

ZASPiL Nr. 39 – February 2005

**Supralaryngeal mechanisms of the
voicing contrast in velars**

Jana Brunner

CONTENTS

Acknowledgements.....	5
1 INTRODUCTION	6
1.1 Voicing and voicelessness.....	6
1.1.1 The physics of voicing.....	7
1.1.2 The physics of voicelessness	8
1.1.3 Stop inventories in the languages of the world	9
1.1.4 The “voicing” contrast in Korean velar stops	11
1.1.5 The “voicing” contrast in German velar stops	12
1.2 State of the art	13
1.2.1 Looping patterns in velar stops.....	13
1.2.2 Previous investigations of Korean velar stops	14
1.2.3 Previous investigations of German velar stops	15
1.3 Phonological descriptions and phonetic correlates	17
1.3.1 Kohler (1984).....	18
1.3.2 Chomsky & Halle (1968)	20
1.3.3 Jessen (1998)	22
1.4 Aims and structure of the study	25
2 METHODS	27
2.1 Subjects	27
2.2 Word material.....	27
2.2.1 Korean.....	27
2.2.2 German	28
2.3 Experimental procedure	28
2.3.1 Acoustic recording.....	28
2.3.2 Articulatory recording: Electromagnetic articulography	28
2.4 Segmentation and labelling	32
2.4.1 Acoustic segmentation and labelling.....	32
2.4.2 Articulatory segmentation and labelling	34
2.5 Calculations	38
2.5.1 Segmental durations	38
2.5.2 Percentages of segmental durations.....	39
2.5.3 Movement amplitudes	40
2.5.4 Euclidean distances.....	40
2.5.5 Velocities	41

2.5.6	Tongue position at closure.....	41
2.6	Developing suppositions	41
2.6.1	Typical productions	41
2.6.2	Ensemble averages	43
2.7	Testing the suppositions	43
2.7.1	Weighting parameters.....	43
2.7.2	Analyses of variance.....	46
2.8	Summary of the methods.....	46
3	RESULTS	47
3.1	Suppositions	47
3.1.1	Korean.....	47
3.1.2	German	48
3.2	Weighting parameters	48
3.2.1	Korean.....	49
3.2.2	German	54
3.3	Deeper analysis of parameters	55
3.3.1	Articulatory parameters for Korean.....	55
3.3.2	Acoustic parameters	63
3.4	Summary of the results.....	72
4	DISCUSSION.....	73
4.1	Comparison of German and Korean velar stops	73
4.1.1	Comparison based on the weighting procedure	73
4.1.2	Comparison of German and Korean articulatory characteristics ...	74
4.1.3	Comparison of German and Korean acoustic characteristics.....	78
4.2	Looking back at the suppositions.....	79
4.3	Influence of the vowel context on the choice of the parameters.....	80
4.4	Articulatory vs. acoustic parameters	81
4.5	Explanations for looping patterns	81
4.6	Features	82
4.7	Conclusion.....	83
	Appendix.....	85
	References.....	142