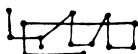




# THE CHRONOLOGICAL DEVELOPMENT OF CARL RUGGLES' MELODIC STYLE

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The music of Carl Ruggles has recently become a subject of theoretical interest again, after a long period of neglect. In particular, Steven E. Gilbert has pointed out certain features of Ruggles' later works which are amenable to "trichordal" analysis.<sup>1</sup> In this paper I shall report the results of some statistical analyses of Ruggles' melodic lines, carried out with the aid of a computer.

Certain aspects of Ruggles' music—the general shape of the lines, the ever-present dissonant sonorities—are so consistent throughout all of his pieces that one can easily get an impression of singular stylistic homogeneity—as though there were no significant changes or developments in style from 1919 (*Toys*) through 1944 (*Organum*). My results suggest just the opposite conclusion—at least with respect to his melodic writing—and lend support to a statement he made in a letter to Henry Cowell in January 1926:

More and more I'm gaining that complete command of line which, to me, is the basis of all music. There is absolutely no comparison between that which I've done [and] that which I'm doing now.<sup>2</sup>

Significant changes in Ruggles' melodic style are manifested in my statistical results in three ways: (1) a gradual shift in the distribution of melodic-interval frequencies; (2) a more and more effective avoid-

<sup>1</sup> Steven E. Gilbert "The 'Twelve-Tone System' of Carl Ruggles: A Study of the Evocations for Piano", *Journal of Music Theory*, Vol. 14, 1 (1970), pp. 68–91; "Carl Ruggles (1876–1971): An Appreciation", *Perspectives of New Music*, Vol. 11, No. 1 (1972), pp. 224–232; "An Introduction to Trichordal Analysis", *Journal of Music Theory*, Vol. 18, 2 (1974), pp. 338–362.

<sup>2</sup> John Kirkpatrick, "The Evolution of Carl Ruggles", *Perspectives of New Music*, Vol. 6, No. 2 (1968), pp. 146–166.

ance of early pitch-class recurrences; and (3) an increase in the frequency and proximity of dissonant relations within his melodic lines.<sup>3</sup>

### *Interval frequencies*

Tables and graphs of interval-frequency distributions for each piece and for certain groups of pieces are shown in Figures 1 through 23; in Figures 24 through 25 the relative frequencies of various intervals and interval-sets are shown, as a function of their chronological sequence (see pp. 43–67). For these latter, the information has been grouped into six data-points, as follows: (1) the period 1919–23 (which includes *Toys*, *Angels*, and the three movements of *Vox Clamans in Deserto*); (2) *Men and Mountains* (“Men”, “Lilacs”, “Marching Mountains”, 1924); (3) *Portals* (1925); (4) *Sun Treader* (1931);<sup>4</sup> (5) *Evocations I–IV* (1937–43); and (6) *Organum* (1944). From these graphs we can get a very clear picture of certain developmental aspects of Ruggles' melodic style. First of all, there is a decisive trend from a relatively diatonic to a highly chromatic idiom, shown by the increased use of minor 2nds and major 7th, and a corresponding decrease in the use of major 2nds and minor 7ths. In addition, there is a significant increase in the frequency of tritones, and (to a lesser extent) perfect 4ths and 5ths, with a decrease in the frequency of minor 3rds, major 3rds, and major 6ths—all of which suggest a progressive elimination of triadic/tonal implications.

In many ways (note especially the graphs for minor 2nds, tritones, major 2nds, minor 3rds, and major 7ths in Figure 24) there is a radical change between *Portals* (1925) and *Sun Treader* (1931)—and it was during just this period that Ruggles made the statement to Cowell quoted earlier. By the same token—according to the same criteria—his last completed work, *Organum* (1944), marks a return to some of the conditions characteristic of the earlier works (see these same interval-plots, Figure 24, and also the superimposed graph for *Organum* vs. earlier groups of pieces, Figure 21). In a sense, of course, *Portals* is a transitional work, between two fairly distinct style-periods. Whether

<sup>3</sup> Note: “dissonant relations” will be used here to mean, exclusively, the relations of the minor 2nd, major 7th, and minor 9th.

<sup>4</sup> Note: partly because of the complexly contrapuntal nature of certain parts of *Sun Treader*, and partly because whole long sections of the piece are nearly identical to earlier sections, I have used only the first half (bars 1 through 118) for input data. I am convinced, however, that this will in no way lessen the significance—or even the effective “accuracy”—of my results.

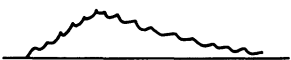
it should be considered the last of the early works or the first of the later works would depend on many factors not considered here, but the superimposed plot (Figure 22) of interval-frequency distributions for *Portals*, the pieces preceding *Portals* (i.e., 1919–24), and those following it (1931–44), clearly suggests that it belongs to the early group, at least in terms of melodic-interval statistics.

Figure 23 shows superimposed plots of interval-frequency distributions for the early vs. the later periods, and here the trends mentioned above can be seen quite clearly—the increase in the use of minor 2nds, tritones, 4ths, 5ths, and major 7ths, and the decrease in the frequencies of most of the other intervals—especially major 2nds, minor and major 3rds, major 6ths, and minor 7ths. The interval-frequency distribution for all of Ruggles' pieces together is shown in Figure 20. As in the plots for individual pieces, these are graphed in two ways, one distinguishing between ascending and descending forms of each interval, the other combining these into one plot of "absolute intervals". It is of interest to note that there are rather significant differences between ascending and descending interval frequencies for certain intervals—most importantly, I think, perfect 4ths and 5ths. What this plot tells us about these two intervals is that ascending 4ths (and descending 5ths) occur much less often in Ruggles' work than descending 4ths (and ascending 5ths). In the first case, descending 4ths are used 1.75 times as often as ascending 4ths. In the other, ascending 5ths occur 2.17 times as often as descending 5ths. This discrepancy is found in most of the individual pieces, too (though there are some exceptions—most notably *Organum*), as well as in the overall statistics, and seems to constitute an important tendency in Ruggles' melodic writing. An explanation of the discrepancy suggests itself immediately. Both the ascending 4th and (even more) the descending 5th can easily imply or evoke a V–I cadential sense, "rooting" the melodic line (harmonically) at the second tone and thus obstructing the ongoing momentum of the line.

Another sort of asymmetry between ascending and descending interval frequencies can be seen in Figure 25. The smaller intervals (up to and including the tritone) occur most often in descending form, while intervals larger than the tritone tend to occur most frequently in ascending form.<sup>5</sup> The shape of the larger melodic gestures implied by

<sup>5</sup> Note: The differences between 4ths and 5ths in this respect, mentioned above, *might* be merely a special case of this more general condition, but I believe the harmonic consideration I have suggested to explain it is, at the very least, an important contributing factor.

this asymmetry is one involving a faster ascent, and a slower descent,

thus:  . I have no way of knowing whether

this is a distinctive feature of Ruggles' style, or whether it is, in fact, typical of other styles as well (though I suspect it is). In any case, it might be an interesting line of investigation for someone involved in comparative studies of musical style.

### *Pitch-class repetition and dissonant relations*

Ruggles' intention to avoid early pitch-class recurrences in his melodic lines has often been mentioned. In *New Musical Resources*<sup>6</sup> (first published in 1930), Henry Cowell described Ruggles' procedure as follows:

Carl Ruggles has developed a process for himself in writing melodies for polyphonic purposes which embodies a new principle . . . He finds that if the same note is repeated in a melody before enough notes have intervened to remove the impression of the original note, there is a sense of tautology, because the melody should have proceeded to a fresh note instead of to a note already in the consciousness of the listener. Therefore Ruggles writes at least seven or eight different notes in a melody before allowing himself to repeat the same note, even in the octave.

And in 1932, Charles Seeger wrote:

The determining feature or principle of the melodic line is that of non-repetition of tone (either the same tone or any octave of it) until the tenth progression. This applies rigidly to the leading melody and characterizes the other parts to a surprising extent, though in *Portals* many repeated notes may be found at the fourth, fifth, and sixth progression. . . . Reiteration (immediate repetition) is occasionally effective, but only occasionally. The repetition of tones resulting from reiteration of phrase (as in the 6th and 7th measures of *Portals* and again in the 9th and 10th) constitutes, I believe, almost the only exception to the principle.<sup>7</sup>

The similarity of this "principle" to analogous procedures in the works of Schoenberg, Berg, and Webern is obvious, but it is important to

<sup>6</sup> Henry Cowell, *New Musical Resources*, (2nd edition), Something Else Press, (1969), pp. 41-42.

<sup>7</sup> Charles Seeger, "Carl Ruggles", *The Musical Quarterly*, Vol. XVIII, No. 4 (1932), pp. 578-592.

note that there may have been a slightly different reason for it in Ruggles' case. Schoenberg has written:

The construction of a basic set of twelve tones derives from the intention to postpone the repetition of every tone as long as possible. I have stated in my *Harmonielehre* that the emphasis given to a tone by a premature repetition is capable of heightening it to the rank of a tonic. . . . It seemed in the first stages immensely important to avoid a similarity with tonality.<sup>8</sup>

Although Ruggles undoubtedly shared this desire to avoid giving any pitch "the rank of a tonic", this was not his only reason, or even his main one. I believe that what he was primarily concerned with was *freshness*—newness, maximal variety of pitch-content—and the sustaining of a high degree of atonal or atonical (but nevertheless *harmonic*) tension. As Seeger observed:

The harmonic variety, added to the extreme floridity of the melodic and contrapuntal fabric, gives one a feeling of having heard a great deal in a very short time.<sup>9</sup>

This is reminiscent of Schoenberg's remarks about Webern's brevity, and perhaps tells us something about the brevity of most of Ruggles' pieces, as well as their small number in his total *oeuvre*.

The fact that it was Ruggles' intention to postpone pitch-class repetitions as long as possible (whether this be after "seven or eight different notes", as Cowell wrote, or "until the tenth progression", as Seeger described it) is thus well documented. To my knowledge, however, no systematic effort has yet been made to determine precisely to what extent this intention was actually realized in the finished works. In order to investigate this aspect of Ruggles' melodic style, the computer program kept a running count of "Lengths of Strings of Different Pitch-classes" ("LSDP"), and computed overall averages ("ALSD") of these string-lengths for the primary melodic line in each of Ruggles' pieces. In *Toys* and *Vox Clamans in Deserto* the "primary melodic line" was simply the voice part. In the other pieces it was generally taken to be the highest part, although secondary, contrapuntal parts were sometimes included when there was a temporary cessation of activity in the upper part. Immediately repeated pitches (or, as

<sup>8</sup> Arnold Schoenberg, "Composition with Twelve Tones (2)", *Style and Idea*, (2nd edition), St. Martin's Press (1975), p. 246.

<sup>9</sup> Charles Seeger, *op. cit.* p. 588.

Seeger refers to them, "reiterated tones") were treated as a single occurrence of that pitch.

In addition to his tendency to avoid early pitch-class recurrences, there is another characteristic of Ruggles' melodic writing which has not been dealt with in the analytical literature. I referred to this earlier as "the frequency and proximity of dissonant relations within his melodic lines". That is, even in the absence of such interval-relations between consecutive pitches, some such relation will generally be found between each new pitch and one of the several immediately preceding pitches. To provide information on this feature, the program was designed to keep a running count of "Lengths of Strings of Consonant Intervals" ("LSCI"), and to compute overall averages of these ("ALSC") for each piece.

In order to clarify the nature of the statistical measures involved here, let us consider the following example—the first long phrase in *Portals*. The twenty-four consecutive pitches in this initial phrase are shown in Figure 26. The numbers immediately above the staff ("LSDP") show the lengths of strings of different pitch-classes preceding (and including) each element in the line. The numbers immediately below the staff ("LSCI") indicate the lengths of strings of pitches preceding each element which are consonant with respect to that element ("consonant" being defined here as any interval *except* the minor 2nd and its derivatives). Consider, for example, the D (element #12) which marks the high-point and approximate mid-point of the phrase. The value of LSDP is 9, meaning that this D is the ninth element in a string, all of whose pitch-classes are different. The value for LSCI is 2, meaning that this D is preceded by only two pitches in consonant relation to it, the *third* preceding pitch—the E<sub>b</sub> of element #9—being in a dissonant relation to it. Note the sudden change in both values at element #13—the B<sub>b</sub> immediately following this high D. The value of LSDP drops from 9 to 3, while that of LSCI jumps from 2 to 8. I now suggest that these two measures, averaged over the total length of each piece, can provide useful indices of an important aspect of Ruggles' melodic style—its "atonal chromaticism"—a part, at least, of what Gilbert calls Ruggles' "twelve-tone system". Other measures are certainly conceivable, but these—especially ALSD—are particularly significant in Ruggles' case, because they relate so closely to his declared intentions.

The values for ALSD and ALSC are shown graphically in Figure 27, and it will be seen that there is a nearly perfect correlation be-

tween ALSD and the chronological sequence in which Ruggles' pieces were written.<sup>10</sup> The correlation between chronological sequence and LSCI is only a little less perfect, reaching its lowest point with *Sun Treader*, and then increasing again (though only slightly) in the later works. Consider for a moment what is meant by the incredibly high values for ALSD reached in *Sun Treader*, the *Evocations*, and *Organum*. It is, in each case, almost 9, which means that at every moment in the process of composing these melodic lines there were only *four* pitch-classes remaining to choose from for the next tone—and not even all of these four would necessarily satisfy certain other conditions, such as the desire for dissonant relations in close proximity. Very severe constraints indeed, for a music which sounds so free!

At this point I almost feel compelled to apologize for using statistics in a study of Carl Ruggles' music—or at least to make some effort to justify it. Carl was a friend and mentor to me, early in my own musical life, and I know well the disdain he had for theoretical constructs detached from the expressive, intuitive core of the musical process. And yet, as Charles Seeger says so perceptively “in memoriam”,

[although] Carl was no theorist . . . he admired it in others, especially when they worsted him in argument or brought some point to support his contention.<sup>11</sup>

I would like to think that the statistical results reported here may indeed support his “contention”, quoted earlier—

More and more I'm gaining that complete command of line which, to me, is the basis of all music . . .

<sup>10</sup> The points marked x in Figure 27—and the numbers in parentheses following the value for ALSD in the tables at the top of Figures 1–18—are values attained when the “phrase-reiterations” Seeger refers to are deleted from the input data. ALSD naturally increases somewhat when this is done, but the general trends in Ruggles' melodic style are well represented even without these deletions.

<sup>11</sup> Charles Seeger, “In Memoriam: Carl Ruggles (1876–1971)”, *Perspectives of New Music*, Vol. 10, No. 1 (1972), pp. 171–174.



	<-13	-13	-12	-11	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7	8	9	10	11	12	13	>13	$\bar{n}$														
Toys (1919)	0	2	0	0	2	2	1	0	3	1	2	0	4	3	0	4	4	5	2	0	0	1	0	2	3	4	5	6	1	0	44													
$\bar{i} = \%$	0	4.5	0	0	4.5	4.5	2.3	0	6.8	2.3	4.5	0	9.1	6.8	0	9.1	11.4	4.5	0	0	2.3	0	2.3	4.5	6.8	2.3	2.3	2.3	0	0	0													
	Also = 4.17														Absolute-interval frequencies: 0														15.9	18.2	11.4	9.1	2.3	6.8	2.3	2.3	6.8	9.1	6.8	2.3	2.3	6.8	0	0

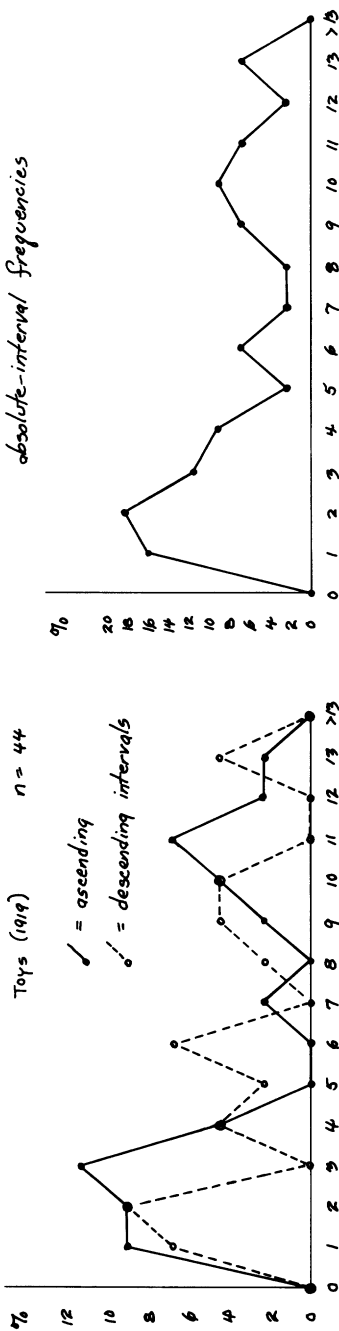


Figure 1 Melodic-interval frequency-distributions for Toys (1919).

	<-13	-13	-12	-11	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7	8	9	10	11	12	13	>13
Angels (1920)	0	0	0	0	2	1	0	1	0	2	1	4	44	6	0	10	5	13	7	4	4	2	0	1	1	0	0	0	0
in %	0.	0.	0.	0.	1.9	.9	0.	9	0.	1.9	.9	3.7	40.7	5.6	0.	9.3	4.6	12.0	6.5	3.7	3.7	1.9	0.	.9	0.	0.	0.	0.	
	ALSD = 5.18														ASFC = 5.45														
	absolute-interval frequencies:														0. 41.9 45.3 15.7 7.4 5.6 3.7 2.8 0. 1.9 2.8 0. 1.9 2.8 0. 0. 0. 0.														

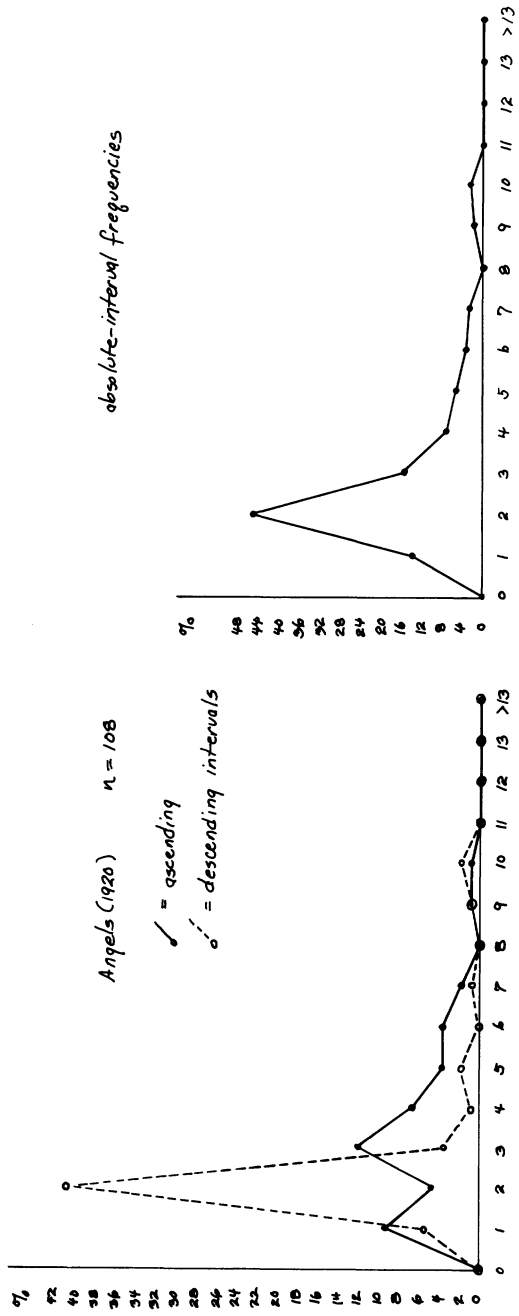


Figure 2 Melodic-interval frequency-distributions for Angels (1920).

(1923)	<-13	-13	-12	-11	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7	8	9	10	11	12	13	>13	$\pi$	
Vox Clamans in Deserto	1	1	0	7	2	8	0	2	5	4	11	9	11	10	0	22	11	16	2	3	4	6	6	1	3	3	0	5	1	154	
in %	.6	.6	0.	4.5	1.3	5.2	0.	1.3	3.2	2.6	7.1	5.8	7.1	6.5	0.	14.9	7.1	10.4	1.3	1.9	2.6	3.9	3.9	.6	1.9	1.9	0.	3.2	.6		
ALSD= 6.51	ALISC= 2.69														absolute-interval frequencies:																
	0.	20.8	14.3	16.2	8.4	4.5	5.8	5.2	3.9	5.8	3.2	6.5	0.	3.9	1.3	1.3	1.9	2.6	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9

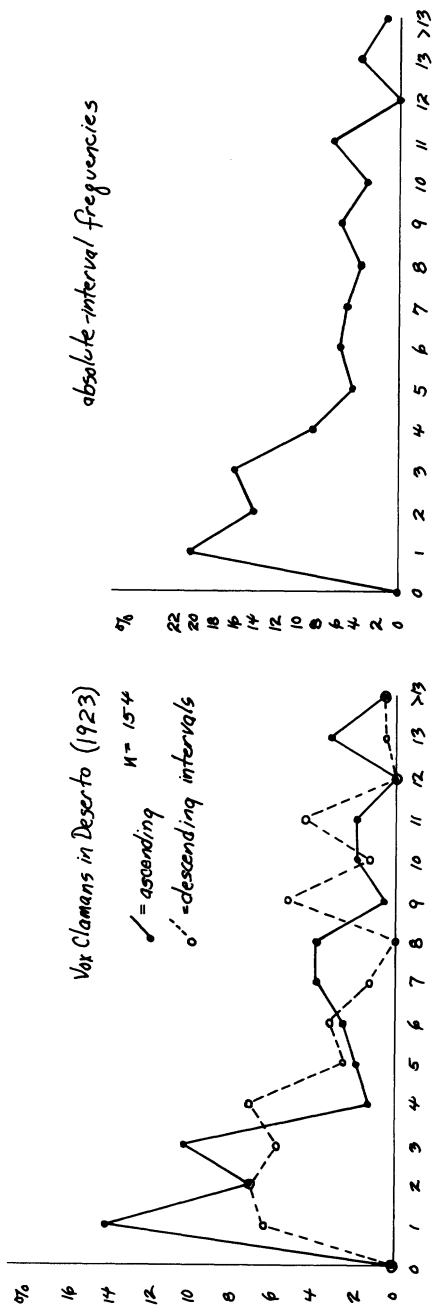


Figure 3 Melodic-interval frequency-distributions for *Vox Clamans in Deserto* (1923).

1919-1923 sub-totals	-13	-12	-11	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7	8	9	10	11	12	13	>13		
in %	1	3	0	7	6	11	1	5	8	7	14	13	59	19	0	36	20	94	11	7	8	9	6	3	6	6	1	6	1	306
	3	1.0	0.	2.3	2.0	3.6	3	10	2.6	2.5	4.6	4.2	19.3	6.2	0.	11.8	6.5	11.1	5.6	2.5	2.6	2.9	2.0	1.0	2.0	2.0	3	2.0	3	
	ALSD = 5.70													ALSC = 3.78																
	absolute-interval/frequencies: 0. 18.0 25.8 15.4 8.2 4.6 5.2 3.9 2.5 4.6 5.9 4.2 3 2.9 .7																													

1919-1923 combined values  
(Toys, Angels, Vox Clamans....)

▲ ascending  
○ descending intervals

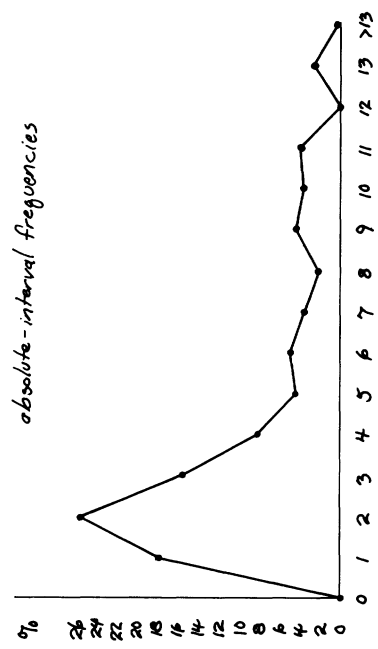
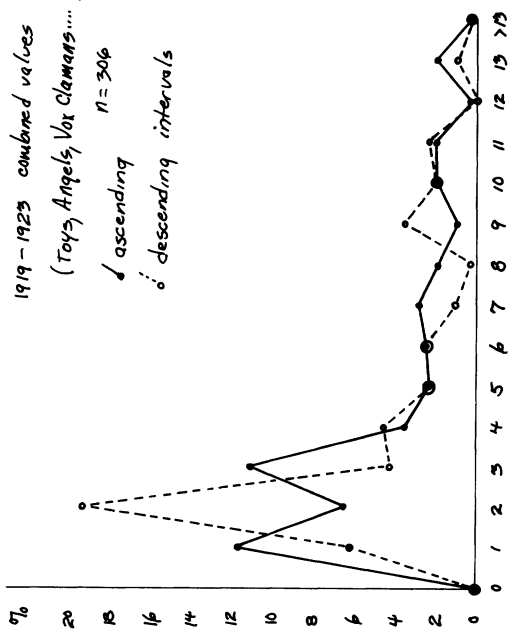


Figure 4 Melodic-interval frequency-distributions for the period 1919-1923.

Men & Attrs:	<-13	-13	-12	-11	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7	8	9	10	11	12	13	>13	<i>n</i>	
I "Men" (1920-1924)	6	4	1	6	3	2	0	1	8	25	5	14	22	25	0	17	10	14	6	9	4	4	3	12	2	5	0	6	7	221	
in %	2.7	1.8	.5	2.7	1.4	.9	0.	.5	3.6	11.3	2.3	6.3	10.0	11.5	0.	7.7	4.5	6.3	2.7	4.1	1.8	1.4	5.4	.9	2.3	0.	2.7	3.2			
ALSD = 6.13	absolute-interval frequencies:															0.	19.0	14.5	12.7	5.0	15.4	5.4	2.3	1.4	6.3	2.3	5.0	.5	4.5	5.9	

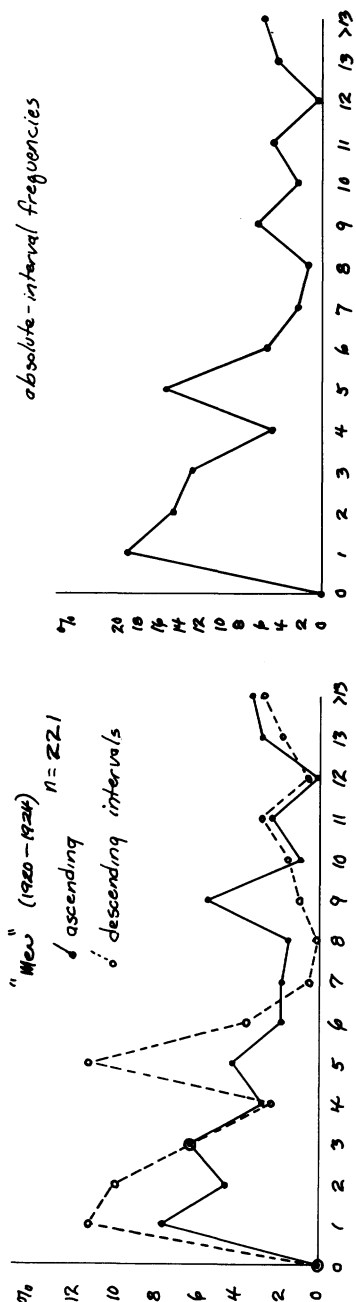


Figure 5 Melodic-interval frequency-distributions for *Men and Mountains I* ("Men", 1920-24).

Men & Mtns:	<-13	-13	-12	-11	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7	8	9	10	11	12	13	>13	n		
II. "Lilacs" (1924)	0	0	0	0	0	0	2	3	5	4	5	7	8	3	0	2	6	10	10	6	4	0	0	0	0	1	0	0	0	76		
in %	0.0	0.0	0.0	0.0	0.0	0.0	2.6	3.9	6.6	5.3	6.6	9.2	10.5	3.9	0.0	2.6	7.9	13.2	13.2	7.9	5.3	0.0	0.0	0.0	0.0	1.3	0.0	0.0	0.0	0.0		
ALSD=7.69	absolute-interval frequencies:															0.66	18.4	22.4	19.7	13.2	11.8	3.9	2.6	0.0	0.0	1.3	0.0	0.0	0.0	0.0	0.0	0.0

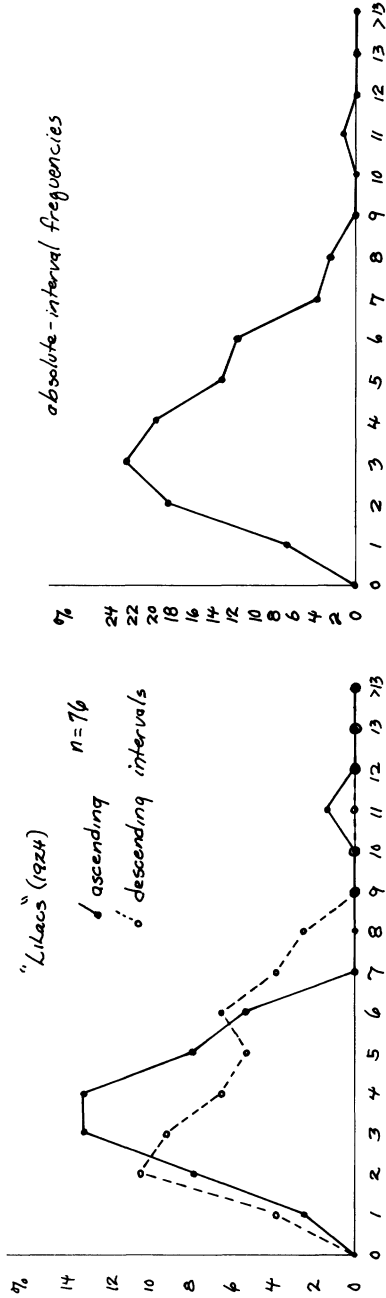


Figure 6 Melodic-interval frequency-distributions for *Men and Mountains II* ("Lilacs", 1924).

Men & Whts.:		<-13	-13	-12	-11	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7	8	9	10	11	12	13	>13	n		
Marching Mountains (1924)		1	0	0	4	4	1	2	1	24	10	6	36	21	32	0	21	58	7	3	4	11	10	2	0	1	8	0	5	2	254		
in %		.4	0.	0.	1.6	1.6	.4	.8	.4	9.4	3.9	2.4	14.2	8.3	12.6	0.	8.3	15.0	2.8	1.2	1.6	4.3	3.9	.8	0.	.4	3.1	0.	2.0	.8			
ALSD = 7.28 (7.52)		absolute-interval frequencies:															0.	20.9	23.2	16.9	3.5	5.5	13.8	4.3	1.6	.4	2.0	4.7	0.	2.0	1.2		

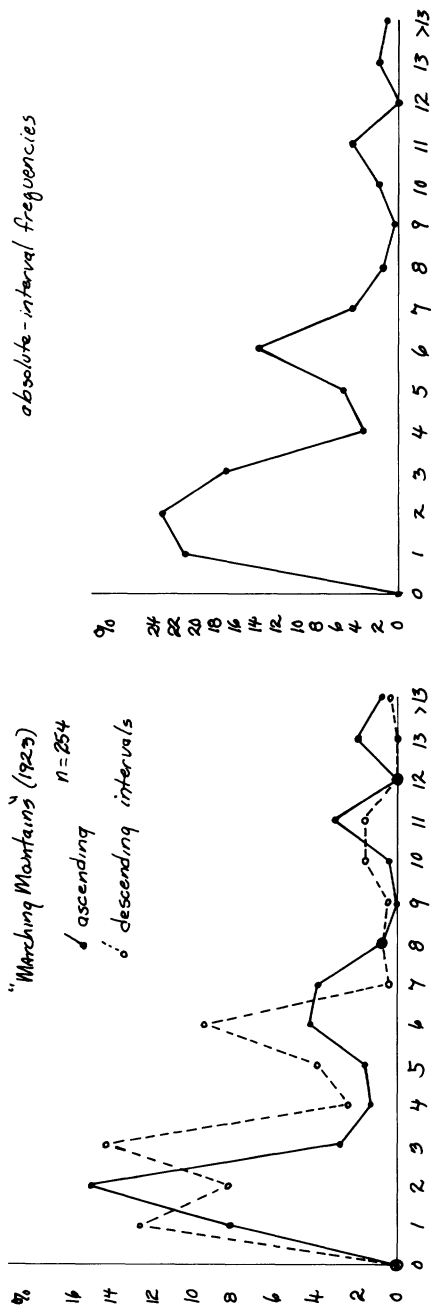


Figure 7 Melodic-interval frequency-distributions for *Men and Mountains III* ("Marching Mountains", 1924).

Men and Mountains I-III (1920-24)	-13	-12	-11	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7	8	9	10	11	12	13	>13															
in %	7	4	1	10	7	3	4	5	37	39	16	57	51	60	0	40	34	31	19	19	19	14	5	12	3	14	0	11	9														
ALSD = 6.98	13	7	2	12	13	5	7	9	6	7	2	9	3	10	0	7	9	8	5	6	3	4	2	5	9	2	2	2															
absolute-interval frequencies:															0	18	19	16	0	6	4	6	10	5	10	2	4	1	2	7	1	2	2	2	1	2	2	2	2	2	2	2	
ALSD = 2.89															0	18	19	16	0	6	4	6	10	5	10	2	4	1	2	7	1	2	2	2	1	2	2	2	2	2	2	2	2

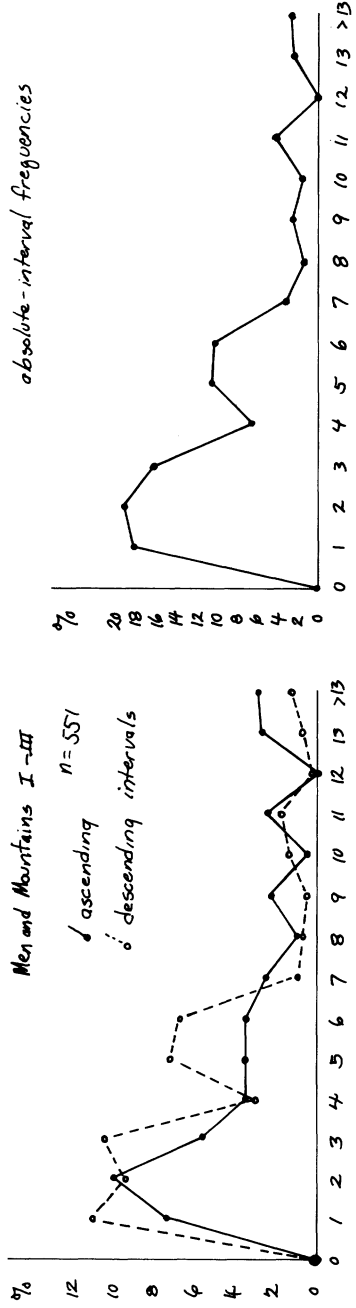


Figure 8 Melodic-interval frequency-distributions for *Men and Mountains I-III* (1924).



	<13	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	
Portals (1925)	6	9	0	4	0	8	4	3	21	12	20	23	44	50	0	53	26	34	23	13	14	8	9	4	4	11	0	11	3	398
in %	1.5	2.3	0.	1.0	0.	2.0	1.0	.8	5.5	3.0	5.0	5.8	11.1	12.6	0.	8.3	6.5	8.5	5.8	3.3	3.5	2.0	2.3	1.0	1.0	2.8	0.	2.8	.8	
ALSD = 8.04(8.00)	absolute-interval frequencies: 0. 20.9 17.6 14.3 10.8 6.3 9.0 2.8 3.3 3.0 1.0 3.8 0. 5.0 2.3																													

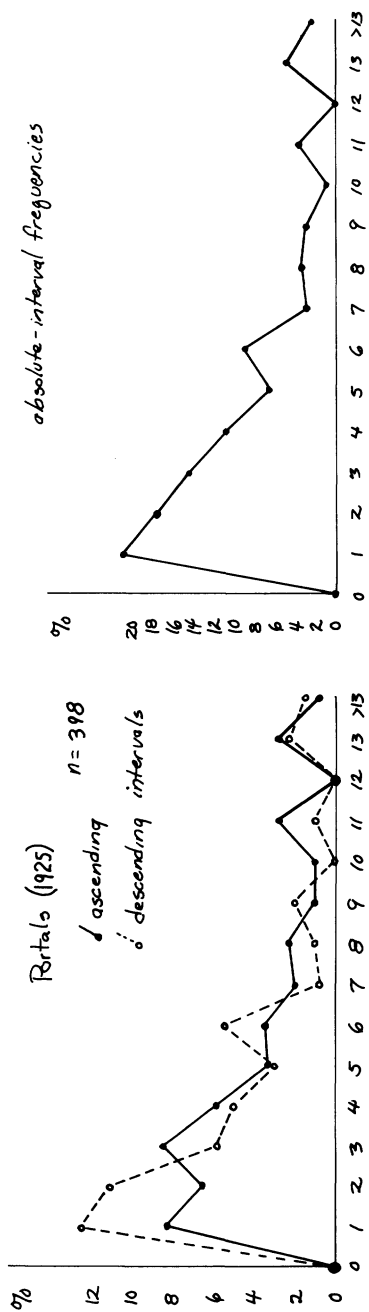


Figure 9 Melodic-interval frequency-distributions for Portals (1925).

1919-1925 sub-totals	<13	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	324	325	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351	352	353	354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375	376	377	378	379	380	381	382	383	384	385	386	387	388	389	390	391	392	393	394	395	396	397	398	399	400	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435	436	437	438	439	440	441	442	443	444	445	446	447	448	449	450	451	452	453	454	455	456	457	458	459	460	461	462	463	464	465	466	467	468	469	470	471	472	473	474	475	476	477	478	479	480	481	482	483	484	485	486	487	488	489	490	491	492	493	494	495	496	497	498	499	500	501	502	503	504	505	506	507	508	509	510	511	512	513	514	515	516	517	518	519	520	521	522	523	524	525	526	527	528	529	530	531	532	533	534	535	536	537	538	539	540	541	542	543	544	545	546	547	548	549	550	551	552	553	554	555	556	557	558	559	560	561	562	563	564	565	566	567	568	569	570	571	572	573	574	575	576	577	578	579	580	581	582	583	584	585	586	587	588	589	590	591	592	593	594	595	596	597	598	599	600	601	602	603	604	605	606	607	608	609	610	611	612	613	614	615	616	617	618	619	620	621	622	623	624	625	626	627	628	629	630	631	632	633	634	635	636	637	638	639	640	641	642	643	644	645	646	647	648	649	650	651	652	653	654	655	656	657	658	659	660	661	662	663	664	665	666	667	668	669	670	671	672	673	674	675	676	677	678	679	680	681	682	683	684	685	686	687	688	689	690	691	692	693	694	695	696	697	698	699	700	701	702	703	704	705	706	707	708	709	710	711	712	713	714	715	716	717	718	719	720	721	722	723	724	725	726	727	728	729	730	731	732	733	734	735	736	737	738	739	740	741	742	743	744	745	746	747	748	749	750	751	752	753	754	755	756	757	758	759	760	761	762	763	764	765	766	767	768	769	770	771	772	773	774	775	776	777	778	779	780	781	782	783	784	785	786	787	788	789	790	791	792	793	794	795	796	797	798	799	800	801	802	803	804	805	806	807	808	809	810	811	812	813	814	815	816	817	818	819	820	821	822	823	824	825	826	827	828	829	830	831	832	833	834	835	836	837	838	839	840	841	842	843	844	845	846	847	848	849	850	851	852	853	854	855	856	857	858	859	860	861	862	863	864	865	866	867	868	869	870	871	872	873	874	875	876	877	878	879	880	881	882	883	884	885	886	887	888	889	890	891	892	893	894	895	896	897	898	899	900	901	902	903	904	905	906	907	908	909	910	911	912	913	914	915	916	917	918	919	920	921	922	923	924	925	926	927	928	929	930	931	932	933	934	935	936	937	938	939	940	941	942	943	944	945	946	947	948	949	950	951	952	953	954	955	956	957	958	959	960	961	962	963	964	965	966	967	968	969	970	971	972	973	974	975	976	977	978	979	980	981	982	983	984	985	986	987	988	989	990	991	992	993	994	995	996	997	998	999	1000	1001	1002	1003	1004	1005	1006	1007	1008	1009	1010	1011	1012	1013	1014	1015	1016	1017	1018	1019	1020	1021	1022	1023	1024	1025	1026	1027	1028	1029	1030	1031	1032	1033	1034	1035	1036	1037	1038	1039	1040	1041	1042	1043	1044	1045	1046	1047	1048	1049	1050	1051	1052	1053	1054	1055	1056	1057	1058	1059	1060	1061	1062	1063	1064	1065	1066	1067	1068	1069	1070	1071	1072	1073	1074	1075	1076	1077	1078	1079	1080	1081	1082	1083	1084	1085	1086	1087	1088	1089	1090	1091	1092	1093	1094	1095	1096	1097	1098	1099	1100	1101	1102	1103	1104	1105	1106	1107	1108	1109	1110	1111	1112	1113	1114	1115	1116	1117	1118	1119	1120	1121	1122	1123	1124	1125	1126	1127	1128	1129	1130	1131	1132	1133	1134	1135	1136	1137	1138	1139	1140	1141	1142	1143	1144	1145	1146	1147	1148	1149	1150	1151	1152	1153	1154	1155	1156	1157	1158	1159	1160	1161	1162	1163	1164	1165	1166	1167	1168	1169	1170	1171	1172	1173	1174	1175	1176	1177	1178	1179	1180	1181	1182	1183	1184	1185	1186	1187	1188	1189	1190	1191	1192	1193	1194	1195	1196	1197	1198	1199	1200	1201	1202	1203	1204	1205	1206	1207	1208	1209	1210	1211	1212	1213	1214	1215	1216	1217	1218	1219	1220	1221	1222	1223	1224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Sun Treader (first half) 1926-31		<-13	-13	-12	-11	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7	8	9	10	11	12	13	>13	n				
21	8	0	24	0	5	4	14	59	19	32	14	9	127	0	83	16	12	11	17	44	25	3	2	1	51	0	16	10	627						
33	13	0	38	0	8	22	9.4	30	5.1	22	1.4	20.3	0	33.2	26	19	18	27	70	40	5	3	2	1.1	2	120	0	38	4.9						
ALSD=881 (93)		ALSC=2.02		absolute-interval frequencies:		0		33.5		4.0		4.1		6.9		5.7		16.4		6.2		1.1		1.1		2		120		0		38		4.9	

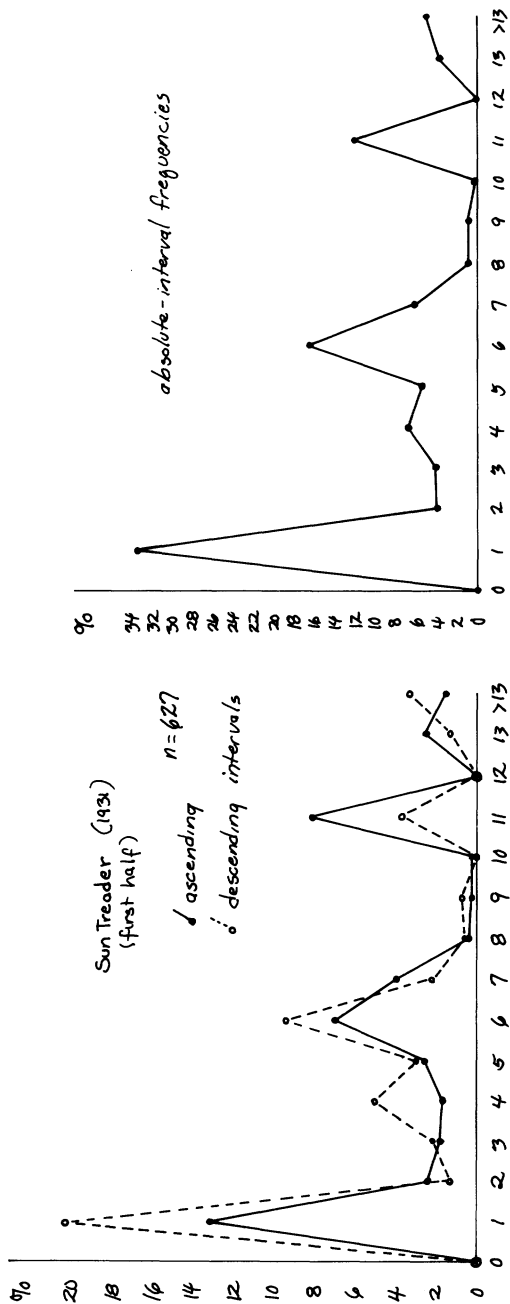


Figure 11 Melodic-interval frequency-distributions for Sun Treader (1931).

Evocation I (1937)		<-13	-12	-11	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7	8	9	10	11	12	13	>15	n
in %		3	0	4	0	0	0	0	10	8	0	2	0	3	0	15	11	5	3	4	7	10	3	1	1	0	0	2	0	92
absolute-interval frequencies:		3.3	0.	0.	4.3	0.	0.	0.	10.9	8.7	0.	2.2	0.	3.3	0.	16.3	12.0	5.4	3.3	4.3	7.6	10.9	3.3	1.1	1.1	0.	0.	2.2	0.	
ALSD = 8.91(9.13) ALSC = 2.42																														
absolute-interval frequencies:		0.	19.6	12.0	7.6	3.3	13.0	18.5	10.9	3.3	1.1	1.1	4.3	0.	2.2	3.3														

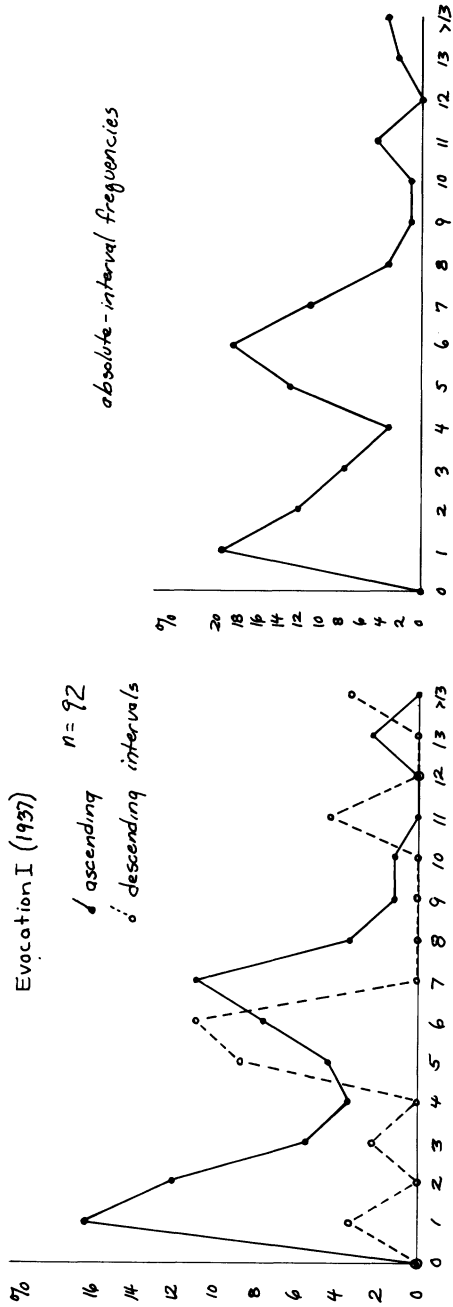


Figure 12 Melodic-interval frequency-distributions for Evocation I (1937).

Evocation III (1940)		-13	-12	-11	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7	8	9	10	11	12	13	>13	n
	n	5	0	0	4	0	4	12	9	26	0	0	0	31	0	22	0	4	0	6	14	17	1	3	0	9	0	3	4	174
	%	2.9	0.	0.	2.3	0.	2.3	6.9	5.2	14.9	0.	0.	17.8	0.	12.6	0.	2.3	0.	3.4	8.0	9.8	.6	1.7	0.	5.2	0.	1.7	2.3		
ALSD = 8.6 (9.29)   ALSC = 2.14		absolute-interval frequencies: 0. 30.5 0. 2.3 0. 2.3 0. 18.4 13.2 16.7 2.9 1.7 0. 1.5 0. 1.7 5.2																												

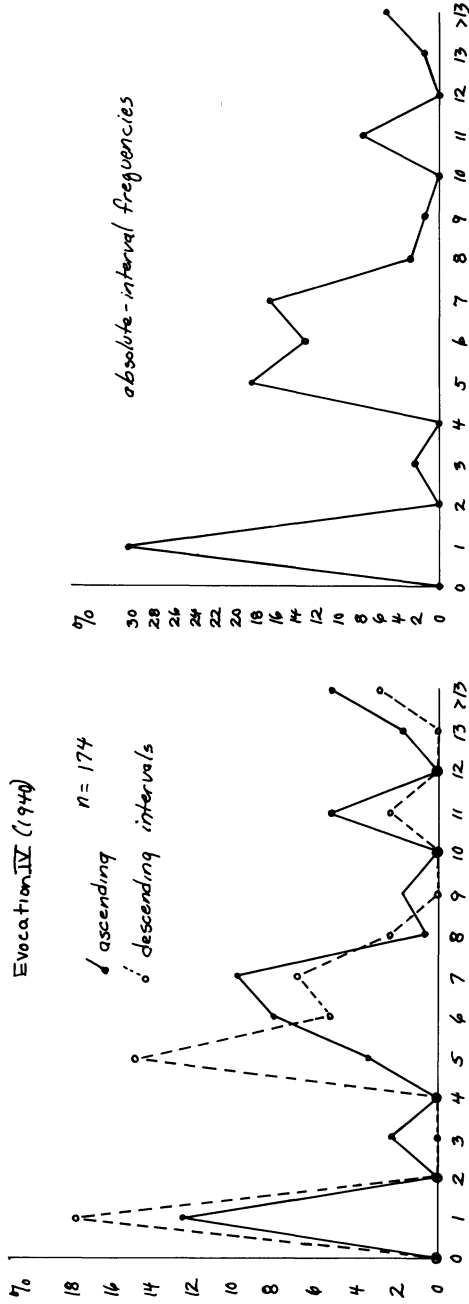


Figure 13 Melodic-interval frequency-distributions for *Evocation IV* (1940).

Evocation II (1941)		<-13	-13	-12	-11	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7	8	9	10	11	12	13	>13	n
in %		2	1	0	10	4	6	3	5	14	27	0	8	12	48	0	48	17	7	10	4	20	15	3	6	1	6	0	2	2	281
absolute-interval frequencies:		0.7	.4	0.	3.6	1.4	2.1	1.1	1.8	5.0	9.6	0.	2.8	4.3	17.1	0.	17.1	6.0	2.5	3.6	1.4	7.1	5.3	1.1	2.1	.4	2.1	0.	.7	.7	
ALSD = 9.16 (7.62) ALSC = 2.50																															
absolute-interval frequencies:		0. 342 10.3 5.3 3.6 11.0 12.1 7.1 2.1 4.3 1.8 5.7 0. 1.1 1.4																													

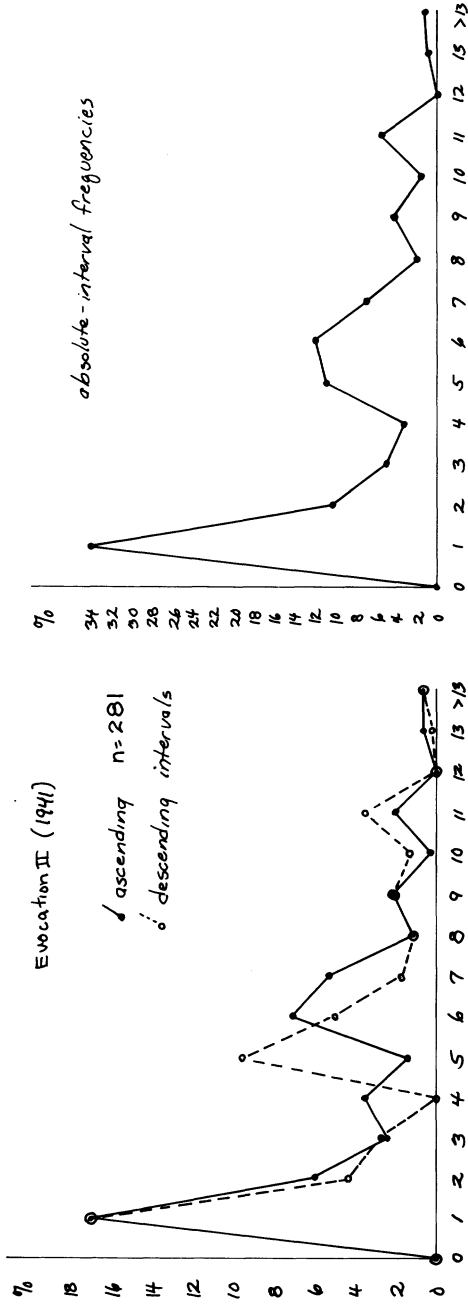


Figure 14 Melodic-interval frequency-distributions for Evocation II (1941).

Evocation II (1943)		<-13	-15	-12	-11	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7	8	9	10	11	12	13	>13	$\lambda$
in %		5	3	0	12	0	0	1	4	11	15	5	11	7	17	0	26	2	5	4	10	12	9	6	3	1	5	0	6	5	185
ALSD = 3.78 (0.98)		2.7	1.6	0.	6.5	0.	0.	.5	2.2	5.9	8.1	2.7	5.9	3.8	9.2	0.	14.1	1.1	2.7	2.2	5.4	6.5	4.9	3.2	1.6	.5	2.7	0.	3.2	2.7	
ALSC = 2.46		absolute-interval frequencies:																													
		0.	23.2	4.9	8.6	4.9	13.5	12.4	7.0	3.8	1.6	.5	9.2	0.	4.9	5.4															

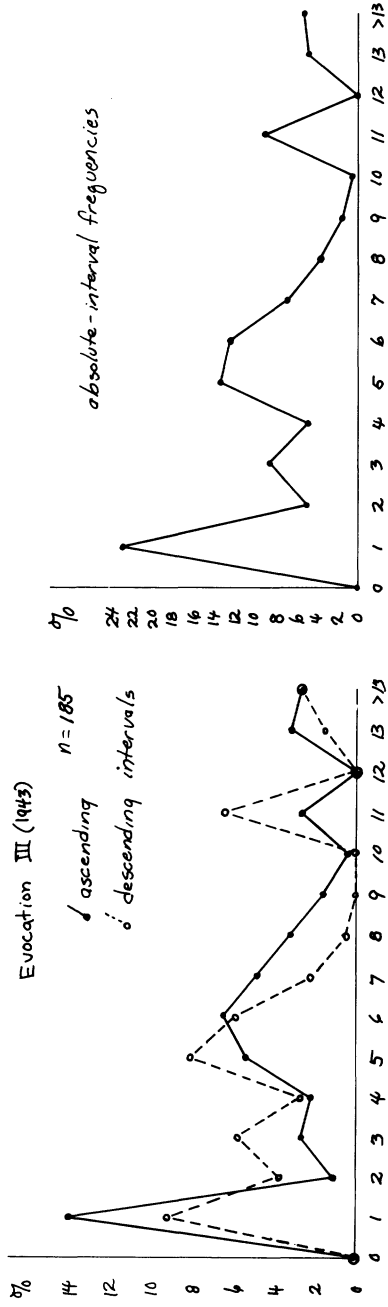


Figure 15 Melodic-interval frequency-distributions for *Evocation III* (1943).

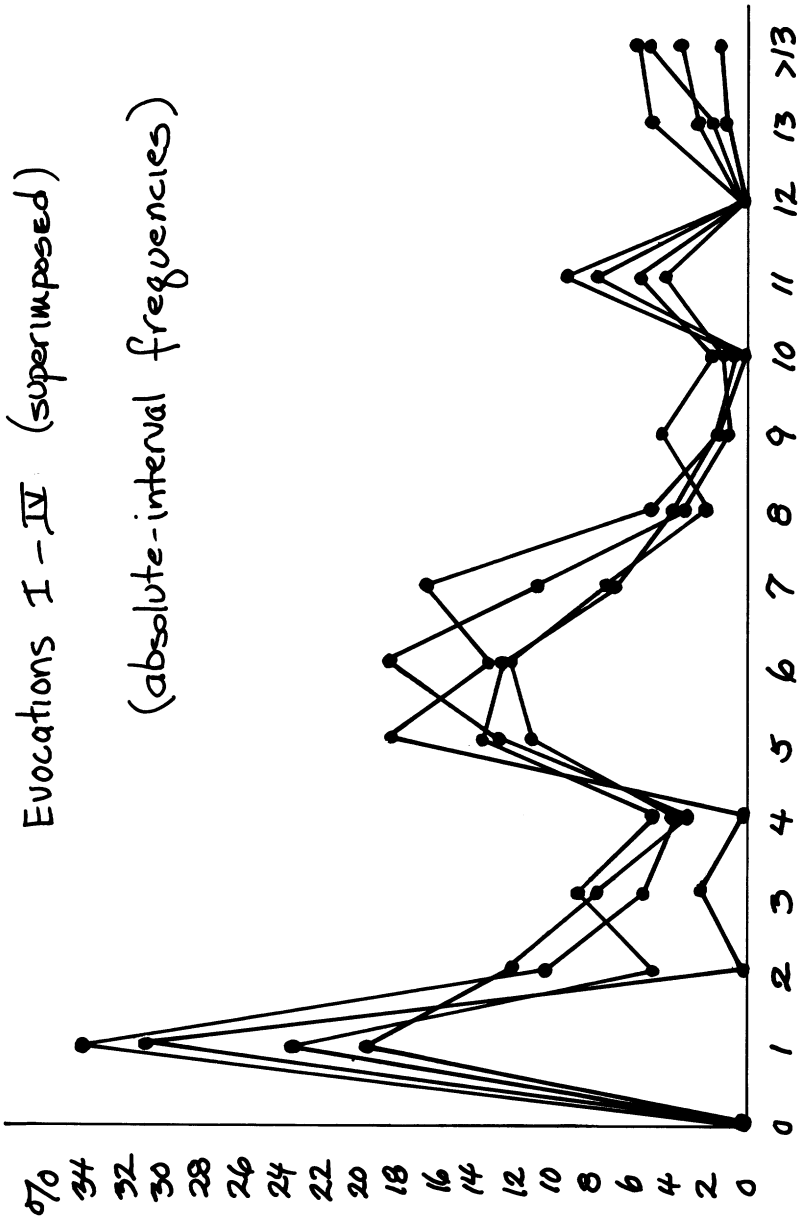


Figure 16 Superimposed plot of melodic-interval frequency distributions for *Evocations I-IV* (1937-43).



Evocations I-III (1937-43)		<-13	-12	-11	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7	8	9	10	11	12	13	>13	n		
in %		15	4	30	4	43	21	45	76	5	21	19	99	0	111	30	21	17	24	53	51	13	13	3	20	0	13	11	732			
		2.0	.5	4.1	.5	.8	1.1	2.9	5.9	10.4	.7	2.9	2.6	135	0	152	41	29	23	33	7.2	70	18	1.8	.4	2.7	0	1.8	1.5			
		ALSD = 8.80 (9.30) ALS = 2.39															absolute-interval frequencies:															
		0															0															
		0															0															

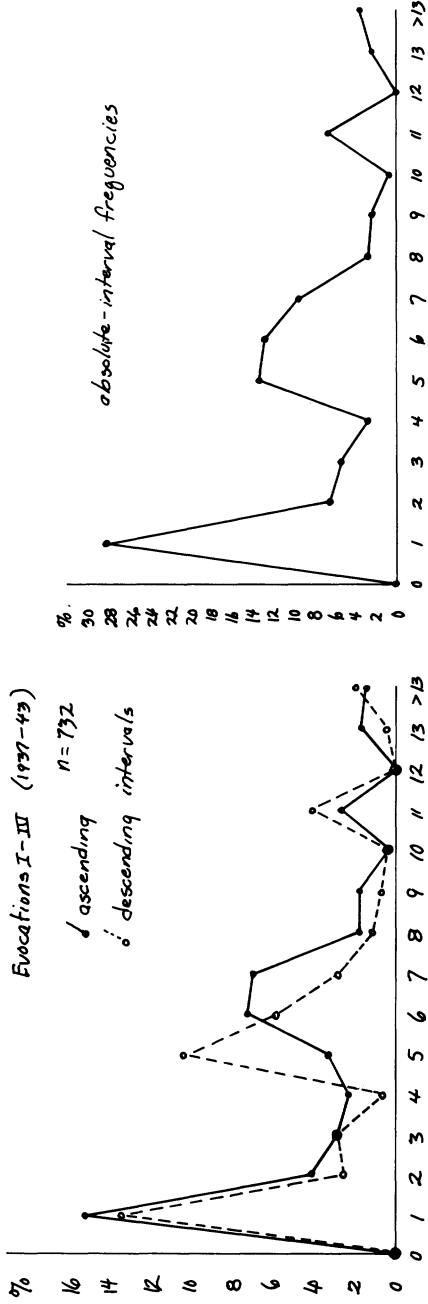


Figure 17 Melodic-interval frequency-distributions (average values) for Evocations I-IV. (1937-43).

		<-13	-13	-12	-11	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7	8	9	10	11	12	13	>13	$\pi$
Organum (1944)		3	0	0	6	0	3	6	6	26	75	5	16	18	59	0	49	15	29	15	14	14	7	11	6	2	5	0	3	2	333
in %		.9	0.	0.	1.8	0.	.9	1.8	7.8	3.9	1.5	4.8	5.4	17.7	0.	14.7	4.5	8.7	4.5	4.2	4.2	2.1	3.3	1.8	.6	1.5	0.	.9	.6		
ALSD=339 (9.77)   ALSC= 2.79		absolute-interval frequencies: 0.																													

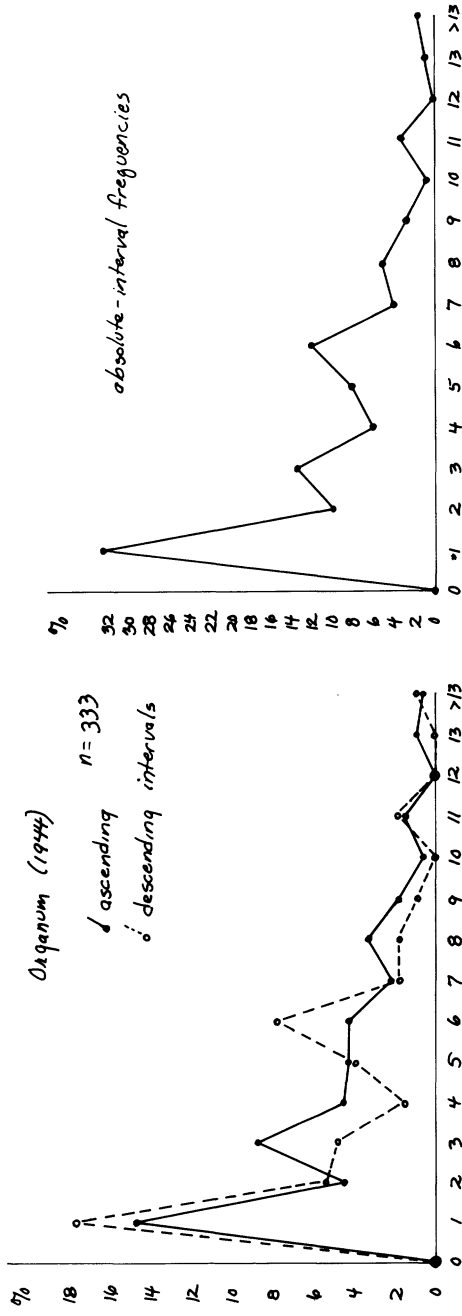


Figure 18 Melodic-interval frequency-distributions for *Organum* (1944).

	<-13	-13	-12	-11	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7	8	9	10	11	12	13	>13	n
1931-1944 sub-totals	39	12	0	60	4	14	18	41	128	108	42	51	46	285	0	279	61	62	43	55	111	83	27	21	6	76	0	32	23	1692
in %	2.3	.7	0	3.5	.2	.8	1.1	2.4	7.6	6.4	2.5	3.0	2.7	16.8	0	14.4	3.6	3.7	2.5	3.3	6.6	4.9	1.6	1.2	.4	4.5	0	1.9	1.4	
absolute-interval frequencies:	0														0	31.2	6.3	6.7	5.0	9.6	4.1	7.3	2.7	2.1	.6	8.0	0	2.6	3.7	

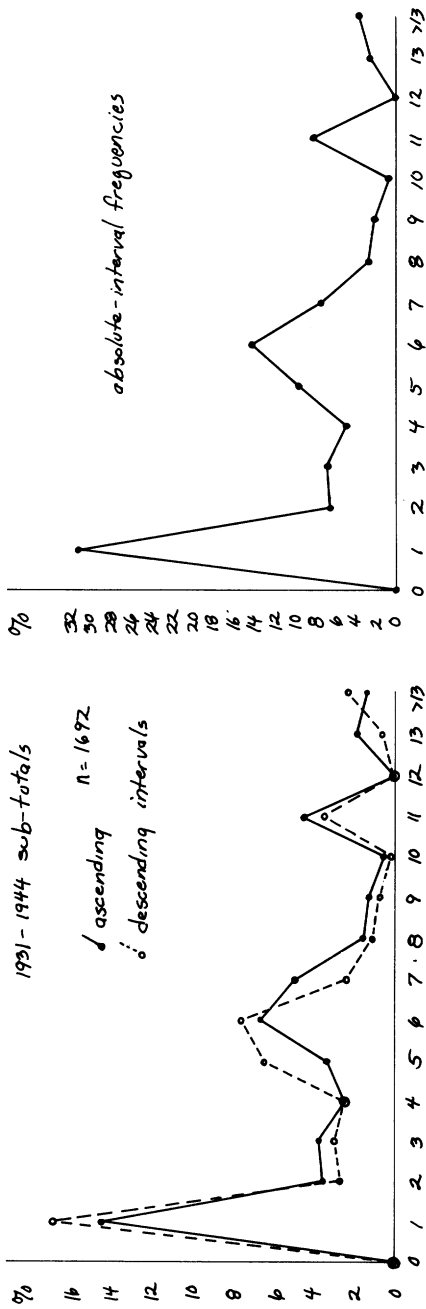


Figure 19 Melodic-interval frequency-distributions for the period 1931-1944.

		<-13	-13	-12	-11	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7	8	9	10	11	12	13	>13	n
All pieces 1919-1944		53	28	1	81	17	36	27	52	195	166	92	144	200	414	0	352	161	161	96	94	152	114	47	40	19	107	1	60	36	2947
in %		1.8	1.0	0.	2.7	.6	1.2	.9	1.8	6.6	5.6	3.1	4.9	6.8	14.0	0.	11.9	5.5	5.5	3.3	3.2	5.2	3.9	1.6	1.4	.6	3.6	0.	2.0	1.2	
absolute-interval frequencies:		0.															26.0	12.2	10.3	6.4	8.8	11.8	5.6	2.5	2.6	1.2	6.4	.1	3.0	3.0	

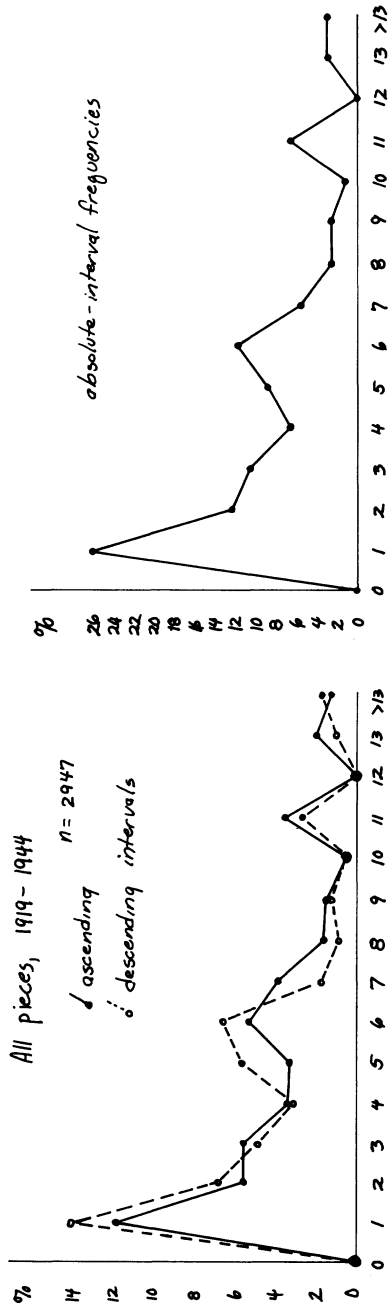


Figure 20 Melodic-interval frequency-distributions for all pieces, 1919-1944.

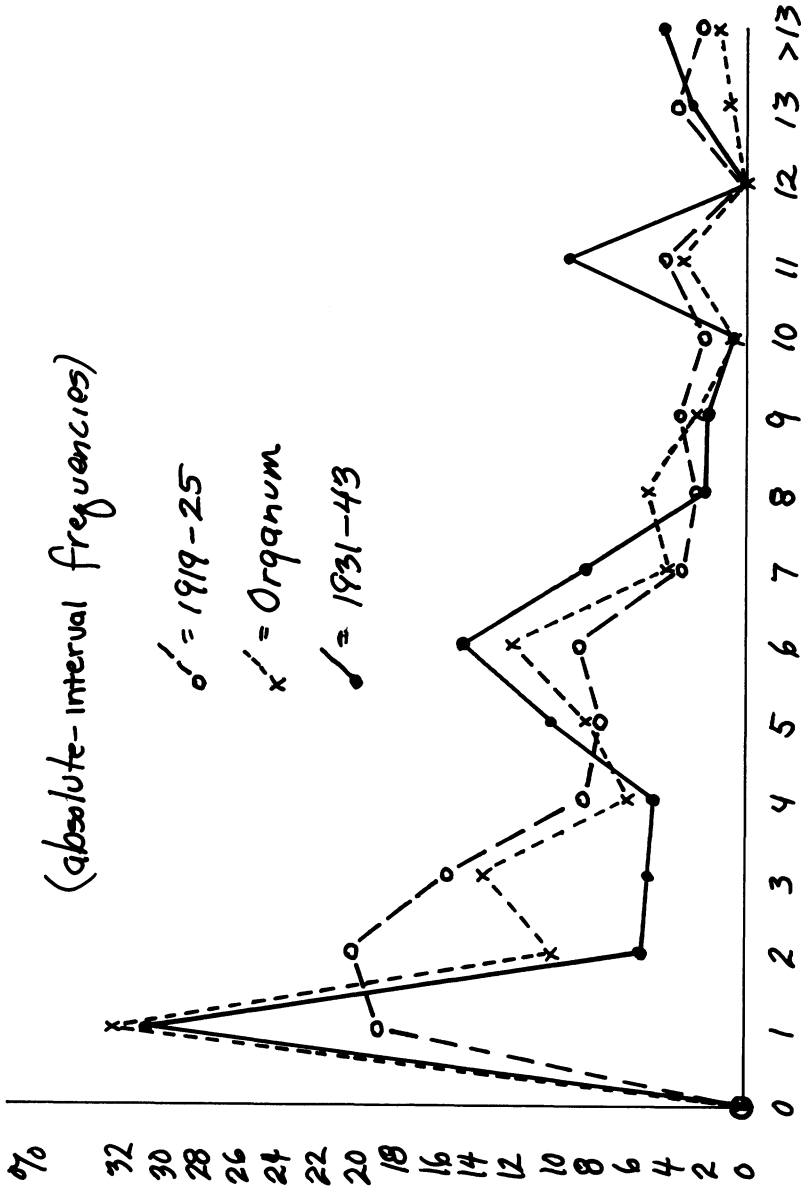


Figure 21 Melodic-interval frequency-distributions for *Organum* vs. the periods 1919-25 and 1931-43.

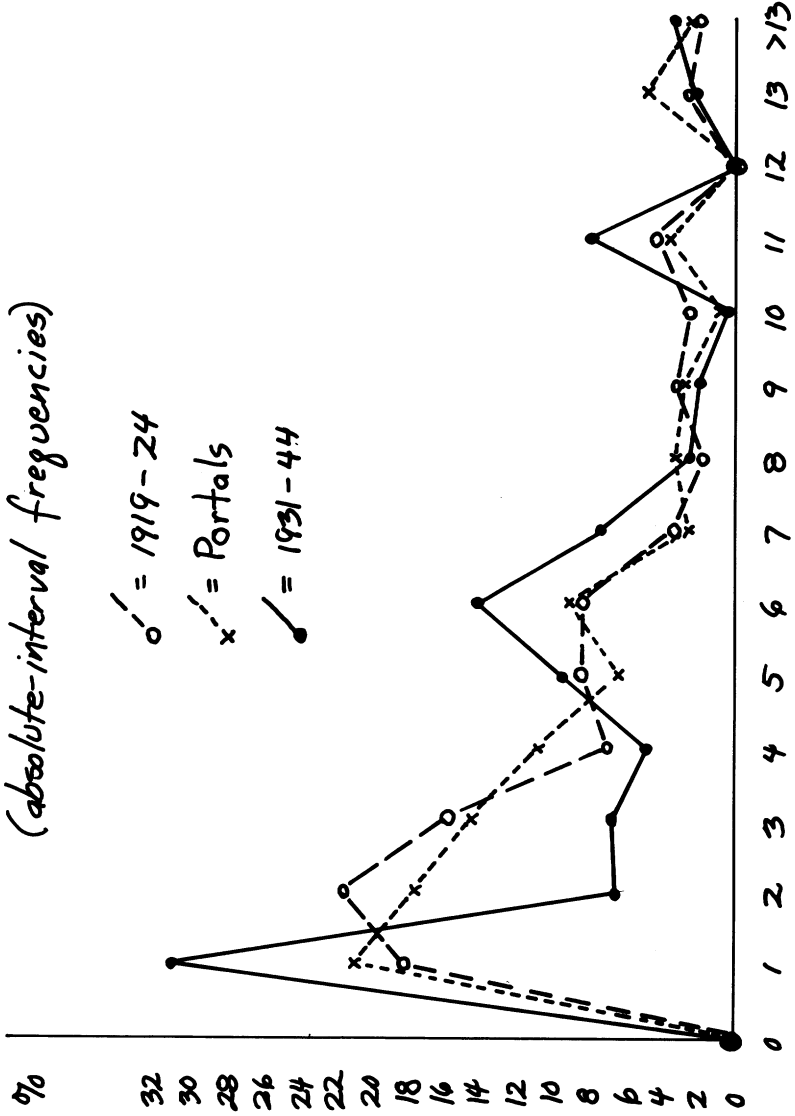


Figure 22 Melodic-interval frequency-distributions for Portals vs. the periods 1919-24 and 1931-44.

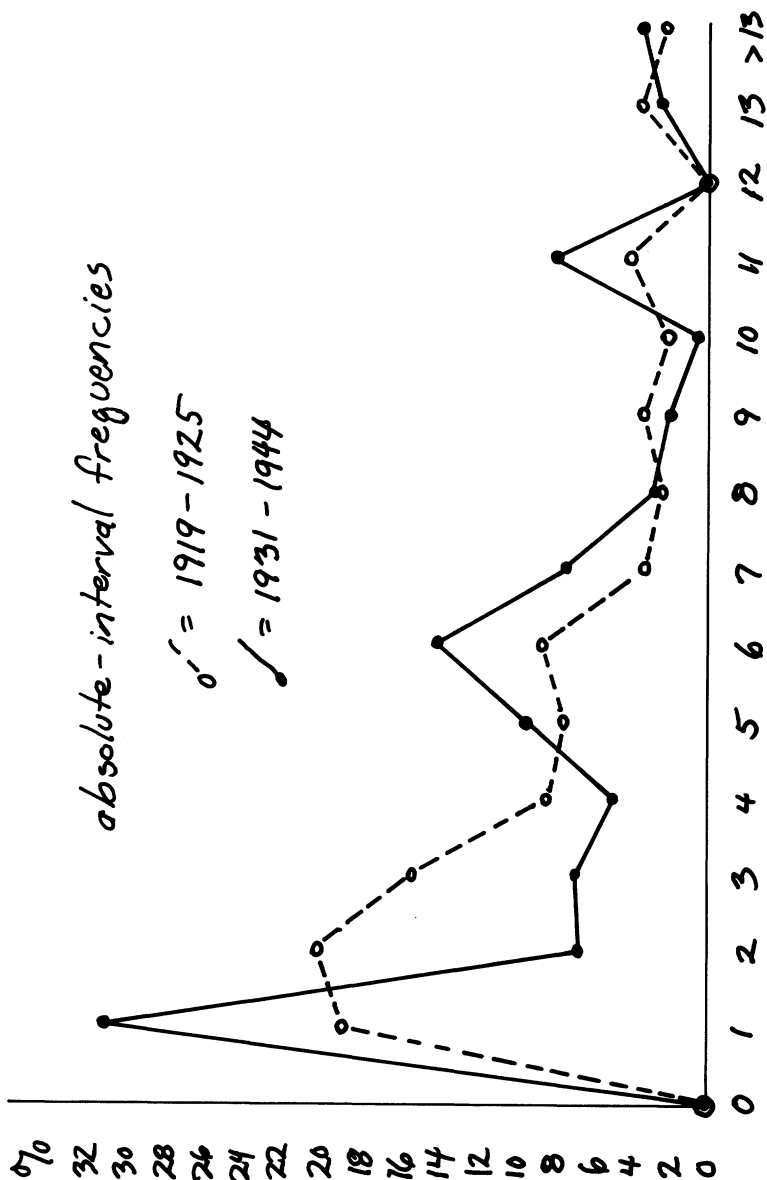


Figure 23 Melodic-interval frequency-distributions for the early vs. the later works (1919-25 vs. 1931-44).

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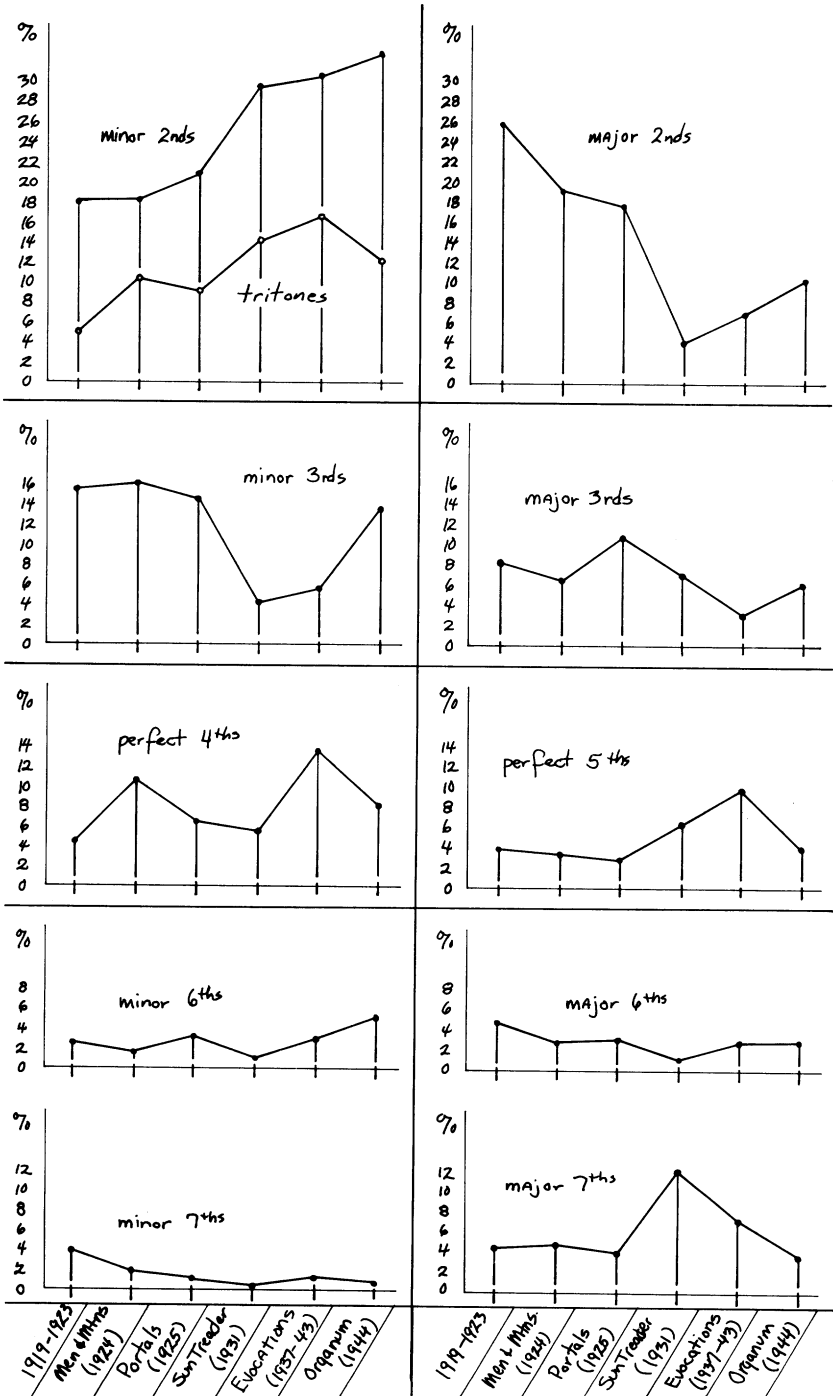


Figure 24 Absolute-interval frequencies as a function of chronological sequence.



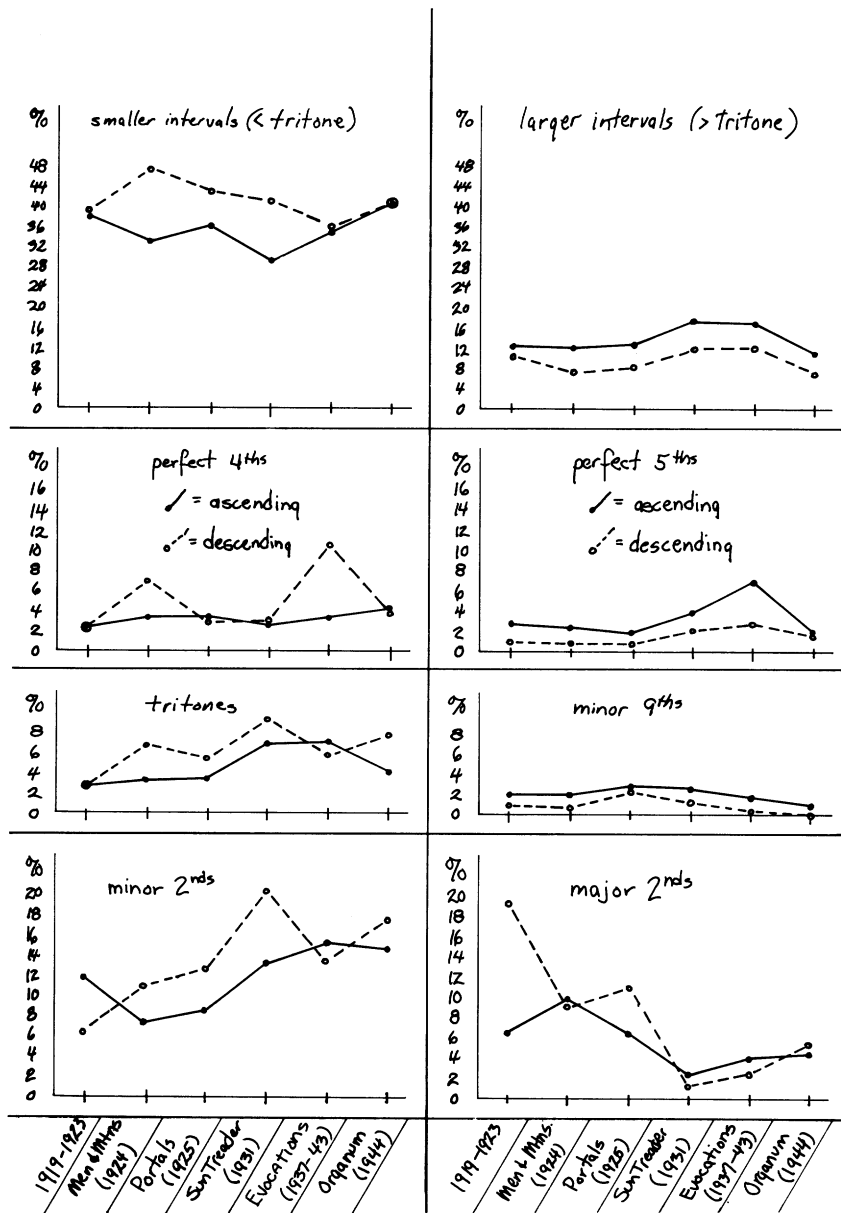


Figure 25 Ascending vs. descending interval frequencies.

Figure 26 Values for LSDP and LSCI at the beginning of *Portals*.

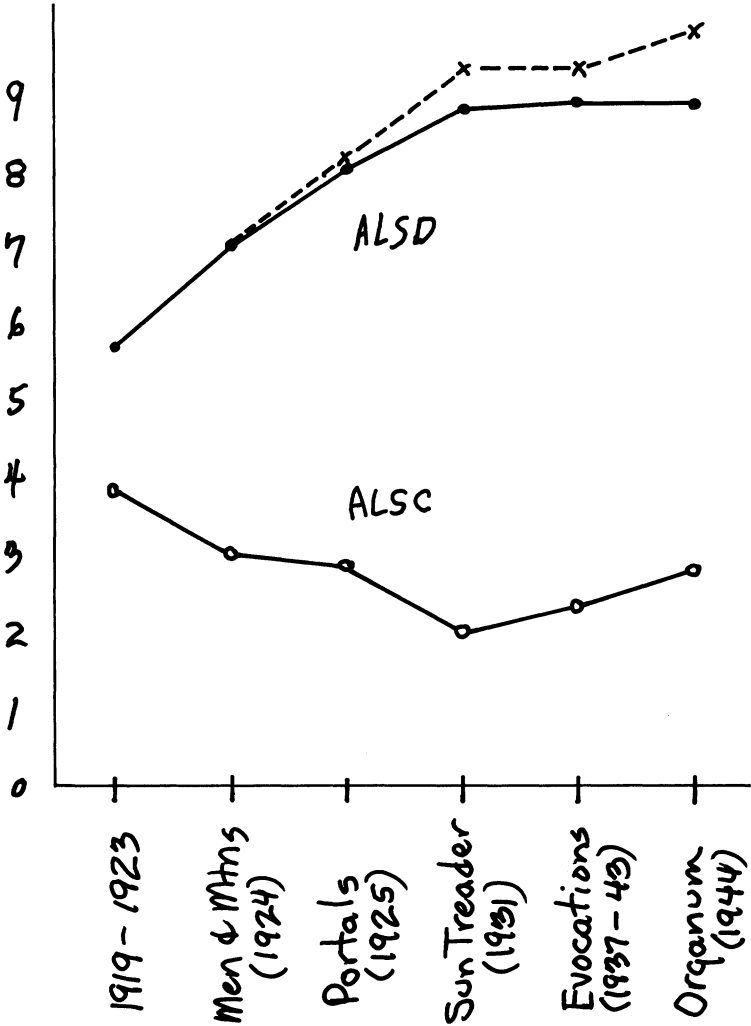


Figure 27 ALSD and ALSC as a function of chronological sequence.