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EAREDNESS (EAR CHOICE IN MONAURAL TASKS): ITS MEASUREMENT AND RELATIONSHIP TO OTHER LATERAL PREFERENCES

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INTRODUCTION

Because of their bearing on questions of brain organization, expressions of lateral preference—the preferential use of one of a pair of bilaterally symmetrical organs—have long been of interest to neuropsychologists. Handedness is of course the most obvious lateral preference, and has been the most extensively studied (see Hardyck and Petrinovich, 1977, and Herron, 1980, for recent discussions); eyedness has also been the subject of considerable attention (see Porac and Coren, 1976). Footedness has been investigated, though less frequently (e.g., Harris, 1958; Oldfield, 1971; Coren and Porac, 1978). The present communication focuses on earedness, which we define as the preferential orientation of one ear toward a sound source or, alternatively, the preferential positioning of a sound source so that it stimulates on ear more than the other.[2] Earedness by this definition is comparable to handedness as it is usually defined (the consistent use of one hand in unimanual tasks), and to eyedness in the sense of sighting dominance (the consistent use of one eye in monocular tasks (Porac and Coren, 1976)).

Asymmetrical ear use appears to have been investigated in only a few laboratories. Kovac and Horkovic (1970a,b) suggested observing while S (a) listened to the ticking of a clock or watch placed under a blanket, and (b) inserted the earpiece of a transistor radio. Berman (1971) instructed children to "(p)ut your ear against that wall [to the child's R] and tell me if you hear anything," a second trial then being done with the wall to S's L. He also had Ss listen with one ear to the ticking of a watch placed (a) 2 ft to S's L, (b) directly in front, and (c) 2 ft to the R. Berman found that, by contrast with strength of handedness and footedness, strength of earedness (and eyedness) were poor correlates of intelligence as measured by the Columbia Mental Maturity Scale.

Coren and Porac (1978) and Coren et al (1979) studied the validity of self-report questionnaires on lateral preferences, and included questions regarding ear use. There was 73-95% agreement between responses to those questions and similar behaviors observed when Ss were subsequently tested.

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[2]The term "earedness" appears to have been used only rarely in our sense of the word. Kovac and Horkovic (1970b) included as indices of earedness tasks which would qualify under our definition, though they also included other types of measure, e.g., interaural differences in sensitivity and discrimination. Kovac (1973) used the term to refer to responses to a question about which ear the subject thinks serves hearing better.

The apparently related terms "ear preference" and "ear dominance" have been used with a variety of meanings which do not directly concern us here. For example, "ear preference" has been used to refer to the ear from which dichotically presented stimuli were reported first (Bryden 1963); to refer to an ear superiority in a monaural reaction-time task (Simon, 1967; Klisz and Parsons, 1975); and in describing differential accuracy of report of dichotically presented stimuli (Borkowski et al, 1965; Spellacy, 1970; Pizzamiglio 1974).

"Ear dominance" was used as synonymous with their use of "ear preference" by Borkowski et al (1965) and Spellacy (1970). "Ear dominance" has also been used in referring to an interaural difference in experienced loudness when the two ears were stimulated equally (Ghosh et al, 1971).

Porac and Coren (1977) reported correlations between the responses of primary-family members (parents, children, sibs) to their lateral-preferences questionnaire. For ear preference, only the Mother-Son correlation was significant ($N = 95$, $r = .16$, $p < .05$).

Blackstock (1978) observed ear use in autistic and normal Ss while they listened to loudspeakers. Although he did not directly report which ear was placed to the speaker more frequently, he did report differences in total amount of time spent with an ear up to a speaker. (Blackstock used both verbal and musical stimuli; we discuss his study later in this paper.)

A number of investigators have addressed the question of agreement among lateral preferences, typically focusing on the concordance between handedness and other preferences. Footedness appears to be somewhat more concordant with handedness than eyedness is: footedness has been reported to agree with handedness in 94-98% of R-handers and 64-68% of L-handers, while eyedness (sighting) has been reported concordant with handedness in approximately 69-70% of R-handers and 55-60% of L-handers by Merrell (1957)[3] and by Teng et al (1979).

At least two varieties of explanation can be proposed for concordance. The first, a neurological explanation, might be invoked to account for the handedness-footedness concordance. Given that one cerebral hemisphere is "dominant" in the sense that it is predisposed to initiate or control behavior, then expressions of that dominance will include preferences for the use of those structures, such as the contralateral hand and foot, whose sensory/motor functions are predominantly mediated by the dominant hemisphere.

This neurological explanation cannot accommodate concordance between handedness and eyedness. The eyes normally move conjugately, so that it is head and neck adjustments which position one eye as the sighting eye; and the neck muscles are almost always bilaterally engaged to assume or maintain a head position. With respect to sensory projections, from hemidecussation of the optic nerves, each eye sends half of its afferent projections to one side of the brain and half to the other. Thus, both motorically and sensorially, each eye appears to be as strongly connected to one hemisphere as to the other. One might then explain handedness-eyedness concordance by a behavioral account based on differences in the ease with which certain body positions can be assumed and maintained. This account supposes that there would be better eye-hand coordination and skill when the sighting eye is more in line with the hand in use (Parsons, 1924). Porac and Coren (1976, p. 888) review a number of studies providing support for the view that concordant hand-eye dominance confers an advantage in psychomotor skills, and conclude: "Empirically, it is clear that better sensorimotor performance results when the dominant eye is used and when that eye is ipsilateral to the dominant hand."

Because both explanatory principles apply, one might expect a handedness-earedness concordance. First, the sensory information for the hands and for the ears are both projected predominantly contralaterally (although less so for the ears), so that the hand

[3] Merrell (1957) misinterpreted his Tables 4 and 5 to indicate no relationship between handedness and eyedness; in fact, his data do show a significant degree of concordance (cf. Levy, 1976).

and ear of one side share a primary involvement with the dominant hemisphere. Second, by reasoning analogous to that proposed for the hand-eye concordance, one could argue that in monaural-unimanual tasks, the use of the same-sided hand and ear would result in less body twisting (and hence less awkwardness, better balance, and greater motor readiness) than would crossed hand-ear combinations. Since only the second of these considerations applies to hand-eye concordance, while both apply to hand-ear concordance, one might expect a higher degree of concordance between handedness and earedness than between handedness and eyedness. We may note, however, that Berman (1971, p. 382) mentions informally that of the lateral preferences he studied, ear preference was the least concordant with the others.

In the present paper, we report the results of studies in which ear preference was measured, including an investigation of lateral preferences in telephone use, and of studies determining whether differential ear preferences would be elicited by verbal and by musical stimuli. In devising the tasks and testing environment, we took care to minimize the influences of (1) other lateral preferences, e.g., handedness and footedness, which might have operated if S had to handle the sound source, or had to stoop or lean to listen to it; and (2) asymmetries in the environment which might have induced S to favor a particular body orientation.

EXPERIMENT I: EAR CHOICE INFLUENCED BY INCIDENTAL ASYMMETRY IN SUBJECT'S ORIENTATION

Subjects

Undergraduate university students (34 M, 19F) participated as part of their introductory psychology course work (44 self-declared R-handers and 9 L-handers); none had any known unilateral sensory or motor defect. The study was advertised as a "perception" experiment, and persons responded to requests for Ss in general, or for L-handers in particular.

Apparatus

Fig. 1 shows the booth in which S's ear choice was tested. Plain white drapes provided a uniform visual environment regardless of S's orientation. A single earphone speaker (7 cm diameter) mounted on a rod projected through the drapes. The height of the earphone was adjusted for each S so as to be at S's ear level when standing. Instructions to, observations of, and conversations with S all took place via a loudspeaker, TV camera, and microphone located visibly over S's head. S held a response button in one hand, and held both hands behind the back. A wire leading from the button passed through the drapes above S and at the end of the booth opposite the earphone.

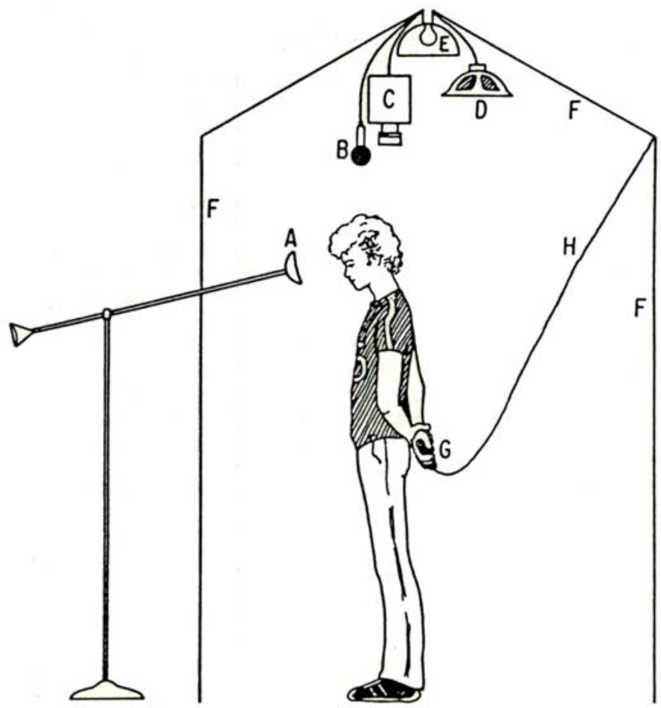

Fig. 1: Earphone test environment. A: earphone; B: microphone; C: camera; D: overhead speaker; E: 100W light; F: white drapes; G, H: response button and wire.

Procedure

S entered through the drapes where the earphone mount projected into the booth, the experimenter holding the drapes to one side or the other to permit entry. S was told to take the response button in one hand, and to hold both hands behind the back. The 4 combinations of L- or R-parted drapes and L- or R-hand on the button were evenly distributed across Ss. The part in the drapes was then closed; the experimenter moved to another room, and all further interaction with S was via the TV-intercom system. Tape-recorded instructions directed S to listen at the earphone and, if a faint clicking sound (embedded in white noise) could be heard, to press the response button. There were 10 trials separated by 20-sec intertribal intervals during which S was free to move about. On each trial, the ear placed to the earphone was noted.

After the 10 earphone trials, S was taken to another room and asked to write his-her name, and to throw a ball at a target. The hand used for writing and throwing were noted. In addition, 3 indices of eyedness were obtained: S was asked to (1) look into a small hand-held slide viewer, (2) fixate on the experimenter's nose while looking into a 2 x 2-cm hole in a sheet of paper (8.5 x 11 in.) held at arm's length, and (3) sight the experimenter's nose along two aligned pencils which S held one in each hand (both eyes open). Eyedness was defined by the eye used in a majority of the 3 tests. (Of all the 302 Ss reported on in this paper, the same eye was used in all 3 eyedness tasks by 76%.) Lastly, S was asked if he/she was R- or L-handed.

Results

The way that almost all Ss oriented an ear to the earphone was by turning the whole body rather than by rotating only the head. Earedness was defined as the ear used in the majority of trials. In fact, most Ss (84%) did not switch ears at all from trial to trial.

Results were examined using the computer program BMDP3F which analyzes multiway frequency tables using a log—linear model (Dixon and Brown, 1977). In this program, G^2 (the likelihood-ratio chi square) is computed for testing both partial and marginal associations. Ss' earedness, handedness, eyedness, sex, hand holding button, and side entered through drapes were used as factors.[4] A constant (0.5) was added to each cell before analysis (Dixon and Brown, 1977).

Remarkably, the only result even approaching statistical significance was the interaction between earedness and side entered through the drapes (G^2 part (1) = 6.93, p = .009; G^2 marg (1) = 7.84; p = .005). Of the 26 Ss who entered with the drapes parted to the R of the earphone, 23 (88%) used their R ears. Of the 27 who entered through L-parted drapes, 16 (59%) used their L ears. What seems to have happened is that, once inside the booth, Ss oriented themselves toward the experimenter standing in the site of entry and this orientation brought one ear closer to the earphone. The closer ear was then used on the earphone task.

Because the side-of-entry effect was so strong and might therefore have overridden endogenous ear preferences which would have been manifested in a symmetrical testing situation, we eliminated the factor altogether in a second experiment by having S enter the booth facing the earphone.

EXPERIMENT II: ASSOCIATIONS AMONG EAREDNESS MEASURES, AND CONCORDANCES WITH HANDEDNESS

Introduction

In order to enable S to enter the booth without lateral bias, a symmetrical door was built into the wall behind the booth, on the side opposite the earphone mount. This door was hinged at its top rather than at its side, so that it swung open upward rather than laterally.

In addition to the earphone task used in Experiment I, Experiment II included a second measure of earedness, namely, listening to a ticking watch (Coren and Porac, 1978). We also investigated ear choice during the most common monaural task in our culture, viz., telephone use.

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[4]We interpret as statistically reliable those interactions generating G^2 values whose associated probability values ≤ .05 both for partial and for marginal tests (Dixon and Brown, 1977). We will not report main effects from these analyses since these reflect matters of subject selection. For example, here in Experiment 1, the significance of the main effect of handedness (G^2partial (1) = 14.9; p = .0001) simply means that we had more right-handed subjects than left-handed ones.

Subjects

Undergraduates (102 F, 90 M) were solicited and selected as in Experiment I; 132 were R-handed, 60 L-handed.

Procedure

The experimenter held the symmetrical entry door overhead with both hands. Verbally, without the use of any hand gestures, S was directed to take the response button in one hand, to enter straight into the booth, to stand on two footprints painted on the floor inside the booth, and to put both hands behind the back. The drapes and door were then closed symmetrically behind S. Thus, S was directed by a symmetrically-standing experimenter, entered the booth straight on through a symmetrical door, and stood on footprints facing the earphone straight on. As in Experiment I, S held a response button behind the back. The hand on the button was varied across Ss.

Earphone Task

Instructions from the overhead loudspeaker then informed S that he/she was free to move around inside the booth. As in Experiment I, S was instructed to put an ear up to the earphone and press the response button if a faint clicking noise was heard. There were 5 such trials with 20-sec intertribal intervals. The ear used on each trial was noted, and S's earedness on this task was defined as the ear used on the majority of trials.

Stopwatch Task

After the 5 earphone trials, the experimenter approached the booth on the earphone side, and removed the response button and the earphone and its mount from the booth. He then asked S to stand once more on the footmarks, and placed in front of her/him a small 4-ft-high table with a stopwatch, covered by a cloth, in its center. The drapes were reclosed and the experimenter left the room. S was instructed via the overhead speaker to bend over, keeping the hands behind the back, to listen through the cloth, and to respond verbally if a ticking from the watch could be heard. The ear placed to the watch on this single trial was noted.

Telephone Task

A wall-telephone-type intercom headset was modified so that externally it was bilaterally symmetrical.[5] The telephone was suspended on a metal rod, directly in front of S (Fig. 2). For 75 Ss a small 4-ft-high table was placed under the phone in front of S with a sheet of paper and a pencil placed symmetrically on top of it. For 78 Ss no table was present during this test. In both conditions, the experimenter said only that S was to answer the phone when it rang; no instructions regarding writing were given. The

[5] The reader will note that the typical desk telephone is laterally asymmetrical, having the receiver cord attached to the L side. We have been unable to track down the origin of this convention.

experimenter then left the room, and rang the phone. The hand and ear used by S to answer the phone were noted. During a short conversation over the phone, Ss in the "writing table" condition were asked to write on the page. The hand used for writing, and the hand and ear used on the phone while S was writing, were noted.

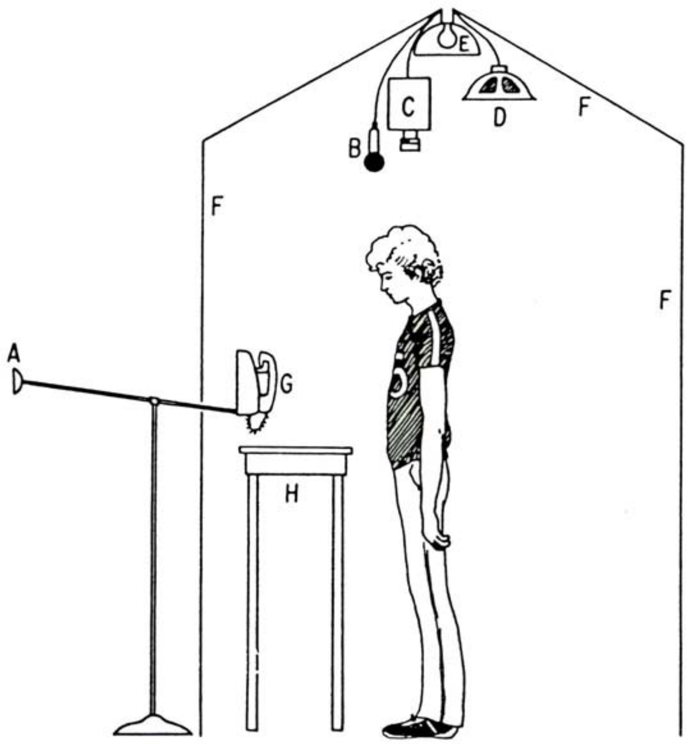

Fig. 2: Telephone test environment. G: telephone; H: writing table. Other symbols as in Fig. 1.

Not all Ss received all 3 types of ear-choice tests, but those who did received them in the order: earphone, stopwatch, telephone. All 192 Ss received the earphone test, 41 received the stopwatch test followed by the telephone test, and 112 received the earphone test followed by the telephone test.

After these tests, each S was tested for handedness and eyedness as in Experiment I, and queried regarding the presence or absence of L-handed parents or siblings.

Results

As in Experiment I, the majority of Ss (82%) did not vary their ear at all from trial to trial on the earphone task.

Among the 41 Ss who completed both the earphone and the stopwatch tests, there was a strong relationship between the ear preferred on the two tasks: $X^2_c(1) = 8.79$, $p = .003$, phi = 0.51. Of the 41 Ss, 31 were concordant on the two tasks.

A BMDP3F analysis was performed on the 192 Ss who completed the earphone task, with earedness, handedness, eyedness, sex, presence or absence of familial L-handedness, and hand holding the button as factors.

Endogenous Factors

Ear choice interacted significantly with handedness (G^2 (part (1) = 6.11; G^2 marg (1) = 5.65, $p = .02$). Of the dextrals, 81 (68%) used their R ears; of the sinistrals, 35 (58%) used their L ears. When concordance was tested for each of the handedness groups separately, the chi square approximation of the binomial test showed that the R-handers favored their R ears significantly ($X^2_c(1) – 6.37$; $p < .02$) while the L-ear preference of L-handers was not significant. However, a 2 x 2 chi-square test of handedness by concordance—discordance indicated that the percentage concordant for dextrals (61%) did not significantly differ from that of sinistrals (58%).

We did not find a significant handedness-by-eyedness interaction. The majority of both dextrals (68%) and sinistrals (57%) sighted with their R eyes. The chi square approximations of the binomial test indicated that this preference was significant for dextrals ($X^2_c(1) = 16.73$, $p < .001$) and non significant for sinistrals ($X^2_c(1) = 0.82$). The greater concordance in our R-handers than in our L-handers is in agreement with Merrell (1957) and Teng et al (1979). The difference between the handedness groups in concordance was statistically reliable ($X^2_c(1) = 9.64$, $p < .01$).

Among our 132 R-handed Ss, the tendency to be R-eyed (68%) was greater than the tendency to be R-eared (61%). By contrast, among our 60 L-handed Ss, only 43% were L-eyed, a proportion smaller than the 58% who were L-eared. An appropriate procedure for assessing the difference between handedness/eyedness concordance and handedness/earedness concordance in the same Ss is McNemar's test for the significance of changes (Siegel, 1956). That test applied to the data for detrals yields $X^2_c(1) = 1.08$, and for sinistrals yields $X^2_c(1) = 1.83$, ps >.1.

There was a significant four-way interaction among earedness, eyedness, handedness, and familial L-handedness (G^2 part (1) = 8.54, $p = .004$; G^2 marg = 6.53, $p = .01$). This appears to reflect the facts that:

(1) among Ss with familial L-handedness, R-eyed Ss showed a high concordance between handedness and earedness (phi = .58), whereas L-handed Ss did not (phi = -.06);

(2) among Ss without familial L-handedness, eyedness was not a correlate of the handedness/earedness concordance, which was weak for both eyedness groups (phi = .21).

Manipulated Factor

Because in this experiment the influence of the side of entry into the booth was eliminated, the only manipulated variable was the hand in which the response button was held. Surprisingly, this latter variable was significantly related to ear choice on the earphone task (G^2 part (1) = 11.89, p = .0006; G^2 marg (1) = 11.61, p = .0007). The relationship was an inverse one: 57% of those holding the button in their R hands used their L ears, and 69% of those holding the button in their L hands used their R ears. This effect appears significantly related to the fact that, because Ss rotated their entire bodies in putting an ear up to the phone, the wire from the button led away from S in a straighter line if the ear on the side opposite to the hand holding the button was used than if the same-side ear was used. The wire was stiff enough that in the latter condition, a very slight torque was exerted on the wrist. It is our impression that this slight wrist torque, though perceptible if focused upon, was not consciously attended to by our Ss. There were no significant interactions between the "hand holding button" factor and any other factor; and the hand on the button in the earphone task was not predictive of the ear subsequently used in the stopwatch task ($X^2_c(1) = .02$).

Telephone Use

A BMDP3F analysis was performed on the hand/ear combination used in answering the phone with L/L and R/R as the two alternatives; no one answered with the crossed combinations. Sex, eyedness, handedness, earedness (choice on the earphone task), familial L-handedness, and presence or absence of writing table were the other factors.

The only significant two-way interaction involving telephone answering was with handedness (G^2 part (1) = 3.71, p = .05; G^2 marg (1) = 4.31; p = .03). This effect reflects the fact that 74% of the 53 L-handers used the L/L combination, whereas 49% of the 102 R-handers used R/R (cf. Gerstman, 1975, p. 284). No other two-way interaction involving telephone use approached significance. In particular, the ear used in the earphone task was not predictive of the ear used in the telephone task (ps > .61). (Neither was the ear used in the stopwatch test (p > .3).) Nor were there any reliable higher-order interactions among earedness, telephone answering, and any other assessed factors.

There was a reliable three-way interaction among the hand/ear combination in answering the telephone, S's handedness, and the presence or absence of the writing table (G^2 part (1) = 5.24, p = .02; G^2 marg (1) = 7.36, p = .007). When no writing table was present, a majority of both R-handers (62%) and L-handers (88%) picked up the phone with their dominant hand and held it against the ipsilateral ear. When the writing table was present, the majority of R-handers (65%) answered the phone with a L-hand/L-ear combination; whereas most L-handers still answered with the L/L combination, but the proportion dropped to 58%. Clearly, the expectation of writing caused Ss to tend to keep their writing hand free.

When asked to write, of the 17 R-handed Ss in this "writing table" condition who had answered the phone with the R/R combination, 10 (59%) switched to a L-hand/R-ear

Combination, 5 (29%) held the phone to the R ear with a raised R shoulder, and 2 (12%) switched to the L/L combination. Of the 15 self-declared L-handers in this condition who had answered with the L/L combination, 8 (53%) switched to a R-hand/L-ear combination and 5(33%) switched to a L-shoulder/L-ear combination;1 S switched to R/R, and 1 stayed with L/L, writing with his R hand. Interestingly, almost all of these "writing-table-condition" Ss who had answered the phone with the dominant hand and ipsilateral ear stayed with their original ear on the telephone, even though they were thereby required to adopt seemingly awkward postures. When the frequencies with which these 28 "awkward" Ss adopted particular hand/ear combinations were cross-tabulated with ear choice on the earphone task, there was no indication that the two were related. That is, the fact that some Ss maintained their original ear on the telephone even though it meant adoption of an awkward posture does not appear to be a result of particularly consistent ear preferences in those Ss.

There were no other statistically reliable interactions.

EXPERIMENT III: ELIMINATION OF THE BUTTON-WIRE EFFECT

Introduction

In Experiment II, the hand in which S held the button played a large role in determining ear-choice on the earphone task. In order to determine whether this effect derived from the presence of the wire leading away from the button, 57 additional Ss (31 R-handers, 26 L-handers; 29 M, 28 F) were run on the earphone task, this time with a wireless button.

Procedure

Procedure was identical to Experiment II except that before entering the booth, S was handed a response button similar in shape and size to that used in Experiment II, but without a wire; S was told that the button was a "mini-transmitter." S then entered the booth and kept the hands behind the back; as in Experiment II, the hand holding the button was varied from S to S. The stopwatch test and the telephone test were omitted in this series. A BMDP3F analysis was performed using ear choice, handedness, eyedness, familial L-handedness, sex, and hand holding the button as factors.

Results

As in Experiment II, there was a reliable interaction between ear choice and handedness (G^2 part (1) = 4.36, p = .04; G^2 marg (1) = 5.85, p = .02). Of the L-handers, 65% used their L ears; of the R-handers, 74% used their R ears. The ear choice by hand=on=button interaction did not approach reliability (p > .2), nor were there any other reliable interactions.

Among these 57 Ss, the handedness-eyedness relationship was in the expected direction (71% of R-handers sighted with their R eye; 58% of L-handers sighted with their L eye) although not statistically reliable (G^2 part (1) = 1.72, p = .19; G^2 marg (1) = 3.11, p =

.08). Among these Ss, the tendency toward earedness-handedness concordance was slightly stronger than that toward eyedness-handedness concordance in both L- and R-handers; however, this difference in the degree of concordance was not reliable by the McNemar test applied to either handedness group separately, or the total sample.

EXPERIMENT IV A, B: TESTING EAR PREFERENCE WITH VERBAL OR MUSICAL STIMULI

Introduction

It has been well documented that there is a R-ear superiority for processing speech stimuli, and a L-ear superiority for processing certain non-speech sounds, including music. Although such interaural differences are slight and usually only demonstrable in dichotic listening tasks (Kimura, 1967), they have occasionally been found in difficult monaural tasks (e.g., Kallman, 1977). These small asymmetries in auditory-information processing are thought to reflect the lateral specialization of cognitive functions in the human brain (Harnad et al, 1977).

Given these asymmetries, one might ask whether there is a tendency to favor one ear over the other while listening to such stimuli. Specifically, is there a tendency to listen to music more with the L ear than with the R, and to speech with the R ear more than with the L?

Kinsbourne (1972) has provided evidence for differential eye and head turning depending on the nature of the stimuli. He found that questions which required verbal thought elicited more rightward head and eye movements than leftward, and questions requiring spatial thought more leftward movements than rightward. Further, he suggested a mechanism to account for this differential head turning, namely, that cognitive tasks which asymmetrically engage the hemispheres produce heightened attention and associated tendencies to turn toward the side of space contralateral to the more involved hemisphere (Kinsbourne, 1973, 1975). His model allows us to predict differential ear use for verbal and musical auditory stimuli. Attention to verbal stimuli should engage the L brain more than the R and make Ss either attend to their R ears or turn rightward; attention to musical stimuli should engage the R brain more than the L and make Ss either attend to their L ears or turn leftward.

Some observations by Blackstock (1978) are relevant here. He allowed 18 children (7 normal, 11 autistic) and 18 normal adults to select freely to listen to speech or musical stimuli with either ear. The autistic children listened to all stimuli longer with their L than with their R ears. Normal Ss tended to listen longer with their R than with their L ears to some verbal stimuli, and longer with their L than with their R ears to some musical stimuli. Blackstock did not report how often his Ss chose to put one or the other ear up to the loudspeakers, but rather how long they held their ears there once the choice was made.

Here we report the results of experiments in which we recorded the head-ear orientations adopted by Ss while they attended to musical or verbal stimuli. In both experiments, R-handed undergraduate students were tested in the symmetrical booth described above.

EXPERIMENT IV A.

Ss were 16 M and 9 F, informed by the overhead speaker that, on each of 40 trials, he/she would hear either musical or verbal stimuli from the earphone facing him/her (Fig. 1). A stimulus was a sequential pair of either 3-note melodies (piano) or English words, embedded in white noise; 20 music and 20 word trials were presented in pseudo-random order. In Trials 1-20, the overhead speaker was silent while the stimuli were presented from the earphone. In Trials 21-40, competing stimuli, either spoken words (on word trials) or piano music (on music trials) were played from the overhead speaker at the same time that the earphone stimuli were presented. Before each trial, S was informed via the overhead speaker which stimulus type was about to be presented. The task was to decide whether the two members of the earphone pair were identical and, if so, to press the button (with wire) held behind the back.

Over all 40 trials, 15 Ss (60%) used the same ear (7 R, 8L) among the remaining 10 Ss, there was no correlation between ear choice and stimulus type. On Trials 1-20, the R ear was used on 56% of the music trials and on 56% of the word trials. On Trials 21-40, the corresponding percentages were 55 and 50.

EXPERIMENT IV B.

Because the majority of Ss did not vary the ear choice when stimulus type varied across trials, we turned to a procedure in which each S made head-ear orientations to only one stimulus type. We also attempted to guard against the possibility that Ss might "program" the motor pattern of their turn (including direction) immediately after they were informed that they would need to turn. Our intent was to "prime" the appropriate hemisphere both by informing S in advance (from overhead) which type of material he would hear and by having him attend to that stimulus, before he was instructed to turn his head.

Ss were 46 men; each S stood on the footprints, facing the earphone described above. He was instructed via the overhead speaker to listen carefully to a 20-sec passage of either piano music (N: 23) or technical speech (N: 23) from the same overhead speaker. He was then instructed to put an ear up to the earphone in order to listen to a similar passage; his task was to press the wireless button held behind his back if the passage differed from the earlier one. Of the 23 Ss in the speech condition, 15 used their R ears, as did 18 of the 23 Ss in the music condition (X^2_c (1) = 0.43, N.S.)

GENERAL DISCUSSION AND CONCLUSIONS

Earedness – ear choice in a monaural task – was found to be concordant with handedness in 74% of R-handers and 65% of L-handers, under conditions in which environmental asymmetries were very carefully controlled (Experiment III). Earedness was not related to eyedness, even though they are both motor preferences involving paired cephalic sensory organs.

Since ear preference was strongly influenced by seemingly minor environmental asymmetries (side of entry, button wire), and since it did not influence telephone use, earedness appears to be a very weak lateral preference.

Handedness was the only endogenous factor predictive of telephone-answering style. Interestingly, telephone answering was strongly influenced by S's expectations regarding writing, another unimanual activity. Ss answering an isolated telephone most often did so with the dominant hand (and ipsilateral ear). When the writing table was present, this tendency decreased reliably. Unsurprisingly, Ss tend to keep their writing hand free under such circumstances.

Lastly, differential ear preferences were not elicited by putatively hemisphere-specific stimulus types.

SUMMARY

A total of 373 normal young adult subjects were distributed among 5 experiments measuring earedness. Handedness, eyedness and familial L-handedness were also indexed. Special care was taken to remove environmental asymmetries when determining ear preference when listening to sound from a suspended earphone, and from a stopwatch on a table, and for using a telephone symmetrically constructed and displayed. Ear preference was strongly influenced by seemingly minor environmental asymmetries and did not influence telephone habits, and must be considered a very weak lateral preference. Earedness was as concordant with handedness as eyedness was found to be; earedness was concordant with handedness in 74% of dextrals and 65% of sinistrals, but earedness was not related to eyedness. Earedness did not vary with putatively hemisphere-specific stimulus types (music, speech). Laterality of telephone use was jointly determined by handedness and the expectation of writing, not by earedness.

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