Stereotyped movements in a group of autistic children

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Summary

The authors studied the stereotyped movements presented by a group of 20 autistic children, evaluating the patient observation protocols according to a psychodynamic model of autism. The stereotyped movements were analysed considering ten different parameters: type, site, morphology, frequency, association, complexity, active sensory channel, trigger event, affect during stereotyped movement, and function. The results indicate that each autistic child possesses highly idiosyncratic “stereotypical behavioural equipment”, which includes behaviours ranging from simple, reflex-like actions, to much more complex movement patterns. Stereotyped movements were found to appear, in response to different stimuli, at moments when the subject’s psychophysical state needed “resetting”. Eight possible functions of stereotyped movements were identified. These correspond to two main purposes: reinforcement or weakening of the autistic barrier. The need for rehabilitation is questioned, since not all stereotyped behaviours interfere with exploratory and cognitive activities.

KEY WORDS: autism, child psychiatry, stereotyped movements.

Introduction

Stereotyped movements are repetitive and rhythmical, invariable in terms of their position, and apparently bizarre and without function. During childhood and adolescence, they appear in a wide range of disorders: sensorial deficit and mental retardation, some syndrome complexes such as the Cornelia De Lange, Fragile X, and Lesch-Nyhan syndromes, and some pervasive developmental disorders (PDDs), such as Rett syndrome and autism (1-5).

In autistic children stereotyped movements are polymorphous and may include both simple movements, such as hand-flapping, and complex ritual movements (2,4,6-8). Both subjects with a low and those with a normal IQ can present stereotyped movements. The stereotyped movements of autistic children are closely related to the social environment they inhabit, while those of mentally retarded children are more fragmentary (9).

The aetiology and significance of stereotyped movements are still debated (1,2,6). Many theories or models, e.g., developmental, learning, homeostatic, and psychodynamic (1,2), have been advanced in order to explain repetitive motor behaviours, as have the theories of “weak central coherence” and “executive dysfunction” (9).

This study focuses primarily on the psychoanalytical model of autism, and discusses other theories only in passing.

According to the organic theory, stereotyped movements originate from brain damage (particularly to centres located in the frontal cortex, basal ganglion and dopamine system) and from neurotransmission disorders.

The developmental theory, on the other hand, regards stereotyped movements as extensions of the repetitive movements normal in early development, which, possibly as a result of some particular dysfunction, have become fixed abnormal repetitive behaviour patterns.

According to the learning theory (Skinner’s operant conditioning model), stereotyped movements are responses to certain environmental factors, i.e., to a perceptual stimulus generated by the behaviour itself.

The homeostatic theory, on the other hand, considers stereotyped movements as products of activation by self-stimulation. They may be increased (in the absence of stimulation, as in subjects with severe sensorial deficits) (10); or reduced (in the presence of excessive stimulation).

The weak central coherence and executive dysfunction theories explain stereotyped movements as the consequence of a specific cognitive style or incapacity to regulate behaviour.

Psychoanalytical studies over the last 50 years have developed a complex theoretical model of autism that is often confused with the early observations of Kanner (11). Nowadays, autism is actually thought to be a result of both organic and environmental factors (12). The psychoanalytical model of autism has altered since
Stern's studies of newborns and infants (13). The idea of the existence of a normal autistic phase in infancy has now been abandoned, and as a result so has the interpretation of infantile autism as an arrest at, or a regression to, this phase (14). Today, autism is believed to derive from an abnormality of mental function that affords the affected child a certain degree of protection from experiences liable to produce in him a type of archaic anxiety individually experienced as intolerable suffering (12,15-20). Tustin (14-16), for example, believes that autistic children, through the altered processing of normal experiences, erect a protective autosensual barrier.

According to the psychoanalytical theory, stereotyped movements in autism generate, through an instinctual mechanism of release and control, a sense of bodily continuity (with the mother), and thus a sense of security. Subjects are thought, through this mechanism, to maintain homeostatic conditions characterised by a low level of stimulation, i.e., conditions similar to those of the womb (12,15-20). The role of stereotyped movements in producing conditions in which the object is perceived fragmentarily with mono-sensory qualities rather than in its entirety has also been described (29). Arnaud (21) found that stereotyped movements are flexible behaviours, at times used to increase the internal-external barrier, and at others to filter the external stimulus, thereby allowing different degrees of isolation or exchange.

Virole (22), through a morphological analysis of the dynamic typology of the stereotyped movements of autistic children, described different types, such as swinging, rotation, incorporation, expulsion, expulsion-reception, hand agitation, perforation, pinching, and scission. The author hypothesised that stereotyped movements are repetitions of movements related to emotionally significant experiences. In fact, some stereotyped movements of autistic subjects are very elaborate and relatively specific to the single child. These may be fragments of behaviours: traces of a relational experience in which the movement is expressed and fixed. This fascinating theory was also formulated by Freud (23).

Some psychoanalytical hypotheses regarding the function of stereotyped movements overlap with non-psychoanalytical theories. In particular, with the homeostatic theory, according to which stereotyped movements guarantee an acceptable level of activation; with the learning theory, which interprets stereotyped movements as fragments of relational significance (stereotyped movements produce sensorial stimuli and the movements and stimuli reinforce one another reciprocally); and with the theories that consider autistic subjects to be affected by a disorder of sensorial integration, in which stereotyped movements are related to a mental function dominated by a fragmented and monosensorial perception of the object. It is likely that stereotyped movements are caused by multiple factors and possible that all the aforementioned models contribute to this complex phenomenon; accordingly, a multidimensional model should probably be developed (14).

The aim of this study was to analyse the morphology and identify the possible functions of stereotyped movements in a group of autistic children according to the latest psychoanalytical theories regarding mental function in autism.

### Materials and methods

The study enrolled 20 autistic subjects (14 M + 6 F), aged 1.8-4.9 years (mean 3.1±1.1); IQ: 0.22-0.62 (mean: 0.35±0.1). The sample was selected from a group of 70 children with PDD. The inclusion criteria were:

- age not above 5 years;
- absence of comorbidity with other disorders;
- diagnosis of autism based on DSM-IV criteria.

The presence of minor neurological disorders or of specific EEG alterations were not considered to constitute exclusion criteria.

Each child – hospitalised or attending a day-hospital – was examined by a clinician and underwent a complete work-up that included a neurological examination, routine blood test, test for metabolic disorders, CT scan, MRI, EEG, eyesight and hearing tests.

The diagnosis of PDD was made by a child psychiatrist in accordance with the DSM-IV criteria. The diagnosis of autism was confirmed after three observations of the child, three interviews with the parents, and two observations of the child-parent relationship.

The three observation sessions – each lasting 50 minutes – always took place at the same time, and always in a room equipped with simple toys (dolls, lego, paper, crayons).

The observer – always the same child psychiatrist trained in psychodynamic diagnosis – in accordance with the rules of psychoanalysis, assumed a non directive attitude, had only rare verbal exchanges with the child, and did not influence his/her activity. At the end of the session the observer compiled a detailed report describing the events that occurred as the session progressed. The report included descriptions of the child’s behaviour, verbalisation and feelings, of the child-observer relationship, of “countertransference” phenomena and of possible verbal exchanges and external events such as noise.

The following list of 10 stereotyped movement parameters, derived from data contained in the literature, was created for the purposes of this study:

- kind: use or non use of an object;
- site: part or parts of the body involved;
- morphology: description of movement;
- frequency: sporadic (from 1 to 3 times), recurrent (4-9 times), or sub-continuous (>10 times);
- association: presence of different stereotyped movements in the same subject;
- complexity: simple (a single movement such as handclapping); complex (two or more movements occurring in association or in rapid succession, e.g., hand clapping and rocking);
- prevalently active sensory channel: number and type (auditory, visual, tactile, proprioceptive);
- trigger event: external (noise); internal (affectionate state); relationship-related; conversation (verbal exchange); the child’s approaching of/distancing from the therapist; separation from parents;
- affect: affective state of the child while stereotyped movements are being performed (feeling or mood);
- function: aim of movement and strategy employed (reinforcement of autistic barrier through over- stimulation of sensory channel).
The observation session reports were analysed in the light of this list and the following data was produced:

- description of stereotyped behaviours;
- frequency of recurrence of such behaviours;
- events, behaviours, interactions, affects (feelings or moods) preceding and following the stereotyped movements;
- possible function of stereotyped movements.

These data were converted into percentages for descriptive purposes.

Results

Sixteen (80%) of the 20 subjects examined presented more than one stereotyped movement. Only two children presented a stereotyped behaviour pattern that was similar in all evaluated parameters. In total 34 different (in one or more parameters) stereotyped behaviours were identified. This finding strongly suggests that the stereotyped movements of the single child are idiosyncratic.

Kind

Stereotyped movements involving (17; 50%) and not involving (17; 50%) the use of an object were found to be equally represented.

Site

The use of the hands prevailed both in stereotyped movements involving (15; 44.1%) and those not involving (10; 29.4%) an object. Two stereotyped movements were observed that involved the use of the hands alone, and these were clapping and wing-like flapping of the hands. However, in the majority of cases (23; 67.6%), stereotyped hand movements were produced in association with the use of objects (11; 32.3%), with the use of other parts of the body (8; 23.5%), or with the use of other parts of the body and objects (4; 11.8%). All the stereotyped movements involving the hands, even those produced in association with other parts of the body and/or objects, involved the upper body parts, e.g., head, eye, mouth, ear. We observed 9 (26.5%) stereotyped movements that, with or without an object, involved the whole body.

Morphology

The most frequently observed activity was manipulation or banging of objects (11; 32.3%). The next most prevalent movements were stereotyped movements such as body positioning, rocking, and rotation of the body (7; 20.6%). These were followed by movements such as touching the body with the hands (4; 11.8%); moving or swinging objects or hands in front of the eyes (3; 8.8%); clapping or swinging the hands (2; 5.9%); observing objects closely (2; 5.9%); opening, closing, filling, and emptying objects (2; 5.9%); touching surfaces (2; 5.9%); and others (1; 2.9%).

Frequency

Half of the stereotyped movements (17; 50%) were recurrent; these were fairly evenly distributed between those involving (9; 26.5%) and those not involving the use of objects (8; 23.5%). These were followed by sporadic movements (9; 26.5%), 6 (17.6%) not involving and 3 (8.8%) involving the use of objects, and finally by sub-continuous movements (8; 23.5%), 2 (5.9%) not involving and 6 (17.6%) involving the use of objects.

Association

Most of the stereotyped movements observed were found to occur in association with other stereotyped movements. Of the 34 stereotyped behaviours observed, 30 (88.2%) were complexes of two or more associated movements. Association was identified in 16 (47%) of the stereotyped behaviours not involving and in 14 (41.2%) of those involving the use of an object.

Just one (2.9%) of the stereotyped behaviours not involving the use of an object was found to occur in isolation as opposed to three (8.8%) of the stereotypies involving the use of an object.

Complexity

Twenty-one (61.8%) of the stereotyped movement behaviours were simple, while 13 (38.2%) were more complex sequences of movements, involving for example the hands and the body. In detail, stereotyped movements not involving the use of an object could be simple: 12 (35.3%), or complex: 5 (14.7%), as could those involving objects: 9 (26.4%) and 8 (23.5%) respectively.

Sensory channel

The sensory channel found to be most active was the tactile channel, or touch (18; 52.9%), followed by the proprioceptive (15; 44.1%), visual (13; 38.2%), and auditory (8; 23.5%) ones. The number of active sensory channels was greater than one in 18 behaviours (52.9%), while it was restricted to one in the other 16 (47%). The sensory channels employed were, according to the type of stereotyped movement, the following: stereotyped movements not involving the use of an object: 1 channel (9; 26.5%); more than one channel (8; 23.5%). Stereotyped movements involving the use of an object: 1 channel (7; 20.6%); more than one channel (10; 29.4%).

Trigger event

In 24 cases (70.6%), a trigger event preceded the stereotyped movements. In 15 cases (44.1%), it was a relationship-linked event, i.e., a reaction to separation from the parents (with or without a reaction of anxiety), (7; 20.6%); a reaction of anxiety/depression or anger at the sight of the observer (3; 8.8%); a response to the child’s own moving away from or approaching of the observer (3; 8.8%); or to a verbal stimulus from the observer (2; 5.9%). In 6 cases (17.6%) the stereotyped movements were preceded only by anxiety or anger, apparently without a cause or produced by frustrating events such as not be able to get or use a plaything. In 3 cases (8.8%) stereotyped movements were preceded by an exterior stimulus such as noise or an interior stimulus such as interest in an object. In 10 cases
(29.4%) no trigger event was observed; the absence of an apparent cause was more frequent in stereotyped movements involving the use of an object, 7 (20.6%), than in those not involving the use of an object, 3 (8.8%).

Affect (feelings/mood)

Descriptions of the affective state of the child during the performance of stereotyped movements were as follows: no affect in 8 (23.5%); pleasure in 6 (17.6%); anxiety in 1 (2.9%); and not reported in 19 (55.9%). Stereotyped movements involving the use of objects: no affect in 7 (20.6%); pleasure in 4 (11.8%); anxiety in 1 (2.9%). Stereotyped movements without objects: no affect in 1 (2.9%); pleasure in 2 (5.9%).

Functions (significance)

For 31 of the stereotyped behaviours, we identified the following eight functions. Table I reports the incidence of each of these functions.

Isolation

Stereotyped behaviours resulting in isolation are frequent and appear in response to external, internal, or relational stimuli that seem to interrupt a state of isolation. They produce an intensification of the isolation and a reinforcement of the internal/external barrier. These movements can be complex and long. For example, the response to the sound of an ambulance siren in one autistic girl was a stereotyped movement complex that consisted of clapping the hands and then placing them against the wall, rocking, and placing one leg over the other until a self-erotic state was produced, associated with marked hypertonia.

Release

Stereotyped behaviours allowing a release of tension appear in response to external, internal, or relational stimuli that produce an increase of activation. The tension generated by seeing or touching an object, or by a noise, is released (reduced) through a simple, brief reflex movement such as moving the hands.

Protection

Stereotyped behaviours that have a protective function appear in response to internal, external or relational stimuli. The effect of protective stereotyped behaviours would be to raise moderately the autistic barrier. They are observed in children with a permeable autistic organisation (frequent eye contact, search for interaction) and produce a transitory withdrawal followed by a new opening up of the relation. They transitorily protect the child, and were observed in patients with a flexible (i.e., not severe) autistic organisation.

Support

Stereotyped behaviours that serve a support function signal the beginning or the end of a movement that has a specific purpose. They do not interfere with other types of movement. For example: L. touches his/her hands and smiles then grabs an object; C. twirls an object with one hand while, with the other, grabbing a new object, which he/she then observes.

Auto-sensual

Auto-sensual stereotyped behaviours have no apparent cause and may produce pleasure, excitement or trance. They consist of rotational or physical contact with surfaces.

Cancellation

Cancellation-type stereotyped behaviours typically follow an explorative activity or a positive/negative relational experience. Their function appears to be that of cancelling out the experience, and replacing it with a different sensorial stimulus. For example: T. twirls a cube after having first assessed its shape with her/his hands for a moment. The visual perception of the twirling object cancels out the previous non-circular tactile experience of the form.

Recall

Stereotyped behaviours with a recall function reproduce fragments of relationships with family members. They serve to engage the observer in the same type of interaction and can be identified by the pause (waiting for a response) that follows the behaviour. For example: M. looks at her observer and shakes her head, she laughs, reaches out with a grabbing gesture, and then waits for a response. This pattern is part of a “grabbing daddy’s hair” game, previously played with her father.

Stereotyped games

We observed a stereotyped behaviour that involved the unrolling and rolling up of a strip of ribbon. The patient would stop at length to observe the end of the ribbon that was held in a particular position. The stereotyped behaviour needed the collaboration of another person whose hand was used solely as a lifeless support to hold the ribbon. This behaviour served to reproduce a pleasurable experience that was similar to a game, but did not have the characteristics of a game. Because the child was interested in reproducing both a specific perceptual event that required the help of another person, and the pleasurable affective state that accompanied that event, this behaviour, involving the child and the mother at home, could not be classed as a ritual.

Table I shows the distribution of these different functions according to stereotyped movement type.

Discussion

The aim of this study was to describe analytically the stereotyped movements observed in a sample of autistic children and to classify the different behaviours observed. Only 2 of the 20 patients observed presented
Stereotyped movements in autistic children

Table I - The functions of stereotyped movements.

<table>
<thead>
<tr>
<th>Function</th>
<th>With object no.</th>
<th>Without object no.</th>
<th>Total no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Isolation</td>
<td>7</td>
<td>6</td>
<td>13</td>
</tr>
<tr>
<td>Release</td>
<td>1</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Protection</td>
<td>2</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Support</td>
<td>2</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Self-sensual</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Cancellation</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Recall</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Stereotyped games</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>No function</td>
<td>2</td>
<td>1</td>
<td>3</td>
</tr>
</tbody>
</table>

behaviours fulfilling all eight function parameters and the entire sample produced a total of 34 different behavioural profiles. We did not find any recurrent or prototyped profiles. Considering that all our subjects fulfilled the standard criteria for a diagnosis of autism, this total may be attributable to the presence of different levels of disorder, or to the type of method used to gather information. Confirmation of these data in wider and different studies would indicate that the distinctive characteristics of stereotyped movements in autism are their polymorphism and their idiosyncratic use in the single child. As regards the aetiology of autism, it would appear that both neurobiological and relational factors are involved. The relational factor may account for the choice of a certain stereotyped movement when the subject finds himself in a particular situation. In fact, most of the stereotyped movements observed involved the upper part of the body and in particular the hands, the eyes and the mouth.

Indeed, the neuropsychological importance of this region, because of its major cortical specialisation and representation, is well recognised, but it is also important from an emotional and cognitive point of view, playing, as it does, a central role in primary relations. Sight, touch, speech, and sucking all emphasise the communicative exchanges characteristic of the mother-child relationship. Even though active movements seem devoid of communicative and social significance and apparently serve no particular function, our analysis of them has allowed us to hypothesise that stereotyped movements assume a precise meaning within the limits of autistic function outlined by psychoanalysis. Morphologically, the stereotyped behaviours were found to range from simple, reflex-like, actions (shaking the hands in response to a sound) to complex movements having a simple organisation and elementary aims. By elementary aims we mean, in accordance with the circular reaction model (24), the reproduction of an action in order to obtain a certain effect. The simple stereotyped movements were morphologically similar in all the children while the complex ones differed and represented distinctive traits of the individual children.

It seems then that stereotyped behaviours might be classifiable according to their different levels of complexity, which could, in turn, correspond to different expressions of autistic functioning. This hypothesis needs to be verified through further studies that relate stereotyped movements to disorder severity, evaluated according to a standard clinical symptoms profile.

The children observed displayed a wide repertoire of stereotyped movements that appeared at different moments during the observation sessions and in relation to different events. These events created a need, at that given moment, to “re-set” the psychophysical state of the child. For example, the response to an environmental interference such as noise could be a repetitive activity (clapping hands), typical of the release stereotype, or a complex postural or motor sequence of stereotyped movements. In the first case, as in the second, the stereotyped behaviour was followed by isolation.

The stereotyped behaviours were at times preceded by a positive or even a negative emotion, but suffering or anguish rarely followed their appearance. The active sensorial channels used during the stereotyped movements were mainly those associated with the mother-child relationship, such as touch and proprioception.

During recurrent stereotyped movements, sensorial activity and affective state varied from neutrality to euphoria and the child, appeared immersed in a psychophysical state of his own making, and free from anguish. We interpreted this state, according to the psychoanalytical model, as the production of a “sensation-movement shell” that protected the child by rendering the self more cohesive and sparing him/her anguish. The eight motor stereotyped movement functions identified appear to represent, predominantly, two things:

- the obtaining or restoration of a condition of isolation (e.g., isolation, release, cancellation, auto-sensual);
- the creation of the conditions for a minimum of internal-external exchange (e.g., protection, support, recall).

This would fit in with the observations of Arnaud (21) regarding the flexibility of autistic stereotypes.

The classification of stereotyped movements according to their meaning has implications as regards rehabilitation.

Regardless of the chosen treatment, the therapist faced with stereotyped movements should bear in mind that
these movements are actually much more organised and sophisticated than they seem and that their significance is variable too. We therefore believe that stereotyped movements in which there is also scope for explorative activity, either before or during the movement, should not be impeded. On the contrary, the excessive use of stereotyped movements of the "cancellation" type, for example, needs to be contrasted. These stereotyped movements interfere with elementary experiences of the object and hamper development. Our observations lead us to believe that stereotyped movements should be considered as "stereotypical autistic equipment" i.e., as a set of motor-sensorial instruments that are active in the autistic condition. As the study of these behaviours is extremely complex, more active collaboration among the leading researchers in this field would be desirable.

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