Translation processes and aging¹

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Two disparate age groups, a younger group between 18 and 29 and an older group between 64 and 81, performed a choice auditory RT task which involved depressing a right- or left-hand key in response to a monaural pure tone (directional cue) or a binaural verbal command of "right" or "left" (symbolic cue). There were significant differences between age groups and between cue conditions. However, the prediction that older Ss would have greater difficulty than younger Ss in translating the symbolic content of the command was not supported.

Although considerable information is now available concerning the effect of aging on sensorimotor performance, much remains to be learned about the relationship between specific task characteristics and the aging process. Welford (1958) has suggested that the problems experienced by older people on many tasks are not due to perceptual or motor limitations but, rather, to difficulties with "translation processes." He reviews a number of studies which show that the aged have more difficulty than the young on tasks in which the display-control relationships have been complicated or in which intervening steps have been inserted between perception and responding action.

In a recent study, Simon (1967) investigated the effect of a reversal of S-R correspondence in an auditory display on the reaction time (RT) of older and younger Ss. The Ss' task was to depress a right- or left-hand key in response to a tone in the right or left ear. Results indicated a strong tendency to associate right-ear stimulation with a right-hand response and left-ear stimulation with a left-hand response. Reversing the S-R relationship by requiring Ss to respond with the hand contralateral to the ear stimulated introduced an additional spatial translation and produced a significant slowing in RT. This slowing, which was significantly greater for older Ss than for younger Ss, was interpreted as evidence of a translation difficulty in older Ss.

The present study was designed to investigate further the effect of aging on the translation process. In this study, the process of interest involved a symbolic rather than a spatial translation. Two disparate age groups responded to directional and symbolic cues in a choice auditory RT task. The directional cue condition involved depressing a key (right or left) corresponding to the ear in which a tone was heard. The symbolic cue condition involved depressing the appropriate key in response to a verbal command of "right" or "left" presented binaurally. If one assumes that the symbolic cue differed from the directional cue in that it re-

quired an extra step of translating the symbolic content of the command, and if one assumes that aging affects this translation process, then one may predict that the difference between RT to the directional and symbolic cues will be significantly greater for the older group than for the younger group.

Subjects

The Ss were 24 University of Iowa undergraduate volunteers between the ages of 18 and 29 (average age 20.1) and 24 senior citizens between the ages of 64 and 81 (average age 70.1). Half of the Ss in each age group were male and half were female. All Ss were given a standard audiometric screening test in which tones of 500, 1000, and 2000 cps were presented to each ear separately. None of the younger Ss had a hearing loss greater than 10 dB at any one of these three "speech" frequencies while all older Ss had grossly normal hearing for their age (Birren, 1964).

Apparatus

The apparatus provided a measure of choice RT to a series of auditory stimuli which were presented to S through Grason-Stadler TDH-39 matched earphones. Two telegraph keys were positioned 10 in. apart on a table in front of S. Instructions were to depress the correct one of the two keys as quickly as possible after hearing the stimulus. The instructions and stimulus materials were recorded on tape and presented at approximately 80 dB by a Sony TC 500 Stereocorder. Onset of the stimulus activated a Hunter Klockcounter which stopped when S pressed the key. Depressing the key also signalled E as to which key (or keys) had been pressed.

Procedure and Experimental Design

Each S performed on two blocks of trials. In one block, the stimulus was a 1000 cps monaural tone. S was told that he would hear the tone in either his right or left ear and that he was to respond by depressing the corresponding (right or left) key. In the other block of trials, the stimulus was either the word "right" or the word "left" presented to both ears simultaneously, and, again, S was instructed to respond by depressing the appropriate key. Each block of trials consisted of a predetermined random sequence of 42 tones or commands, half of which called for a right response and half a left response. The first four trials in each block, two right and two left responses, were practice trials. A ready signal was presented 2 sec prior to each stimulus. It consisted of the simultaneous onset of a warning light and a 2000 cps, 80 dB binaural tone of 500 msec duration. There was a 7 sec interval between stim-

Table 1. Auditory reaction time (msec) as a function of age and the cue properties of the stimulus

Age Groups	Cue conditions		Mean	Difference
	Symbolic Cue	Directional Cue		
Older Group	556	429	492	127
Younger Group	403	297	350	106
Mean	479	363		

uli. Six males and six females from each age group performed first on the monaural tone trials and then on the binaural voice trials. The other half of the Ss in each age group performed on the same conditions but in a reversed order.

Results

Median RTs were computed for each S for the monaural tone (directional cue) and binaural voice (symbolic cue) trials. Table 1 summarizes the mean RTs of the two age groups for these two treatment conditions. An analysis of variance revealed that the younger group responded significantly faster than the older group (350 vs 492 msec; $F=28.02$, $df=1/44$, $p<.001$), and that responses to the directional cue were significantly faster than to the symbolic cue (363 vs 479 msec; $F=123.03$, $df=1/44$, $p<.001$). The difference in RT between directional and symbolic cues tended to be greater for the older group than for the younger group (127 vs 106 msec), but this hypothesized interaction fell far short of statistical significance. The analysis also revealed a significant order effect ($F=6.35$, $df=1/44$, $p<.05$), reflecting an improvement from the first to the second block of trials.

Discussion

Results of this study failed to reveal the hypothesized greater translation difficulties in the older group. Although the absolute difference in RT between directional and symbolic cue conditions was 20% greater for the older group than the younger, the proportionate increase in RT was actually greater for the younger group than for the older (36% vs 30%).

The present results differ markedly from those

obtained in a previous study (Simon, 1967) in which an added spatial translation produced more than twice the amount of slowing in an older group than in a younger group. Why should older Ss experience difficulty with the translation in one experiment and not in the other? Clearly, the two studies involved different kinds of translation, i.e., spatial translation in the previous study and symbolic translation in the present one. Moreover, the previous study required Ss to override firmly established natural response tendencies (i.e., respond with the hand contralateral to the ear stimulated), whereas the translation involved in the present study required no such unnatural response.

Our results suggest that aging may not affect all translation processes equally. Older Ss seem especially vulnerable in situations which demand an incompatible response, i.e., where the S-R relationship is not "natural" or where a previously acquired habit interferes with the appropriate response. This interpretation is not unlike that of Belbin, Belbin, & Downs (1966) who were concerned with the implications of translation processes to the problem of training older workers. They failed to confirm their hypothesis that introducing a change in response modality (translation) between learning and subsequent testing would produce greater difficulty for older than for younger Ss. The absence of translation difficulties in their study, as in ours, seems to be related to the fact that no active interference was present.

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Note

1. This research was supported by the Graduate College of the University of Iowa. The author acknowledges the assistance of Philip Tolin in collecting the data.