

CLINICAL EVIDENCE AGAINST THE MOTOR THEORY OF SPEECH PERCEPTION

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In recent years a number of linguists, including A. Liberman (1957) and P. Denes (1965), have put forward a theory to the effect that "speech is perceived by reference to articulation, that is, the articulatory movements and their sensory effects mediate between the acoustic stimulus and the event we call perception"¹.

The basic idea of this motor theory of speech perception is not new. As far back as 1925, L. Stein wrote: "Wir können ja oft nur dann einen Laut richtig hören, wenn wir auch die kinästhetische Vorstellung desselben haben und in die Tat umsetzen können." And in 1932 S. Jones suggested that "the listener refers what he hears to how he would say it. Thus he translates exteroceptor into proprioceptor sensations, the kinaesthetic memory serving as stimulus."

There are, however, a number of facts which do not fit in well with the motor theory of speech perception. Let us examine some of them:

A few years ago, F. Lhermitte and coll. (1963) reported the case of a 43-year-old woman who could hardly move and could no longer speak though she had no paralysis. „Or, the authors write, *il nous semblait que la malade avait peut-être une activité psychologique bien supérieure à celle que son état moteur laissait paraître et qui avait l'apparence d'un coma ou d'une profonde léthargie. Et, comme elle était capable de fléchir l'avant-bras sur le bras, nous avons utilisé ce mouvement comme étant le moyen pour elle d'exprimer une réponse affirmative. Nous lui avons donc dit que nous lui poserions différentes questions et nous lui avons demandé de fléchir l'avant-bras lorsqu'elle voudrait répondre par l'affirmative à une question. Ce code nous a permis de découvrir des capacités intellectuelles dont on ne pouvait prévoir la persistance. Lui ayant demandé, par exemple, de fléchir l'avant-bras lorsque son prénom serait prononcé, une liste de prénoms a été énoncée, un silence de deux secondes environ séparant l'émission de chaque prénom pour laisser à la malade le temps d'effectuer le geste-réponse. La malade a parfaitement reconnu son prénom „Jeanne“. Il en a été de même de son nom de famille. Et ceci, malgré l'énoncé de prénoms et de noms*

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¹ A. Liberman (1957).

phonétiquement voisins des siens (par exemple Prévost, Prouvot, Pourot, alors que son nom était Pouveau). Elle a reconnu le nom de l'actuel Président de la République et celui de son prédécesseur, dans une liste de noms d'hommes célèbres. Elle a correctement répondu par le même geste de flexion de l'avant-bras lorsqu'on lui a demandé d'indiquer la date de la „Libération de Paris“ (1944) dans une série de nombres à 4 chiffres. Elle a été capable d'effectuer les opérations simples telles que $4 + 9$, $5 + 8$, 7×5 , etc., en fléchissant l'avant-bras lorsque l'observateur énonçait le chiffre correspondant au résultat correct de l'opération. Il en a été de même pour le problème suivant: j'achète un paquet de cigarettes qui coûte 150 francs, je paie avec un billet de 500 francs; combien me rend-on?“

Some years previously, H. Fang and J. Palmer (1956) had reported a somewhat similar case: “So-called ‘akinetic mutism’... was observed in case 1 of our series and lasted for approximately four days. During that period the patient was not comatose, but he showed flaccid quadriplegia and facial diplegia. He was totally anarthric and unable to move his head or neck. He was able to respond to simple verbal commands by opening and closing his eyes; the frequency of eye-blinking and the pauses between blinks were coded so as to convey slightly more complicated commands. Thus, the only remaining avenue of communication between this patient and his outside world was his ability to close his eyelids on volition.“

In the case reported by Lhermitte and coll. the akinetic mutism was due to a softening of the reticular formation. In the case reported by Fang and Palmer, it was also due to a brainstem disease.

Now, if “the articulatory movements and their sensory effects mediate between the acoustic stimulus and the event we call perception”, how did these speechless patients manage to understand what they were told?

It might of course be argued* that in the adult speaker “the reference to articulatory movements and their sensory consequences must somehow occur in the brain without getting out at the periphery”.² Accordingly, the two patients described above could understand what they were told because their brainstem lesion did not prevent them from translating the acoustic stimuli into their motor equivalents at a higher level, i.e. in the cortex.

The following case history will show up the weakness of this argument:

On September 11th, 1965, late in the evening, Joseph V. was assailed by bandits who severely beat him. Joseph succeeded in reaching a hotel whose owner called for a doctor. The physician arrived and found a stupefied patient with several head wounds. The doctor had Joseph taken to hospital. The next morning, they discovered that Joseph, though he was quite in his senses, could not speak a word. No other neurological symptom could be discovered, however. The patient was referred to

another clinic for further investigation. Joseph wrote his daughter that he was lying in hospital because he had had a fall and he told her not to worry. A week after the aggression, the patient's health condition suddenly deteriorated: Joseph was in a fever and he complained in writing about violent headaches. A röntgenographic investigation of the skull revealed a temporo-parietal fracture. On September 23rd, Joseph was trepanned: his wound was cleansed and the bone fragments tied together. On September 27th, a neurolinguistic investigation revealed that the patient's inner speech and gestural language were intact. The patient could read and write correctly. He had no oro-pharyngeal apraxia and no paralysis. He understood everything one told him but could not utter a single word: all his attempts at speaking resulted in unintelligible grunts. In short, Joseph had a cortical anarthria without any concomitant dysphasic impairment; his mutism was solely due to a general disturbance of his motor speech patterns; Joseph could not speak because the cortical programs that cause words to be vocalized were completely disordered. As I have shown elsewhere³, this diagnosis has been corroborated by the results of follow-up examinations of the patient.

The three cases adduced above indicate that as a result of a brain injury one may lose one's ability to utter words without at the same time losing one's ability to understand speech. This dissociation strongly suggests that motor speech patterns are by no means a necessary link “between the acoustic stimulus and the event we call perception”.

Yet another case which points to the same conclusion has been reported by E. Lenneberg. This author had the opportunity to examine a young boy who was able to answer syntactically complex questions and to obey even tape-recorded verbal orders though he had never been able to speak. This well-documented case shows that one may learn to understand speech even though one is unable to develop vocal skills.

It follows from the above that the motor theory of speech perception, if it be any good at all, “accounts for only one of several ways in which (speech) perception is established”, as P. Denes himself admitted at the preceding congress.

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³ Lebrun (1967).

* See Fry's remarks in the discussion below.

² A. Liberman (1957).

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DISCUSSION

Fischer-Jørgensen:

The cases of grown-up aphasics are rather difficult to judge; the fact that children may be able to perceive differences (e.g. t : k) before being able to produce them seems more conclusive; for this must mean that the coordination between perception and motor commands has not yet been established.

Fry:

As far as I know, no one would say that there is only one way of perceiving speech, namely by reference to the motor patterns by which we generate speech. The question is really: "In normal conditions, what contribution can be made by the motor system to the perception and reception of speech?" Most of the cases cited by Dr. Lebrun are not very relevant because the patients have at some time developed the motor mechanism of speech and there is no reason why the cortical patterns should not be available. The only pertinent cases are those in which the movements of speech have never been made and these simply serve to emphasize the fact that by the very nature of speech, we can never say that a certain operation is carried out in one way only and in no other. Experience shows that if such statements are made they are pretty sure to be wrong.