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ABSTRACT

A reliable, easily administered performance test of selective attentional ability was sought. A monaural listening task provided a baseline control for adequate hearing and memory; a dichotic listening task then provided indices of ability to focus attention and resist distraction while a simultaneous listening task provided measures of ability to broaden attention and monitor multiple information channels at the same time. Results showed the binaural tasks to be sensitive to individual differences, revealing a wide range of performance scores on each task and a variety of performance relationships between the two tasks. These results tended to have high reliability. In addition, comparisons between tasks suggested that the dichotic listening task is the most difficult of the three tasks. Finally, significant practice effects were apparent for binaural tasks. Altogether, it was concluded that the three listening tasks used in the present study represent a useful method for the investigation of individual differences in and performance patterns of selective attention. (Author)

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Abstract

A reliable, easily administered performance test of selective attentional ability was sought. A monaural listening task provided a baseline control for adequate hearing and memory; a dichotic listening task then provided indices of ability to focus attention and resist distraction while a simultaneous listening task provided measures of ability to broaden attention and monitor multiple information channels at the same time. Results showed the binaural tasks to be sensitive to individual differences, revealing a wide range of performance scores on each task and a variety of performance relationships between the two tasks. These results tended to have high reliability. In addition, comparisons between tasks suggested that the dichotic listening task is the most difficult of the three tasks. Finally, significant practice effects were apparent for binaural tasks. Altogether, it was concluded that the three listening tasks used in the present study represent a useful method for the investigation of individual differences in and performance patterns of selective attention.

A Performance Test of Individual Differences in Selective Attention

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The world is filled with the miracles of selective attention--the doting mother who is able to see every graceful move that her son, the left tackle, makes regardless of what acts of aggression are occurring among the other 21 people on the same football field; the student who is able to simultaneously study his history lesson and annoy his neighbors with the frenetic music of his favorite rock group; or the sports car enthusiast whose abundance of dashboard instruments makes it no more difficult for him to place his key in the ignition. Not surprisingly, then, the phenomenon of selective attention has been the focus on considerable research, as investigators have sought to describe and explain this remarkable and vital phenomenon.

Overall, the gist of both everyday observations and empirical research is that the filtering out of irrelevent material is a relatively easy task for most people, with the possible exception of schizophrenics or other psychopathological groups (McGhie, 1969; Wishner & Wahl, 1974). However, everyday observation also suggests that individuals differ from one another in their filtering ability. Some students are much more disrupted in their studies than others by the heavy breathing of their roommate's girlfriend in the next room; some executives are much more able than others to tolerate a noisy air conditioner in their offices. We marvel at the incredible ability of some to concentrate in the face of almost any kind of chaos or cacophony and lament the sceptibility of others to even minimal distraction.

Just as people can focus their attention, however, they can also selectively broaden their attention. When we drive, for example, we scan the road ahead and try to be aware simultaneously of traffic signs, pedestrians, and other cars ahead, behind, and beside us. Furthermore, common experience again tells us that some people are better than others at attending broadly to a wide variety of inputs.

It is reasonable to believe, then, that there are clear individual differences in filtering and broadening (i.e., selective attentional) ability, a skill which has been implicated as important to one's ability to form discrete concepts (e.g., Payne, 1971), to respond rapidly and accurately (e.g., Shakow, 1962), to estimate size and distance (e.g., Calloway & Dembo, 1958), even to judge time (e.g., Curton & Lordahl, 1974). Furthermore, as Nideffer (unpublished manuscript, 1975) has pointed out, it is likely that one's ability or inability to control attention will have major effects on performance and achievement in any number of life situations. The young man who is easily distracted is likely to be frustrated in his aspirations to become a surgeon; the policeman who cannot keep track of many aspects at once may find himself in trouble in a riot situation, as may the housewife in a room full of children. Thus, an individual's aptitude for selective attention seems a useful thing to try to determine.

Nideffer has approached this task by means of a self-report inventory, his Test of Attentional and Interpresonal Style (TAIS), with encouraging results; he has found significant relationships between reported attentional styles and such life consequences as student grade point average and police applicant screening decisions (Wolfe & Nideffer, 1974; Nideffer & Wiens, 1975).

Perhaps the most widely used method of investigating selective attention, however, that used by Broadbent, Treisman, Moray and others in their formulation and elaboration of "filter" theory (Egeth, 1967), is dichotic auditory presentation. Although most dichotic presentation investigations have focused mainly on the uniformities of performance in order to elucidate the general processes involved in selective attention, it seems likely that similar dichotic presentation techniques could also be used to reveal individual differences. The notion of dichotic presentation tasks to provide an index of selective attentional ability is, in fact, particularly appealing, since an objective, performance task would permit not only empirical tests of relations between attentional ability, role performance, and other cognitive and perceptual abilities (e.g., reaction time, size constancy, time estimation), but also would allow one to assess the short-term influences of such factors as emotion, motivation, practice, and training on attentional performance. The present study, then, represents an attempt to develop dichotic presentation tasks which will be sensitive to stable individual differences and may therefore provide an objective index of each individual's current attentional functioning.

Methodology

Experimental Procedure

Three simple listening tasks were used to provide indices of attentional ability.

1. Monaural listening: In the baseline or monural listening task, one syllable words were presented to the S's left ear, and subjects were instructed to listen to and try to remember these words. Seven lists of words were presented to each S, length of the word lists varying consecutively from 2 to 8

different words; each word in each list was repeated 3 times in random order. In other words, Ss first heard 2 different words repeated three times each, then 3 different words repeated three times each, etc. Immediately following each list of words, Ss were presented with a printed list of words, which included the words they had just heard and twice that number of words they had not heard, and asked to pick out the words they had just heard through the earphones.

2. Dichotic listening: In the dichotic listening task, designed to test how well Ss could focus their attention and filter out distraction, different words were presented simultaneously to the Ss' left and right ears; and Ss were instructed to listen to and remember only the words coming to the left ear and to ignore the words coming to the right ear. Again, there were seven lists of words varying in length from two to eight different words. Again, following each auditory presentation, Ss were presented with a longer printed list of words. This time the printed lists contained the target (left ear) words, the distractor (right ear) words, and the same number of control (non-presented) words, and the Ss were instructed to pick out only the words they had heard in the left ear.

3. Simultaneous listening: In this task, designed to tap Ss ability to broaden or disperse their attention, different words were again presented simultaneously to the left and right ears. In this task, however, Ss were instructed to listen to and try to remember the words from both ears.

Ss were 30 college freshman volunteers. Words in each list were one-syllable ones selected on the basis of meaningfulness ratings from Archer's (1960) list of CVC trigrams and were presented via tape recorder earphones. To determine the stability of performance over time, these tasks were administered twice with at least 48 hours between each administration.

Measures

Subjects' responses to recognition lists were scored for the number of left ear words correctly identified (Recognition) and the number of control words incorrectly identified (Control Errors). In addition, the number of right ear words identified was noted for the two binaural tasks; for the dichotic listening task, these identifications represent errors (Intrusion Errors), the instructions being to pick out only words from the left ear. Finally, each of these scores were summed across all seven words lists in each task and combined to yield a shorthand index of performance efficiency. The Overall Index was essentially the number of words correctly identified minus the number of errors (Index = Rocognition - Control and Intrusion Errors); for the simultaneous listening task, where there were twice as many target words to be recalled, total recognition was divided by two before subtracting errors (Simultaneous Listening Index = ½(left ear Recognition + right ear Recognition) - Control Errors). The maximum value for the Index, if the Ss identified all the target words and made no errors, was 35 for each task.

Results

Table 1 presents the frequency distributions of Overall Index scores for both sessions 1 and 2. The range of scores for the relatively simple monaural listening task was somewhat constricted; as expected all Ss did relatively well. Considerable spread of scores occurred, however, for the other two tasks, particularly for the dichotic listening task. Furthermore, as Table 2 shows, Ss differed also in the relationship between dichotic listening and simultaneous listening performance. Many Ss did relatively well on both tasks while an equal number did relatively poorly on both; in addition, there were a fair number of Ss who did poorly on one task but relatively well on the other.

As is also apparent from Table 1, performance in the second session was generally better than in the first, median Overall Index scores being somewhat higher for session 2. Table 3 summarizes the differences in mean performance between these two sessions. There are clear differences for simultaneous listening mean left ear and total Recognition being greater in the second session, and for dichotic listening, Ss remembering more target words, making fewer Intrusion Errors, and thus raising their Overall Index of performance on the second try.

Nevertheless, with the exception of Control Errors, Ss performed similarly with respect to one another across both sessions. Those who showed efficient dichotic listening performance in session 1, for example, also tended to do so in session 2, as shown by the test-retest correlations of scores in Table 4. Recognition and Overall Index scores showed significant stability for all tasks, and, for the dichotic listening task, all scores, including Control Errors showed high test-retest correlations.

Discussion

All subjects, then, did relatively well on the monaural listening task, suggesting that whatever differences appear for dichotic and simultaneous listening tasks cannot be accounted for simply as differences in hearing or memory ability. In addition, these binaural results cannot be attributed to general competence factors. It was not the case that subjects did well on both binaural tasks or poorly on both, as a general competence model would predict. Approximately 40% of the subjects did well on one binaural task and relatively poorly on the other. Nor was superior performance correlated with higher verbal intelligence as measured by WAIS vocabularly score. Thus, the wide range of scores which were elicited by binaural presentation seems to be attributable to individual differences in handling the attentional requirements of the tasks--namely, to differences in the ability to ignore distracting material or to monitor multiple information channels. Furthermore, despite the benefits of practice, these differences persisted from session to session, scores showing significant correlational stability across time. Thus, it appears that stable individuals differences in selective attentional ability do exist and can be detected by a simple testing procedure.

Furthermore, these tasks provide additional information about the nature of selective attentional ability. Beyond the confirmation of these listening tasks as useful means to explore individual differences in attentional functioning, for example, the present data also provide group information about the nature and relative difficulty of the various tasks. Unfortunately time limitations do not permit discussion of these aspects at this time, so I will just mention that the data suggest that Ss were able to broaden their attention more effectively than they were able to focus it.

One finds also from the data that learning does occur which can improve performance. Particularly in the dichotic listening task, subjects were able to better their performance on their second exposure to the tasks, remembering more words and/or making fewer errors. Individuals can, it seems, adapt to binaural presentation and improve with practice. Just how much improvement is actually possible or how subjects effect this improvement is not yet clear;

nevertheless, it is encouraging to know that there may be things which a poor selective attender can do or learn which will decrease his difficulty.

In summary, then, the simple listening tasks of the present study hold promise for the investigation of many aspects of the phenomenon of selective attention. In particular, they provide objective, reliable indices of individual performance which can be used to elucidate the specific consequences of poor selective attention, the external influence of such things as practice or strategy on performance, and the nature and relationship between various attentional skills. In fact, research along these lines is already in progress.

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Table 1

Frequency Distribution of Overall Index Scores

	Session 1			Session 2		
Score[a]	ML	DL	SL	ML	DL	SL
34 - 35	5			7	2	
32 - 33.5	7	4		12	3	1
30 - 31.5	11	3	2	4	4	3
28 - 29.5	3	2		4	4	3
26 - 27.5	3	3	4	1	6	6
24 - 25.5	1	5	7	2	1	4
22 - 23.5			7		3	3
20 - 21.5		4	6		2	4
18 - 19.5		3	3			3
16 - 17.5		4			1	3
15.5		2	1		3	
Median	31.8	25.0	23.5	33.0	27.0	24.5

[a]Maximum score = 35

ML = Monaural listening
DL = Dichotic listening
SL = Simultaneous listening

Table 2

Relationship between DL and SL performance scores

Session 1

DL Overall Index Median = 25.0
SL Overall Index Median = 23.5

		DL > Mdn	DL < Mdn
SL	> Mdn	9	6
SL	< Mdn	6	9

Session 2

DL Overall Index Median = 27.0
SL Overall Index Median = 24.5

		DL > Mdn	DL < Mdn
SL	> Mdn	$9\frac{2}{3}$	$5\frac{1}{3}$
SL	< Mdn	$5\frac{1}{3}$	$9\frac{2}{3}$

DL = Dichotic listening
SL = Simultaneous listening

Table 3

Practice Effects

	Mean Session 1	Mean Session 2	Mean difference	t[a]
M Recognition	32.50	32.93	-0.43	-1.82+
M Control Errors	1.53	1.37	0.17	0.57
M Index	30.97	31.57	-0.60	-1.29
D Recognition	28.43	30.00	-1.57	-2.75**
D Intrusion Errors	4.27	3.13	1.13	2.18*
D Control Errors	0.93	1.10	-0.17	-0.71
D Errors (Control and Intrusion)	5.20	4.23	0.97	1.54
D Index	23.23	25.77	-2.53	-2.32*
S Recognition (left ear)	25.87	27.40	-1.53	-2.52*
S Recognition (right ear)	26.67	27.27	-0.60	-0.75
S Recognition (total)	52.53	54.67	-2.13	-2.14*
S Control Errors	3.03	3.03	0.00	0.00
S Index	23.17	24.30	-1.13	-1.45

M = Monaural
D = Dichotic
S = Simultaneous

+ $p < .10$
* $p < .05$
** $p < .01$

[a] two-tailed t-tests for paired comparisons; n = 30

Table 4

Test - retest correlations[a]

	ML	DL	SL
Recognition	.71**	.66**	.59**
Control errors	.31+	.49**	-.08
Intrusion errors	---	.57**	---
Overall Index	.58**	.63**	.46**

ML = Monaural listening
DL = Dichotic listening
SL = Simultaneous listening

[a] n = 30 for all correlations

+ $p < .10$
* $p < .05$
** $p < .01$