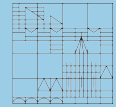# The Matter of the Root

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The Root in Maltese

A large number of verbs in Maltese are composed of two basic derivational morphemes, **a consonantal root** and **a pattern** (*binyan*), interwoven within each other in a non-concatenative manner. **The root** is a **discontinuous** morpheme of **3 or 4 consonants** in fixed sequence. The consonants, also known as radicals, form a skeleton on which the vowels are intercalated and affixes are added.

Repulsion of Likes

It has long been noted in studies on Semitic languages that **consonants with a similar place of articulation feature are avoided** in triliteral roots (cf. Greenberg 1950; Bachra 2001; inter alia). More recently, this principle of Similar Place Avoidance (SPA) has been confirmed for other (non-Semitic) languages (e.g., Pozdniakov & Segerer 2007; Mayer et al. 2010).

Moreover, a similar observation has been made for avoidance of successive consonants with **similar manner** features (e.g., Twaddell 1939 for German; Iverson & Salmon 1992 for Proto-Indo-European).

We intend to investigate whether such a tendency for the *repulsion of likes* can also be maintained for Maltese with respect to (i) place of articulation and (ii) manner of articulation features.

Data

We seek to answer these questions by investigating the phonological structure of an **exhaustive list of 1,958 verb-creating roots** in Maltese which we compiled using Serracino-Inglott (1975-1989) and Aquilina's (1987-1990) dictionaries as well as Mifsud's (1995: 272- 295) corpus of loan verbs which are fully assimilated into the root-and-pattern system.

The matrices show the results for the respective category successions (rows represent the first consonant, columns the second consonant). Each cell contains the counts for the **observed successions (obs)** and the calculation of the **expected frequency (exp)** under the assumption of independence between successive consonants. Additionally, we calculated the **discrepancy (diff) between the observed and expected frequencies** according to the formula in (1):

$$(1)\quad diff = 100 \cdot \frac{(obs - exp)}{exp}$$

Place of Articulation

We divided the sounds of Maltese into **three major place of articulation categories**: labial (l), coronal (c) and dorsal (d). The tendency has been tested on successive consonants in all roots (left matrix) and only in triconsonantal roots (right matrix). No significant differences between both lists could be observed.

Fig. 1: Results for all roots (left matrix) and triliteral roots (right matrix) with respect to place of articulation distinctions

Different Positions within the Triliteral Root

Fig. 2: Matrices for the different positions in Maltese triliteral roots. For instance, the top left matrix represents the results from the first to the second consonant. The bottom right matrix shows the results for positions 2 to 3 ignoring identical consonants (which make up 171 out of 1005 in total for this position).

Manner of Articulation

We divided the sounds into **two major manner categories**: obstruents (o) and sonorants (s). The results in Fig. 3 confirm the tendency not only for place but also for manner of articulation distinctions.

Fig. 3: Results for all roots with respect to manner of articulation distinctions

Conclusions

Although Maltese has been under intense language contact with Romance and English, its root consonants follow the constraints found in Arabic and Hebrew with respect to SPA. The more general principle of the repulsion of likes also holds for manner of articulation features (and, to a lesser extent, for voice features).

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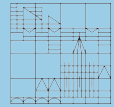
Supplementary Material

The following matrices show the results for the different categories for the different positions within the triliteral root, including (left matrices) and ignoring (right matrices) identical consonants.

Place of Articulation

	l	c	d			l	c	d
l	exp: 36 / obs: 0 / diff: -100.0%	exp: 94 / obs: 126 / diff: 34.04%	exp: 37 / obs: 43 / diff: 16.22%	**l**		exp: 36 / obs: 0 / diff: -100.0%	exp: 94 / obs: 126 / diff: 34.04%	exp: 37 / obs: 43 / diff: 16.22%
c	exp: 105 / obs: 140 / diff: 33.33%	exp: 273 / obs: 188 / diff: -31.14%	exp: 108 / obs: 159 / diff: 47.22%	**c**		exp: 104 / obs: 140 / diff: 34.62%	exp: 270 / obs: 185 / diff: -31.48%	exp: 108 / obs: 159 / diff: 47.22%
d	exp: 75 / obs: 77 / diff: 2.67%	exp: 195 / obs: 250 / diff: 28.21%	exp: 77 / obs: 22 / diff: -71.43%	**d**		exp: 75 / obs: 77 / diff: 2.67%	exp: 195 / obs: 250 / diff: 28.21%	exp: 78 / obs: 22 / diff: -71.79%

Fig. 4: Matrices for positions 1 to 2 in triliteral roots with respect to place of articulation distinctions (labial, coronal, dorsal)

	l	c	d			l	c	d
l	exp: 45 / obs: 37 / diff: -17.78%	exp: 128 / obs: 143 / diff: 11.72%	exp: 42 / obs: 37 / diff: -11.9%	**l**		exp: 37 / obs: 1 / diff: -97.3%	exp: 106 / obs: 143 / diff: 34.91%	exp: 37 / obs: 37 / diff: 0.0%
c	exp: 117 / obs: 122 / diff: 4.27%	exp: 335 / obs: 325 / diff: -2.99%	exp: 111 / obs: 117 / diff: 5.41%	**c**		exp: 94 / obs: 122 / diff: 29.79%	exp: 267 / obs: 217 / diff: -18.73%	exp: 94 / obs: 117 / diff: 24.47%
d	exp: 46 / obs: 50 / diff: 8.7%	exp: 133 / obs: 129 / diff: -3.01%	exp: 44 / obs: 45 / diff: 2.27%	**d**		exp: 40 / obs: 50 / diff: 25.0%	exp: 115 / obs: 129 / diff: 12.17%	exp: 40 / obs: 18 / diff: -55.0%

Fig. 5: Matrices for positions 2 to 3 in triliteral roots with respect to place of articulation distinctions (labial, coronal, dorsal)

Manner of Articulation

	o	s			o	s
o	exp: 529 / obs: 491 / diff: -7.18%	exp: 289 / obs: 328 / diff: 13.49%	**o**	exp: 528 / obs: 489 / diff: -7.39%	exp: 288 / obs: 328 / diff: 13.89%
s	exp: 120 / obs: 159 / diff: 32.5%	exp: 65 / obs: 27 / diff: -58.46%	**s**	exp: 119 / obs: 159 / diff: 33.61%	exp: 65 / obs: 26 / diff: -60.0%

Fig. 6: Matrices for positions 1 to 2 in triliteral roots with respect to manner of articulation distinctions (obstruents vs. sonorants)

	o	s			o	s
o	exp: 404 / obs: 367 / diff: -9.16%	exp: 245 / obs: 283 / diff: 15.51%	**o**	exp: 322 / obs: 248 / diff: -22.98%	exp: 208 / obs: 283 / diff: 36.06%
s	exp: 220 / obs: 258 / diff: 17.27%	exp: 134 / obs: 97 / diff: -27.61%	**s**	exp: 183 / obs: 258 / diff: 40.98%	exp: 119 / obs: 45 / diff: -62.18%

Fig. 7: Matrices for positions 2 to 3 in triliteral roots with respect to manner of articulation distinctions (obstruents vs. sonorants)

	s	f	r			s	f	r
s	exp: 95 / obs: 79 / diff: -16.84%	exp: 96 / obs: 96 / diff: 0.0%	exp: 104 / obs: 121 / diff: 16.35%	**s**		exp: 95 / obs: 79 / diff: -16.84%	exp: 96 / obs: 96 / diff: 0.0%	exp: 104 / obs: 121 / diff: 16.35%
f	exp: 168 / obs: 175 / diff: 4.17%	exp: 170 / obs: 141 / diff: -17.06%	exp: 184 / obs: 207 / diff: 12.5%	**f**		exp: 167 / obs: 175 / diff: 4.79%	exp: 168 / obs: 139 / diff: -17.26%	exp: 184 / obs: 207 / diff: 12.5%
r	exp: 59 / obs: 69 / diff: 16.95%	exp: 60 / obs: 90 / diff: 50.0%	exp: 65 / obs: 27 / diff: -58.46%	**r**		exp: 59 / obs: 69 / diff: 16.95%	exp: 60 / obs: 90 / diff: 50.0%	exp: 65 / obs: 26 / diff: -60.0%

Fig. 8: Matrices for positions 1 to 2 in triliteral roots with respect to manner of articulation distinctions (stops, fricatives/affricates, resonants)

	s	f	r			s	f	r
s	exp: 102 / obs: 110 / diff: 7.84%	exp: 98 / obs: 74 / diff: -24.49%	exp: 122 / obs: 139 / diff: 13.93%	**s**		exp: 83 / obs: 52 / diff: -37.35%	exp: 77 / obs: 74 / diff: -3.9%	exp: 104 / obs: 139 / diff: 33.65%
f	exp: 104 / obs: 81 / diff: -22.12%	exp: 99 / obs: 102 / diff: 3.03%	exp: 123 / obs: 144 / diff: 17.07%	**f**		exp: 83 / obs: 81 / diff: -2.41%	exp: 77 / obs: 41 / diff: -46.75%	exp: 104 / obs: 144 / diff: 38.46%
r	exp: 113 / obs: 129 / diff: 14.16%	exp: 107 / obs: 129 / diff: 20.56%	exp: 134 / obs: 97 / diff: -27.61%	**r**		exp: 95 / obs: 129 / diff: 35.79%	exp: 88 / obs: 129 / diff: 46.59%	exp: 119 / obs: 45 / diff: -62.18%

Fig. 9: Matrices for positions 2 to 3 in triliteral roots with respect to manner of articulation distinctions (stops, fricatives/affricates, resonants)

Voice

	v	u			v	u
v	exp: 222 / obs: 194 / diff: -12.61%	exp: 169 / obs: 198 / diff: 17.16%	**v**	exp: 222 / obs: 193 / diff: -13.06%	exp: 168 / obs: 198 / diff: 17.86%
u	exp: 347 / obs: 376 / diff: 8.36%	exp: 265 / obs: 237 / diff: -10.57%	**u**	exp: 346 / obs: 376 / diff: 8.67%	exp: 264 / obs: 235 / diff: -10.98%

Fig. 10: Matrices for positions 1 to 2 in triliteral roots with respect to voice distinctions (voiced, unvoiced)

	v	u			v	u
v	exp: 328 / obs: 325 / diff: -0.91%	exp: 241 / obs: 245 / diff: 1.66%	**v**	exp: 272 / obs: 227 / diff: -16.54%	exp: 199 / obs: 245 / diff: 23.12%
u	exp: 251 / obs: 255 / diff: 1.59%	exp: 183 / obs: 180 / diff: -1.64%	**u**	exp: 209 / obs: 255 / diff: 22.01%	exp: 152 / obs: 107 / diff: -29.61%

Fig. 11: Matrices for positions 2 to 3 in triliteral roots with respect to voice distinctions (voiced, unvoiced)