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Rhythm and Dominance*

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Abstract

Subjects were tested by a short experimental procedure involving tapping of a rhythm with one limb with a simultaneous regular beat with another limb. Informal observations had suggested a rhythm dominance effect—that this was dramatically easier with some limb combinations. Notably it was easy when the right hand tapped the rhythm and the left hand the beat but almost impossible the other way round. Equally, both hands dominated both feet. Our tests revealed enormous individual differences, subjects separating neatly into three groups. Some people could not do the task at all, some could do it with any limb combination, the latter group including all the serious musicians tested. For the remainder the rhythm dominance effect was clear. However, the laterality effect was the same (right hand advantage) for a majority (60%) of left handers. We conclude, then, that this effect is linked to language dominance and not handedness. In addition it seems there is a task scheduler which imposes its own view in combining this laterality effect with the dominance of hands over feet.

This paper has its origins in restlessness. During a highly boring seminar, one of us, seeking distraction, discovered a previously unremarked asymmetry. This effect we call the *rhythm dominance effect.* It is to be seen if one tries to tap a rhythm with one limb while maintaining a steady beat with another limb. This proved to be easy when the right hand took the rhythm and the left hand took the beat but almost impossible when the left hand took the rhythm and the right hand the beat. Similarly the left hand was dominant over the right foot which in turn was dominant over the left foot.

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*The first experiment formed part of a dissertation submitted in part fulfillment of the B.A. degree by the first author. Requests for reprints should be sent to John Morton, M.R.C. Applied Psychology Unit, 15 Chaucer Road, Cambridge CB2 2EF, England.

Superficially these effects seem to be related to dexterity, since the original observations were on a right-handed person. However, the rhythms were simple enough to be tapped by even the left foot as long as they were unaccompanied. In addition the nature of the breakdown with the non-favorable combination was usually that the dominant limb took over the rhythm. Any account based on lack of adequate motor control of the non-dominant limb would lead to predicting something more like a breakdown of timing; i.e., degradation rather than the disruption which was experienced.

The experiments we report were carried out in an attempt to study the generality of the findings. In particular we were concerned to discover the asymmetry shown by left-handed subjects and to probe the full range of skill. Thus we were at pains to include a sample of practicing musicians.

Subjects

The subjects were mainly undergraduates. Before testing they were classified for handedness and also as musician or non-musician. The shortened Oldfield Handedness Questionnaire (Oldfield, 1971) was used to classify handedness and gave a laterality quotient ranging from +100 (right-handed) to −100 (left-handed).

The criteria used for classification as a musician were to have had instrumental lessons for more than six years and to be at the moment an active classical instrument musician. Six years was an arbitrary choice. It was felt that there is a watershed after about four to six years of music lessons. Parental pressure may cause non-musical pupils to continue with lessons, but probably not past the six year stage.

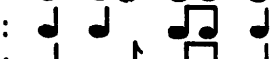
Testing procedure

The test involved tapping a rhythm with one limb while tapping a regular beat with another limb. With the four limbs in all possible arrangements there were twelve combinations to test.

There are two alternative methods for testing these twelve combinations. One is to test each with a different rhythm. This method runs into difficulties in the comparison of results because it did not seem possible to find twelve different rhythms of equal difficulty. The alternative method is to use the same rhythm to test all twelve combinations. This has the possible disadvantage that learning may improve those combinations tested later. However the twelve limb combinations vary in their difficulty, so if they are tested in

ascending order of difficulty this will offset the learning effect since we are anticipating breakdown with the later ones. So the latter alternative was the method chosen; this had the added advantage of being a much shorter procedure (about five minutes per rhythm). Thus it was possible to test three different rhythms before the subjects' patience was exhausted. Note that in principle we could get negative transfer as well as, or instead of learning. We will discuss this possibility later.

A preliminary experiment was conducted to investigate the relative difficulties of about twenty-five different rhythms, using just right-hand rhythm, left-hand beat. The most striking feature to emerge from this was the great range of abilities of subjects to tap a rhythm with one hand while maintaining a beat with the other. So in picking the three rhythms for the test it was difficult to reach a compromise whereby the tests could be done without some subjects becoming impatient, either because the rhythm was too difficult or because it was too easy. Finally three rhythms were chosen of slightly differing difficulty. They all consisted of one bar of 4/4 time. The three rhythms were:

Rhythm 1: 
Rhythm 2: 
Rhythm 3: 

The subjects had to maintain a steady beat of crotchets with the "beat limb", and then superimpose the test rhythm with the "melody limb" once the beat had been firmly established. The rhythm and beat were synchronised, of course, so that for rhythm 2, the two limbs tapped in unison except for the extra tap after the third beat for the rhythm. To obtain rough similarity between the subjects in the speeds at which they tapped the rhythms, the rhythms were recorded on a tape recorder at a speed of about ♩ = 90, i.e. one every $\frac{2}{3}$ second. The rhythm was played to the subject as many times as he wanted, and the subject was asked to make sure he had grasped the melody fully by tapping it with the four individual limbs separately.

Now came the crucial part of the test: assessing whether a subject could perform the rhythm against beat with a particular pair of limbs. Rather than using mechanical methods of assessment we capitalized on our discovery of a simple method of assessment; the subject's own reaction to each test. It turned out that in all cases there was a clear-cut distinction between the combinations that they could perform with ease and those that they could not do at all. They were always offered a second attempt in case the first had failed for lack of concentration. Often this second try was refused, however, because they knew there was no chance of their managing it; sometimes they even found it disturbing to attempt it.

The marking of the tests thus turned out to be quite simple. Subject and experimenter had to agree on the result of each test, but agreement was always easily obtained because success or failure on each test was obvious.

The whole point of this experiment was to elicit a spontaneous response rather than a practised performance. Some of the subjects could undoubtedly have managed with practice those combinations which they found impossible on the first attempt. But to allow even a small amount of practice introduces other variables, for it is possible to develop a stratagem to get round the task. An algorithm could be set up whereby the task would no longer be considered as a rhythm and beat but as an integrated series of movements; that is considering separately each beat (or half beat if necessary) as units of movement with the choice of unit being limited to four; namely left and right together, left only, right only, no movement. In this way the third rhythm could be tapped with the two hands as the following eight equally spaced events:

1. Both hands
2. Nothing
3. Left
4. Right
5. Both
6. Right
7. Both
8. Nothing

The danger of such stratagems being evolved was minimized by allowing the subject a maximum of two attempts on each combination.

Order or presentation

The order of presentation of the three different rhythms was varied among subjects. The order of testing of the combination of limbs for each rhythm was based on a scale of difficulty as mentioned in the introduction. That is, in the order *right hand; left hand; right foot; left foot.* The actual order used for the right-handed subjects is shown in Table 1. For left-handed subjects R and L were reversed. Thus they started with LH/RF.

Testing—experimental procedure

The subjects were first asked to fill in the Oldfield handedness questionnaire. They were then read a short passage of instruction

> "This is a test of the ability of one limb to keep a steady beat going, while another limb taps out a more complex rhythm on top of this beat. Taking all four limbs there are twelve combinations of pairs of limbs, and I shall ask you to attempt the

> rhythm with each of these twelve. There are three rhythms in all, thus making thirty-six short tests. We shall spend very little time on each test, moving straight on to the next test if you cannot do it first time. Let me know whether you think you did it satisfactorily or not. All the rhythms are based on a four beat bar. Keep the steady four beats going with the "beat" limb and tap out the rhythm with the "melody" limb."

After making sure they were sitting comfortably with each limb free to move, the tape was turned on. Some further instruction was on tape:—

> "The beat will first be established and then the melody rhythm added to it. Use this method when you attempt the rhythm. If at any time you are unsure of the melody ask for it to be replayed.
> Melody One..."

The beat was established with two full measures on the tape and then the experimenter took over the beat with his hand while the melody was played on the tape. The subjects were asked if they were thoroughly familiar with each rhythm and then were asked to tap it separately with each limb to make sure. Then the combination was given and the subject attempted it. Agreement between subject and experimenter was reached over the test and then the next combination of limbs given.

The procedure was repeated with the other two rhythms.

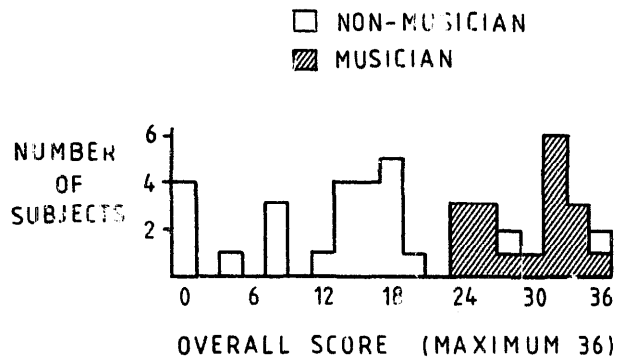
Results

In certain of the following analyses the results of those subjects are omitted who scored either 100% or 0% on all the tests.

1. Overall scores—distribution

The overall scores of all subjects out of a possible total of thirty-six are displayed in Figure 1. There is a grouped distribution into "good" subjects, scoring between 23 and 36, and "fair" subjects, scoring between 12 and 19, with a residue of "poor" subjects, scoring nine or less. The latter group included four subjects who scored zero. These subjects were remarkable for their inability to tap even the simplest rhythm against a beat. They were able to tap the rhythm with any single limb, but on attempting to superimpose it upon a beat they broke down every time. In some cases they were incapable of tapping crochets against quavers, i.e., twice as fast with one hand as with the other. Because of this extreme inability we suspect that they probably form a separate group. A fifth group exists of those subjects who could not tap the simplest rhythms with one hand alone. We did not include such subjects in further testing.

Figure 1. *The distribution of scores across subjects.*



The most significant feature to emerge from the distribution is the relation between the musician classification and these groups. All the musicians scored highly and only two non-musicians scored highly. The median scores were 31 for the musicians and 13 for the non-musicians. Such differences transcend significance tests. Within the musician group there were a variety of instruments, though predominantly keyboard and string players. We were unable to find any differences between these two small groups.

2. *Order of presentation of melodies*

Three matched groups of eight subjects each (a subset of the total tested) were presented with the melodies in different orders. Their total scores for each melody rhythm were compared for interaction with order of presentation by an analysis of variance. It was found that there were no interactions significant at the $p = 0.05$ level between groups, nor between order of presentation of melody and groups. Thus the learning effect on the task for the whole duration of thirty-six tests is not significant.

3. *Limb dominance in right-handed subjects*

In Table 1 we have presented the data for each limb combination for the right-handed subjects. It is evident that there is a severe discontinuity between performance with the dominant combinations and that with the non-dominant combinations. The 'adjusted' values for the non-musicians in Table 1 were obtained by eliminating the 4 subjects who were completely unable to perform the task at all and the subject who got all the tasks correct. Eliminating these subjects sharpens the discontinuity between dominant and non-dominant combinations. To a first approximation all the dominant combinations except one can be performed perfectly, and none of the non-dominant

Table 1. *Pairs of limbs in order of testing*

	Dominant Combinations						Non-Dominant Combinations					
rhythm beat	RH LF	RH RF	RH LH	LH LF	LH RF	RF LF	RF LH	LH RH	RF RH	LF LH	LF RH	LF RF
non-musicians (n = 19)	0.73	0.73	0.63	0.67	0.67	0.37	0.07	0.09	0.11	0.09	0.11	0.11
musicians (n = 12)	1.00	1.00	1.00	1.00	0.97	0.97	0.61	0.75	0.67	0.44	0.81	0.72
non-musicians* adjusted (n = 14)	0.93	0.93	0.78	0.83	0.83	0.43	0.02	0.05	0.07	0.05	0.07	0.07
all left-handers (n = 11)**	0.51	0.61	0.67	0.79	0.76	0.67	0.39	0.36	0.33	0.21	0.39	0.39

*Subjects scoring 0% or 100% were excluded for this row.
**Note the left-handers were actually tested in a different order with R and L exchanged in the order given. Thus LH/RF was actually the first order tested, and LH/RH was tested before RH/LH etc.

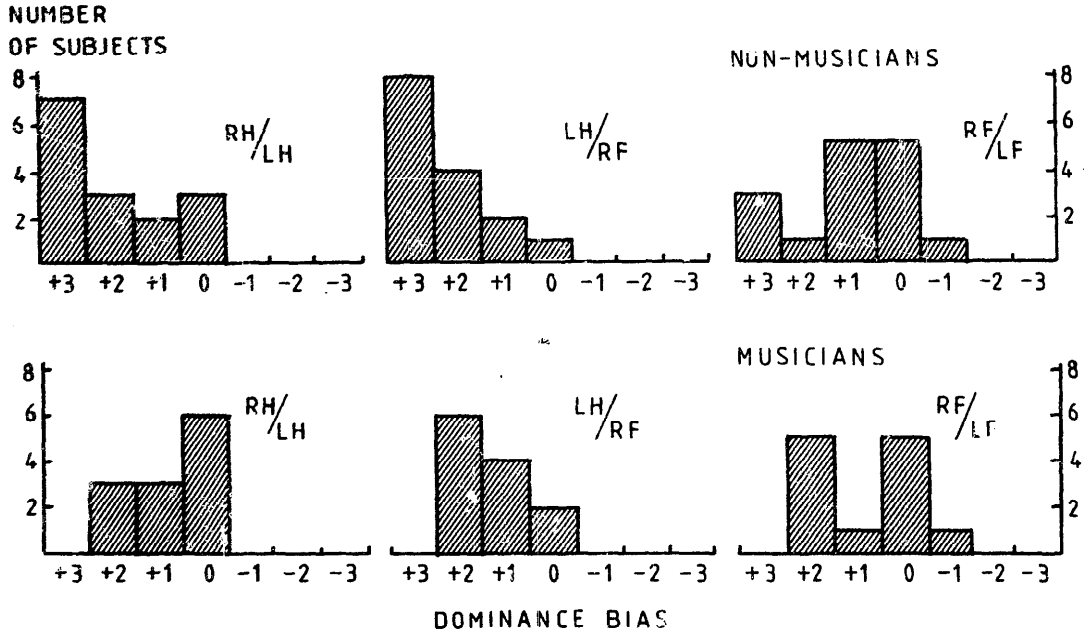
ones can be done at all. The exception is RF/LF, where the right foot takes the melody and the left foot the beat. In this case the subjects managed to perform the task on 0.43 of the trials. Basically 5 of the 14 subjects in this group could not do the task at all with the feet.

For the musicians there is also a discontinuity, masked by a ceiling effect. With more difficult melodies it is possible that bigger differences could be found. Among the non-dominant combinations the LF/LH combination is worse than LF/RF for 9 musician subjects with 3 equal ($p = 0.002$, sign test), and worse than LH/RH for 8 subjects with 4 equal ($p = 0.004$). Since these are *a posteriori* comparisons the probability values should be multiplied by 30 (15 possible tests × 2-way). Thus we do not feel secure enough in these differences to attempt to interpret them.

i. To confirm dominance in the particular combinations RH/LH, LF/RF, RF/LF

For each of these combinations and for each melody a score of +1 was given if the test could only be performed with the higher ranking limb of the pair; −1 if it was performed with the lower ranking; and 0 if it was performed by both or neither. So for three melodies scores could range from +3 to −3. Results are displayed as histograms in Figure 2. The distributions were tested with the χ^2 one-sample test against the distribution expected if the subjects succeeded randomly. All the difficulties for non-musicians were significantly biased with $p < 0.001$. For the musicians the bias for RH/LH was not signifi-

Figure 2. *The distribution of dominance bias for various limb combinations. Each subject is given a score from +3 to −3 computed by subtracting successes on non-dominant limb combinations from those on the dominant combinations. Subjects who succeed on all 6 trials with one pair of limbs would score 0 as would those who failed on all 6.*



cant; for LH/RF, $p < 0.001$ and for RF/LF $p < 0.01$. The musicians were showing a ceiling effect and it is not clear whether they would show a handedness effect with more complex rhythms.

ii. Differences between musicians and non-musicians

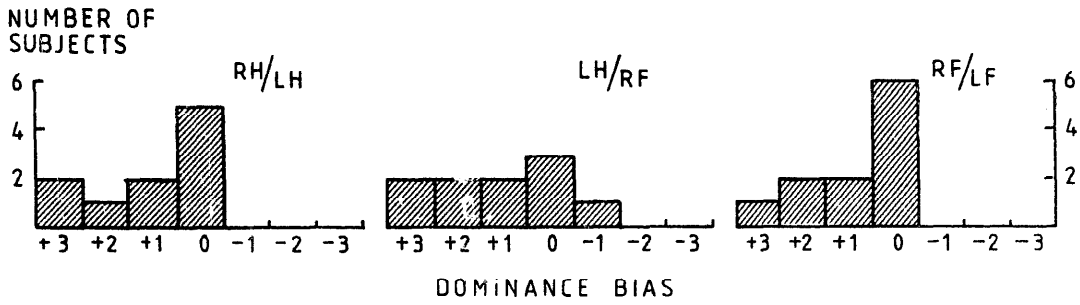
The distributions of the musicians and non-musicians in the histograms (Figure 2) were compared by the χ^2 test for two independent samples. A significant difference in distribution holds at the $p < 0.05$ level for the RH/LH and LH/RF results, but there is no difference in distribution in the RF/LF results.

4. Limb dominance in left-handed subjects

A different order of combinations was used for sinistrals, based on the assumption that their order of limb dominance would be LH, RH, LF, RF. The order for dextrals was used, substituting left for right and vice versa.

The sinistrals' results were treated in the same way as those of the dextrals but pooling the five musicians and the five non-musicians. The results are set out in Figure 3 (omitting one subject who scored only 3 out of 36, all 3 being hand–foot combinations).

Figure 3. *The distribution of dominance bias for left-handers. See Figure 2 for further information.*



The results in Figure 3 show that five out of ten subjects have right hand dominance over left and five have right foot dominance over left. These numbers are too small to subject to statistical analysis. The overall laterality dominance can be seen by combining the score for hands and feet. Thus (RH/LH + RF/LF) – (LH/RH + LF/RF) gives positive scores for six subjects with four equal (2 of whom managed none of the combinations and 2 of whom got all correct with all three melodies). This gives $p = 0.032$ by a two-tailed sign test.

There is thus a good indication that the pattern for the left-handed subjects is the same as that for the right-handed subjects. Certainly there is no shred of evidence to suggest that left-handers display the opposite pattern to right handers.

Discussion

Rhythm dominance

The postulate that there is an order of rhythm dominance among the limbs (RH, LH, RF, LF) is confirmed to a greater or a lesser extent in 25 out of 30 dextrals. Right hand dominance over left hand is confirmed in 17 out of 30 cases, left hand over right foot in 23 out of 30 cases and right foot over left foot in 14 out of 30 cases. The results of the non-musicians are highly significant but the musicians' results are rather more equivocal. Note that there was not much evidence for a 'distance' effect along the dominance sequence. Thus RH/LF was not significantly easier than RH/LH.

The most obvious account of the dominance effect would be by appeal to the differential dexterity of the limbs. This would account very simply for the advantage of the hands over the feet. The advantage of right over left, as we shall see, presents some problems for the generality of this explanation. Provins and Cunliffe (1972) have shown that for dextrals the right hand is superior to the left in manipulative dexterity over a wide range of motor

performance tests: dexterity, handwriting, dart throwing, tapping, ratchet test, strength, endurance. But this dexterity effect is unlikely to be the explanation for rhythm dominance. Dexterity and manipulative skills played little part in this test. The subjects all found the rhythms very simple to tap with all four limbs singly at the rather slow speed selected for this study (♩ = 90), and there appeared to be no difference between the single limbs' performances at the level of latitude allowed by the test, which although not lax could only be constrained by the senses of rhythm of the experimenter and subject and their combined subjective opinions. Also Provins and Cunliffe's results show that left-handers have preferred hand superiority for manipulative skills, but this study shows that left-handers have, if anything, non-preferred hand superiority (five sinistrals had right hand rhythm dominance, and five showed right foot dominance over left foot).

The alternative explanation is that this dominance effect is a reflection of cerebral hemispheric lateralization. Wolff, Hurwitz and Moss (1977) tested subjects for ability to tap in time to a metronome and found no difference between hands. But they also tested the tapping of a simple rhythm with either hand, measuring the performance electronically and processing by computer to detect fine irregularities. They found that significantly better performances were obtained with the right hand, even with left-handed subjects. They concluded that "in both sinistrals and dextrals the left hemisphere is specialized for precise temporal control of fine motor actions of the left and right hands". This conclusion may be rather ambitious in ascribing the precise temporal control of both hands to one hemisphere. A superior performance by one hemisphere does not necessarily imply a total lack of participation by the other hemisphere.

Nevertheless there is evidence from other sources that in dextrals the sense of rhythm is lateralized to the left hemisphere. Bogen and Gordon (1971) used unilateral intra-carotid injections of amobarbital. This has the effect of causing a temporary stoppage of neural activity in one hemisphere. After a right carotid injection patients' ability to sing is grossly impaired; the singing is amelodic and with slurred articulation, but the rhythm of the song is preserved thus indicating that the rhythmic element in singing is possibly mediated by the left hemisphere. These authors provided no evidence, however, on the effects of injections of amobarbital into the left carotid on the rhythmic component of singing.

There is evidence that the perceptual processing of rhythm is biased in favour of the speech hemisphere. This comes from dichotic listening trials to rhythm (Robinson and Solomon, 1974). A number of other studies point to left hemisphere involvement in those musical judgements which involve relational, as opposed to wholistic, processing (see Bever, 1980). Bever indicates

that increasing musical ability is accompanied by a shift, overall, from right hemisphere processing to left supposedly as relational processing increases. Rhythmic output could be regarded as a relational skill. Perceptual processing and motor output aspects of rhythmic ability are not necessarily one and the same thing however. Their hemispheric association may be misleading.

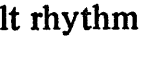
Wolff *et al.*, make no reference to the language hemisphere in their conclusions, preferring the term "left hemisphere". In fact the lateralization of the representation of language in the cortex is an important consideration when interpreting sinistrals' laterality results. The side of language dominance is the best indication there is as to the extent of actual reversal of hemispheric function in a left-handed person.

Estimation of the frequencies of left, right or bilateral language dominance in the general population is beset with difficulties, as discussed by Levy (1974). However, most sources estimate that between 55% and 65% of left-handed subjects have left hemisphere language dominance. Milner, Branch and Rasmussen (1964) estimate that 64% of sinistrals have left hemisphere, 20% have right hemisphere, and 16% have bilateral language representation. From this we would only expect 20% of left-handers to show a reversal of the dominance pattern observed in dextrals. Our initial sample was too small to allow this to be tested so we performed a supplementary experiment.

Experiment on left-handers

The subjects were undergraduates at Cornell University who had responded to a notice calling for "Lefties" to volunteer. A total of 40 subjects were tested of whom 35 were left-handed on the Oldfield Questionnaire. The other five all wrote with their left hands which fact had led them to volunteer.

The sole purpose of the experiment was to establish lateral asymmetry. Thus only the two hands were tested against each other. The same initial procedures were adopted as in the main experiment except that alternate subjects were started with the right hand taking the rhythm. The simplest of the rhythms was used to start with. The procedure was then varied freely in response to the subject's ability at the task. At one extreme there were subjects who found it virtually impossible to do any combination with the two hands. In some cases this was overcome by practice and training—always being careful to equate practice with the two combinations. The subject would then often show an asymmetric transfer to another rhythm. In a more difficult case a subject managed to tap a rhythm of 2:1 with the right hand with vocal support while tapping the beat with his feet. He failed to repeat this feat with his left hand.

At the other extreme there were musicians who found the task easy in both combinations. They were tried on a more difficult rhythm (). If

this failed to differentiate the hands they were asked to 'doodle' or improvise with one hand while tapping a beat with the other.

The result of these manipulations was to get a clear behavioural breakdown with one combination where the other combination succeeded. The diagnosis was always agreed by the subject. In 10 cases it was not possible to detect asymmetries in performance. In these cases the subjects were asked which combination they preferred.

Results

Of the 35 subjects, 21 showed better performance when the right hand took the rhythm. That is, they behaved like right-handers. A further 4 subjects had a clear left-hand advantage. Of the 10 remaining subjects 2 expressed a preference for the right hand, 3 for the left hand, and 5 could not decide.

On the basis of the figures 64:16:20 for a left:mixed:right hemisphere for language we would expect 22:6:7 from our group. The correspondence of the data to these values seems close enough to encourage us in the conclusion that the handedness biases shown in this task are controlled not by ordinary handedness factors but by the language hemisphere. Our evidence, while highly suggestive, needs confirmation with a group of left-handers whose language hemisphere has been independently established. If such data confirms the hypothesis then we suppose our procedure might be adapted to provide a rapid method of establishing the language hemisphere.

This explanation of rhythm dominance by hemispheric specialization does not account for the dominance of hands over feet and in particular the dominance of the left hand over the right foot in those subjects we suppose to have a dominant left hemisphere. A simple dexterity explanation is unlikely since, as already pointed out, the melodies were simple enough and performed at a slow enough rate to allow all the limbs to perform them. In addition, Table 1 shows that the RF/LF combination, while not perfect, is possible, whereas the RF/LH combination is virtually impossible. We cannot explain the RF/LH result, then, by supposing that the right foot cannot cope with the rhythm. Note, also, that simple capacity notions will not serve the purpose either. Suppose one argues that the right foot needs more capacity (in any sense of the term) than the left hand in doing the rhythm, and that this makes the LH/RF combination possible but the RF/LH combination impossible. A simple model for this would state that the rhythm was more difficult than the beat and that the capacity requirements for the dual task could be calculated as the sum of the values for the separate limbs. The value for each limb would be a multiple of the capacity required for the limb and the difficulty factor for the task assigned (r and b for rhythm and beat respectively). Thus the LH/RF combination would 'cost' (LH. r + RF. b).

The RF/LH combination would 'cost' (RF. r + LH. b). Since RF > LH and $r > b$, the latter value must be greater than the former, and thus that combination would be the more difficult.

There are a number of other ways of talking about capacity or effort, but they would all suffer the same fate when faced with the observation that the left foot must be worse than the left hand at any task. Thus RF/LF would 'cost' more than RF/LH. Since RF/LH is not possible, RF/LF should not be possible either. However it is possible. Thus capacity, or similar notions cannot be used in accounting for the asymmetries.

For these reasons we feel that a richer model has to be postulated in which dual task performance is considered. Most of the little related work seems to be concerned with pairs of activities which are unconnected rather than coordinated. In this context, Peters (1977), concludes that "the central nervous system, in the voluntary guidance of movement, can produce only one basic rhythm at a time". (p. 463). This conclusion is echoed by Klapp (1979) who observed that with periodically repeating key-presses, performance was degraded if the two hands were not synchronized. There was no degradation of performance when one hand pressed twice as fast as the other compared with the two hands responding identically.

In both these papers the nature of the degradation was that of the one limb driving the other so that performance tended to be synchronized. If we look at the nature of breakdown in the non-preferred condition in our task we often find that the structure of the task is preserved but that the streams are reversed either partly, with both hands taking the rhythm for example, or completely. The other common breakdown is an inability to initiate movement. It is as though the limbs refuse to obey instructions.

We interpret this feeling in the following way. We assume a central 'scheduler' responsible for organizing bi-manual (or other two-limb) coordination. We assume that the scheduler has information about the relative dexterity of hands and feet and thus will prefer either hand over either foot. In addition we assume that it has a preference for limbs controlled directly by the speech hemisphere. This could be because subjects sing the rhythm to themselves, using the speech motor systems. Left to itself the scheduler would organize which limb would perform which task. If we attempt to instruct the scheduler to adopt and maintain a different assignment we have the effect that it refuses or is unable to maintain the task. We apologize for the homonculus flavour of the description, but it is the simplest way to talk about a device which is capable of autonomous activity against the intentions of its owner.

In the case of the musicians we conclude that it is the scheduler which is the cause of their superior performance. It would be reasonable to suppose

that pianists might develop a facility to keep rhythms going on the left hand with a beat on the right. It is not clear why violinists, for example, should develop such a facility with the left foot. A simpler account is that the mechanism we have termed the scheduler is better able to maintain two streams of activity. This ability generalizes to all limb combinations. It is not possible at the moment for us to say whether muscial training has an effect on the scheduler or whether those children with flexible schedulers become good musicians. The final story, then, will have to include dexterity, dominance, an ability to keep two streams separate and an ability, for the musicians, to maintain suboptimal pairings of limbs and tasks.

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Résumé

Les sujets ont été testés avec une procédure expérimentale courte impliquant un battement rythmique avec un membre pendant qu'un autre membre scande simultanément un rythme régulier. Des observations informelles avaient suggéré un effet de dominance rythmique et une plus grande facilité de certaines combinaisons. Ainsi est-il plus facile de rythmer avec la main droite et de scander avec la main gauche, mais il est presque impossible de faire l'inverse. De même les deux mains sont dominantes par rapport aux deux pieds. Nos tests révèlent d'énormes différences individuelles et l'on peut séparer les sujets en trois groupes. Le premier n'arrive pas à effectuer la tâche, le deuxième peut l'effectuer selon n'importe quelle combinaison des membres; ce dernier groupe inclue tous les musiciens sérieux. Pour les restants l'effet de dominance rythmique est net. L'effet de lateralité, c'est-à-dire l'avantage de la main droite se retrouve chez la majorité (60%) des gauchers. Nous en concluons que cet effet est lié à la dominance pour le langage et non pour les mains. En outre, il semble qu'il y a un programmeur de la tâche qui s'impose en combinant l'effet de lateralité avec la dominance des mains sur les pieds.