身心障礙學童固著行為制約
功能的分析

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摘要

本文旨在從文獻中探討身心障礙學童固著行為的制約功能，並根據該行為的功能提出可行性的介入策略。身心障礙學童常有固著行為的產生，導致此行為的主要原因可能是操作制約（operant）所形成的。此制約假設通常以實驗分析的方法來驗證固著行為的原因。文獻顯示，固著行為可能是由五種操作制約功能所形成：包括感官性正增強、感官性負增強、社會性正增強、社會性負增強、及多重增強的作用。本文即在檢視此五種操作功能的可能性，最後並提出可減少此異常行為的支持方案之建議。

關鍵詞：固著行為、操作制約功能、功能分析
Analysis of the Operant Functions of
Stereotypical Behavior in Persons with
Developmental Disabilities

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Abstract
Evidence has shown that students with developmental disabilities often displayed high rates of stereotypical behavior. Nevertheless, the exact functions of stereotypy in such population were unclear. One hypothesis regarding the functions of students’ stereotyped behavior was widely accepted in recent researches. The perspective of this hypothesis is operant functions which asserted that positive social reinforcement, negative social reinforcement, positive sensory reinforcement, negative sensory reinforcement, or multiply reinforcement may serve to maintain such stereotypical behaviors. The purposes of this article were to (1) examine and analyze these operant functions of stereotypic behaviors exhibited by students with developmental disabilities, and (2) make some suggestions for how to use positive behavior support program developed from functional analysis to deal with this aberrant behavior.

KEY WORDS: Stereotypical Behavior, Operant Function, Functional Analysis
A. Introduction

Stereotypical behavior was often found in persons with mental retardation, autism, or related severe disabilities (Kennedy, Meyer, Knowles, & Shukla, 2000; Reid, Parsons, Phillips, & Green, 1993; Rojahn & Sisson, 1990). The origin and function of stereotypical behavior in these people remains unclear. The most widely accepted of possible functions in literatures are operant perspectives (LaGrow & Repp, 1984). Contemporary researchers further posit that high rates of stereotypy are connected to environmental conditions and social reinforcement, both negative and positive (Durand & Carr, 1987; Kennedy et al., 2000; Mace & Belfiore, 1990). Therefore, the purposes of this article were twofold. First, through literature review, examine these operant functions of stereotypy exhibited by students with developmental disabilities. Second, make some suggestions regarding using positive behavior support program developed from functional analysis to deal with this aberrant behavior.

B. Operant Functions

Behavioral analysis posits that stereotypies are maintained by positive and negative social and/or sensory reinforcement (Kennedy et al., 2000; Sprague, Holland, & Thomas, 1997). In other words, stereotypic behavior exhibited by children with disabilities might communicate with drawing attentions from others, escaping from task demand, or producing self-stimulation. Some types of stereotypies may be acquired through an operant learning process (Hollis, 1971). The operant learning might be shaped from a variety of sources of reinforcement. For instance, in a survey of residential staff regarding persons with developmental disabilities and stereotypies, Wieseler, Hanson, Chamberlain, and Thompson (1985) reported that of the most common consequences following stereotypic behavior 3% of the ratings indicated positive environmental consequences, 4% rated task escape/avoidance, and 92% ranked self-stimulation as the most common outcome. This study suggests that stereotypical behavior
serves sensory consequences, positive reinforcement, and/or negative reinforcement in different individuals with developmental disabilities. Although lots of studies mentioned below were conducted in American, so far, there were solely a few premature studies examined the causes of stereotypy via functional analyses in Taiwan (see Table 1). Thus, my focus of examination would be put in the perspectives of different operative functions served to maintain stereotypy displayed by individuals with disabilities in U.S.A., and that would be addressed below.

(A) Positive and Negative Sensory Reinforcement

It was initially assumed that this behavior was maintained by sensory consequences (Lovaa, Newsom, & Hickman, 1987). This hypothesis postulates that repetitive behaviors function to modulate sensory input to an individual when the environment lacks or provides too much stimulation. Support for this position can be found in Rincover's (1978) study. He demonstrated that three subjects' stereotypical behaviors could be maintained by different sensory consequences. These results have been supported by subsequent studies (Devany & Rincover, 1982). In accordance with these findings, Mason and Newsom (1990) investigated 3 children with severe mental retardation and also found that sensory changes effectively reduced children's repetitive hand movements. These studies suggest that sensory consequences function as positive and/or negative reinforcers maintaining stereotypy.

Recent studies used analogue functional analyses (Iwata et al., 1994) to simulate a lack of environmental stimulation. If environments occasion people engaging in stereotypy, individuals might exhibit high incidences of stereotypy in alone conditions. Some researchers have proposed these functions (Sturme, Carlsen, Crisp, & Newton, 1988; Wehmeyer, Bourland, & Ingram, 1993). They pointed out that high levels of stereotypy associated with alone conditions would suggest that aberrant behavior was maintained through intrinsic reinforcement (self-stimulation), if such environments
provide impoverished and austere levels of stimulation. Consistent with this view, Runco, Charlop, and Schreibman (1986) found that the highest rates of stereotypic behavior occurred when the children were left alone in a separate room.

More evidence comes from studies using analogue functional analyses to detect the relationship between alone settings and stereotypical behaviors (Applegate, Matson, & Cherry, 1999; Mason & Iwata, 1990; Sturmey et al., 1988; Wehmeyer et al., 1993). These studies suggest a lack of stimulating environments can control high rates of stereotypic behaviors. On the other hand, stereotypy might also be emitted to reduce over stimulation (i.e., negative sensory reinforcement).

1. Noisy conditions. Some researchers also found that noisy situations may serve as a negative reinforcer to control stereotypy. For example, using analogue functional analyses to assess the causes of stereotypy in one student with autism, Tang, Koppelin, Caruso, and Kennedy (2002) have shown that stereotypical behaviors (covering ears with hands) served to escape from noises in the environment. The student's covering ears served as an escape from peers' screaming or crying. This study suggests that stereotypy might function as negative sensory reinforcement to escape or avoid high arousal and/or noises in the environment.

Although sensory consequences may contribute to the maintenance of stereotypic responses, it still lacks robust evidence to conclude that these stimuli can be responsible for the development of the stereotypy due to difficulties in measuring these events (Kennedy, 1994). It is difficult to declare that stereotypy is maintained by sensory consequences unless the consequence can be systematically manipulated to demonstrate its relation to this behavior. In most cases, it is often hard to detect sensory consequences. Some cases even have no antecedent consequence events associated with stereotypy. Therefore, unless all potential antecedent and consequence variables that might contribute to stereotypy are thoroughly examined, there remains a lack of evidence to show that sensory
consequences cause stereotypy.

(B) Negative Social Reinforcement

Some behaviors are maintained by negative reinforcers involving escape or avoidance of noxious social stimuli (Iwata, Dorsey, Slifer, Bauman, & Richman, 1982; Weeks & Gaylord-Ross, 1981). This viewpoint posits that individuals might exhibit high rates of stereotypy to escape from demands or noxious settings. Consistent with this position, Durand and Carr (1987) manipulated experimenter attention and task difficulty and demonstrated that some stereotypic behavior, such as body rocking and hand flapping, was increased when difficult task materials were presented to 4 children with developmental disabilities. Their results showed that difficult task materials were discriminative for stereotyped behavior and suggest that the children might have a learning history of escape from task demands by engaging in stereotyped responding.

Consistent with Durand and Carr's (1987) study, Sturmey et al. (1988) experimentally manipulated four conditions (alone, demand, play, and attention) to assess their effects on 3 subjects' stereotypic responding. The results showed that one of the three subjects emitted high rates of stereotypy during academic demands. Mace and Belfiore (1990) also found similar results. Their investigation showed that one woman's stereotypic responding was negatively reinforced by escape from task demands. Wehmeyer et al. (1993) also supported this finding. Their study revealed that demand conditions induced high rates of stereotypy in one subject with Rett syndrome.

Although some individuals' stereotypical behaviors could be emitted to escape noxious stimuli, others might function for other reinforcers. Contrary to the view that stereotypy is strongly related to task demands, Repp, Felce, and Barton (1988) found that stereotypies were not maintained by negative reinforcers. Instead, stereotypic behavior served to lessen stimulation in the environment. Similarly, Applegate et al. (1999) found that
stereotypies were maintained by nonsocial consequences, such as alone conditions and self-stimulation, rather than an escape from the task demand.

(C) Positive Social Reinforcement

Some behaviors are maintained by positive reinforcers involving attention or tangible items from others (Carr & Durand, 1985; Carr & McDowell, 1980). This positive reinforcement perspective hypothesizes that individuals might exhibit high levels of stereotypy to obtain attention or favored items from others.

1. Attention. Stereotypical behaviors might function to get attention in low stimulation environments. In a study that assessed the relationship between stereotypy and related environmental variables in 101 children with developmental disabilities, Thompson and Berkson (1985) found that stereotypical behavior was negatively related to teacher attention. The same conclusion was found in Bihm, Poindexter, Kienlen, and Smith (1992) who studied the perceptions of staff of the classes of reinforcers and stereotypic behaviors of 470 people with severe or profound mental retardation, and found that social attentions were negatively related to stereotypy.

Contrary to this view, Repp et al. (1988), in a study with 2 students with severe mental retardation who exhibited stereotypic responding, found that stereotypyies were maintained by self-stimulation rather than positive reinforcers, such as attention from staff. Similar to Repp et al.'s (1988) study, Durand and Carr (1987) studied 4 children with developmental disabilities who displayed stereotypic behavior. They found that some stereotypic behavior, such as body rocking and hand flapping, was unaffected by reduced rates of adult attention. In another study, Mace and Belfiore (1990) also found a lack of evidence that the subject's stereotypic responding was maintained by attention from the experimenter.

These inconsistent findings suggest that the functions maintaining stereotypy are so complex that no single study has thoroughly detected all
its functions. Further studies conducted in comparison with a variety of attention and other variables are needed.

2. Tangible items. Although little research has studied stereotypy to assess its function to obtain tangible items, some individuals with developmental disabilities did emit stereotypy to obtain some items. In an earlier study, Hollis (1971) investigated 2 subjects with severe mental retardation who displayed stereotypic responding in an institution and found that one subject's stereotyped rocking movements were maintained by tangible items.

It is uncertain whether exhibition of stereotypy from some persons with developmental disabilities is to gain tangible items despite previous studies showing toys or objects might reduce the frequency of stereotypy. It is possible that tangible items might exert their control over stereotypy via social attention due to positive reinforcement mediating another's actions (Iwata et al., 1994). Thus, research often uses attention, rather than tangibles to examine the functions of stereotypy. It is also likely that people with developmental disabilities might rarely emit this behavior to obtain tangible items or access to preferred activities. This contention is supported by the Applegate et al. (1999) study that examined the functions of stereotypical behaviors in 417 institutionalized persons with mental retardation. They found that the tangible items only accounted for a very small proportion of the stereotypy. Stereotypical behavior in many cases was maintained by nonsocial consequences rather than getting tangible items.

**(D) Multiply Determined Stereotypy**

Despite considerable research and a number of hypotheses, such as self-stimulation (positive and/or negative sensory reinforcement), positive social reinforcement, and negative social reinforcement, no conclusions apply to all individuals who emit stereotypy. This suggests that the functional control of stereotypy might be multiple and complex (Kennedy
et al., 2000; Sprague et al., 1997). One single factor may not account for all causes of stereotypy. Stereotypy might be maintained by positive sensory reinforcement or negative sensory reinforcement, respectively, in some individuals with mental retardation, but for other cases, positive social reinforcement or negative social reinforcement might reasonably account for its causes. In some instances many of these functional cases may be the reason for stereotypy. This stance is supported by Kennedy et al. (2000).

In a study that analyzed the multiple functions of stereotypical behaviors for 5 students with autism, Kennedy et al. (2000) found that 2 students' stereotypy occurred at high rates in attention, demand, and no attention conditions. For 2 other students, stereotypy exhibited at high rates in attention, demand, recreation, and no attention conditions. Consistent with Kennedy et al.'s (2000) study, Sprague et al.'s (1997) analogue functional analysis showed that 2 subjects displayed high rates of stereotypy across multiple conditions. They found that one subject engaged in high frequencies of stereotypical behaviors in alone, play, social, and demand conditions, while the other exhibited frequent stereotypy in alone, play, and social conditions. Further support comes from Pyles, Riordan, and Bailey (1997) who examined environmental variables associated with stereotypy in 5 persons with developmental disabilities and found that all subjects exhibited higher rates of stereotypy across alone, attention, absent materials, not given demands, and disruptive environments. In accordance with the just mentioned studies, Singh, Landrum, Ellis, and Donatelli (1993) used analogue functional analysis to assess 3 subject's stereotypy and also found that stereotypy occurred at high rates across demand, alone, social attention, and differential reinforcement conditions during the five days of testing.

These studies suggest that stereotypical behaviors are more complex than previously proposed. Stereotypical behavior not only occurs because of sensory reinforcement, but also for social reinforcement.
C. Implications for Intervention
(A) A Need for Expanded Assessment

In a review of the literature on stereotypy, LaGrow and Repp (1984) reported that studies conducted between 1960 and 1980 often focused on testing the effects of behavioral technology, such as punishment, differential reinforcement, timeout, overcorrection, and DRO on stereotypy regardless of the functions of these behaviors and environmental influences. Therefore, the treatment effects were relatively inconsistent, and maintenance in treatment only lasted a short time period. Lovaas et al. (1987) even pointed out that stereotypical behaviors usually returned to full strength when the experimental reinforcers for the alternative behaviors were withdrawn. When choosing a treatment program irrespective of why someone engages in stereotypy, the investigators acted as if all persons engage in the behavior for the same reason, and as if a particular treatment for reducing stereotypy would be powerful regardless of behavioral functions. Without evidence that reveals the functional relation between treatment and stereotypy, researchers, at best, employ a trial-and-error approach. Therefore, the results taken across subjects in these studies clearly show great inconsistency.

In contrast, recent research (Durand & Carr, 1987; Kennedy et al., 2000; Mace & Lalli, 1991; Repp et al., 1988; Runco et al., 1986) used functional analyses to assess the variables controlling stereotypical behavior and developed treatment procedures derived from assessment findings. The rationale behind functional analyses is that changing a behavior may require an understanding of its functional causes. If the functions of a problem behavior can be determined, a more appropriate way of intervention may be developed (Horner & Carr, 1997). A functional analysis of stereotypy should be a part of the treatment procedure, and the specific treatments should be based on such an analysis (Repp et al., 1988). Thus, the treatment can be an effective process for treating stereotypic behavior in its specific context (Haring & Kennedy, 1990). Therefore, there
is a need to extend assessments to consider the functions between behavior-environmental variables and stereotypical behaviors in order to develop appropriate and effective treatments to decrease stereotypy.

Current research often focuses only on self-stimulation of stereotypy in the form of positive reinforcement. Other events like positive social reinforcement, or negative social reinforcement seems to be ignored. Investigators might need to expand assessment conditions to experimentally examine the possible multiple functions of stereotypy. Moreover, although some functions, such as positive or negative sensory consequences might be difficult to measure, some environmental stimuli, such as noise, can be measured and tested to further assess the subject's behavior. Thus, using scientific instruments to extend assessment and to detect the functions of stereotypy is needed. Researchers might employ a variety of sources to collaborate the functional hypothesis (Kennedy, 2000).

(B) Stereotypy Assessed like Self-injury

The relation of stereotypy may be close to self-injury in persons with mental retardation (Kennedy, 2000). Stereotypic behaviors may share many similarities with self-injurious behavior. For example, stereotypic responding may be exacerbated by isolated rearing and unenriched environments, suggesting a similar finding that poor stimulating environment was usually associated with self-injury (Horner, 1980). Several theorists have proposed that there are connections between stereotypies and self-injury (Barron & Sandman, 1983). Some researchers suggest both stereotypic and self-injurious behavior as self-stimulating, without a distinction between the two (Barron & Sandman, 1983). Others posit what might be a developmental progress from stereotypic to self-injurious behavior, and stereotypy and self-injury might share topographical, functional, and developmental similarities (Guess & Carr, 1991). Rojahn (1986) further found that prevalence of stereotypic behavior among individuals with self-injury was 65%. These results reveal that
stereotypy is positively correlated with self-injury in several aspects. Similar to the study of Rojahn (1986), Wieseler et al. (1985) found that stereotypic behavior shared topographical features and even 32% of the variables correlated with the occurrence of self-injury. It is likely that self-injurious behaviors may have begun as stereotypic behaviors but, by differential reinforcement, come under the control of positive and/or negative social reinforcement (Kennedy, 2000).

Although an exact relationship between stereotypy and self-injury still remains to be detected, the assessment procedures and methodology used in self-injury might also be appropriately applied to assess the functions of stereotypy. For example, in a study that used functional analyses to assess stereotypic responding displayed by 3 persons with mental retardation, Sturmey et al. (1988) demonstrated that the operant methodology of Iwata et al. (1982), originally developed for self-injury, can be successfully extended to the analyses of a variety of topographies of stereotypic behaviors. They used four analogue environments (alone, social disapproval, academic demand, and unstructured play) to assess and experimentally manipulated these conditions to detect the functions of stereotypy. Current research also uses the same methodology to examine the functions of stereotypy. Similar to the analyses of self-injurious behaviors in the study of Iwata et al. (1982), the functions of stereotypical behaviors have been found to maintain positive and/or negative social and/or sensory reinforcers (Kennedy et al., 2000). Thus, the operant methodology employed in self-injurious behaviors may also be used to assess the functions of stereotypies due to the functional similarities between these behaviors.

**(C) Interventional Implications**

1. The functions of stereotypical behaviors appear to be complex and multiple across individuals and settings. Stereotypy might serve different functions in some persons with mental retardation despite the same or
similar topographies. Repp et al. (1988) suggested that no single treatment procedure is universally effective. Changing a behavior may require an understanding of its controlling functions. If a function can be detected, a more appropriate way of obtaining the desired consequence could be programmed (e.g., functional communication training). Therefore, only by finding out the functions behind stereotypy, can successful interventions be designed and developed.

2. An assessment-based intervention, therefore, should be developed appropriately from a functional analysis. It should provide with functional equivalent behavior to compete with the disruptive behavior. If stereotypy is maintained by sensory consequences, removal of those consequences could reduce or eliminate this behavior. For example, Rincover (1978) sequentially eliminated the reinforcing properties of stereotypic responses for 3 persons with mental retardation. Because sensory reinforcers are able to maintain high rates of stereotypy, they may be used in training appropriate behavior. Sensory reinforcers (such as toys and music) have been used to decrease stereotyped responses in studies (Gunter et al., 1984).

3. If stereotypical behaviors are maintained by escape or avoidance from demands, interventions to decrease these aberrant behaviors have taken different aspects believed to maintain the target behavior (Mace & Belfiore, 1990). One approach, negative reinforcement extinction, has been to avoid the stereotypies in reducing task requirements. This is accomplished by either guiding compliance with the task or presenting repeated trials of task (Mace & West, 1986). Another strategy has been to eliminate some task requirements, to select easier tasks (Weeks & Gaylord-Ross, 1981), to teach the subject to request assistance for difficult tasks (Durand & Carr, 1987), or to request a break from task engagement (Durand & Kishi, 1987). Another alternative intervention is the high-probability command sequence (Mace, et al., 1988).

4. Besides negative reinforcers, positive consequences might also maintain stereotypy. If an individual engages in aberrant stereotypy because
of positive reinforcement, positive reinforcement extinction combined with other reinforcement-related procedures should be most effective (Repp et al., 1988). Also functional communicational training might be useful owing to its providing a functional equivalent to gain positive reinforcement.

5. Stereotypy might also be maintained by multiple and complex functions, such as positive and/or negative sensory and/or social reinforcement. More effective treatment programs could be developed only if treatment is matched to the function of stereotyped behavior. With respect to this multiple control behavior, rather than merely focus on one specific function, researchers have to scrutinize the multiple reasons maintaining the problem behavior and develop appropriately functional equivalent behaviors to decrease the problem behavior, perhaps in context sensitive interventions.

6. Finally, it is noted that stereotypic behavior might be a means of communication. Children with severe or profound mental retardation might exhibit high frequencies of stereotypy due to poor communicative abilities and low language expression. Some researchers have demonstrated that individuals with disabilities with lower verbal abilities exhibited higher rates of stereotypy (e.g., Dadds et al., 1988). It is possible that people with mental retardation use stereotypy as a means to express their needs, such as obtaining attention, getting tangible items, or escaping/avoiding task demands. If stereotypy is maintained by these positive and/or negative social consequences, functional communication training might reduce the rates of stereotypy.

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Table 1

*Studies conducted via Functional Analyses of Stereotypy in Taiwan*

<table>
<thead>
<tr>
<th>Researchers</th>
<th>Subjects</th>
<th>Analyzed Functions</th>
<th>Interven tional Strategy</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tang, J-C. (2002)</td>
<td>one child with multiple disabilities</td>
<td>sensory (visual) reinforcement</td>
<td>FCT</td>
<td>reduced stereotypy</td>
</tr>
<tr>
<td>Tang, J-C., &amp; Lee, S-H. (2002a)</td>
<td>one student with autism</td>
<td>sensory (tactile) reinforcement</td>
<td>string</td>
<td>reduced stereotypy</td>
</tr>
<tr>
<td>Tang, J-C., &amp; Lee, S-H. (2002b)</td>
<td>one child with autism</td>
<td>sensory (auditory) reinforcement</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Chung, Y-C. (2003)</td>
<td>two children with autism</td>
<td>multiple + automatic reinforcement</td>
<td>FCT + NCR</td>
<td>decreased stereotypy</td>
</tr>
<tr>
<td>Tang, J-C. (2003)</td>
<td>one adolescent with multiple disabilities</td>
<td>sensory (visual) reinforcement</td>
<td>Visual game</td>
<td>reduced stereotypy</td>
</tr>
<tr>
<td>Tang, J-C. (2004a)</td>
<td>one child with mental retardation</td>
<td>sensory (tactile) reinforcement</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Tang, J-C. (2004b)</td>
<td>one adolescent with mental Retardation</td>
<td>sensory (tactile) reinforcement</td>
<td>Preference objects</td>
<td>reduced stereotypy</td>
</tr>
<tr>
<td>Tang, J-C. (2004c)</td>
<td>one child with mental retardation</td>
<td>sensory (tactile) reinforcement</td>
<td>Preference objects</td>
<td>decreased stereotypy</td>
</tr>
<tr>
<td>Tsai, P-L. (2005)</td>
<td>three children with autism</td>
<td>multiple + sensory Reinforcement</td>
<td>Preference items</td>
<td>reduced stereotypy</td>
</tr>
</tbody>
</table>

FCT = functional communication training. NA = not available. NCR = noncontingent reinforcement