

Diversity in Neurological Physiotherapy: A Content Analysis of the Brunnstrom/Bobath Controversy

ANT T. LETTINGA

Institute of Human Movement Sciences, University of Groningen, Groningen, The Netherlands

Abstract

Physiotherapy offers a great variety of movement therapies for patients with the same medical diagnosis, some of which appear to be diametrically opposed to each other. Many therapies have branched out into new derivative forms of treatment without settling the arguments with their predecessors. Many experts argue that the initial step in dealing with this problem of diversity is to establish a uniform, unequivocal

language in order to prevent the participants from talking at cross-purposes. This paper, however, introduces an alternative approach to clarifying disagreements in physiotherapy by presenting an analysis of a well-known controversy – the Brunnstrom/Bobath debate – as an example. Rather than applying a single language believed to be neutral to both therapies, the content of Bobath and Brunnstrom's textbooks has been contrasted as if these were written in two different languages, each

ordering therapeutic techniques, goals and rationales in a specific way. This “discourse” analytical approach throws a new light on the nature of diversity articulated in neurological physiotherapy.

KEY WORDS: Content analysis – controversy – discourse – effectiveness research – history – movement therapy – philosophy of science and medicine – stroke rehabilitation – uniform language.

INTRODUCTION

Physiotherapists who want to train the loss of movement skills of patients following stroke can choose from a variety of treatment possibilities. There are indeed many alternatives in physiotherapy, not only for patients with neurological disorders (1,2), but also for many other diagnostic groups (3,4). The difficulty, however, is that differences and similarities between available therapies are seldom mapped out in detail. In movement therapy for patients following a stroke, for instance, controversies are articulated in general opposing standpoints such as muscle education vs. neurophysiological facilitation, inhibition vs. stimulation of spasticity, or authority-based vs. evidence-based. Hence public debate between proponents of diverging therapies often end up highlighting the strengths of their own preferred therapy and attacking the others on their weaknesses.

Over the past two decades clinical researchers have been called in to objectify which therapy produces the best effect. More often than not, however, these

researchers also compare diverging therapies in terms of general oppositions. Particularly in stroke rehabilitation, competing movement therapies have been compared as if they were closed packages (5–8). Nowadays more and more professionals are starting to question the value of effectiveness research in which the relationships between the therapies compared are so vaguely defined (9–14). According to these authors, effectiveness research is not just a matter of methodological and statistical expertise, but requires a detailed understanding of the content and assumed working mechanisms of the therapies scrutinized.

It has been argued that physiotherapy should map out its content and articulate the differences and similarities between competing therapies in a uniform, unequivocal professional language. Rose (15), for instance, wrote in 1986 that common terms such as movement dysfunction, muscle imbalance, weakness and spasticity must be clarified and operationally defined before the content of therapies can be exposed and systematically described. Contempo-

rary experts seek alliance with internationally accepted health classifications, such as the International Classification of Impairments, Activities and Handicaps (ICIDH2) and attempt to adjust these to the specific requirements of physiotherapy (16,17). Heerkens et al. (16), for instance, expected that the use of such a uniform language “facilitates developments, for example, in the areas of registration (record-keeping), treatment protocols, and research into the effects of physical therapy interventions” (p. 431).

In this article I will introduce an alternative approach for mapping out the contents of movement therapies, one that is more or less at odds with the establishment of a uniform professional language. Rather than trying to capture the relations between diverging therapies in a single, so-believed “neutral” language, their competing knowledge claims and related practices will be analysed as if these were described in different languages, each ordering therapeutic reality in their own specific way. To demonstrate this discourse analytical approach, the example of two seemingly opposite views on the treatment of patients with spastic hemiplegia, namely Brunnstrom (18) and Bobath’s view (19), will be used, but first a brief account of the background of discourse analysis will be presented.

DISCOURSE ANALYSIS

There is a traditional trend in analytical work whereby the content of texts is interpreted with the purpose of detecting the “real” message of the writer. According to this tradition I could, in the new millennium, argue with the defenders or critics of Bobath and Brunnstrom therapies about what these authors exactly meant by their statements about movement therapy for stroke patients in the 1970s. But I have no desire to join in an argument about what Bobath and Brunnstrom did or did not really say in their textbooks. In addition I do not intend to spend time assessing the value of their statements. Instead I will begin my analytical work by placing the questions concerning the “real” meaning and “validity” of their statements in parentheses. In doing so I am following another trend in textual analysis set by theorists of science and medicine who regard texts as having a life of their own (20–25). In

this tradition, the “real” meaning of a text is recognized as an illusory or at least as an infinitely renegotiable concept (21).

In abandoning the notion of writers of texts as central “meaning makers” I adopt the notion of decentred subject as elaborated by the French philosopher Foucault.¹ In his “discourse” analyses of medicine he did not attempt to understand the meaning of a statement by focusing on “the treasure of intentions that it might contain, revealing and concealing, but by the difference that articulates it upon the other real or possible statements, which are contemporary to it or to which it is opposed in the linear series of times” (20, p. xvii). A discourse can be articulated as a system of linguistic and material entities mutually informing and performing on each other (23). Like Foucault I make no attempt to understand statements (for instance, those of Bobath) on the basis of the wealth of intentions they contain, but rather on the basis of the difference with other possible statements of the same subject matter (for instance those of Brunnstrom). That is, I shall compare the content of Bobath and Brunnstrom’s textbooks as different discourses, each ordering the movement problems of stroke patients, the therapeutic techniques, the desired outcomes and accompanying rationales in a particular way. Thus, rather than trying to understand key words in neurological physiotherapy from a referent’s point of view, I attempt to explore them by analysing how they are both similar to, and different from, key words in other statements about the same subject matter. Here I will show how such a comparative, discourse analytical approach may clarify disagreements in neurological physiotherapy without using predetermined operational definitions of terminology. This means that we have to begin with uncertainty, and little by little attempt to understand how terms and techniques, words and things, define one another within particular discourses, in this case the Brunnstrom and Bobath “discourses”.²

THE CONTENT OF THE BRUNNSTRÖM/BOBATH CONTROVERSY

The content of Bobath and Brunnstrom’s textbooks will be compared as different discourses by: (i) tracing their adversaries; (ii) focusing on the key terms in which the competing treatment views are formu-

lated; (iii) unravelling the intertwinement of terms and techniques; and (iv) exploring the different ways scientific principles find a place in, and give shape to, the content of both therapies.

Strength is a poor criterion

Like many innovations, new movement therapies do not appear out of the blue. More often than not they come into being as a reaction to limitations of previous endeavours to counter particular problems. Tracing these adversaries and analysing the arguments advanced for or against them is a way of opening up the content of therapies. In both Brunnstrom and Bobath's textbooks traces of arguments with their predecessors can be found, and it is with some of these arguments we begin this discourse analysis.

Brunnstrom. "This book is the outcome of a special interest in patients with neuromuscular disorders, which dates from World War II. After the war, the large number of stroke patients encountered in rehabilitation clinics prompted me to turn my attention particularly to the problems of patients with hemiplegia who seemed to respond poorly to conventional techniques". In these two sentences taken from the preface to her textbook *Movement Therapy in Hemiplegia: a Neurophysiological Approach* (18), Signe Brunnstrom describes her motives for developing a new therapy for patients with hemiplegia. But it is not the intention here to explore further her motives and intentions – for example by attempting to answer the question why this Swedish educated therapist went to America and decided to combine her therapeutic work with research activities. Rather we will explore in more detail the content of her sentences by focusing on such questions as "which training techniques are conventional according to her?" and "why does she label them as poor and conventional?"

Chapter 1 of her book contains an answer. There we encounter a conventional type of training that is conceived of as being "poor" for training patients with hemiplegia. In Brunnstrom's words: "patients with hemiparesis did not respond very well to 'muscle re-education' as employed by physical therapists in the training of patients with lower motor neuron lesions" (18, p. 22). She does not explain, however,

what muscle re-education implies; she does no more than indicate that it is applied in the training of patients with lower motor neuron lesions, and we know that hemiplegia is usually the result of lesions in the upper motor neuron.

In chapter 2 Brunnstrom returns to this issue by explaining why muscle tests – originally devised by Dr R. W. Lovet to assess progress in post-poliomyelitis patients – are poor tests for assessing progress in patients with hemiplegia. The testing criterion of the well-known muscle test is strength as measured by the patient's ability to perform individual joint movements with gravity eliminated, against gravity, and against gravity and added resistance. Brunnstrom articulates, however, that: "In hemiplegia individual joint movements cannot be performed as long as spasticity is present; therefore movement patterns, not individual joint movements, must be tested" (18, p. 35). Clinical experience also indicates that strength might vary a great deal according to numerous circumstances, such as the lying, sitting or standing position of the patient with spastic hemiplegia and the position of limb segments with respect to each other. According to Brunnstrom, strength *per se*, therefore, cannot be used as a testing criterion for patients with hemiplegia. Instead it should be based on the typical recovery stages of these patients, as described by the neurologist, Twitchel (28).

Let us now return to our questions. Which training is insufficient, according to Brunnstrom, for the treatment of patients with hemiplegia? The answer is the muscle re-education techniques employed for the treatment of the movement problems of post-poliomyelitis patients. And why are they insufficient for training patients with hemiplegia? Because they focus their attention on individual joint movements, and experience tells us that individual joint movements cannot be performed as long as spasticity is present in hemiplegic patients. Furthermore muscle re-education makes use of muscle strength for assessing progress, but the strength of individual muscle groups cannot be reliably tested in patients with spastic hemiplegia. Assessment and treatment of patients with spastic hemiplegia should therefore concentrate on movement patterns, which manifest themselves during the typical recovery stages of these patients.

Bobath. In the post-war years the physiotherapist Berta Bobath, supported by her neurologist husband Karl Bobath, also developed a movement therapy for patients with lesions of the upper neuron. It has been said that it was in the same period that they began a new life in Britain. But in this case too I will not go into the personal circumstances and historical forces that made the Bobaths decide to leave the European continent to go overseas and develop a movement therapy for patients with central neurological disorders. Instead I will concentrate on the content of Bobath's textbook, entitled *Adult Hemiplegia: Evaluation and Treatment* (19,29), looking for statements in which she relates her new therapy to that of conventional therapy. One conventional therapy, which she labels as "the concept and assessment of muscle power" (19, p. 18), resembles muscle education therapy as articulated in Brunnstrom's book.³

Bobath argues – as does Brunnstrom – that: "The testing of muscle power of individual muscles, such as done in poliomyelitis and other conditions of muscle weakness, is unreliable for hemiplegic patients" (19, p. 18). Weak muscles of patients with spastic hemiplegia may be capable of contracting strongly when participating in a mass flexion or extension movement pattern, but at the same time may be incapable of generating strength in movements that deviate from these spastic patterns. According to Bobath: it is the counteraction of spastic antagonists rather than the disuse atrophy that should be held responsible for the weakness of the hemiplegic muscles. "Atrophy of muscles through inactivity can develop very quickly in traumatic and in some orthopaedic conditions, especially after long-term immobilization in casts and braces. It is rare in cases of spasticity where the peripheral nerve supply is intact and circulation to muscles not interfered with" (19, p. 19). For these reasons, she considers the weakness of muscles in hemiplegia and the need for strengthening exercises as a problem secondary to that of abnormal co-ordination in postural control and movement. The patient's primary problem is "not a lack of muscle power on the affected side, but the inability to direct the nervous impulses to his muscles in the many varied ways and in the different combinations of patterns used by a person with an intact central nervous system" (19, p. 59). The effort

involved in strengthening muscles reinforces the few abnormal postural patterns of flexor and extensor spasticity, which leads to a static function at the expense of dynamic control.

So which conventional training is, according to Bobath, insufficient for treatment of patients with hemiplegia? The answer is the heavy resistance exercises employed to counter reduction of muscle volume in the weakened muscles of post-poliomyelitis patients and patients with orthopaedic conditions. And why are they regarded as contra-productive in patients with spastic hemiplegia? Because the effort used only adds to the dominance of the abnormal patterns of flexor and extensor spasticity, and thus prevents patients from employing more normal movements. Thus also Bobath states in her textbooks that therapists should understand hemiplegic patients' movement behaviour in terms of movement patterns rather than in terms of muscle strength.

Spasticity is not the issue

Bobath and Brunnstrom thus developed their movement therapies as a reaction to limitations of conventional muscle strengthening exercises. However, they not only had an enemy in common: they were also each other's adversaries. Although both authors kept patterns of movement in mind rather than localized muscles when assessing the movement problems of patients with spastic hemiplegia, they dealt with the patterns in two contradictory ways. In public debates this contradiction is often articulated in the trade-off "discouraging" vs. "encouraging spasticity". Here we will try to gain a deeper insight into this controversy by focusing on the key terms and exploring how they are both similar to and different from one another. Thus we will not concentrate first and foremost on the conflicting statements themselves but more on their constituent elements. In doing so we dissociate ourselves from the idea that in order to clarify the dispute key terms must have a clear meaning set in advance.

"*Spasticity*". "Heavy resistance exercise (31), irradiation (32), and the use of associated reactions and mass synergies (33) may be useful means of strengthening weak and unresponsive muscles, but should be avoided in the case of patients with upper motor

neuron lesions, i.e. in whom tonic reflexes are disinhibited and dominant to the total, or almost total, exclusion of every other pattern of co-ordination of posture and movement" (19, p. 60). In this quotation Bobath articulates the harmful consequences of strengthening exercises for patients with hemiplegia at one and same time with those of Brunnstrom's therapy. Both conventional muscle strengthening in the form of heavy resistance exercises and the use of "associated reactions" and "mass synergies" should be regarded as counter-productive in the treatment of patients with spasticity, as they would only "reinforce the few existing abnormally increased tonic reflexes and, with that, spasticity" (19, p. 60).

Does the above imply that although Brunnstrom focuses her training of patients with hemiplegia on movement patterns rather than on individual muscles, she ignores the harmful consequences of spasticity? We might be led to believe so, especially when we read the arguments Brunnstrom advances against the Bobath therapy. "According to these views, the patient must not be allowed to use the basic limb synergies of flexion and extension, nor must the effect of tonic neck reflexes and other attitudinal reflexes be evoked to facilitate or inhibit movement, but attempts must be made from the beginning to develop normal responses. The author has come to the opposite conclusion, namely, that during the early recovery stages the hemiplegic patient should be aided and encouraged to gain control of the basic limb synergies, and that for such purposes selected afferent stimuli of proprioceptive and exteroceptive origin are justified and advantageous" (18, pp. 3–4).

At first glance the "discouraging" vs. "encouraging" spasticity conflict might be appropriate when characterising the dispute. But when we consult the manuals of both therapies, and focus on the term "spasticity" to see what they have to say about it, it becomes clear that the contrast between the two approaches does not exactly correspond to the nature of the conflict. Although it is true that Bobath urges therapists to prevent "spasticity" by "special techniques of handling the patient, techniques which counteract the abnormal patterns of tonic reflex-activity" (19, p. 60), Brunnstrom's conclusion is not diametrically opposed to Bobath. On the contrary: her manual also contains bits of text advising thera-

pists to prevent and inhibit spasticity. She indicates, for example, that attention should be paid to the patient's bed posture by placing the hemiplegic limbs in the most favourable positions, i.e. "without interference by spastic muscles" (18, p. 57). The flexed hip-knee position is recommended, as it should have "an inhibitory effect on the extensor muscle of knee and ankle, thus counteracting the development of excessive uncontrolled tension in these muscles, a tension that would prove to hinder ambulation" (18, p. 58).

"*Basic limb synergies*". But if there is no real disagreement about the approach to "spasticity", what exactly is going on? To answer this question we not only have to examine the statements made about spasticity, but we also need to subject the term "spasticity" itself to careful examination by relating it to other key terms in the argument. It so happens that in both the books in question the term "spasticity" only partially has the same meaning. Where Bobath only uses the term "spastic" to qualify the nature of the movement patterns so typical for the movement repertoire of patients with hemiplegia, Brunnstrom uses two terms – "spasticity" and "basic limb synergy". This implies that before an answer can be given to the question of whether "spasticity" is a desirable or undesirable phenomenon in training of patients with hemiplegia we have to be clear about the sort of "spasticity" we are talking about.

In Bobath's language the answer is brief: she emphasizes that "spasticity is not confined to any one muscle or muscle group but is co-ordinated in definite synergetic patterns" (19, p. 60). Moreover she believes that more normal co-ordination cannot be obtained in patients with spastic hemiplegia, "as long as released tonic reflexes are active, evidenced by the abnormal postural patterns of extensor and flexor spasticity" (19, p. 60). The reason is that the spastic patterns result in exaggerated static function at the expense of dynamic postural control. Bobath tries to prevent this fixation in a few abnormal patterns of posture and movement by means of inhibition techniques. More normal movement patterns can then be facilitated. To put it briefly, Bobath regards the definite "patterns of flexion and extension spasticity" as undesirable phenomena in the training of patients

with hemiplegia, as their dominance stops the patients from employing more varied movement combinations.

More words are required in Brunnstrom's language, as she draws a distinction between "spasticity" and "basic limb synergy". "Spasticity" is described as "an excessive form of tension in muscles" in her texts and is thus regarded as an isolated characteristic of muscles. The "basic limb synergies of flexion and extension", on the other hand, are articulated in terms of mass flexion and extension patterns of movement (see quotation from Brunnstrom's text at the beginning of this section). Further analysis reveals that it is the "spasticity" – the excessive form of tension in muscles – that should be discouraged in the Brunnstrom therapy (for instance, with the help of specific postures in bed), and the "basic limb synergies of flexion and extension" that should be encouraged in early training.

This implies that neither "spasticity" in Brunnstrom's meaning of the word nor the "spastic patterns" in Bobath's definition are really the issue in this controversy. It is merely that Brunnstrom and Bobath disagree about how the basic limb synergies should be dealt with. Should they be discouraged or encouraged? Brunnstrom argues as follows: "Far from preventing further improvement, the synergies appear to constitute a necessary intermediate stage for further recovery" (18, p. 4). This "necessary intermediate stage" in which the basic limb synergies are trained is, according to Bobath, counter-productive. Movement in terms of mass flexion and extension synergies should be prevented immediately following the onset of hemiplegia, because they will reinforce the spastic patterns of posture and movement and thus counteract improvement in function.

Unlearning mass synergies

In the hope of coming across terms which will enable us to describe the conflict more accurately let us now look more closely at what Brunnstrom refers to as the "intermediate stage" by focusing on the techniques that she developed in order to train the basic limb synergies. In so doing we also assume that words and techniques mutually inform one another within a particular discourse.

"*Selected afferent stimuli*". Brunnstrom indicates that during this intermediate stage therapists have to assist hemiplegic patients in achieving mastery over their basic limb synergies – and to that end all kinds of techniques are justified. According to Brunnstrom the "intermediate stage" covers the period following the onset of hemiplegia, when the originally flaccid condition comes to an end (stage 1) and spasticity begins to develop (stage 2), and then reaches its height (stage 3). In stage 1, therapists have to evoke the basic limb synergies in the hemiplegic side by applying selected resistance exercises to the non-hemiplegic side. The patient is, for instance, asked to bend his "sound" arm against resistance employed by the physiotherapist, as a consequence of which a mass flexion synergy has to emerge in the flaccid arm. Therapists can also make use of the facilitatory effect of tonic neck reflexes to evoke a flexion or extension synergy in the upper limb, such as the asymmetric tonic neck reflex, by asking the patient to turn his head in a forceful way towards or away from the hemiplegic side. This means that whereas in conventional training muscle-strengthening resistances were applied against individual joint movements in the hemiplegic side, Brunnstrom recommends that therapists apply selected resistance against joint movements of the patient's non-hemiplegic side.

During this first stage of recovery therapists are thus urged to evoke basic limb synergies in a reflexive manner. This means that patients carry out the synergies without any intrusion on the part of their own will. In this first stage the patient can be compared to a puppet, obliged to react to certain stimuli. However, a patient differs from a puppet in that at a later stage he can apply himself consciously to the movement. Instead of letting this stereotypical movement simply happen, he can – albeit with the help of certain stimuli – perform an intentional movement. He can imagine that a free reaction is involved. And this is what is stimulated in the second stage of recovery. To quote Brunnstrom: "Semivoluntary movements may then materialize from an interaction of reflex and voluntary impulses, and the patient experiences the sensation and satisfaction that accompanies a voluntary muscular contraction" (18, p. 8). However, it is not possible to speak of a volun-

tary movement in Brunnstrom's language until the basic synergies can be initiated solely through the patient's will. It is then that the patient has reached the third stage of recovery.

Brunnstrom refers to these first three recovery stages as "intermediate", because once patients have gained control over the basic limb synergies therapists have to assist them in effecting movement combinations which deviate from the gross limb synergies. "When a patient progresses beyond stage three, spasticity begins to decrease, and some movement combinations that deviate from the basic limb synergies become available" (18, p. 45). Patients are, for instance, trained to deviate from the path of the flexor synergy by inhibiting strong shoulder components such as abduction. The instruction can be that the patient has to bring his hand to his mouth while pressing his elbow firmly to the side of his body. In addition, other flexor activities should be trained such as hand to chin, hand to ear, hand to opposite elbow, and so on.

Thus during the earliest stages of recovery, the basic limb synergies are, as far as Brunnstrom is concerned, desirable movements that should be stimulated. In the final stages, however, therapists have to assist patients in ridding themselves of the dominance of these synergies over their movement performance by inhibiting strong components of the limb synergies and facilitating movement combinations that deviate from these overall patterns. On the other hand, immediately following the onset of hemiplegia, Bobath applies reflex-inhibiting movements in an attempt to prevent patients getting use to what are, in her opinion, limited patterns of movement and posture. The movements must not only inhibit abnormal reflex activity but also facilitate normal automatic and voluntary movement. Thus, it is not so much that Brunnstrom and Bobath's therapies are completely opposed, but that the contradictory recommendations for treatment refer primarily to what Brunnstrom calls the early recovery stages.

"Association reaction" and "association movement". Brunnstrom labels the basic limb synergies that are reflexively evoked in the patient's hemiplegic side in the early recovery stages as "association reactions". In Bobath's book there are also passages discussing

the phenomenon of "association reaction". Both authors refer to Walshe's definition (34): this describes association reactions as tonic reflexes, "i.e. released postural reactions in muscles deprived of voluntary control" (18, p. 24; 19, p. 8). The only difference is that as far as Bobath is concerned all such reactions are undesirable as they "produce a widespread increase of spasticity throughout the affected side, which issues in an accentuation of the hemiplegic attitude" (19, p. 9), whereas as far as Brunnstrom is concerned they are desirable in early training. Could it be that in the term "association reaction" we have found a term suitable as an aid to describing the conflict in question?

At first glance it might seem that an "association reaction" means the same in both languages. But this is not the case. In fact the term derives its meaning from the term "association movement". In their work both Brunnstrom and Bobath once again refer to different phenomena when they speak of an "association movement". In Brunnstrom's work an "association movement" refers to the same basic limb synergies as an association reaction does, except for the fact that an "association movement" involves the human will while an association reaction does not. In other words, Brunnstrom distinguishes an "association movement" from an "association reaction" along the voluntary/involuntary axis. The following quotation says it all: "As long as the limb synergies are dominant, voluntary and associated movements are likely to have identical shapes, and both are manifestations of primitive movement patterns" (18, p. 8).

By way of contrast, in Bobath's writings an association reaction is distinguished from association movement in order to indicate that the former is an abnormal phenomenon and the latter normal. Bobath writes in this context that "associated movements are normal and well co-ordinated" (18, p. 8). It so happens that an "association movement" can be observed in healthy young children and adults and also on the hemiplegic patient's unaffected side when new or difficult tasks are being learnt. An "association reaction", however, manifests itself in hemiplegic patients' affected side when they make voluntary forceful movements in other parts of the body. To prevent the manifestation of association

reactions patients should not use any part of their body with excessive effort, according to Bobath.

A common definition of the term “association reaction”, therefore, does not help us in clarifying the Brunnstrom/Bobath controversy. Although the difference between Brunnstrom and Bobath does not stem from the fact that they both use the term “association reaction” to designate different movements, it appears that this term is linked up to – and informed by – other phenomena and other sets of events. Brunnstrom regards it as an element in the chain of events necessary for recovery, which is why she encourages association reactions and movements by means of selected stimuli of exteroceptive and proprioceptive origin. Bobath, on the other hand, advocates prevention of them by exposing the patient as little as possible to those stimuli that provoke them, because they are abnormal and may thus counteract recovery. However, the “associated movements” in her meaning of the term need not to be counteracted by the therapist since patients can stop them at will.

But the fact that Bobath refuses to speak of recovery of function in a hemiplegic patient who is learning flexion and extension synergies does not signify a refusal to accept that Brunnstrom’s stimulation techniques may help patients to encourage the limb synergies. On the contrary, experience shows that synergies of this kind occur only too readily in hemiplegia patients. What Bobath does object to is the assumption that movement in the form of basic synergies is a *sine qua non* of further improvement. In Bobath’s view the stimulation of basic limb synergies is the very thing that prevents further improvement. The crucial question, therefore, is not whether patients with hemiplegia can learn to make the stereotypical flexion and extension movements on their own, but rather to what extent they can unlearn them once they have made themselves familiar with moving in these synergies.

Different motor and developmental theories

Thus far we have shown how different ways of talking and writing about the movement problems of patients with hemiplegia are related to the different actions being undertaken. However, it is not only words and techniques that interdefine one another in

a discourse; theories can also play this type of informing role. Identifying the theoretical notions and unravelling how they co-constitute the languages under examination may also be helpful in clarifying the dispute. Here we will explore and compare the different ways in which several theoretical notions co-construct the content of the Brunnstrom and the Bobath discourse. In doing so we take theories, just like techniques, as one of the ordering elements within a discourse.

An ontogenetic theory. In both Bobath and Brunnstrom’s textbooks there are many passages in which an inherent theory about a hierarchical organization of the nervous system is present. This type of theory assumes that higher centres are normally in command of lower centres, which in turn control primitive and more automatic behaviour (35). Lesions in the brain, such as those following a stroke, prevent the higher cortical centres from controlling centres on a lower level. As a result the lower level movements occur in a released exaggerated form. Bobath, for example, argues along such lines when she explains the cause of spasticity: “Spasticity is caused by the release of an abnormal postural reflex mechanism which results in exaggerated static function at the expense of dynamic postural control” (19, p. 13). And Brunnstrom adopts a similar line by arguing that: “When the influence of higher centres is temporarily or permanently interfered with, normal reflexes become exaggerated and so-called pathological reflexes appear” (18, p. 3).

But if it is true that a hierarchical theory of motor control forms the basis of the Bobath as well as the Brunnstrom therapy, as it has so often been articulated (35–39), how can we then explain their conflicting treatment recommendations? In other words, how can we explain that Bobath wants us to suppress the exaggerated spastic patterns right from the start and Brunnstrom recommends that we evoke the basic limb synergies in early training? Closer examination reveals that both textbooks not only have a hierarchical theory of the nervous system in common but also contain diverging theoretical notions of motor development and motor learning. And it is these latter notions which appear to be partially responsible for the conflicting treatment recommendations. Let me illustrate this.

In her writings Bobath indicates that a “normal postural reflex mechanism” – which consists of a great many and widely varying automatic movements such as righting reactions and equilibrium reactions – forms the necessary background for normal movements and functional skills. Such a postural reflex mechanism, which gradually develops “with the maturation of the infantile brain” (19, p. 3), is essential in the building up of motor patterns for adult life. Knowledge of normal motor development in infancy is therefore useful for understanding the exaggerated pathological patterns of posture and movement in adults with hemiplegia. “Instead of a normal postural tone we find spasticity; instead of normal reciprocal innervation we find exaggerated co-contraction; and instead of normal co-ordination of righting, equilibrium, and other protective reactions such as protective extension of the arm against falling, we find a few static and stereotyped postural patterns” (19, p. 7). This pathological postural reflex mechanism should be counteracted right from the onset of hemiplegia, according to Bobath.

Inspired by Magnus’s “shunting rule” (40,41) Bobath attempted to inhibit “the outflow of excitation into the established ‘shunts’, i.e. synaptic chains of the spastic patterns” (19, p. 15), by changing the relative positions of parts of the body and limbs when handling the patient. By seizing upon these so-called “key points of control” therapists should teach hemiplegic patients to avoid falling into spastic patterns, break them up and re-synthesize them in different combinations for functional use. Thus it is believed that the established shunts (or synaptic chains of spastic patterns) can be redirected “into channels of the higher integrated patterns of more normal movement co-ordination” (19, p. 15). So Bobath’s hierarchical theory of motor control appears to be linked to an ontogenetic theory of motor development and a “shunting” theory of motor learning.

A phylogenetic theory. By way of contrast, Brunnstrom indicates that the so-called pathological reflexes were present during a certain phylogenetic period and may therefore be considered “normal” when, in spastic hemiplegia, that portion of the central nervous system which regulates motor re-

sponses has reverted to an earlier developmental stage. Influenced by work of the neurologist Hughlings Jackson (42), she suggests that although neurophysiologists of today may not in every respect subscribe to Jackson’s ideas, his theoretical notions nevertheless give a rather elementary explanation of the neuropathology of patients with lesions in the upper motor neuron. Jackson’s explanation is that the nervous system of patients with brain damage reverts to a lower level of evolution, which is why they perform mainly automatic movements, which allows for very few combined movements. “A dissolution of the nervous system, which may be expressed as evolution in reverse, has taken place” (18, p. 8). The basic limb synergies are therefore seen as “primitive spinal cord patterns which have been retained throughout the evolutionary process” (18, p. 3). While in normal man these primitive movement patterns are modified through the higher centres in a multitude of ways, they retain their primitive stereotyped character in patients following a stroke.

In line with this theory of motor development informed by phylogenesis, Brunnstrom takes motor learning as a process that runs from primitive to more developed, i.e. the patient has first to master the primitive stage before being capable of attaining a higher level. Damage to the brain has caused the patient to regress to a primitive stage of development and (s)he has again to go through the whole process of development in order to achieve recovery. Control over the basic limb synergies is, therefore, seen as a necessary interim stage on the road to recovery and motor learning as a matter of superimposing developed movement patterns on primitive ones.

But it is not only the phylogenetic approach that informs Brunnstrom’s discourse: she also collected data based on empirical observation of the patients’ natural recovery process, data which supported the notion that recovery takes a path characterized initially by overwhelming dominance on the part of the basic synergies followed by a reduction of their influence and finally independence from them (35,43). In theory Brunnstrom assumes that despite the fact that “spasticity” occurs sooner or later in hemiplegic patients, it remains a temporary problem, i.e. it increases during the early recovery stages and decreases during the later ones. Patients following a

stroke who have achieved the final recovery stages are proof of this. However, practice taught her that there are only a few patients who achieve a total cure. Many remained stuck at one of the stages of recovery, mainly patients with a particularly stubborn form of spasticity. "Severely involved patients may remain indefinitely in a stage that allows for few movement combinations only" (18, p. 8).

Thus Brunnstrom has a particular category of patients in mind when she seeks evidence for her treatment view, namely those patients that have reached the final three recovery stages. Does Bobath have a similar category of stroke patients in mind for her treatment recommendations? It does not seem so, for Bobath tends to find support for her treatment largely as a result of experience with patients whose recovery came to a halt. "It has even be found possible to improve gait and balance, and the use of the arm, in many patients with longstanding residual hemiplegia, though function of the hand has been found possible only in those patients who had no, or little sensory deficit" (19, p. 59). Experience with long-standing residual hemiplegia revealed the existence of the unsuspected and untapped potential in patients affected sides, which short-term compensatory rehabilitation did not at all touch. Thus by seizing on key points of control of the body of patients who could make a few movement combinations only, Bobath experienced that she could get more normal activity out of their affected sides. That is why she believes that quicker and better results can be obtained if therapists train patients in the early stages of recovery to avoid falling into definite patterns of spasticity.

CONCLUSION

Comparing the languages used by both sides to describe their treatment views turns out to be an interesting way of tracking down essential differences between the two. An initial comparison between Brunnstrom's language and that used by Bobath provided us with some information. The key terms used in each language turned out not to correspond completely, which led to different lines of separation being drawn between the phenomena. A second comparison in which the techniques were taken into account also showed that in both languages the

words are related one to another in a different way. And a third attempt – in which different theoretical notions were the focus of attention – showed that both languages are informed by diverging theories of motor development and motor learning, and also by different subgroups of patients.

Now I will focus attention on a fourth interesting difference in which both therapies under scrutiny divide up their therapeutic reality: Brunnstrom employs the distinction between "primitive" and "developed" in order to classify the abnormal movement behaviour of the hemiplegic side, while Bobath speaks of a distinction between "pathological" and "normal". These two separate themes can, in one way or another, be found in the three different examples already discussed.

The first example is this: "spasticity" – or, better, "patterns of spasticity" – appears to be the core concept in Bobath's therapy, while in Brunnstrom's therapy the core concept is constituted by "the basic limb synergies of flexion and extension". "Spasticity" has a negative connotation in the Bobath discourse. Its manifestation in definite flexion and extension patterns of posture and movement is seen as pathological, something that has to be counteracted using inhibition techniques before more normal movement patterns can be facilitated. Conversely, in the Brunnstrom discourse the core concept "basic limb synergy" has a positive connotation: the basic synergies of flexion and extension have to be encouraged with the help of stimulation techniques because they are seen as primitive movement patterns that first have to be brought to full maturity before the patient is capable of making more developed movements.

The second example, which has to do with the dichotomy between "association reaction" and "association movement", brings the different modes of ordering more explicitly into the spotlight. In Brunnstrom's discourse both "association reactions" and "association movements" occur in a stroke patient's hemiplegic side. The difference is that an "association reaction" is involuntary or reflexive in character and is therefore regarded as a more primitive movement than a voluntarily initiated – thus more developed – "association movement". Bobath, by way of contrast, qualifies an "association

reaction” as a pathological phenomenon in the patient’s movement behaviour and, in turn, an “association movement” as a normal phenomenon that occurs in healthy subjects and on the non-hemiplegic side of subjects following stroke. This implies that although whenever either Bobath or Brunnstrom uses the term “association reaction”, they may be referring to the same movement, the term itself is part of two different stories and two different sets of events.

A third example of such an attempt at creating order can be found in their informing theories. Brunnstrom supports the view that treatment should imitate “evolution in reverse”, by superimposing developed motor behaviour on primitive behaviour, whereas Bobath urges therapists to bypass this intermediate stage by suppressing the pathological spastic patterns and training normal patterns immediately after the onset of hemiplegia.

DISCUSSION

By taking as a mode of entry into this study the vocabularies used by Brunnstrom and Bobath to describe their preferred movement therapies for patients with stroke-induced hemiplegia, we have obtained greater insight into the controversy surrounding the two authors’ methods. On the surface it seems as if the conflict is all about diametrically opposed treatment views. This analysis has shown that it is not so much the treatments that are completely opposed but that the contradictory recommendations for treatment refer only to what Brunnstrom calls the early recovery stages. In fact, Brunnstrom believes that one can speak of recovery of movement if a patient can master the primitive limb synergies, while for Bobath there is no question of recovery unless a patient can make movements that deviate from the primitive mass flexion and extension synergies.

This analysis also indicates that it is not the hierarchical theory of motor control that should be held responsible for the conflicting treatment recommendations but rather their diverging learning theories. This means that Brunnstrom and Bobath mainly disagree on the question of whether or not adults with hemiplegia are able to unlearn the mass flexion and extension synergies of the limbs once they have been trained to use them. And the realization that

Brunnstrom developed her movement therapy largely on the basis of experience gained with patients who recovered spontaneously, while Bobath mainly took as her examples the patients whose spontaneous recovery came to a halt, means that recommendations for treatment made by either party may be effective for different categories of hemiplegic patients.

These insights may help effectiveness researchers to articulate a clear theory about the differences in outcome that might be expected when a Brunnstrom therapy is compared with a Bobath therapy (44). The choice can then be made for outcome measures and criteria of inclusion and exclusion that are tailored to specific therapeutic points of contention. In addition these insights may help practising therapists to enhance professional communication, i.e. not by appealing to a standardized language outside this very practice itself (such as in international health care classifications) but by identifying and specifying crucial differences between languages within this very practice. For example, many key terms employed in Brunnstrom’s and Bobath’s textbooks to articulate their disagreements may appear to be the same but they are, in fact, assigned a wholly or partially different meaning and they also form part of radically different classifications. Standard classifications such as the ICDH may easily skip over everything that is shown to be different between both therapies and would therefore be more likely to obscure rather than clear up the controversy.

I hope to have demonstrated that by unravelling the tangles of vocabularies, techniques, goals and theoretical notions within competing therapies and contrasting them, it is possible to cast a different light on perceived diversity in physiotherapy practice and research. This does, however, not imply that an analytical approach of this kind will cause the problems that exist between various views on treatment in physiotherapy to vanish. But at least it is possible to formulate the problems in a different way, or to propose alternative problems to those already encountered. With respect to the Brunnstrom/Bobath controversy, for instance, instead of arguing about spasticity or mass synergies, professionals can pass on to a constructive discussion about the consequences of ordering the treatable factors and treat-

ment goals of movement therapy for patients with hemiplegia in terms of primitive/developed and pathological/normal. Participants could ask themselves to what extent and in what way the ordering attempts involved can promote or hinder therapeutic innovation on the part of stroke rehabilitation.

NOTES

1. In his philosophical work Foucault calls the central position of the individual subject in Western thinking into question. In doing so he challenges the ideas of phenomenological and existentialistic inspired philosophers (20,23,25).
2. See for content analyses of more contemporary approaches to treatment of stroke patients (26,27).
3. Bobath also voiced objections to other conventional therapies, including the "method of compensatory rehabilitation". See for a comparative analysis of compensatory and facilitation approaches to treatment of stroke patients (30).

ACKNOWLEDGEMENTS

This article is a revised version of chapter 2 of my PhD thesis, "Diversity in neurological physiotherapy: a comparative analysis of clinical and scientific practices", University of Groningen, 2000. My supervisors Prof. Dr. P. J. M. Helders, Prof. Dr. P. Rispen and Prof. Dr. A. Mol are gratefully acknowledged for helpful criticism and comments.

REFERENCES

1. Mathiowetz V, Haugen JB. Motor behaviour research: implications for therapeutic approaches to central nervous system dysfunction. *Am J Occup Ther* 1994;48:733–45.
2. Ashburn A. A review of current physiotherapy in the management of stroke. In: Harrison MA (ed). *Physiotherapy in stroke management*. Edinburgh: Churchill Livingstone, 1995:3–22.
3. Farrell JP, Jensen GM. Manual therapy: a critical assessment of role in the profession of physical therapy. *Phys Ther* 1992;72:843–52.
4. Wenger NK. Cardiovascular conditions. In: Fuhrer MJ, editor. *Assessing medical rehabilitation practices: the promise of outcomes research*. Baltimore, Maryland: Paul H. Brookes Publishing Co, 1997:347–66.
5. Logigian MK, Samuels MA, Falconer J, Zager R. Clinical exercise trial for stroke patients. *Arch Phys Med Rehabil* 1983;64:364–7.
6. Dickstein R, Hocherman S, Pillar T, Shaham R. Stroke rehabilitation; three exercise therapy approaches. *Phys Ther* 1986;66:1233–8.
7. Wagenaar RC, Meijer OG, van Wieringen PCW, et al. The functional recovery after stroke: a comparison between Neuro Developmental Treatment and the Brunnstrom-method. *Scand J Rehabil Med* 1990;22:1–7.
8. Langhammer B, Stanghelle JK. Bobath or Motor Relearning Programme? A comparison of two different approaches of physiotherapy in stroke rehabilitation: a randomised controlled study. *Clin Rehabil* 2000;14:361–9.
9. Ashburn A, Partridge C, DeSouza L. Physiotherapy in the rehabilitation of stroke: a review. *Clin Rehabil* 1993;7:337–45.
10. Keith RA, Lipsey MW. The role of theory in rehabilitation assessment, treatment and outcomes. In: Glueckauf R, editor. *Improving assessment in rehabilitation and health*. California: Sage Publications Inc, 1993:33–58.
11. Lettinga AT. Chen and the art of bridging gaps: about the foundations and pillars of theory-driven evaluation. In: Bos JG, Hendrickx HME, Reynders K, Schäperclaus GA, editors. *Terugblikken en vooruitzien*. Groningen: Stichting Kinderstudies, 1994:7–18.
12. Johnston MV, Stineman M, Velozo CA. Outcomes research in medical rehabilitation: foundations from the past and directions for the future. In: Fuhrer MJ, editor. *Assessing medical rehabilitation practices: the promise of outcomes research*. Baltimore, Maryland: Paul H. Brookes Publishing Co, 1997:1–41.

13. Keith RA. The role of treatment theory. In: Fuhrer MJ, editor. *Assessing medical rehabilitation practices: the promise of outcomes research*. Baltimore, Maryland: Paul H. Brookes Publishing Co, 1997:257–74.
14. Keith RA. Treatment strength in rehabilitation. *Arch Phys Med Rehabil* 1997;78:1298–1304.
15. Rose JR. Description and classification – the cornerstones of pathokinesiological research. *Phys Ther* 1986;3:379–81.
16. Heerkens YF, Brandsma JW, Lakerveld-Heyl K, van Ravensberg CD. Impairments and disabilities – the difference: proposal for adjustment of the international classification of impairments, disabilities and handicaps. *Phys Ther* 1994;74:430–42.
17. Jette AM. Physical disablement concepts for physical therapy research and clinical practice. *Phys Ther* 1994;74:380–6.
18. Brunnstrom S. *Movement therapy in hemiplegia: a neurophysiological approach*. Hagerstown: Harper and Row, 1970.
19. Bobath B. *Adult hemiplegia: evaluation and treatment*, second edition. London: William Heinemann Medical Books, 1978.
20. Foucault M. *The birth of the clinic: archaeology of medical perception*. New York, Vintage Books Edition, 1975 (originally published as: *La naissance de la clinique*, Presses Universitaires de France, 1963).
21. Latour B, Woolgar S. *Laboratory life: the construction of scientific facts*. Princeton, New Jersey: Princeton University Press, 1986.
22. Latour B. *The pasteurisation of France*. Cambridge, Massachusetts and London, England: Harvard University Press, 1989 (originally published as: *Les microbes*, Metaillé, Paris, 1984).
23. Mol A, Lieshout P van. *Ziek is het woord niet. Medicalisering, normalisering en de veranderende taal van de huisartsen geneeskunde en geestelijke gezondheidszorg, 1945–1985*. Nijmegen: SUN, 1989.
24. Berg M, Mol A. *Differences in medicine: unravelling practices, techniques and bodies*. Durham and London: Duke University Press, 1998.
25. Kendall G, Wickham G. *Using Foucault's methods: introducing qualitative methods*. London: Sage Publications, 1999.
26. Lettinga AT, Siemonsma PC, van Veen M. Entwinement of theory and practice in physiotherapy: a comparative analysis of two approaches to hemiplegia in physiotherapy. *Physiotherapy* 1999;85:476–90.
27. Lettinga AT, Mol A. Clinical specificity and the non-generalities of science: on innovation strategies in neurological physiotherapy. *Theor Med Bioethics* 1999;20:517–35.
28. Twitchell TE. The restoration of motor function following hemiplegia in man. *Brain* 1951;74:443.
29. Bobath B. *Adult hemiplegia: evaluation and treatment*, third edition. London: William Heinemann Medical Books, 1990.
30. Lettinga AT, Mol A, Helders PJM, Rispens P. Differentiation as a qualitative research strategy: a comparative analysis of Bobath and Brunnstrom approaches to treatment of stroke patients. *Physiotherapy* 1997;83:538–46.
31. Walters CE. Interaction of the body and its segments. *Am J Phys Med* 1967;46:1.
32. Knott M. Introduction to and philosophy of neuromuscular facilitation. *Physiotherapy* 1967;53:1–2.
33. Brunnstrom S. Associated reactions of the upper extremity in adult patients with hemiplegia. *Phys Ther Rev* 1956;35:4.
34. Walsche FMR. On certain tonic or postural reflexes in hemiplegia with special reference to the so-called “associated movements”. *Brain* 1923;46:2–33.
35. Gordon J. Assumptions underlying physical therapy intervention: theoretical and historical perspectives. In: Carr JH, Shepherd RB, editors. *Movement science, foundations for physical therapy in*

rehabilitation. Rockville, Maryland: Aspen Publishers, Inc., 1987:1–31.

36. Keshner EA. Re-evaluating the theoretical model underlying the neurodevelopmental theory. *Phys Ther* 1981;61:1035–40.

37. Held JM. Recovery of function after brain damage: theoretical implications for therapeutic intervention. In: Carr JH, Shepherd RB, editors. *Movement science, foundations for physical therapy in rehabilitation*. Rockville, Maryland: Aspen Publishers, Inc., 1987:155–77.

38. Smith RH, Sharpe M. Brunnstrom therapy: is it still relevant to stroke rehabilitation? *Physiother Theory Practice* 1994;10:87–94.

39. Lennon S. The Bobath concept: a critical review of the theoretical assumptions that guide physiotherapy practice in stroke rehabilitation. *Phys Ther Rev* 1996;1:35–45.

40. Magnus R. *Körperstellung*. Berlin: Julius Springer, 1924.

41. Magnus R. Some results of studies in the physiology of posture. *Lancet* 1926;531–6:585–8.

42. Jackson JH. Evolution and dissolution of the nervous system, 1884. In: Taylor J, editor. *Selected writings of John Hughlings Jackson*. New York: Basic Books, 1858:45–75.

43. Brunnstrom S. Motor testing procedures in hemiplegia. *Phys Ther* 1966;46:357–75.

44. Lettinga AT, Reynders K, Mulder Th, Mol A. Pitfalls in effectiveness research: a comparative analysis of treatment goals and outcome measures. *Clin Rehabil*, 2002;16:125–32.

ADDRESS FOR CORRESPONDENCE:

Ant T. Lettinga
Institute of Human Movement Sciences
University of Groningen
P O Box 196
NL-9700 AD Groningen
The Netherlands
Tel: + 31-50-3632610
Fax: + 31-50-3633150
E-mail: A.T.Lettinga@ppsw.rug.nl

Submitted May 21, 2001;
accepted for publication 15 October 2001