MUTUAL COMPLEMENTATION OF VC- SEQUENCES IN CENTRAL BAVARIAN

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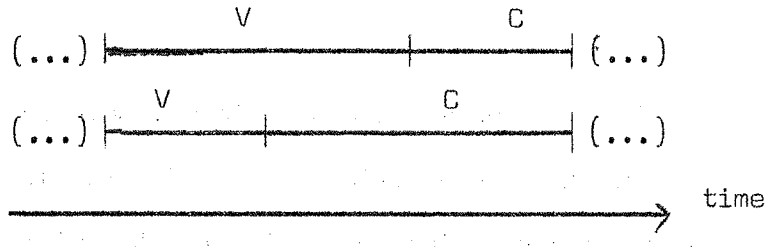
Ratios of duration and the domain of quantity

As a rule investigations of duration and quantity contain not only absolute values of segment durations but also several kinds of ratios due to the multitude of factors affecting the duration of a given segment (Elert 1964:51 f). Based on minimal pairs, contrasting optimally only in different durations of the identical segment, the vowel-to-vowel ratio (V/V:) and the consonant-to-consonant ratio (C/C:) are calculated. These two ratios being paradigmatic, the vowel-to-consonant ratio (V/C) refers to syntagmatic relations.

The ratio of V/C ratios (V:/C : V/C:), a double ratio, is considered basic to the perception of quantitative contrasts in a language (Elert 1964:171 ff).

Dealing with the phonological concept of quantity and its phonetic manifestations as duration (physiologically and acoustically) and length (perceptually) it seems necessary to start from the domain of quantity. In those languages which utilize durational contrasts distinctively, the domain of quantity may be different: the sound or sequence of sounds over which quantity is manifested may be only one segment (only the vowel, only the consonant, the vowel and the consonant), two segments (stressed vowel and the following consonant), or larger units (Lehiste 1970:42).

In the Nordic languages of Standard Swedish, Norwegian and Icelandic a reversed relationship, called mutual complementation (Lehiste 1970:49), between the duration of the stressed vowel and the following consonant is observed. Thus a long vowel is followed by a short consonant and a short vowel is followed by a long consonant:

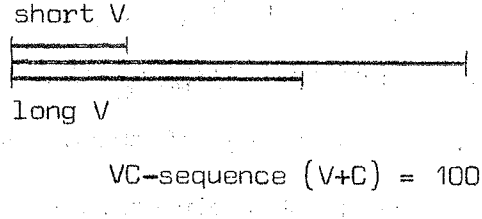


A similar reversed relationship between vowel and consonant is reported for the Upper German dialect of Central Bavarian (CB). (Kufner 1957, 1961. Bannert 1972). The domain of quantity in the Nordic languages as well as in CB is the VC-sequence which does not seem to be the case for Standard German.

The distribution of mutual complementation in CB is in general restricted to words longer than one syllable: # (...) C^3 V C ... # , where the vowel is stressed and the second syllable contains a sonorant (vowel, lateral or nasal).

The vowel-to-sequence ratio V/VC

Due to the fact that distinctive durational (= quantitative) contrasts in CB always are manifested over the VC-sequence I assume that these two segments together constitute a timing unit at a certain level of the language. Instead of relating vowel duration to the duration of the following consonant, the duration of which varies considerably after long and short vowel, by calculating the V/C ratio, it might therefore be more relevant to calculate the vowel-to-sequence ratio (V/VC ratio), thus expressing the duration of the vowel with reference to the whole VC-sequence.



Material

To describe the durational relationships of VC-sequences in CB, some preliminary measurements based on mingograms (operation speed 100 mm/sec), the V/VC ratio and some observations pertaining to one informant G will be presented. One portion of the material was collected in December 1972, the other in March 1973. The pair Gegal [g̊e:gal] versus Gekal [g̊ekal] (name of a hill vs. grilled chicken) appeared in both recordings. This material is compared to measurements from Informants G and A of January 1972. The stressed vowel, the following (medial) consonant (C_m), and the prosodic patterns (prosodies) (cf. Gårding and Lindblad 1973) were varied. In order to affect segment duration heavily, four prosodies were chosen:

(1) neutral isolated statement (isolated words),

(2) neutral sentence statement, e.g. / i hab s Bupal gseng/, (I saw the little doll), where the test word is stressed,

(3) fast isolated statement (isolated words),

(4) emphatic sentence statement with topicalization, e.g. / s Bupal hab i gseng/.

The testword and the variables of the investigations are summarized in the table on the following page.

Results

Tables 1, 2, and 3 give the following values: the mean segment duration (msec) of the vowel and the consonant, the mean duration of the VC-sequence, the decrease (or increase, marked with +) in % of the observed means for prosodies (2), (3), and (4) relative to prosody (1) (neutral isolated statement), the V/C and V/VC ratios in %, the change of these ratios in % with reference to prosody (1), and the range of their variation in %.

Test-word	Prosody	Mean duration (msec) V	C	V+C	Decrease from prosody (1) in % V	C	V+C	Ratios % V/C	V/VC	Change of ratios % V/C	V/VC	Range of variation % V/C	V/VC
Biabal (long vowel)	(1)	138	50	188	0	0	0	276	73	0	0	119	8
	(2)	128	39	167	7,2	22,0	11,2	328	77	52	4		
	(3)	100	43	143	27,5	13,5	23,9	233	70	-43	-3		
	(4)	120	37	176	0,7	22,0	6,4	362	78	76	5		
Bibal (long vowel)	(1)	116	56	172	0	0	0	207	67	0	0	95	9
	(2)	106	45	151	9,4	19,6	12,2	236	71	29	4		
	(3)	94	51	145	19,0	8,9	15,7	184	65	-23	-2		
	(4)	117	42	159	+ 0,9	25,0	7,5	279	74	72	7		
Bupal (short vowel)	(1)	79	150	229	0	0	0	53	35	0	0	27	9
	(2)	66	121	187	16,5	19,3	18,3	55	35	2	0		
	(3)	59	88	147	25,3	41,3	35,8	67	40	14	5		
	(4)	84	105	189	+ 6,0	30,0	17,5	80	44	27	9		
Feda (long vowel)	(1)	143	58	201	0	0	0	246	71	0	0		
	(3)	101	38	139	29,4	34,5	30,8	266	73	20	2		
Feta (short vowel)	(1)	104	169	273	0	0	0	62	38	0	0		
	(3)	83	124	207	20,2	26,6	24,2	67	40	5	2		

Table 1. Mean duration (msec) of the vowel V, the following consonant C, and their sum (V+C) of five testwords and different prosodies from the recordings of December 1972, medial consonant C_m = /b/ and /d/, informant O. Decrease (or increase in a few cases, marked by a +) in % of the durations of V, C, and V+C from prosody (1) = the isolated testword as a neutral statement. V/C and V/VC ratios in %. Change of these ratios with reference to those of prosody (1). Range of variation in % of these ratios.

Test-word	Prosody	Mean duration (msec) V	C	V+C	Decrease from prosody (1) in % V	C	V+C	Ratios % V/C	V/VC	Change of ratios % V/C	V/VC	Range of variation V/C	V/VC
Gekal	(1)	93	155	248	0	0	0	60	38	0	0		
	(2)	83	123	205	10,8	21,4	17,3	68	40	8	2	25	8
	(3)	66	94	160	29,0	39,4	35,4	70	41	10	3		
Dec 1972	(4)	92	108	200	1,1	30,3	19,3	85	46	25	8		
Gegal	(1)	123	64	187	0	0	0	193	66	0	0		
	(2)	109	65	174	11,4	+ 1,5	6,9	168	63	-25	- 3	52	6
	(3)	79	49	128	35,8	23,4	31,5	161	62	-32	- 4		
	(4)	112	53	164	8,9	17,2	12,3	212	68	19	2		
(1 Gekal	(1)	112	196	308	0	0	0	57	36	0	0		
	(2)	84	131	215	25,0	33,2	30,2	64	39	7	3	19	7
	(3)	93	123	216	17,0	37,2	29,9	76	43	19	7		
March 1973	(4)	89	120	209	20,5	38,8	32,1	74	43	17	7		
Gegal	(1)	173	87	260	0	0	0	199	67	0	0		
	(2)	122	68	190	29,5	21,8	26,9	180	64	-19	- 3	72	8
	(3)	118	65	183	31,8	25,3	29,6	182	65	-17	- 2		
	(4)	126	50	176	27,2	42,5	32,3	252	72	53	5		

Table 2. Same as Table 1, but only for the pair Gegal-Gekal from two different recordings (December 1972 and March 1973), informant G.

Test-word	Prosody	Mean duration (msec) V	C	V+C	Decrease from prosody (1) in % V	C	V+C	Ratios % V/C	V/VC	Change of ratios % V/C	V/VC	Range of variation % V/C	V/VC
Dafal (long vowel)	(1)	167	116	238	0	0	0	144	59	0	0	53	7
	(2)	137	79	216	18,0	31,9	23,6	174	63	30	4		
	(3)	133	75	208	20,3	35,4	26,4	178	64	34	5		
	(4)	138	70	208	17,4	39,6	26,4	197	66	53	7		
Nasn (long vowel)	(1)	177	111	288	0	0	0	159	61	0	0		
	(3)	113	72	185	36,2	26,1	35,8	157	61	-2	0		
nassn (short vowel)	(1)	132	190	322	0	0	0	70	41	0	0		
	(2)	98	148	246	25,8	22,0	23,6	66	40	-4	-1		
biassn (short vowel)	(1)	135	192	328	0	0	0	70	41	0	0		
	(3)	95	138	233	29,6	28,2	29,0	68	41	-2	0		
baissn (short vowel)	(1)	144	191	334	0	0	0	75	43	0	0		
	(3)	111	150	261	22,9	21,4	21,8	74	43	-1	0		

Table 3. Same as Table 1, different testwords (C_m = /f, s/), informant G.

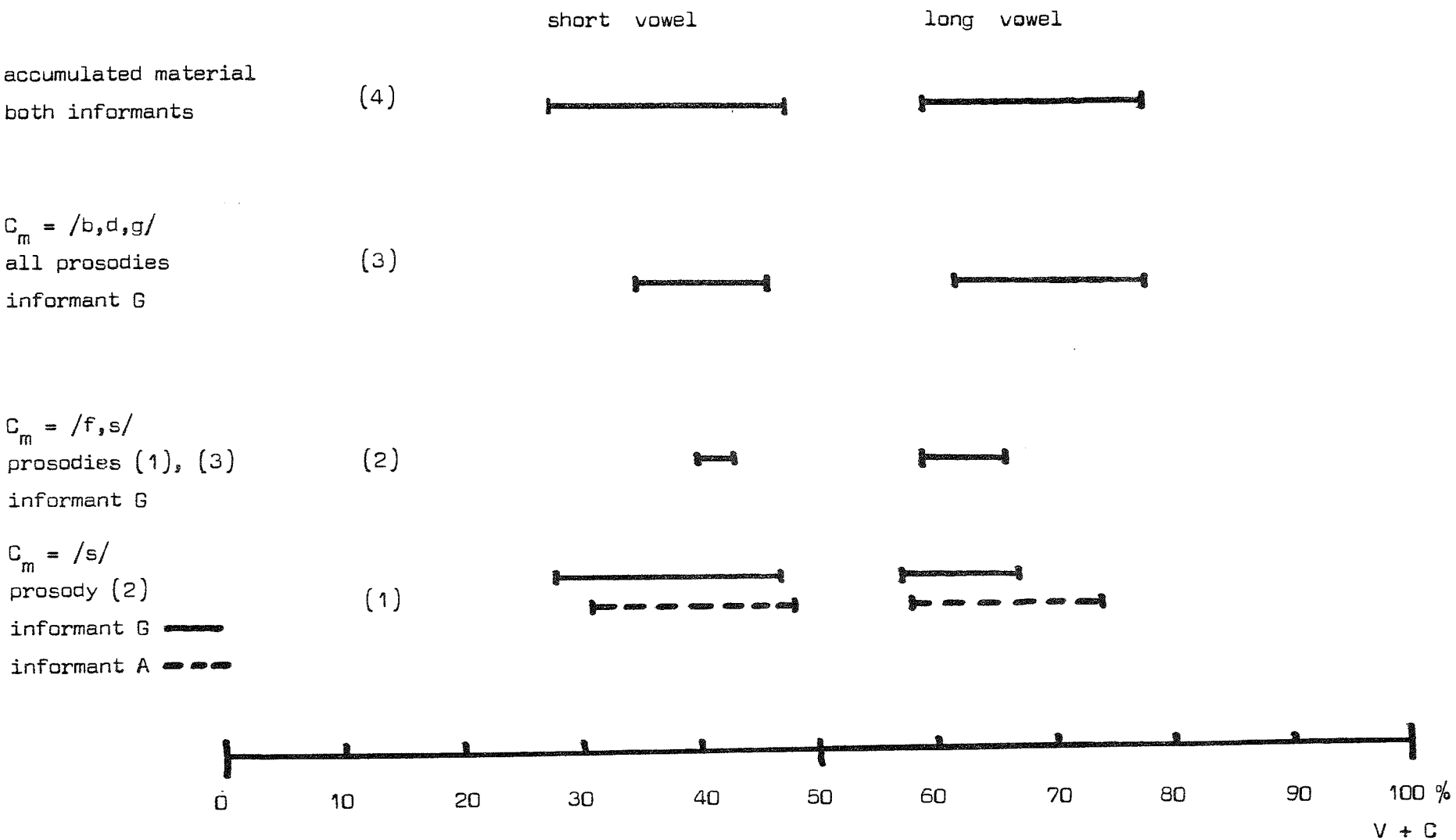


Diagram showing the V/VC-ratios of the accumulated material (4) and grouped according to certain variables (1-3). See text.

Date and Informants	Test words: longvowel short cons.	Test words: short vowel long cons.	Prosodic patterns (prosodies)
	C_m = /S/:		
Jan 72 G, A	bäsa Wiesn Basl etc. (Bannert 1972:9)	grässa wissn Massl	(2)
Dec 72 G	Biabal Bibal Gegal	Bupal Gekal	(1), (2) (3), (4)
	Feda Nasn	Feta nassn biassn baissn	(1), (3)
March 73 G	Gegal Dafal	Gekal	(1), (2) (3), (4)

The diagram shows the V/VC ratios for the accumulated material, containing all variables for informants G and A, and the V/VC ratios grouped according to the following variables:

(1) C_m = /s/, informants G and A, January 1972, (2) C_m = /f,s/, informant G, December 1972 and March 1973, (3) C_m = /b,d,g/, informant G, December 1972 and March 1973, (4) the complete material reported, informant G.

The following observations can be made:

1. The sum of the absolute durations of short vowel and long (voiceless) consonant (V+C) is always greater than that of the corresponding long vowel and short (voiced) consonant. This is in agreement with Elert's findings for Standard Swedish (Elert 1964:160).

2. The value of the V/VC ratio is always largest in prosody (4), that is,

the vowel duration increases relative to the duration of the VC-sequence when a given word is produced at the very beginning of an emphatic sentence statement. The value of the V/VC ratio for short vowel and following long and voiceless stop consonant (Bupal, Gekal, Feta) is smallets in prosody (1) (isolated neutral statement). The order of the V/VC values of the three other prosodies does not vary systematically for long vowels. This might be explained, at least partially, by the fact that short consonants after long vowels are often, but not always, produced with voicing, thus obscuring potential tendencies.

3. The range of variation of the V/VC ratio for each test word and its prosodies is rather constant, about 8 %, while the V/C ratio varies differently for long and short vowels, from 52 to 119 % for the long vowel and from 19 to 27 % for the short vowel:

Test word	range of variation in %	
	V/C	V/VC
Biabal	119	8
Bibal	95	9
Gegal	52	6
	72	8
Dafal	53	7
Bupal	27	9
Gekal	25	8
	19	7

4. The range of the V/VC ratios for the whole material of informant G (Jan and Dec 1972, and March 1973), all the segmental variations (vowel and consonant), and the four prosodies appears to be the same for short and long vowel, about 20 %. The V/VC ratio for the short

vowel of prosody (2) (neutral sentence statement) varies from 28 to 47 %, that for the long vowel from 57 to 77 %. All the other prosodies fall within the same limits (see diagram).

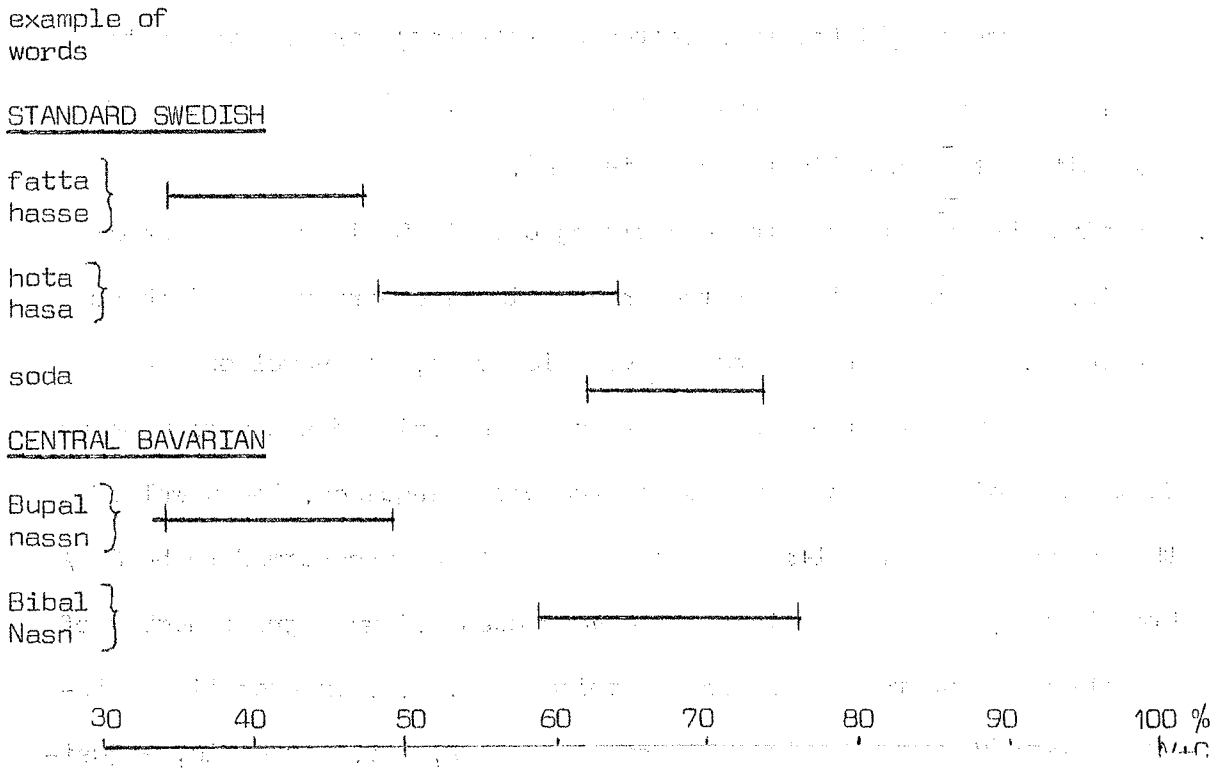
5. Assuming the VC-sequence to be a timing unit in CB it does not seem difficult to write rules for the programming and performing of these sequences. In order to program disyllabic words, the vowel of the sequence short vowel+long consonant would be assigned a duration being 33 % (one third) of the duration of the whole sequence. The vowel of the sequence long vowel+short consonant would be programmed to be 66 % (two thirds) of the duration of the VC-sequence. Then a great number of adjustments have to be made or are being made, e.g. in emphatic statements the V/VC ratio is to be increased by v %, etc. Automatic, adjustments not due to lexical conditioning will change the V/VC ratio of the acoustic output, e.g.

   (a) if the vowel is an open monophthong or a diphthong, the V/VC ratio will increase by x %.

   (b) if the vowel is closed, the V/VC ratio will decrease by y %.

   (c) if the short consonant is produced voiceless, the V/VC ratio will decrease by z %.

6. A comparison of V/VC ratios for the CB material and corresponding Standard Swedish (SS) material (70 words by 8 speakers) calculated from Elert's measurements (Elert 1964:91 ff) shows that the V/VC ratios for the short vowel in both languages coincide. Short stop consonants in SS may be either voiceless or voiced, thus the V/VC ratios for short voiced consonants in SS are higher than those for voiceless consonants. In CB short consonants, both stops and fricatives, are usually manifested voiced. Therefore the V/VC ratios for short consonants in CB are like those for short voiced consonants in SS, that is, they are higher than those for short voiceless consonants:



7. The V/C and the V/VC ratios change in parallel, reflecting syntagmatic relations. But as to my CB informants, the V/VC ratio appears to yield a simpler description of the data:

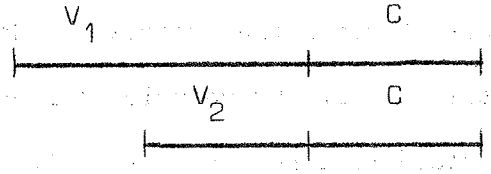
(a) the range of V/VC ratios for the informants is identical (about 20 %) for both long and short vowel,

(b) the range of variation of the V/VC ratios is about 8 % for the four prosodies of each test word,

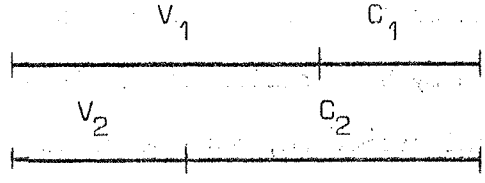
(c) there is good correspondance between the V/VC values of the two informants of CB (material of January 1972, Bannert 1972:53) and between CB and SS.

Calculating the V/C ratio, the duration of the vowel (the denominator of the ratio) is expressed as a function of the duration of the consonant (the numerator of the ratio). From a mathematical point of view this ratio is meaningful if the numerator is constant. Thus the V/C ratio should be an appropriate measure in cases where

vowels, the durations of which vary considerably, are followed by a consonant with a rather constant duration as depicted by the following figure:



But if the V/C ratio is calculated for languages with mutual complementation where the numerator varies as much as the denominator this ratio consists of two variables indicated by the following figure:



As shown above, the duration of the vowel + consonant sequence functions as a constant numerator in the V/VC ratio.

The reported data are, of course, very limited. But further measurements providing a more systematic treatment of mutual complementation in CB are in progress.

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