrow come
 ‘Zhang allowed Li to come tomorrow.’
- b. Zhang_i bu daying Li_j[e_{ij} mingtian lai]
 Zhang NEG allow Li mingtian come
 ‘Zhang doesn’t allow Li to come tomorrow.’
- c. *Zhang daying [ec mingtian lai]
 ‘Zhang approved/allowed to come tomorrow.’
 (test: *Zhang daying lai, keshi mei lai.
 *‘Zhang allowed to come, but didn’t come.’
 But this sentence can mean: ‘Zhang promised to come, but didn’t’)
- d. *Zhang bu daying [ec mingtian lai]
 ‘Zhang doesn’t approve/allow to come tomorrow.’

Examples in (33) match those examples in (32) in that the predicate verb in these sentences requires an NP object, and the EC in the downstairs clause obligatorily refers to the matrix object but not the matrix subject. But when *daying* has the reading of “allow”, the sentence structure will change accordingly in terms of its grammaticality and, therefore, the control structure is different from that when *daying* has the reading of “promise”. This demonstrates the double feature of the verb *daying*.

Also, unlike *daying* (‘promise’), which takes non-finite as well as finite clauses, *daying* (‘allow’) does not seem to form a grammatical sentence if the sentence contains a downstairs finite clause. If such a “*daying*” sentence is grammatical, it must be of the “promise” type.

- (34) a. *Zhang_i daying Li_j [e_{ij} mingtian hui lai]
 ‘Zhang allowed Li that he_{ij} will come tomorrow.’ (= promise)
- b. *Zhang_i daying Li_j [ta_{ij/k} mingtian neng lai]
 ‘Zhang allowed Li that he_{ij/k} can come tomorrow.’ (= promise)
- c. *Zhang_i bu daying Li_j [ta_{ij/k} mingtian keyi lai]
 ‘Zhang allowed Li that he_{ij/k} can come tomorrow.’ (= promise)

These examples further show that *daying* represents two structurally different verbs.

Below, I briefly review the two Chinese negative particles *mei* and *bu*, which may help the analysis of the control structure of *daying*. In general, the difference between *mei* and *bu* is that *mei* negates the completion of an event, while *bu* provides a neutral negation.

- (35) a. Wo mei kai men
 I NEG open door
 ‘I didn’t open the door.’
- b. Ta mei shang xue
 he NEG ascend school
 ‘He didn’t go to school.’
- c. *Zhangsan mei zhidao zhejian shi

Zhangsan NEG know this matter
 'Zhangsan didn't know about this matter.'

d. *Lisi mingtian mei shang xue.
 Lisi tomorrow NEG attend school
 'Li will not go to school tomorrow.'

Examples (35a) and (35b) show that *mei* negates the completion of the event *kai men* 'open the door' and *shang xue* 'go to school', hence the interpretation "...didn't...". Example (35c) contains the durative verb *zhidao* 'know', which cannot be negated by *mei*. The sentence is, therefore, ill-formed. *Shang xue* in (35d) is modified by *mingtian* 'tomorrow' and thus becomes a future event. The negative particle *mei* is not applicable in this sentence, and hence proves ungrammatical. However, all the sentences in (36) can be negated by *bu*, since it provides a neutral negation.

- (36) a. Wo bu kai men
 I NEG open door
 'I won't open the door.'
- b. Ta bu shang xue
 he NEG ascend school
 'He doesn't/won't go to school.'
- c. Zhangsan bu zhidao zhejian shi
 Zhangsan NEG know this matter
 'Zhangsan doesn't/didn't know about this matter.'
- d. Lisi mingtian bu shang xue.
 Lisi tomorrow NEG attend school
 'Li will not go to school tomorrow.'

With a clear distinction between the two negative particles, we can easily tell that *mei daying* refers to "didn't promise/allow" while *bu daying* means "doesn't/didn't promise/allow".

As shown earlier in (23) and (24), *daying* generally does not allow upstairs passivization. But upstairs passivization is quite common in sentences where *daying* has the reading of "allow". Furthermore, passivization of the embedded non-finite clauses is also allowed.

- (37) a. Li bei daying mingtian lai.
 Li by allow tomorrow come
 'Li was allowed to come tomorrow.'
- (test: Ruguo Li mei bei daying mingtian lai, wo mingtian ye bu lai.
 if Li NEG by allow tomorrow come I tomorrow also NEG come
 'If Li is not allowed to come tomorrow, I won't come either.')
- b. Bingren_i bei yisheng_j daying [_{i/j} chu yuan].
 patient by doctor allow go-out hospital
 'The patient is allowed by the doctor to leave the hospital.'
- c. Mama_i zhongyu daying haizi_j [_{i/j} bei ren daizou].
 mother finally allow child by man take-away
 'The mother finally allowed the child to be taken away.'

- d. Baogao ren daying zhetiao xiaoxi mingtian bei gongkai
report man allow this news tomorrow by publicize
'The reporter allowed this piece of news to be publicized tomorrow.'
- e.*Baogao ren daying zhetiao xiaoxi mingtian hui bei gongkai
report man allow this news tomorrow will by to publicize
'The reporter allowed that this piece of news will be publicized tomorrow.' (daying = 'promise')
- f. Zhetiao xiaoxi bei baogao ren daying mingtian bei gongkai
this news by report man allow tomorrow by publicize
'This piece of news is allowed by the reporter to be publicized tomorrow.'
- g.*Zhetiao xiaoxi bei baogao ren daying mingtian hui bei gongkai
this news by report man allow tomorrow will by publicize
'This piece of news is allowed by the reporter that it can be publicized tomorrow.'

These examples show that *daying* ('allow') allows passivization in both the matrix clause and the embedded clause, but it does not accept finite clauses as its complement as shown in (34) and (37e) and (37g). However, (37e) can be grammatical only when *daying* has the reading of "promise" (note that *daying* ('promise') takes finite clauses as its complement). (37g) is not grammatical in any case because *daying* ('promise') does not allow upstairs passivization, while *daying* ('allow') does not take embedded finite clauses. Since (37g) has both, it is ungrammatical.

We saw earlier that *daying* ('promise') more often selects a clause rather than an individual NP (with a limited number of exceptions. But *daying* ('allow') seems to allow any NP so long as it is semantically acceptable.

- (38) a. Zhang daying le [Li de yaoqiu]
'Zhang approved Li's request.'
- b. Li de yaoqiu bei (Zhang) daying le
'Li's request was approved (by Zhang).'
- c. A: Zhang daying Li de yaoqiu le ma?
'Has Zhang approved Li's request?'
B: Zhang daying le ec.
'Zhang has approved (it).'
- d. Ta bu daying zhege jihua.
he NEG allow this plan
'He does not approve this plan.'

From the examples in (38), we see that *daying* is closer to the English meaning *approve*. In English, we can have a sentence like (39).

- (39) They approved that the bridge will be built next year.

But the equivalent Chinese sentence with *daying* as its predicate verb will have the interpretation of, "They promised that ...".

- (40) Tamen daying zhezuo daqiao jiang zai mingnian bei jiancheng
 they DAYING this bridge will in next year by build-up
 'They promised/?approved that the bridge will be built up
 next year.'

Interestingly, (40) is questionable in that *daying* ('allow/approve') does not take finite clause. Also, from the point of semantics, a "promiser" is usually more positive than the "allower/approver" about the event of building the bridge. If a Chinese speaker's real intention is "to allow/approve" in such a sentence, s/he would usually choose an unambiguous verb, such as *pizhun* 'allow' or *tongyi* 'approve', rather than *daying*, which has the reading of both "promise" and "allow/approve". Therefore, I would suggest that *daying* is different from its English counterpart *promise* (as interpreted in the literature) both structurally and semantically.

To summarise the properties of *daying* ('allow/promise'): *daying* ('allow/approve') selects object NPs and non-finite clauses only, it is object-control, and allows both upstairs and downstairs passivization. Note that although there are distinct differences in both meaning and structure between the two readings of *daying*, there are also similarities which makes it difficult to tell if *daying* in a sentence has the meaning of "promise" or "allow". For example, both *dayings* select non-finite clauses and allow downstairs passivization. The fact that Chinese is a pro-drop language makes it difficult to judge if a clause is finite or non-finite.

5. Further Discussion

Since *daying* in Chinese exhibits two different sets of properties that bear different meanings, the question arises as to how to differentiate the two meanings of a speaker in a given *daying* sentence like (41), which is similar to (15a) but has a perfective marker *le*.

- (41) Zhang *daying* le Li mingtian lai.
 Zhang DAYING ASP Li tomorrow come.

I suggest a few possible tests that can help determine the lexical content and the control structure of *daying* in a certain sentence. The first is "topicalization". One of the most striking features of Chinese sentence structure is that, in addition to the grammatical relations of "subject" and "direct object", the description of Chinese must also include the element "topic". The topic of a sentence is what the sentence is about and it always comes first in a sentence. For example, in a sentence like (42a), the topic can be either the subject or the object. The topicalized part of the sentence is what the sentence is mainly about and it must come first in the sentence, as shown in (42b) and (42c).

- (42) a. Wo gei le Zhangsan naben shu
 I give ASP Zhangsan that book
 'I gave Zhangsan that book.'
- b. Wo, [e gei le Zhangsan naben shu].
 'As for me, I gave Zhangsan that book.'
- c. Zhangsan, [wo gei le e naben shu].
 'As for Zhangsan, I gave him that book.'
- d. Naben shu, [wo gei le Zhangsan e].
 'As for that book, I gave it to Zhangsan.'

From (42) we can assume that any complete constituent of a sentence, or what the sentence is about, can occur at the beginning of a sentence as the sentence topic. We can use this feature to determine whether a clause is finite or non-finite. Recall that *daying* ('promise') takes both finite and non-finite clauses while *daying* ('allow') takes only non-finite clauses. Therefore, if we can find out that an embedded clause in a *daying* sentence is finite, the predicate

verb cannot have the reading of “allow”, and hence must be interpreted as “promise”. Let us see how (41) can be analyzed in order to see the real structure of the sentence.

- (43) a. Zhang *daying* le Li mingtian lai.
Zhang *Daying* ASP Li tomorrow come
- b. [NP. Li], Zhang *daying* le [e] [IP PRO mingtian lai]. (= allow)
‘As for Li, Zhang has allowed him to come tomorrow.’
- c. [CP. pro Mingtian lai], Zhang *daying* le Li. (= promise)
‘As for coming tomorrow, Zhang has promised Li.’
- d. [CP. Li mingtian lai], Zhang *daying* le. (= promise)
‘As for Li’s coming tomorrow, Zhang has promised.’

The sentence topic in (43b) is obviously an NP, and is therefore the object of the matrix predicate but not the subject of the downstairs clause. The subjectless clause is thus understood as a non-finite clause. One may argue here that the embedded clause in (43b) may well contain a modal verb (e.g., ‘*hui*’ will’) which is omitted, or a zero *pro*, rather than *PRO*, as the subject of the clause. In that case, the sentence may well be one with a finite clause and the predicate verb should thus have the reading of “promise”, not “allow”. Well, as we have seen in (42), the part of the sentence that can be topicalized must be a full grammatical constituent (e.g., subject, object, complement). If the object *Li* is topicalized, what is left in the sentence will be ungrammatical if the omitted modal *hui* ‘will’ is filled up and the zero pronoun is replaced by an overt *ta* ‘he/she’, as in the following.

- (44) *Li, Zhang *daying* ta mingtian hui lai.
‘As for Li, Zhang promised that he will come tomorrow.’

This is because when *Li* is topicalized, the gap it left can only be filled by an anaphoric *PRO*, but not an overt *pro*. This explains why the embedded clause in (43b) is non-finite and the sentence has the reading of “to allow”. If we assume that the embedded clause does contain a zero *pro*, which can be replaced by an overt pronominal, the only correct topicalization form of the sentence to show that *ta* ‘he/she’ can refer freely would have to be something like (45) where an overt preposition *dui* ‘to’ is required.

- (45) Dui Li, Zhang *daying* ta mingtian hui lai
‘To Li, Zhang has promised that he will come tomorrow.’

The topic of (43c) is obviously a finite sentential clause which is moved from the original complement position after the matrix predicate. An easy test to this would be to topicalize the downstairs clause from a sentence in which the predicate verb selects only a non-finite clause (e.g., a sentence like (7b-1) cannot be topicalized as (i) * [*e mingtian lai*], Zhang *shefa* ‘As for coming tomorrow, Zhang tried’). A sentence like, *zhang bi wo mingtian lai* ‘Zhang forced me to come tomorrow’, cannot be topicalized as * [*e mingtian lai*], Zhang *bi wo* ‘As for coming tomorrow, Zhang forced me’. Examples like these suggest that a non-finite clause cannot be topicalized in normal Chinese sentences. Therefore, I assume that the EC in the topic of (43c) is *pro* that refers freely, making the topic a finite clause. Since *daying* (‘allow’) does not take finite clauses, the interpretation of the verb in (43c) must be “promise”. We can also test the grammaticality of the sentence by adding an overt pronoun or a modal verb to the topic of (43c).

- (46) [Ta mingtian (hui) lai], Zhang *daying* le Li.
‘As for his coming tomorrow, Zhang has promised Li.’

Example (43d) is structurally similar to (46) above in that the topic is a finite clause. For the same reason as (43c), *daying* in (43d) carries the meaning of “promise” but not “allow”. Using the above analysis we can predict that, if a *daying* sentence like (41) has the grammatical topicalization such as (43b), the predicate will be “to allow”.

Otherwise it will mean “to promise”, if the sentence can be grammatically topicalized in the pattern of (43c) and (43d).

Following Radford (1988), I propose another method, which I call “passivization method”, to test the different structure of *daying*. We have already discussed how to differentiate a finite clause from a non-finite one in a *daying* sentence. As mentioned earlier, the Chinese verb *daying* allows downstairs clause passivization both in the meaning of “promise” and “allow”. However, in sentences like (47) below, passivization does not create the same semantic content when *daying* has different readings.

- (47) a. Zhang daying yisheng mingtian jiancha bingren.
Zhang DAYING doctor tomorrow examine patient.

If you are uncertain whether the embedded clause in the sentence is finite or non-finite and, hence, cannot decide what reading *daying* has, just passivize the sentence. If the passivized sentence has the same semantic content as the unpassivized one, the matrix predicate *daying* should have the reading of “promise”. Otherwise, it has the reading of “allow”, as shown in the following.

- (48) a. Zhang daying [yisheng mingtian (hui) jiancha bingren].
Zhang promise doctor tomorrow will examine patient.
‘Zhang promised that the doctor will examine the patient tomorrow.’

- b. Zhang daying bingren mingtian (hui) bei yisheng jiancha.
Zhang promise patient tomorrow will by doctor examine
‘Zhang promised that the patient will be examined by the doctor tomorrow.’ (equivalent to (48a) semantically)

- (49) a. Zhang daying yisheng [mingtian (*hui) jiancha bingren].
Zhang allow doctor tomorrow will examine patient.
‘Zhang allowed the doctor to examine the patient tomorrow.’

- b. Zhang daying bingren mingtian (*hui) bei yisheng jiancha.
Zhang allow patient tomorrow will by doctor examine
‘Zhang allowed the patient to be examined by the doctor tomorrow.’ (not equivalent to (49a) semantically)

Note that the insertion of a modal verb (*hui* ‘will’) in (48) is acceptable but not in (49), which shows that the clauses in (48) are finite and *daying* means “promise”, but means “allow” in (49). This “passivization” method can help solve the finite/non-finite problem caused by the fact that Chinese does not have overt complementizers. It can also be used as a means to distinguish the two possible readings of *daying* in an ambiguous sentence like (47). That is to say, if the meaning of a *daying* sentence remains unchanged whether passivized or not, the predicate should have the “promise” reading, otherwise it means “allow”.

Another test that I propose involves the Chinese negative markers *bu* and *mei*. Recall that *bu* is a neutral negation form that can negate an event or a state either in the past, present, or future. *Mei*, on the other hand, negates only the completion of an event. In English, *promise* indicates the certainty of the **promiser** about something either in present, past, or in the future. But an **allower** always allows or does not allow something that is going to happen. Consider the following sentences.

- (50) a. John promised (Lee) to do this.
b. Lee promised that he didn’t do this.

- (51) a. John allowed Lee to do this.
b. John didn’t allow Lee to do this.

- c.*Lee allowed Tom to have done this
- d.*Lee allowed Tom not to have done this.

My assumption here is that in a promise-type sentence, the event of the embedded clause may happen after the event of “promising”, or, a “promise” can still be made after the promised event already took place (e.g., (50b)), and the **promiser** is responsible for the truth that he/she promises for. The sub-event in an allow-type sentence usually takes place under the condition that something has been “allowed”. In this sense, the action of “allow” logically precedes the event of whatever is allowed. Now, let us examine the following Chinese *daying* sentences with negative markers *mei* and *bu*.

- (52) a. Zhang *daying* Li *zuo zhejian shi*.
Zhang DAYING Li do this event

- b. Zhang *daying* Li *bu zuo zhejian shi*.
'Zhang promised Li not to do this.'
'Zhang promised that Li does/will not do this.'

(Note: the difference between the two readings can be tested through “topicalization and “passivization” discussed above)

- c. Zhang *daying* Li *mei zuo zhejian shi*.
'Zhang promised that Li didn't do this.'
test:

A: Ni *gan daying ta mei zuo zhejian shi ma*?
you dare promise he NEG do this event Q
'Dare you promise that he didn't do this?'

B: Wo *gan daying ta mei zuo zhejian shi*.
'I dare promise that he didn't do this.'

- d. Zhang *daying* Li *bu zuo zhejian shi*
Zhang allow Li NEG do this event
'Zhang allowed Li not to do this.'

- e.*Zhang *daying* Li *mei zuo zhejian shi*
Zhang allow Li NEG do this event
'Zhang allowed Li not to have done this.'

In the above examples, *daying* ('promise') takes clauses with negative markers of both *mei* and *bu*, while *daying* ('allow') takes only *bu* in its embedded clause. This suggests that the Chinese *daying* is compatible with two of its English counterparts (“promise” and “allow”, respectively) in that the former can be followed by an event that may happen either before or after the event of “promise”, while the latter describes an event that can only take place after the event of “allow”. Therefore, to negate a *daying* sentence like (52a) by using *bu* and *mei* can help determine whether the sentence predicate has the reading of “promise” or “allow”.

In general, although a *daying* sentence can be ambiguous in terms of its control structure, because *daying* exhibits the properties of both a subject-control verb “promise” and an object-control verb “allow” in addition to the pro-drop factors in Chinese, there are still ways to differentiate the structural and semantic differences of a *daying* sentence. The tests conducted in this section, namely, “topicalization”, “passivization” and “negation”, are just a few examples among the several in different theories.

6. Summary

I have claimed that the Chinese verb *daying*, which is generally taken as the equivalent of the English “promise” in the literature of control discussion, has more than just one reading. These readings (e.g., “promise”, “allow”, etc.) are different not only in their lexical interpretation, but also in their control structure. That is, *daying* is both a subject-control verb (‘promise’) and an object-control verb (‘allow’). The fact that Chinese does not have overt markers for AGR or clause distinction (finite vs. non-finite), and that Chinese allows pronominals to drop, sometimes makes a sentence with *daying* as its matrix predicate ambiguous. However, such ambiguity can be clarified once we have a clear concept of the control nature of the different readings *daying* represents. A number of testing methods are proposed to distinguish different readings in a single sentence. One further point is that the intertwining of different readings is not totally “out of control”, so long as there are correct theories to predict it.

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UNIFYING GAPPING, RIGHT-NODE RAISING, AND V°-COORDINATION

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1.0 The Puzzle

The phenomena known as Gapping and Right-Node Raising (RNR) have attracted much attention in the syntactic literature. The following exemplify each, respectively:

1. Robin ate beans, and Kim rice
2. Robin cooks, and Kim eats, beans

Under the standard analysis of Gapping, the second occurrence of the verb 'ate' in (1) deletes. Two different analyses have attempted to explain (2); in RNR terms (Postal (1974), among others), the identical objects of the conjoined clauses undergo ATB movement and adjoin to the right of the coordination; (3) reflects this transformation:

3. [Robin cooks t_i] and [Kim eats t_i] beans;

Others, such as Ross (1970) and Neijt (1979), claim instead that (2) demonstrates the effect of Backward Conjunction Reduction (BCR); from clausal coordination, the first occurrence of the identical object 'beans' deletes.

A fact noted by Koutsoudas (1971), however, casts doubt upon all these analyses. Koutsoudas observes that precisely those languages which permit Gapping constructions also permit RNR. Languages which lack Gapping also prohibit RNR constructions. Chinese presents such an example of the latter language type; both of the following crash:

4. *Robin da-le nanhaizi, Kim nuhaizi
hit-ASP boy girl
'Robin hit the boy, and Kim, the girl'
5. *Robin da-le, Kim ti-le nanhaizi
hit-ASP kick-ASP boy
'Robin hit, and Kim kicked, the boy'

Since these two phenomena either both occur or both do not occur in a given language, it stands to reason that they should succumb to a similar analysis. However, the standard analyses of Gapping and RNR fail to establish any such connection; Gapping depends upon deletion and RNR relies upon movement. Though both Gapping and BCR invoke a deletion transformation, Neijt (1979) shows that they do not collapse into a single rule. Among other things, Gapping targets clause-medial material and faces strict restrictions on the number of remnants it permits; RNR targets clause-final material only and can leave behind many more remnants. The following examples show this difference in the number of remnants:

6. *Robin ate beans yesterday, and Kim rice two days ago
7. Robin chopped, and Kim peeled, apples with Terry's knife in the kitchen

So present analyses do not capture the hand-in-hand relationship between Gapping and RNR very well. Koutsoudas (1971) also notes another relevant fact, largely ignored in the literature: Precisely those languages

which exhibit Gapping and RNR also license V° -coordination. English and Chinese again contrast:

8. Robin [hit and kicked] the boy
9. *Robin da-le, ti-le nanhaizi
hit-ASP kick-ASP boy
'Robin hit and kicked the boy'

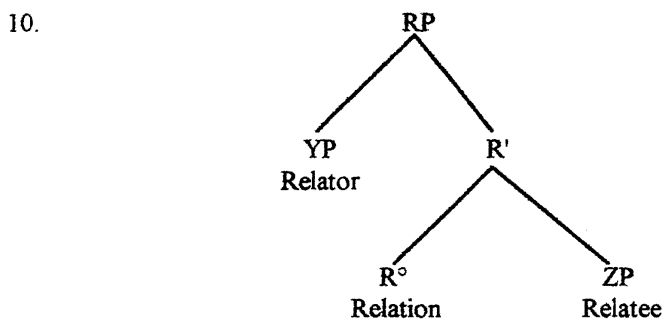
This fact adds to the puzzle: not only should Gapping and RNR undergo a similar analysis; the analysis should also speak to whether or not a language permits V° -coordination. Standard accounts have no way to tie together these three phenomena.

This paper proposes an analysis which unifies these three related syntactic phenomena. The analysis claims that Gapping and RNR do not result either from deletion or from optional movement, but rather from base-generated coordination of a single phrase. The argument takes the following form: first, it introduces the single phrase responsible for both Gapping- and RNR-type constructions, and shows how coordination of this phrase together with required rules of movement result in the canonical word orders such as those in (1) and (2). It then establishes the connection between Gapping, RNR and V° -coordination, and concludes with a brief analysis of complex and 'discontinuous' Gaps that demonstrates empirical advantages of the analysis.

2.0 Relation Phrases

Phrasal coordination provides conceptually the most attractive means of arriving at Gapping and RNR; the challenge stands, however, how to conform to the general requirement (as stated for example in Chomsky (1957:35)) that only like terms may coordinate. No currently recognized syntactic phrase will suffice.

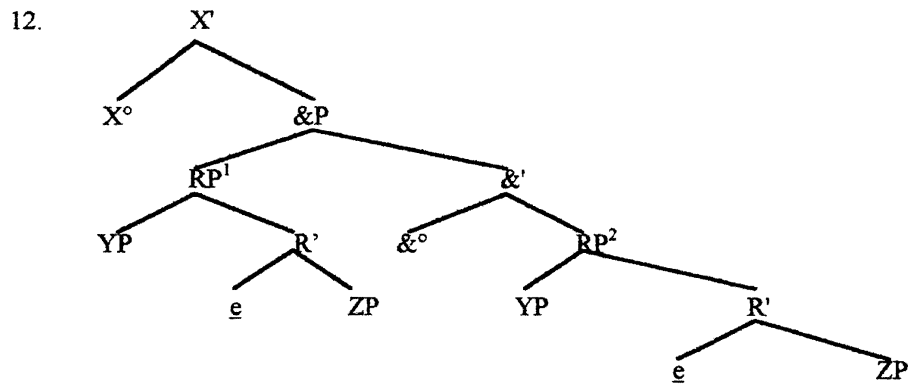
Therefore, this work introduces a new phrase to serve just this end; it proposes that a language may have a Relation Phrase (RP; the motivation for the name will follow). RPs conform to X-bar theoretical principles, and take the following form (in a head-initial language):



The following definitional requirement on RP sets it apart from all other XPs:

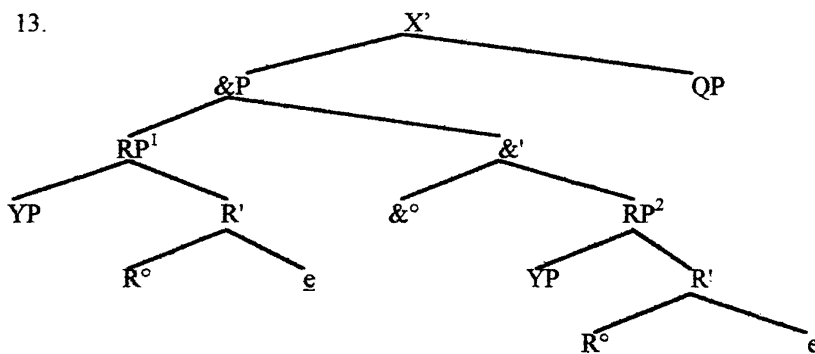
11. An RP must have an underlyingly empty position licensed by a node that immediately c-commands an RP-coordination.

The following diagram will clarify. In (12), an X° head mutually c-commands an RP-coordination, and licenses the empty R° position through a head-to head relation:¹



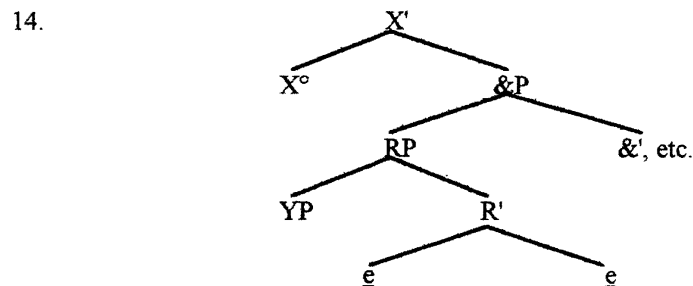
Although the YPs and ZPs above have lexical content, the R^o positions do not; however, they receive licensing from the X^o head and in fact inherit all of the features of the X^o . The RPs in (12) will therefore have the same basic argument structure as the XPs. In a way, this concept of RPs parallels the spirit of SLASH categories in Generalized Phrase Structure Grammar theory and Categorical Grammar; these frameworks admit such constituents as S/NP, which denotes a sentence with an NP 'missing' somewhere, with the missing NP to be filled in through an appropriate structural relation with another term. This work applies such an idea within the GB framework; RPs exist as phrases with something 'missing'.

The empty elements in (12) receive licensing through a head-to-head relationship; similarly, a complement-to-complement relation can license them, as shown below:



Here, the RP-coordination stands in place of an X^o , and the lexically realized R^o terms correspond accordingly; the argument structure of the RPs will mirror that of XP. Note that a complement QP mutually c-commands the RP-coordination; it therefore licenses the empty elements in the [Comp, R^o] positions. The empty elements, under this licensing, can satisfy the selectional requirements of R^o just as the QP would satisfy the selectional requirements of a noncoordinated X^o .

Note that an RP will never have two empty positions, since no single node c-commanding an RP-coordination can satisfy the featural needs of two structurally different positions:



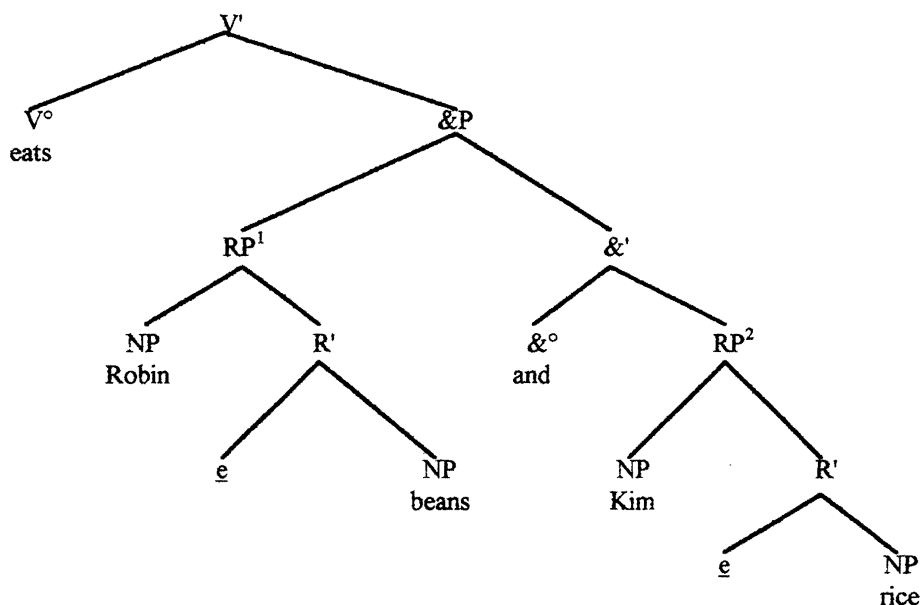
Here, for example, the X^0 head can license the empty R^0 position through the head-to-head relation discussed earlier, but cannot speak to the empty $[Comp, R^0]$ position. Since all empty elements must receive licensing, the form crashes.

RPs, then, have a single empty position in either R^0 or $[Comp, R^0]$.² The rest of this work will attempt to establish the following claim: when R^0 contains an empty element, Gapping-type constructions result; an empty $[Comp, R^0]$ position produces RNR-type constructions. Gapping and RNR, then, actually become mirror images of one another, inextricably linked through the presence of RP in a given language.

3.0 RPs and Gapping

Consider first how RP-coordination can produce Gapping constructions. In such forms, a lexical V^0 mutually c-commands an RP-coordination and licenses empty elements in the R^0 -slots. The relevant part of the underlying structure of (1) under this idea becomes:

15. Robin ate beans, and Kim rice

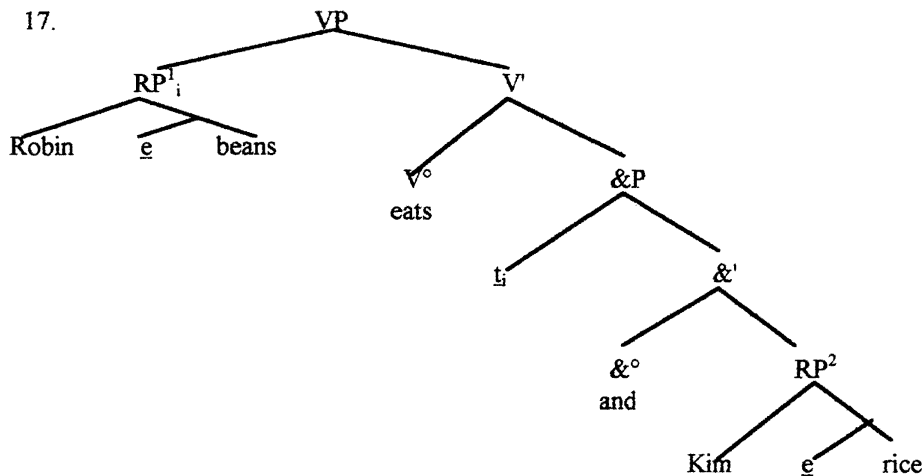


The motivation for the name Relation Phrase now becomes more evident; because the verb binds and licenses the empty elements in R^0 , the syntactic structure immediately reflects the semantic relations as shown:

16. ate(Robin, beans)&(Kim, rice)

The relation of eating holds between Robin and beans, and Kim and rice, respectively. Assume that the R^0 s, by virtue of their relationship with the lexical verb, manage to discharge all Case and theta-roles as needed.

The structure in (15) does not immediately produce the surface word order in English (though this word order does appear in Gapping constructions in Spanish, Irish and other languages). However, the correct English word order results from required movements. Because English requires Case-checking of within its AgrSP and AgroP (as described, e.g. in Chomsky (1993)), RP^1 must raise from its initial position. Though this movement does contravene the Coordinate Structure Constraint (Ross (1967)), Case requirements override this prohibition on movement. (See Zoerner (to appear) for further explanation and examples.) The result of this movement appears as:



From here, the NP 'Robin' may continue raising to [Spec, AgrSP]; the NP 'beans' similarly raises to [Spec, AgroP]. The lexical verb 'eats' for its part passes through Agro^o and ends in Agrs^o; this yields the correct surface order of terms.³

Recall the aforementioned mystery regarding Gapping and remnants; for example, Gapping may not leave behind unlike adverbials together with unlike objects as in (6), repeated below:

18. *Robin ate beans yesterday, and Kim (ate) rice two days ago

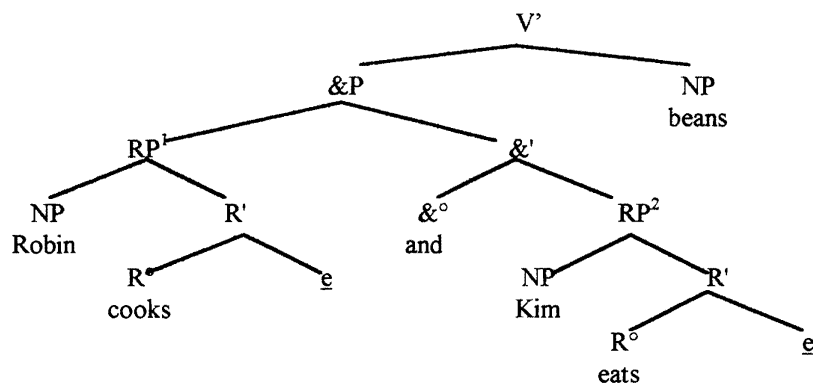
The ungrammaticality of this form provides strong evidence for the RP-analysis and against an analysis of Gapping as a result of VP-coordination (as in, for example, Johnson (1994)). Because the RPs have only three positions--Relator, Relation and Relatee--the unlike adverbials simply have no syntactic home. RPs do not equal VPs, and do not provide an 'extra' position for adverbials as VPs might. Therefore unlike adverbials cannot surface in Gapping constructions; the restriction on the number of remnants Gapping allows falls out directly.

To sum up so far: the RP-analysis of Gapping, then, invokes neither deletion nor optional movement. Coordination of like terms--the RPs--together with required movements produce Gapping-type constructions.

4.0 RPs and RNR

Gapping results when an RP-coordination occupies [Comp, V^o]. On the other hand, RNR results when an RP-coordination fills a V^o position itself. The underlying structure of (2) under this idea becomes:

19. Robin cooks, and Kim eats, beans

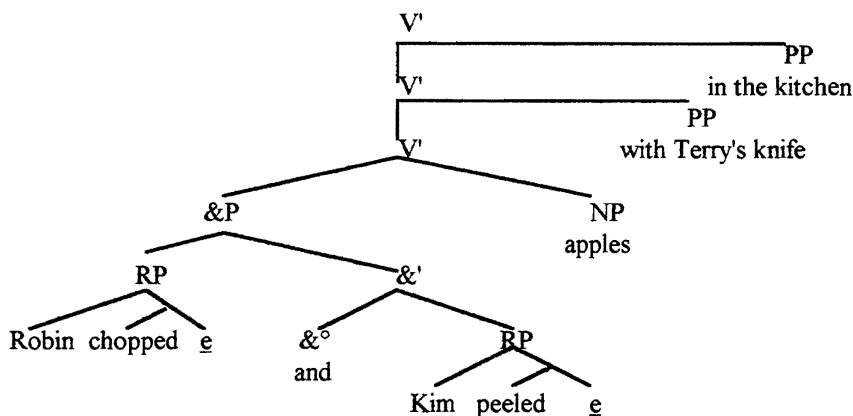


This structure generates the surface word order directly; however, exactly the same movements (this time vacuous) apply here that applied in the Gapping case. RP^1 first raises to [Spec, VP]. From there, the NP 'Robin' raises to [Spec, AgrsP]. Assume that the empty element in RP^1 , by virtue of its association with the lexical NP object 'beans', may satisfy agreement at LF; it therefore raises to [Spec, AgroP]. The verb as always raises and ends in $Agrs^o$; the correct surface order results.

Note in passing an advantage that the structure in (19) enjoys over a BCR analysis; it correctly reflects the prosodic structure of the form. BCR cannot explain the necessary intonational break between the terms 'eats' and 'beans'; under the RP-analysis this pause indicates their membership in different constituents.

The analysis can also account for the fact that RNR, unlike Gapping, may have more than one remnant. Consider the structure of (7), repeated below:

20. Robin chopped, and Kim peeled, apples with Terry's knife in the kitchen



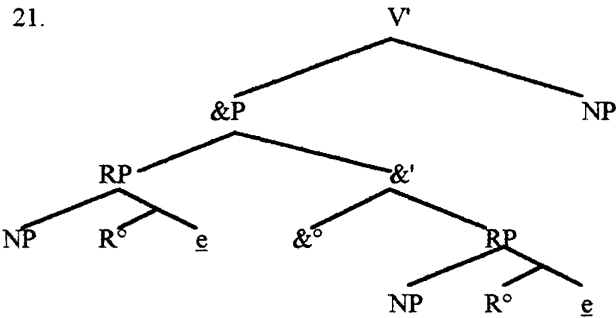
Because English permits any number of rightward PP adjuncts generally, the RNR facts fall out directly. The difference in remnants between Gapping and RNR, then, falls out as a natural consequence of the analysis and does not require any ad hoc stipulation.

To sum up: RP can have an empty element in one of two positions; one of the empty positions results in Gapping, and the other produces RNR. This neatly accounts for part of the puzzle posed at the outset; Gapping and RNR either both occur in a given language or both do not occur due to the presence or lack of RP in a language's inventory. Gapping and RNR go together as two sides of the same syntactic coin.

5.0 RPs and V^o-Coordination

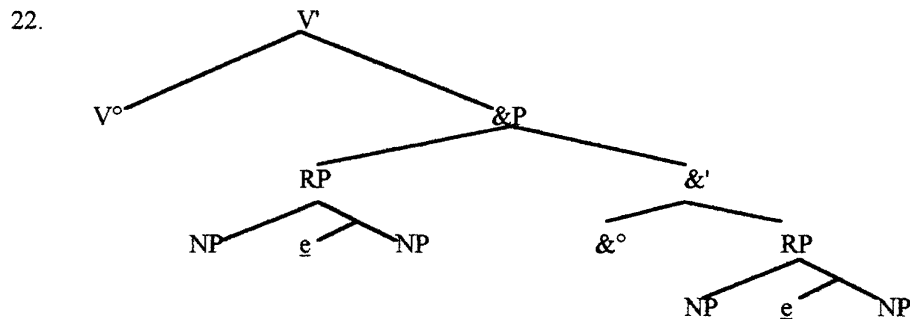
Although the RP-analysis does manage to make the conceptually desirable step of unifying the phenomena of Gapping and RNR, nothing so far has addressed the question of why a language might or might not contain RP in its inventory. English, which contains RP, exhibits both Gapping and RNR; Chinese, which lacks RP, exhibits neither. But the presence or absence of RP needs a more profound explanation.

The previously noted fact that only those languages with Gapping and RNR also have V^o-coordination provides the key to this part of the puzzle and support the ideas underpinning the RP-analysis. Consider again the canonical structure for an RNR construction:



As noted earlier, the RP-coordination stands in lieu of a V° term, and in fact the R° positions contain lexical verbs. Because RNR results from a coordination in a V° position, it follows that those languages which prohibit V° -coordination even of single lexical verbs will also prohibit such RP-coordination.

A look at the canonical Gapping construction points to the same conclusion:



Here, the V° associates with the empty R° positions through c-command. As noted earlier, the R° s in effect become V° s by virtue of this structural relation. In a sense, then, the lexical V° does coordinate. Once again, it follows that those languages which prohibit V° -coordination generally will also prohibit Gapping, which relies crucially on this type of V° -coordination.

It turns out, then, that V° -coordination stands as a primitive. Languages either allow it or they do not, and from this it necessarily follows whether or not they will allow Gapping and RNR. The RP-analysis, then, succeeds in unifying these three phenomena in a principled way.

6.0 Further Empirical Support for the RP-Analysis

In addition to this conceptual advance, the RP-analysis also provides straightforward answers to previously unresolved empirical issues of Gapping and RNR. This section contains a brief look at two such benefits.

6.1 Directionality

Note that under a deletion account, identical verbs in English delete forward while identical objects delete backward:

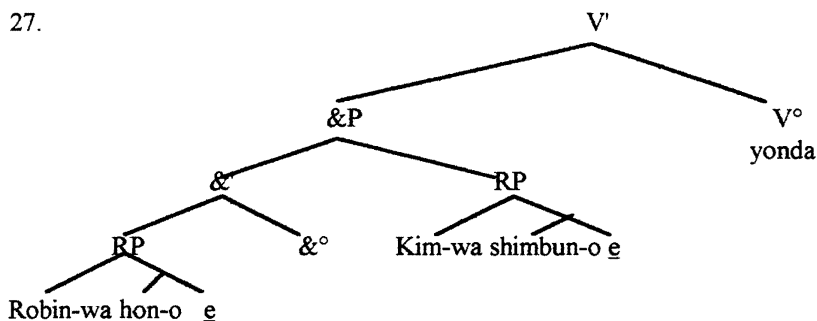
23. Robin eats beans, and Kim rice
 24. Robin cooks, and Kim eats, beans

In a head-final language such as Japanese, the opposite holds; verbs delete backward and objects delete forward:

25. Robin-wa hon-o, Kim-wa shimbun-o yonda
 TOP book-ACC TOP newspaper-ACC read-PT
 'Robin read a book, and Kim a newspaper'
26. Hon-o Robin-wa katta, Kim-wa yonda
 book-ACC TOP buy-PT TOP read-PT
 'Robin bought, and Kim read, a book'

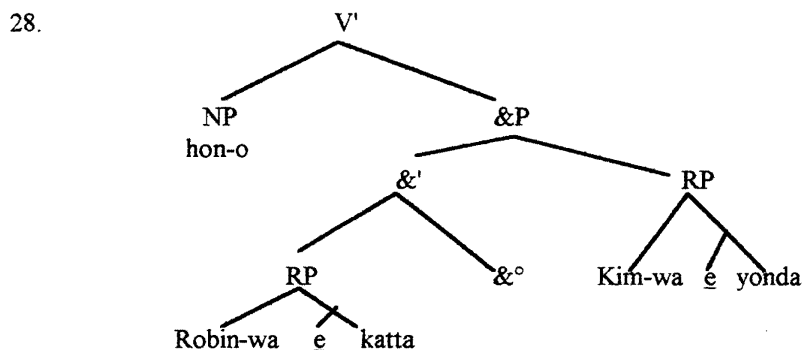
Ross (1970) proposes what amounts to a Directionality Constraint (DC) to account for the difference in verb-deletion and object deletion; the DC states that left-branching terms delete forward and right-branching terms delete backward. This DC does provide a descriptive adequacy, but nothing conceptually motivates it; there seems no a priori reason, for example, why left-branching elements should not delete backward and right-branching elements forward. The DC stands as best as a descriptive generalization.

The RP-analysis, however, does away with any need to stipulate a DC; the order of constituents in Gapping and RNR constructions falls out directly as a result of the language's head-parameter. Previous diagrams have shown how the word order in a verb-initial language such as English results. Now consider the corresponding diagrams in Japanese:



Both the &P and the RP show head-final status just as the Japanese VP does. The base-generated structure above produces the correct surface order of terms. Fukui (1993 and elsewhere) holds that Japanese may lack Agreement nodes entirely; if so, then no movement occurs and the diagram in (27) represents the end of the story. No deletion has occurred, so no need to appeal to a DC arises.

The object deletion facts fall out in the same way. Consider:



Again, the construction contains only one lexical direct object, which necessarily precedes any verb. The base-generated structure produces the correct word order. The impression of forward deletion, then, simply results from the verb-final status of Japanese.⁴ The RP-analysis supplants the DC in both head-initial and head-final languages.

6.2 V+Direct Object Gaps and 'Discontinuous' Gaps

Consider the following two grammatical Gapping examples:

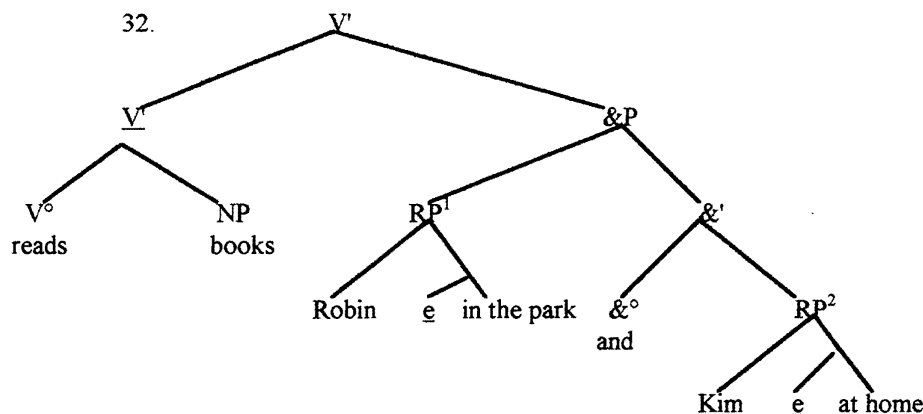
29. Robin reads books in the park, and Kim at home
 30. Robin ate beans yesterday, and Kim rice

(29) shows a complex Gap of a verb and following direct object. (30) shows an apparent discontinuous Gap; the form necessarily means that Kim ate rice yesterday rather than on some other day, so both the verb and the adverbial appear to Gap. Deletion-based Gapping accounts must simply stipulate that Gapping can target a V+DO string or even nonconstituents to produce these two forms. However, these stipulations run into difficulties. If one concedes that deletion may affect a V+DO string, the (b) form should follow from the grammatical input (a) below:

31. a. Robin reads books, and Kim reads books
 b. *Robin reads books, and Kim

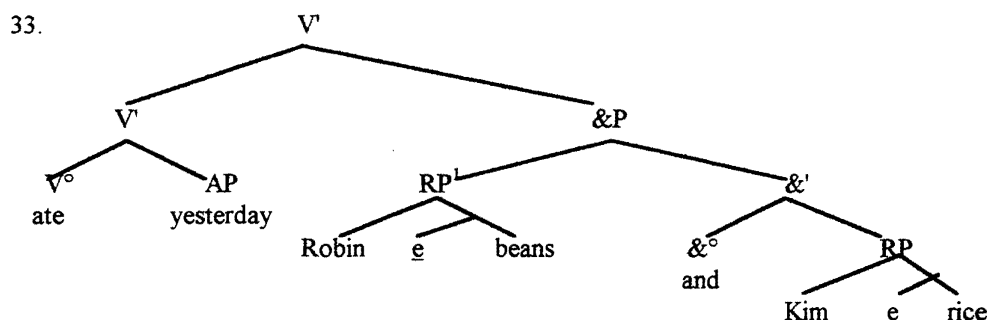
(31b) shows an ungrammatical case of bare argument stranding; the deletion account of Gapping needs an ad hoc stipulation to rule it out. As for (30), the concession that Gapping can apply to discontinuous strings flies in the face of the general assumption that a single transformation operates on a single constituent only.

However, given a single extra claim within the spirit of the analysis, the RP-account can show (29) and (30) as related structures. Recall the previous claim that Gapping-type constructions result when a V° immediately c-commands an RP-coordination. Grant now the following: Gapping may also result when a V' c-commands an RP-coordination. Under this idea, the underlying structure of (29) assumes the configuration:



Here, the underlined V' binds the empty elements within the RPs and thus licenses them. Note that PPs rather than NPs occupy the Relatee positions in the RPs; this comes at no cost since the R°s associate with verbs and verbs permit such PP-configurations. Consider now the required movements that result in the final word order. Both AgrsP and AgroP need Case-checking of an NP. Therefore, first, RP¹ raises to [Spec, VP]. The [Spec, AgrsP] position needs an NP that bears Nominative Case (NOM). Because the NP 'Robin' has received NOM within its RP, it raises to that position and satisfies checking requirements. In a similar vein, [Spec, AgroP] needs an NP that bears Accusative Case (ACC). The PP 'in the park' and the NP 'books' stand as the two possible candidates to undergo such raising; the latter necessarily wins out, though, since unlike the PP it bears the appropriate ACC for feature-checking. Therefore, 'books' necessarily raises to [Spec, AgroP], which produces the correct word order.⁵

The apparent discontinuous Gapping case in fact results from the same basic construction. Accept with Larson (1988) that adverbials occupy the innermost complement of a V°. This means that (30) will have the following underlying structure:



Turn now to the various movements required by the AgrPs. As always, RP¹ raises to [Spec, VP]. From here, the Relator NP 'Robin' raises to [Spec, AgrsP]. [Spec, AgrsP] also needs an NP; here, the NP 'beans' bears the appropriate ACC and raises accordingly. The adverbial 'yesterday' does not raise because it cannot meet the feature-checking needs within either AgrP. It remains in situ while the verb 'ate' raises up to Agrs°; this directly produces the surface word order of (30). So both the V+Direct Object Gaps and the 'discontinuous' Gaps result from the same phenomenon of a V' c-commanding an RP-coordination; whether or not the [Comp, V°] term can satisfy agreement-checking or not determines whether the Gap will surface as complex or discontinuous.

7.0 Conclusion

The introduction of RP unites the syntactic processes of Gapping and RNR, whereas previous analyses have failed to establish this vital connection. Furthermore, it does so in a way that ties them together with V°-coordination, which represents another conceptual advance. The ability of the analysis to handle more complicated cases of complex and discontinuous Gapping suggests strongly that this introduction of RPs renders empirical advantages to accompany its conceptual ones.

NOTES

My thanks go to Robert May for helpful comments and criticisms on an earlier version of this work.

1. Assume along the lines of Munn (1992) that a coordinating conjunction (&) heads its own functional phrase &P.
2. Space limitations preclude a detailed explanation of why empty elements do not surface in [Spec, RP]. Essentially, if a [Spec, XP] term mutually c-commanded an RP-coordination that stood in lieu of an X' constituent, the resulting structure would produce the same word order as straight X'-coordination, but with vacuous empty elements present. Assume that the grammar prohibits such vacuous structure.
3. Assume that Case-checking within an AgrP at LF requires lexical content in the Agr° head; hence the lexical verb rather than the associated empty element raises to that position.
4. Note that the closest NP 'Robin' can scramble over the direct object; this results in the grammatical:
 - i. Robin-wa hon-o katta, Kim-wa yonda
 TOP book-ACC bought TOP read
 'Robin bought, and Kim read, a book'
 However, in no case may such scrambling violate the head-final status of Japanese.
5. Bare argument stranding constructions would require empty elements in both the empty R° and [Comp, R°] positions (as in (14)); the present analysis therefore rules them out at no extra theoretical cost.

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