A PROPOSED SYSTEM FOR THE TEACHING OR RE-LEARNING OF GRAPHIC SYMBOLS

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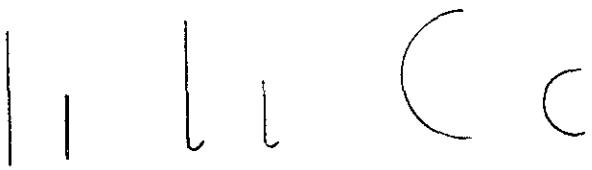
This paper presents a system whereby all capital and lower case letters, together with all numerical symbols, can be constructed from these three shapes: —



Observation of mentally subnormal children suggests that many pass through a stage where the writing of single letters or figures holds a considerable attraction for them. Such children may take a symbol and scrawl it repeatedly over a page. Usually the shapes chosen are the simpler ones, as for instance capitals T, C, L, or O, etc. Often this is more than mere patterning, the children may know the name of the letter that they have written, and even represent it as their signature.

These processes remind one of the stages passed through by the normal child in acquiring spoken language, namely the repetition of sounds, sound combinations and finally simple words, and it is as an attempt to foster and develop this joy in elementary writing that the present system has been evolved. It is suggested that such a system may be found relevant to the following teaching or clinical situations—

1. Teaching writing to mentally subnormal individuals.
2. Helping dyslexic children of otherwise normal intelligence to appreciate letter and number forms.
3. Re-building kinaesthetic patterns for patients with an acquired dysgraphia.
4. Teaching 'sighted' letter and number symbols to the congenitally blind.

The understanding and use of spoken language is, under normal circumstances, brought about by the recognition and understanding of an auditory pattern, and the ability to formulate and project an auditory pattern. In short there is a receptive and an executive side to spoken language. In the same way, reading and writing may be regarded respectively as the receptive and executive sides of written language; thus in setting out to teach or re-establish writing skills, we are involving ourselves in the problems of reading.

The teaching of sighted symbols to the congenitally blind may at first appear an irrelevant side issue, but in fact this is not so. It is a common practice to let blind children feel the shapes of sighted letters and numbers, either by means of solid models, or by having them explore the shapes raised in relief on thick paper, and thereby build up in their minds some kind of mental image of the visual symbols used by those with sight. Montessori's work at the beginning of this century shows the importance of getting sighted children to feel shapes as well as look at them, and recent experiments by Wexler in teaching blind children have also suggested that many of these principles may be applied with advantage to individuals who have sight.

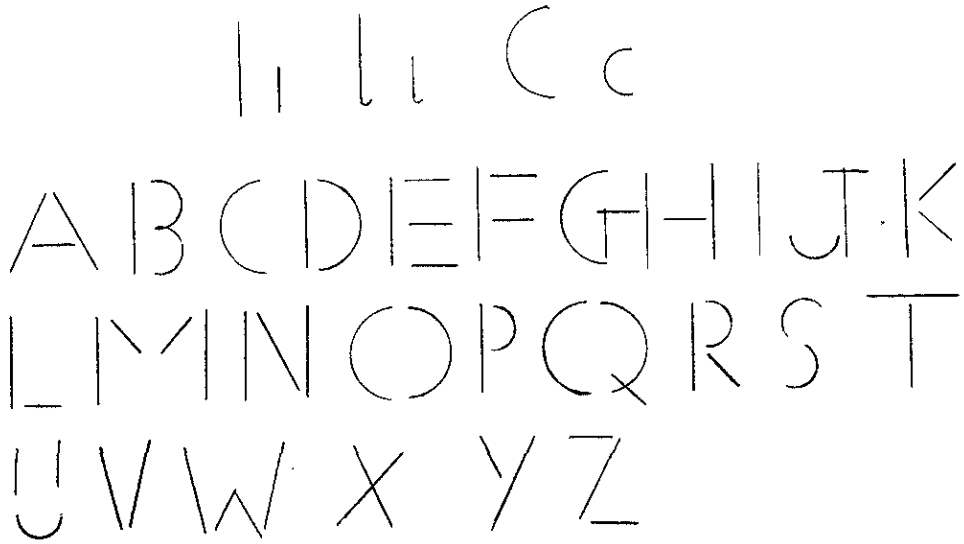


Fig. 1. Static patterns

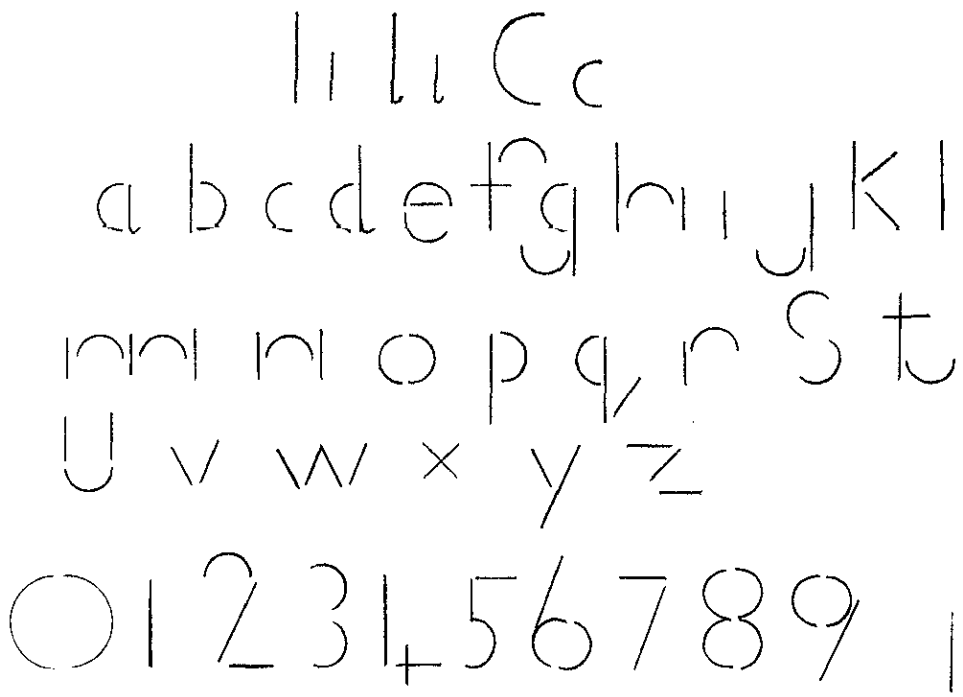


Fig. 2. Static patterns

The System

The system submitted here falls into two main stages: the building of letters and numbers from very simple cut-out models (static patterns), and secondly, the writing of simple shapes (kinetic patterns) which may gradually be synthesized into normal letter or number forms. The two sets of patterns are closely related to each other; in some instances the latter are no more than the moving counterparts of the former, in others they are but slight modifications of them. In many cases the first stage is an introduction to the second, but this is not always found to be necessary. Often the two will run concurrently, and in some instances it is even better to start at stage two and omit the static patterns altogether. It is also frequently unnecessary to submit the pupil or patient to an entire stage; whatever is relevant for a particular individual may be extracted from the general system.

Stage one: work with static patterns (Figs 1 and 2)

It is found that all capital and lower case letters together with all figures are derived from a set of three simple shapes; these are: the straight line, the straight line with a small hook, and, thirdly, the half-circle. There is a large and a small size to each shape, the large one being twice the size of the small except in its width where it remains the same. The proportions selected for our experiments were as follows:—

Long straight line (with and without hook) 20 cms. long, 1 cm. wide

Short straight line (with and without hook) 10 cms. long, 1 cm. wide

Large half-circle 20 cms. diameter and 'circumference' width of 1 cm.

Small half circle 10 cms. diameter and 'circumference' width of 1 cm.

No provision was made for the dot above the lower case 'i' or 'j'.

A number of these shapes was cut out from this plastic, and later, for the sake of economy, from cardboard. The shapes were painted scarlet on one side and a strong bright blue on the other. Two small pads of velcro were stuck on one side of some of these models, and a wooden board of 2 x 1½ft. was painted black with parallel strips of velcro stuck on one of its surfaces. Velcro is a modern synthetic substance produced in rolls about one inch wide and resembling thick tape. It consists of two strips, the inner side of one strip hooking firmly to the inner side of the other. The two surfaces are dissimilar, and lock together in much the same way that a burr clings to a piece of cloth; however a firm pull will separate them. Thus a shape may be attached to the board by means of its velcro pads and so enable a child to explore its contour and direction with his finger without dislodging the pattern from its position.

Practice drills in the use of static patterns

Work with static patterns is suitable for mentally subnormal individuals, dyslexics of normal intelligence and the congenitally blind. For example the teacher may construct a symbol from the shapes, and the pupil follow by:—

1. Building his own model stage by stage as the teacher builds his.

2. Building his own model while keeping in view (or, as in the case of the congenitally blind, in touch) the teacher's completed model which he may or may not have examined during its assembly.

3. Laying his model on top of that constructed by the teacher.

4. Moving his fingers purposefully down the contours of the symbol that either he or the teacher has constructed and fastened to the velcro board.

When a letter has been constructed in this way, it can then be either named or given its phonetic sound; a figure can be named and linked with the number of beads etc. that it represents. By these means 'recognition' of a symbol passes into that stage known as 'recall', and the pupil is able to reproduce any symbol required of him.

Montessori emphasised the importance of 'the tactile sense' in learning visual shapes. Her method however built up a kinaesthetic sense as well as a mere tactile one. Her children learnt the shapes of letters by moving a finger down the outline of a letter cut out in sandpaper and stuck on to a card. Wexler found that neither he nor one of his blind students was able to identify simple shapes bent out of wire and pressed on to the skin. Moreover his student also failed to recognise the shapes when moving his finger tips over the edges of them. However both experimenters were able to recognise the shapes when drawn on the backs of their hands by someone else's finger. Wexler also reports: "My youngest grandchild at the age of 4, who knew her letters by sight only, could recognise these when drawn on her back or even on the sole of her foot, and enjoyed this as a game". Experiments carried out in this hospital will be described later in this paper, but they have also shown that it is a comparatively simple matter for a congenitally blind person to recognise the shapes of letters when drawn on the back of the hand. This is in line with Wexler's findings, but unlike him, we have managed to get this same patient to learn and later to recognise letter shapes and number shapes when she moves her finger round the contours of a symbol cut out in sandpaper. It is probable that the clear recognition of a pattern depends upon the way that it was originally learnt, and that what is important is systematic movement as opposed to mere handling. Thus when Montessori got her children to move their fingers over the sandpaper letters *in the way in which they would eventually come to write those letters,* she was, in effect, teaching both reading and writing, i.e. the recognition of the visual symbol and the movement pattern of its written form, and thereby showing the close interdependence of the receptive and executive aspects of written language. This method of simplified shapes makes use of a similar technique to that of Montessori; the pupil is encouraged to trace out with his finger the shape, and later the complete letter made from several shapes, when they are secured to the velcro board; but he is not permitted to trace the shape or shapes in any way that he chooses. He is made to trace them in the way that he will come to write them when he takes up his pen; hence normal and consistent kinaesthetic habits are built up, and these, because of their unchanging repetition, serve to reinforce the visual memory of a particular symbol. Naturally when the pupil has no sight, everything depends on the development of a highly skilled kinaesthetic sense.

Before leaving this description of stage one, there are two details in presentation which add greatly to the clear recognition of any particular symbol. Firstly, spacing: in order to underline the fact that a seemingly complicated symbol is nothing more than simple combinations from a possible choice of three shapes, these static patterns may be set in such a way that they just fail to approximate to each other; thus the whole is split into its components. For instance the lower case 'd' could be shown like this *d* and the pattern copied with the shapes and then traced with the finger. This was the method that we used in the early stages of teaching our congenitally blind patient to recognise letter and number shapes. Once she realised that she was not faced with having to learn 26 different shapes, but merely various combinations of three shapes, each of which had only two sizes, learning the capital letters of the sighted alphabet no longer seemed to her such a formidable task. The second point in presentation is the use of two colours. It will be remembered that the static shapes were scarlet on the one side and blue on the other, and this gives

us yet another way of showing that a symbol may be split up into smaller and more comprehensive units. Thus the lower case 'd' may be fashioned from a blue half-circle and a red straight line with a hook. Reinhold, describing treatment for dyslexic children with laterality difficulties, points out the need for "Some trick of remembering right and left . . . A mark on the hand or a watch, a piece of thread or an object in the trouser pocket may serve". Such mnemonics could be linked with the building of bi-coloured symbols; e.g. *R*—ed thread in *R*—ight pocket, *BL*—ue thread in *L*—eft pocket, and so lower case 'b' and 'p' are made with red half-circles (because of the right hand pocket) and blue straight lines; similarly lower case 'd' and 'q' are made with blue half-circles and red straight lines, the former having a red straight line with a hook. These ideas would then be reinforced kinaesthetically by finger tracing the static shapes, and by practice over a considerable period in the use of the kinetic shapes.

Stage two: work with kinetic patterns, (fig. 3)

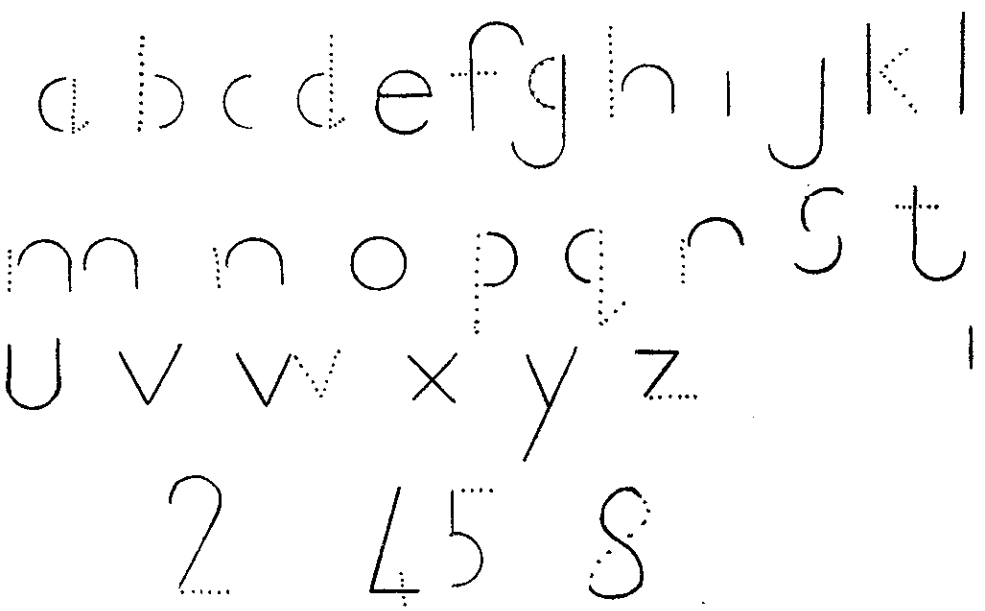


Fig. 3. *Kinetic patterns*

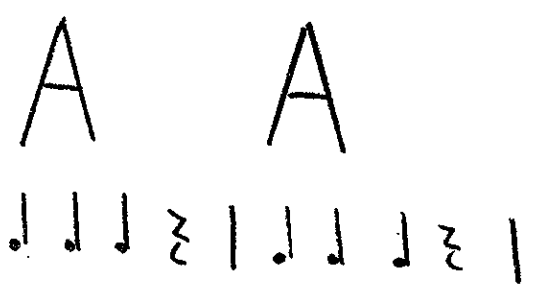
As already pointed out, there are no tangible shapes to these patterns for they are the moving counterparts of the cardboard static shapes; they are the movements of the pen on paper, and may be thought of as the steps of a dance which are first rehearsed by themselves, and then put into a sequence. Nevertheless a glance at fig. 3. will show at once that many of them are constructed from the same number of similarly shaped static elements. However parts of certain symbols are constructed from a single kinetic shape that is the equivalent in movement to two or more static patterns. For example, the long vertical line and half-circle found in lower case 'f', 'g', 'j' and 't' are considered as two static patterns, but only one kinetic one. Lower case 'h' and 'n' are each made from three static patterns, but only two kinetic ones, and 'e', 'o', 'u', 'v' and 'y' are built from only one single kinetic element. The reason

for these modifications is that although visually a symbol may be reduced to simpler static patterns, when it comes to attempting the same kind of thing in kinetic shapes, there is the danger of obscuring the total movement through too much emphasis on its constituent elements. For the same reason it is felt that capital letters and the figures *0, 3, 6, 7* and *9* are best practised as one whole pattern by the time the kinetic stage has been reached. Figure 3 shows the entire lower case alphabet, but only those number symbols that it is thought advisable to break down into smaller kinetic units.

Practice in the writing of a particular symbol may be carried out as follows:— one of the constituent kinetic shapes is written in isolation repeatedly across a page, then the other shape is written across the page on the line below. Finally, on the third line, the first shape is written again, and then the second one a little distance from it, and this is repeated with the space between the two shapes gradually decreasing until both patterns approximate to each other and the symbol has been written. Another method is to have the pupil write out the first kinetic shape of a symbol several times across the page, and then to add the second one beside the first, but a short distance from it; then on the next line to attempt the entire symbol if the earlier stages have been performed easily.

In cases of acquired dysgraphia it would probably be advisable to start at this kinetic stage; for in this way one would be starting from the outset with elements that were familiar in a kinaesthetic sense; for example, there would be no harm in setting out to learn to write a 'z' by first practising a series of 7's, and then later adding a short horizontal stroke to the bottom right hand side. But there would be little point in placing the static shapes on the velcro board a little way from each other in order to show such a patient that the figure '2' was composed of a half-circle, a long oblique straight line and a short horizontal one; though if this was the symbol to be re-established, the therapist could assemble it on the board with the patterns touching each other, and then get the patient to trace his finger down its contour *in the normal writing way,* and this could be a preliminary stage to using a pen and attempting to write the symbol on paper.

In practising the writing of symbols either by finger tracing or by guiding the patient's hand as he moves his pen across the paper, we have found that the use of a consistent rhythm while writing a particular symbol can act as an added reinforcement in learning a kinaesthetic pattern. For example, if we were practising the capital 'A', we would set it to a rhythm of four equal beats, no movement taking place on the last beat. Thus we would move across the page:—



etc.

In the case of 'W' we use a 'Tum-ta-ta- Tum' rhythm, again with a one beat rest at the end, but, as before, leading straight on to the next 'bar':—

etc.

i.e. Down up down Up rest; Down up down Up rest; etc.

This method can add greatly to the enjoyment of practice, and the hand soon begins to pick up the pattern. The one beat rest seems necessary to settle what has just been done, and to prepare for the repeat; it also prevents degeneration into an amorphous sprawl of movement, and unconsciously impresses on the pupil or patient that what is being practised is a short concise pattern of movement repeated over and over again.

Experimental work

At the present time of writing it has not been possible to carry out any large-scale experiments over a wide range of non-writing individuals. Parts of the system have been used to rectify small writing errors among mentally subnormal patients who, though able to write simple words, habitually form certain symbols incorrectly, and in these instances we have been successful. Nevertheless, in order to test the system more searchingly, three non-writing patients were selected: the first was the adult female blind patient already mentioned, and the other two were boys of 11 years. The woman read Braille and Moon, but the children had no previous capacity in either formulating or interpreting any form of written language. As these experiments were to be on such a small scale, it was felt desirable to work as far as possible with patients of extremely low I.Q., as we felt that if such people could be trained to write even only a few words with understanding, we should have gone some way towards vindicating our ideas. A brief profile of each of these patients now follows, together with a description of our teaching methods.

Case one, Joan, aged 39 years

This congenitally blind patient has had no experience of light whatsoever, her spatial concepts are thus confined to what she has experienced by means of touch and movement; her hearing is normal and her speech clearly articulated with an adequate grasp of vocabulary and syntax. Orphaned at an early age, she was brought up in a blind home. She was admitted to this hospital at the age of 20 and assessed with a mental age of 7½ years. Her temperament is a gentle and retiring one; described as 'childish' on admission, it might now be truer to describe her as 'child-like'. When she was about 35 she was able to learn Moon, and this she came to read with considerable ease and fluency. At 37 she began to learn Braille, and in 18 months to 2 years had mastered most of the common contractions as well as the simple uncontracted forms. At 39 she became curious as to the shapes of sighted

letters and wanted to learn how to write them. Training began by getting her to move her fingers over the two sizes of the three basic shapes as they were fixed to the velcro board. The capital forms of the five vowels were then constructed, and she started to build up a mental picture of these as she performed the appropriate writing movements by tracing her fingers over them. A smaller set was then made for her from sandpaper stuck on to thick smooth paper. The proportions used were —long line, long line with hook, and diameter of large half-circle each two inches; the smaller forms being only one inch. The width of each static shape was about $\frac{1}{8}$ of an inch. When she had learnt to recognise the vowels, consonants were added, and thus, before the whole alphabet was learnt, simple words could be read. When many of the letters could be recognised, either by the sandpaper shapes or by having them drawn on the back or palm of her hand, she was taught to hold a pencil and make the required movements on paper. Many of the symbols were taught in an unconventional way from the beginning. Thus capitals 'A' and 'B' were each begun with an upward stroke instead of the usual downstroke. This was to prevent any unnecessary lifting of the pen from the paper; however, as already pointed out, we were extremely firm in insisting that she wrote or fingertraced a symbol in one way only, and to this we largely attribute our success. After 6 months work, Joan was able to write all the capital letters of the alphabet and all the numerical symbols. She was also able to sign her name and to write simple words without a writing-frame; it was not perfect calligraphy, but the spacing between the letters was acceptable. An interesting result following our disciplined approach to the building up of clear tactile and kinaesthetic patterns is the fact that we may now take Joan's index finger and place it at any point along any line of a sandpaper letter; after a few moments exploration she will perform the complete kinaesthetic movement from beginning to end, and name the symbol correctly.

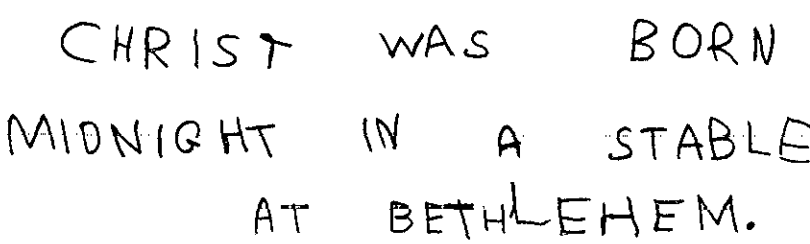


Fig. 4. Joan's handwriting

Figure 4 shows an example of Joan's handwriting. This was done entirely by herself after she had been learning the sighted alphabet for nine months. By using a Venetian writing frame the lines are kept in a straight horizontal direction. Even spacing between letters of the same word is achieved by placing the left index finger over the letter just written. Spacing between adjacent words is achieved by placing the left middle finger over the last letter of one word, and then the index finger next to it. Thus each word is separated from its neighbour by the width of the left index finger.

Case two, David, aged 11 years, 3 months

I.Q. (St-B, LM) 34. This child uses no real speech, although recently he has made attempts to say single words, but these are still more like abstract sounds. Sight and hearing appear to be adequate. He has a reasonable understanding of speech, and so presents a picture of developmental expressive dysphasia. He appeared at first to have a slight bias towards left handedness, but is really ambi-non-dextrous. He is a quiet boy with considerable application. He was trained to

construct a few letters from the static shapes, and then given some kinaesthetic practice on the velcro board. The next stage was to practise writing the letters, and this we did on a blackboard. Very soon after this we put the letters into simple words which were supported by an appropriate picture. The words practised were:— 'CAT', 'CAR', 'SHOE' and 'DAVID'. Capital letters were used. After about five weeks of considerable effort he was able to write these words on request, although he frequently made mistakes and seemed to prefer to write in an ascending vertical line rather than in one moving in a left-to-right horizontal direction. His apparent left handedness caused him some confusion at first, but in the end he decided, of his own free will, that he would use his right hand. Although his spontaneous writing of these words was, and still is, extremely uncertain, he was soon able to copy them either when he saw them already written down, or, when he watched them being fingertraced in the air.

Case three, Paul, aged 11 years

Mongol; I.Q. (Stanford-Binet Form L-M) 37.

This boy's speech is very poorly articulated, and his use of language very rudimentary. He is able to understand speech fairly well, and his hearing and sight are adequate. Although interested in learning to write words, Paul was much more distractable than David. Much the same teaching procedures were used with him as were used with David. He soon learnt the names of the letters, and enjoyed saying them as he wrote them. He learnt to read and write his name and the other three words taught to David. As with David, this stage was rather tenuously maintained after daily sessions over a period of about five weeks; however this concentrated attention on the elements of written language had the effect of slightly improving Paul's articulation.

SUMMARY

This paper describes a system whereby, for teaching purposes, graphic symbols are reduced to a small group of simple static and kinetic patterns. The method has its origins in the work of educationalists such as Séguin and Montessori, while drawing also on the more recent ideas of Wexler in teaching congenitally blind children. The use of a fixed rhythm when performing certain writing movements is also described. The system aims at uniting such separate elements as colour, spacing, shape, stereotyped movement and well defined rhythm into a unified whole in order that each may reinforce the general learning process. Experimental work with one mentally subnormal blind adult and two severely subnormal children is described, and it is suggested that such a system may have a use both in teaching and clinical situations ranging from cases of developmental or acquired dyslexia and dysgraphia, to teaching sighted symbols to the congenitally blind.

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