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Acquiring Aural Interval Identification Skills Vs. Ordered Grouping

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ACQUIRING AURAL INTERVAL IDENTIFICATION SKILLS: RANDOM VS. ORDERED GROUPING

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INTRODUCTION

Several previous studies have established the effectiveness of programmed instruction in student acquisition of aural interval identification skills, whether the instruction be in the form of taped materials or computer-assisted instruction (e.g., Spohn and Poland; Tarratus and Spohn; Killam and Lorton; Hofstetter, 1975; Wasserman; Killam, Lorton, and Schubert; and Humphries). In the present study, we examine the effectiveness of *ordered* presentation of intervals in student acquisition of aural identification skills. Although various researchers have developed tables of the most commonly confused intervals along with rank orderings of interval difficulty, marked differences in study length, in ages and prior musical training of subjects, and in specific type(s) of intervals included—both between studies and in relation to the present study—make detailed comparisons of their results impractical. Previous investigations that, for the purposes of the current study, provide the most relevant information are those by Spohn and Poland; Jeffries; and Hofstetter (1979). In addition, because Ortmann considered various aspects of interval acquisition in such detail and with such great insight, his landmark 1934 study is also included.

Ortmann examined the patterns of errors made by students aged ten to adult with one to ten years of previous musical training. His graphs represent a compilation of the errors these students made in first, second, and third years of drill on identifying harmonic intervals. Table 1 lists the most typical errors Ortmann found. He cautions that specific percentages of confusion for each interval would no doubt vary from study to study and, therefore, focuses his discussion on the most prevalent confusions. After examining the frequency and patterns of confusion, Ortmann placed the

intervals in categories—*most difficult*: m3, TT (tritone), m6, m7; *less difficult*: M3, P4, P5, M6; and *least difficult*: P1, m2, M2, M7, P8.

Table 1. Ortmann: Typically Confused Intervals.

	% of total errors	In Order of Decreasing Frequency, Most Frequently Confused With					
P1	rare	P8					
m2	4%	M2	m3				
M2	3%	m2	m3	m7			
m3	15%	M3	P4	TT			
M3	6%	m3	P4	m6			
P4	9%	P5	M3	TT	m3		
TT	13%	P4	m6	m3	P5, m7	M3	M7
P5	7%	P4	m6	M3, TT, M6			
m6	14%	M6	P5	P4	TT		
M6	8%	P5	m6	P4m, m7			
m7	15%	M7	m6	TT, M6			
M7	6%	m7	m6				
P8		rare	P1				

Table 2. Spohn and Poland: Most Common Interval Confusion.

	In Order of Decreasing Frequency, Most Frequently Confused With				
m2	M2				
M2	m2	m3			
m3	M3	M2	P4, P5		
M3	m3	P4, P5			
P4	P5	M3, TT		m3	
TT	P5	m6	m3	M6, M7	
P5	P8	M6	P4		
m6	M6	TT	m7	P5	M7
M6	P5	P4, M7		TT	
m7	m6	TT	M6	M7	P5
M7	m7	m6	P5		
P8	P5, M6				

INTERVAL IDENTIFICATION

Spohn and Poland, based on the results of melodic ascending interval recognition they conducted at The Ohio State University, also determined the most common interval confusions (see Table 2) and ranked the difficulty of identifying each interval (see Table 3).

Table 3. Spohn and Poland: Ranking of Difficulty of Intervals.

From Easiest to Most Difficult

1	P8
2	M2
3	m2
4.5	M3
4.5	P4
6	P5
7	M6
8	M7
9	m3
10	TT
11	m7
12	m6

The typical confusions shown in Tables 1 and 2 are the same or similar for several intervals (approximately a 70% correspondence), although the intervals of confusion are markedly different for the P5 and P8. Spohn and Poland's order of interval difficulty, with the exception of the placement of the M7, confirms Ortmann's findings. Using the results shown in Tables 2 and 3, Spohn and Poland grouped the intervals into levels of difficulty (shown in Table 4) based, in part, on the ease with which an interval considered in isolation can be identified. In addition, they placed intervals that are easily mistaken for each other in different levels whenever possible to reduce the probability of identification errors. Using these levels of difficulty, Spohn and Poland developed a set of listening tapes for student drill on ascending melodic intervals. Students who worked with these tapes were able to identify ascending melodic intervals with a high degree of proficiency. Tarratus and Spohn verified the effectiveness of these taped drills in a follow-up study at Northwestern State College of Louisiana.

Table 4. Spohn and Poland: Levels of Difficulty.

Level I	M2, P4, M7, P8
Level II	m2, M3, TT, M6
Level III	m3, P5, m6, m7
Level IV	m2, M2, P4, M7, P8
Level V	m3, TT, P5, M6, m7
Level VI	m2, M2, m3, M3, P4, TT, P5, m6, M6, m7, M7, P8 (all intervals)

Jeffries investigated whether students at UCLA would learn to identify intervals more effectively if they were presented in small steps of increasing difficulty rather than in random order. The rank order of difficulty Jeffries used, based on his own testing, is somewhat different from Ortmann's and from Spohn and Poland's rankings, except in the designation of the most difficult intervals. Jeffries' order, listed from least to most difficult, is: P8, M2, P5, M3, M7, m2, M6, P4, m3, A4, m7, m6. Although Jeffries labels the organization of the other series random, it should more accurately be termed *arbitrary*. Because he used taped exercises, the order of the random presentation was necessarily determined before the experiment began, and only one such random order was devised. In other words, all students who worked with tapes of the randomly ordered presentation learned to identify the intervals in exactly the same order: M3, P4, m3, m2, A4, m7, P5, P8, M2, M7, M6, m6. Jeffries found the random order superior to difficulty order. He speculates the difference in learning success resulted because the more difficult intervals were presented later in the ordered sequence, so the students practiced more on the easier intervals; thus, they had insufficient drill on the more difficult ones.

Hofstetter found competency-based learning of interval identification skills more effective, although less popular with the students, than a strictly sequential method of exercise presentation. Hofstetter speculates that the high degree of proficiency required—90%—led to high student frustration. Both groups practiced aural skills using the GUIDO computer-assisted instruction system. The test subjects were second-semester University of Delaware music students who, the first semester, had completed the levels of ascending melodic interval drill shown in Table 5. Although Hofstetter attributes these levels to Benward (Workbook in Ear Training, 1969), they are very similar to Spohn and Poland's levels. Apparently, Spohn and

Poland, Benward, and Hofstetter would all agree the best strategy for developing interval identification skills involves: 1) presentation of intervals in a series of levels with an increased number of choices at higher levels; and 2) presentation of less easily confused intervals together in the lower levels, saving the more easily confused intervals for presentation together in the higher levels. Benward and Hofstetter interrupt the increase in number of choices at Level 6, probably to compensate for the concentration of easily confused intervals at that level.

Table 5. Hofstetter (Benward): First Semester Levels of Difficulty, Ascending Melodic Intervals.

Level I	M2, P4, M7, P8
Level II	m2, M3, TT, M6
Level III	m3, P5, m6, m7
Level IV	m2, M2, M3, P4, M7, P8
Level V	m3, TT, P5, m6, M6, m7
Level VI	m6, M6, m7, M7
Level VII	All intervals

In the second semester (the one in which Hofstetter tested the effectiveness of competency-based learning), the controlling organizational factors are different, although an increase in difficulty is still apparent (see Table 6). The order of levels again follows Benward's. Levels in which all intervals are possible choices are interspersed with levels with only six choices, but those six choices are more easily confused with each other than were those used in the earlier levels completed during the first semester. Descending melodic intervals and harmonic intervals are presented in separate sequences along with a review level (Level 4), which includes all ascending *and* descending melodic intervals, inserted after the last descending melodic interval level and before the first harmonic interval level. Yet, the overriding organizational principle appears to be unchanged: more easily confused intervals are grouped together in higher levels. Clearly, the assumption is that interval identification problems should become increasingly more difficult as students progress through an ordered sequence.

Table 6. Hofstetter (Benward): Second Semester Levels of Difficulty.

Level I	m2, m3, P4, P5, M7, P8, descending melodic
Level II	M2, M3, TT, m6, M6, m7, descending melodic
Level III	All descending melodic intervals
Level IV	All ascending and descending medolic intervals
Level V	m2, m3, P4, P5, M7, P8, harmonic intervals
Level VI	M2, M3, TT, m6, M6, m7, harmonic intervals
Level VII	m2, M2, m3, M3, m6, M6, m7, M7, harmonic intervals
Level VIII	All harmonic intervals

Table 7. Interval Groupings Used in This Study.

Grouping I	M2, P4, P8
Grouping II	m2, M3, P5
Grouping III	TT, M6, m7
Grouping IV	m3, m6, M7
Grouping V	M2, M3, P5, P8
Grouping VI	m2, P4, M6, M7
Grouping VII	m3, TT, m6, m7
Grouping VIII	M2, M3, P4, M7, m6, P8
Grouping IX	m2, m3, TT, P5, M6, m7
Grouping X	P1, m2, M2, m3, M3, P4, TT, P5, m6, M6, m7, M7 P8 (all intervals)

METHODOLOGY

The purpose of the present investigation was to determine whether presenting interval drills in an easy-to-difficult ordered set of groupings affects student acquisition of aural identification skills. To avoid the problem Jeffries found in presenting the more difficult intervals last, all intervals were presented at each level, in groupings of increasingly larger numbers of intervals from which the student was directed to identify the correct one. Students practiced identification skills, choosing correct an-

swers from groupings of intervals selected using one of two methods: 1) groupings of intervals were randomly chosen for each example; or 2) groupings were predetermined. The predetermined groupings were based primarily on Spohn and Poland's levels of difficulty, with their interval organization modified to make the increase in difficulty between levels more gradual and to delay, as long as possible, including easily confused intervals in the same group (see Table 7).

The groupings were then organized into the levels shown in Table 8. For each type of interval, melodic or harmonic, the lowest level consists of four groups of three intervals each, followed by a level of three groups of four intervals each, a level of two groups of six intervals each and, at the highest level, a group of all intervals.

Table 8. Contents of the Levels of Presentation.

	Type of Interval Presentation	Number of Choices
Level 1	Ascending melodic	3
Level 2	Ascending and descending melodic	4
Level 3	Ascending and descending melodic	6
Level 4	Ascending and descending melodic	12
Level 5	Ascending and descending harmonic	3
Level 6	Ascending and descending harmonic	4
Level 7	Ascending and descending melodic, quality and size entered separately	13
Level 8	Ascending and descending harmonic	6
Level 9	Ascending and descending harmonic	12
Level 10	Ascending and descending harmonic, quality and size entered separately	13
Level 11	Ascending and descending melodic and harmonic, quality and size entered separately	13

Since harmonic intervals are commonly considered more difficult than melodic, the melodic intervals were presented in lower levels than the corresponding groups of harmonic intervals. In addition, descending melodic intervals, which are generally considered more difficult than ascending melodic intervals, were not introduced until Level 2.

In the random presentation strategy, the answer pool contained a different randomly chosen group of intervals for each example. In the predetermined presentation, the group was chosen randomly from one of the predetermined groupings of intervals shown in Table 7. For both groups, the number of intervals was determined according to the current level specifications. The correct answer for each example was randomly selected from the intervals in the chosen group.

The subjects used in this study were students enrolled in Aural Training I at Ohio State University in Autumn Quarter 1986. To eliminate possible teacher bias, students were selected from two sections taught by different teachers, and each method of presentation was used by a different subset of the subjects from each class. Based on the results of an interval pretest and on an evaluation of their past theory study, aural training, and years of instrumental/vocal performance study, pairs of students with similar backgrounds and knowledge were randomly assigned to different groups. The melodic and harmonic interval portion of the final examination was used as a posttest to measure student achievement. Eighteen students in the random group and twelve in the predetermined group completed all aspects of the study.

The instructional materials consisted of an Apple Macintosh microcomputer equipped with headphones and custom-designed interval dictation software. Extensive records kept for each student included section, presentation group, and level information; interval played; the student's response; the length of time the student worked on each example; number of sessions; and time and date information for each session. The program is mastery-based, with the student required to identify and notate 80% of the examples correctly before advancing to the next level. For each student, the goal was to reach Level 6 by the end of the quarter.

In addition to two hours of class time each week, all students enrolled in Aural Training I are routinely required to practice aural identification and dictation skills in the Aural Training Lab a minimum of one hour a week. Because of the course structure, most dictation practice necessarily takes place in the Aural Training Lab. The participants in this study spent a portion of that time using the interval dictation program on the Macintosh. Taped drill was also available, but the students were instructed not to use the tapes for aural interval identification practice.

Students controlled their own progress in working through the program, and all student communication with the Macintosh was accomplished via the mouse. Students determined when they were ready to hear the interval, to have an interval checked, to continue to the next example, or to end a session. Current level and mastery information remained on the screen throughout each session. For each interval example, the student was

given a beginning pitch, which appeared in traditional music notation on the screen. In addition, for each harmonic interval example, an arrow on the staff indicated whether the second pitch was higher or lower than the beginning pitch. Students were expected to identify and notate the interval correctly. They could hear each interval played twice. For melodic (and harmonic) intervals, the duration of each pitch (or pair) was approximately one and one-half seconds.

Students could have each answer checked twice. They received credit toward mastery, however, only if they both identified and notated the interval correctly the first time. If they simply forgot either to identify or notate the interval, they were prompted to supply the missing portion of the answer before it was checked. If they entered a wrong answer, the computer responded with specific information: for example, "Hint: check the accidental again"; "You have notated the interval in the wrong direction"; "Your notation and identification match, but both are wrong"; and so on. If the student missed an interval notation or identification twice, the computer gave the correct notation and identification. Students could then click the mouse on the appropriate box to hear and/or see the correct interval and their own wrong answer(s).

The posttest consisted of eight melodic and eight harmonic intervals, which the student was asked to identify and notate. All intervals, except the unison, were randomly divided into two groups, and each of these groups of six intervals served as the choices for half the problems on the melodic interval section. The choices on the harmonic interval section were randomly divided into groups of four intervals, and one group of four interval choices was given for each set of four problems. Each example was played twice, and each problem was worth two points: one each for identification and notation. The posttest scores were recorded as percentages of correct answers.

RESULTS AND DISCUSSION

The results from the posttests were evaluated using the Statistical Package for the Social Sciences (SPSS-X), run at Ohio State's Instruction and Research Computer Center. To determine if a statistically significant difference existed between the interval identification skills of the two groups as a result of the study, a t-test based on a division of the posttest scores by presentation group was performed. To check for possible teacher bias, a second t-test was used to compare the performances of the two sections.

Although the mean score of the random presentation group is higher than the mean score of the predetermined presentation group, the results of the t-test on posttest scores divided by method of presentation (Table 9) show there is no significant difference at the .05 level. In other words, the method of presentation seems to have little effect on student acquisition of aural interval identification skills.

Table 9. Results from the T-test Performed on the Posttest Scores of the Two Presentation Types.

Variable	Number of Cases	Mean	Standard Deviation	T-Value	Degrees of Freedom	Probability
Random	18	81.6111	12.985	1.15	28	0.258
Predetermined	12	75.5833	15.448			

The results of the t-test performed on the posttest scores divided by section (Table 10) show no significant difference at the .05 level. Teacher bias was not a factor in the results of the study.

Table 10. Results from the T-test Performed on the Posttest Scores of the Two Sections.

Variable	Number of Cases	Mean	Standard Deviation	T-Value	Degrees of Freedom	Probability
Section 1	13	80.0000	14.866	.27	28	0.791
Section 2	17	78.5882	13.888			

Since the ability to distinguish any interval in an arbitrary context is a fundamental goal, all of the answer choices for the posttest were randomly chosen. These random choices could perhaps have influenced the outcome in relation to the harmonic portion of the test because the random group was, presumably, already accustomed to this arrangement of choices. Very few students, however, reached Level 6 (the four harmonic interval choices) prior to the posttest. Moreover, even fewer of the random presentation group reached Level 5 (the first harmonic interval level). As a result, the effect of random selection (in the answer pool for the harmonic interval portion) on the results of the posttest was probably negligible. The random selection should have had no effect on the outcome of the melodic-interval portion of the test since most students in both groups had already mastered Level 4 (all twelve intervals). Choosing from just six melodic intervals should, therefore, have been a relatively easy task, regardless of which presentation group the student had been assigned to.

Although the posttest required both identification and notation of intervals for mastery, there was very little difference in the students' performance of these two tasks. There was also little difference between performance on the melodic and harmonic portions of the posttest.

In addition to the t-tests, Spitbol programs were used to extract information from the student data files kept by the interval-dictation program. One Spitbol program developed confusion tables that show the percentages of error for every interval combination within each of the three types (melodic ascending, melodic descending, and harmonic). Another program produced statistics for each group as a whole for the entire quarter. These data included the average number of sessions, the average time per session, the total time spent, and the average level achieved.

Very few students reached the harmonic interval levels, and they completed so few examples the resulting confusion tables are of doubtful validity. The confusion tables for melodic intervals, however, are informative. Four of these matrices are shown in Table 11.

Regardless of how the confusion tables are considered—individually or in various combinations—correspondences to either Spohn and Poland's or Ortmann's findings are, at best, approximate. For melodic intervals in the random group, the most typical errors correspond only about half the time to Ortmann's findings, even when the results in both studies are considered rather generally as *trends* rather than as specific orders of confusion. The correspondence between ascending melodic interval errors and Spohn and Poland's table of ascending melodic interval confusions (approximately two-thirds) is somewhat closer.

Table 11. Confusion Tables of Melodic Intervals.
(All numbers in the confusion tables are percentages)

Table 11a. Melodic Ascending, Random Presentation:

		Student's Answer											
		P1	m2	M2	m3	M3	P4	TT	P5	m6	M6	m7	M7	P8
Correct Answer	P1	**100**												
	m2		**85**	4	5			3	2	1		1		
	M2		5	**90**		2	3	1						
	m3		2	3	**78**	4	2	3	3		1	1	2	
	M3		2	1	6	**69**	6	6	5	2	2	2	1	1
	P4				4	2	**86**		4		1	1	2	1
	TT			1	1	1	6	**63**	5	6	5	7	3	2
	P5		1		3	1	4	3	**80**	2	3	2	1	2
	m6				4	1	1	10	9	**43**	14	10	7	
	M6		1			2	2	6	10	7	**56**	6	8	3
	m7							2	7	8	9	**63**	8	3
	M7					2	2	5	1	9	7	11	**62**	2
	P8									3	2	2	2	**91**

Table 11b. Melodic Ascending, Predetermined Presentation.

		Student's Answer											
		P1	m2	M2	m3	M3	P4	TT	P5	m6	M6	m7	M7	P8
Correct Answer	P1	**100**												
	m2		**93**		2	2			1				1	
	M2		1	**94**		2	1		1					
	m3		1		**79**	1	1	8	1	8				
	M3		5	3	1	**82**	3		6					
	P4			3		3	**85**			1	1			7
	TT				2	1	1	**60**	4	5	7	19		1
	P5				2	11	3	2	**74**	1	3			4
	m6				2	2	5	4		**60**	1	8	17	1
	M6					1	2	2			**86**	5	2	1
	m7							12		16	11	**61**		1
	M7						3	3		27	10	3	**51**	5
	P8						4		7	1			4	**84**

Table 11c. Melodic Descending, Random Presentation:

		Student's Answer												
		P1	m2	M2	m3	M3	P4	TT	P5	m6	M6	m7	M7	P8
Correct Answer	P1	**100**												
	m2		**82**	13				2		2			2	
	M2		3	**69**	7	5	5	7	2		2	2		
	m3			3	**60**	22	7	1	6			1		
	M3			2	8	**67**	2	6	6	3	3	5	2	2
	P4				4	7	**69**	4	11		4	2		
	TT		1	1	3	4	7	**58**	3	4	7	8	5	
	P5					2	2	12	**75**		2	2	2	5
	m6				3		2	9	13	**42**	7	7	4	13
	M6				3		5	3	14	8	**57**	8	3	
	m7							13	7	4	16	**44**	7	9
	M7					2	2	7	11	5	18	9	**36**	9
	P8						6	4	6	8	4		2	**70**

Table 11d. Melodic Descending, Predetermined Presentation:

		Student's Answer											
		P1	m2	M2	m3	M3	P4	TT	P5	m6	M6	m7	M7	P8
Correct Answer	P1	**100**												
	m2		**90**		10									
	M2		2	**73**	2	20			2	2				
	m3			2	**60**	10	6	14	2	4		4		
	M3					**70**	6	4	23					
	P4			2		10	**74**	2		2	4		4	2
	TT				12	2	8	**39**	8	12	6	14	2	
	P5					13	2	4	**60**		8	2		11
	m6				4	4	6	23	11	**30**		13	6	2
	M6						9	2	11		**45**	11	23	
	m7							16	12	27	8	**31**	4	2
	M7						7	4		7	20	11	**40**	11
	P8			2			4	2	16	2			4	**70**

Comparisons with the predetermined group's typical melodic interval confusions show even less correlation: all are within the 30% to 40% range except for the extremely low (12.5%) correspondence between Ortmann's findings and the predetermined group's typical confusions of ascending melodic intervals. Of course, errors made by students in the predetermined groups would not be expected to correspond to errors by students who were able to choose their answers from all possible intervals since the less easily confused intervals were purposely grouped together as much as possible. Indeed, the typical patterns of confusion in the predetermined groups do seem to be quite different from any of the other findings. Students were still easily able to identify intervals incorrectly with some regularity; instead of identifying intervals with the most typical wrong answers, however, they confused them with whatever incorrect choices they had available.

The rank ordering of interval difficulty for each combination of melodic interval direction and presentation type is shown in Table 12. None of these orders matches Ortmann's or Spohn and Poland's, although there is some agreement as to which intervals are most difficult: TT, m6, and m7 were most often missed in their studies and in this one. Instead of their

problematic m3, however, the M6 and M7 were the additional members of this study's most difficult intervals, with just one exception: the M6 does not appear to have been particularly difficult for students in the predetermined presentation group when they practiced identifying ascending melodic intervals.

Table 12. Rank Ordering of Interval Difficulty, Separated by Melodic Interval Direction and Presentation Group.

From easiest to most difficult:

Melodic Ascending:		Melodic Descending:	
Random	Predetermined	Random	Pretermined
P1	P1	P1	P1
P8	M2	m2	m2
M2	m2	P5	P4
P4	M6	P8	M2
m2	P4	M2, P4	M3, P8
P5	P8	M3	m3, P5
m3	M3	m3	M6
M3	m3	TT	M7
TT, m7	P5	M6	TT
M7	m7	m7	m7
M6	TT, m6	m6	m6
m6	M7	M7	

The percentage of correct intervals for each presentation group and each melodic interval type is shown in Table 13 (harmonic intervals omitted because of small sample).

The average percentages correct for each group working on the same kind of melodic interval (ascending and descending) are very similar. For ascending melodic intervals, the predetermined group fared slightly better, while the random group's percentage is slightly higher for descending melodic intervals. Given that the predetermined group, except in Level 4, worked on groups of intervals that should have been relatively easy to distinguish, it would seem the predetermined group's percentages of correct answers should be substantially higher. Instead, it appears students continued to choose a wrong answer about the same percentage of time,

even when the "best" wrong answers were removed from their consideration. As might be expected, students in both groups had fewer correct responses for descending melodic intervals.

Table 13. Percentage of Correct Intervals.

Type of Interval	Type of Presentation	Average Correct %
Melodic Ascending	Random	74%
	Predetermined	78%
Melodic Descending	Random	64%
	Predetermined	59%

The errors shown in the confusion matrices in Table 11 are more scattered in the random groups (i.e., show a wider range of errors) because the students had a wider range of wrong choices in most of the levels. (The random confusion tables have approximately 25% more entries than the corresponding predetermined confusion tables.) Yet, as shown in Table 11, the total percentage of errors remains about the same in both groups.

Additional data concerning time spent and level achieved are shown in Table 14. The time spent on each question and the total time spent during each session are very similar. The predetermined group, however, worked an average of almost two more sessions during the quarter and achieved an average of almost one level higher. On average, neither group reached the goal of Level 6: the average student in the random group did not reach even the lowest harmonic dictation level, while the average predetermined student barely reached the first harmonic interval level.

In addition to reaching a higher level, the students in the predetermined group also spent more time working on the computer, even though they did not score significantly better on the posttest and their mean score was, in fact, somewhat lower. Apparently, the random-group students were able to acquire at least as much skill—and more efficiently.

Table 14. Time, Session, and Level Results.

	Random Presentation	Predetermined Presentation
Average Time Spent Per Question	51 seconds	48 seconds
Average Time Spent Per Session	21.05 minutes	20.13 minutes
Average Number of Sessions	4.94	6.67
Average Total Time	1.73 hours	2.24 hours
Average Level Achieved	4.22	5.0

CONCLUSIONS AND QUESTIONS

The results of this study raise questions about what many aural-training teachers consider to be common knowledge. Placing less easily confused intervals together in small groups for beginning student practice, with a gradual increase in both the size of the groups and the difficulty of distinguishing between intervals in the groups, would seem to be a more effective means of acquiring aural interval identification skills than using groups of randomly chosen intervals. Yet, the random grouping strategy appears to have been at least as effective and was, apparently, more efficient in helping students acquire these skills. In addition, regardless of whether the groupings consisted of randomly selected intervals or intervals that are not easily confused, each group averaged about the same. These unexpected findings raise a number of questions concerning our usual ways of teaching aural interval identification skills. If random groupings work as well as carefully chosen groupings based on patterns of errors documented in previous research, it would appear we still know relatively little about how students acquire these skills.

If supposedly easily distinguishable *distractors* do not result in more accuracy, then perhaps the content of the groupings does not matter. Of course, since there is not complete agreement as to which intervals are most easily confused, perhaps the wrong *easy* intervals were grouped together. It is also possible the wrong principle was used for grouping intervals together in the lower levels. Perhaps we are not really helping by making the beginning tasks easier. Perhaps the *most* easily confused intervals should be grouped together so students can learn to differentiate from the beginning. Perhaps the groupings are not even necessary; or perhaps gradually increasing the size of the groups is not the best procedure. Considering the similarity between melodic and harmonic interval identification success on the posttest, perhaps separating melodic intervals from harmonic intervals is also unnecessary.

Before we all change our accustomed methods of teaching, more research is also necessary to determine whether the findings of this study are broadly applicable or are peculiar (for some, as yet, unknown reason) to this specific population of students. To begin, the same experiment should be repeated with larger groups, perhaps over a longer time, so more reliable statistics for harmonic intervals could be included as well. In addition, other methods of groupings (e.g., beginning with easily confused intervals) and other sizes of groups (if, indeed, intervals should be grouped together at all) should be examined. More research into which intervals are most easily confused, in terms of interval type (melodic ascending, melodic descending, and harmonic), is also needed.

The results of this study challenge the validity of some of our most basic aural-training assumptions and raise a question that most musician-teachers have not even considered. If an apparently logical and reasonable pedagogical organization, even one with some possible imperfections, is no more effective than a random organization, what do we really know about how students acquire aural interval identification skills? Perhaps, regardless of how we present intervals, students create their own individual learning structures to acquire these skills. If so, a random order that makes no assumptions concerning what we as teachers might perceive to be best, would probably work as well for a diverse population of students as any—and might work better than most. The random groupings may be just as effective, and perhaps more efficient, because they are likely to coincide more often with a miscellaneous collection of individual learning styles. Clearly, we still have a great deal to learn. Hopefully, this study is only the first in a series of investigations that will eventually answer the essential question: how can students most effectively and efficiently acquire aural interval identification skills?

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