Clinical Reviews & Cases

Free-Operant Preference Assessment to Increase the Mand Variety of a Child with Autism Spectrum Disorder

Sara Orsini[1], Marco Esposito[1,2]*, Denise Smith[3], Bruna Monopoli[1], Federica Mondani[1], Maria Teresa Dipierro[1], Giovanna Gerardi[1], John Sykes[4], Francesca Fotia[4], Monica Mazza[2,5] and Marco Valenti[2,5]

[1]*Autism Research and Treatment Centre, Una Breccia nel Muro, Italy.*

[2]*Department of Applied Clinical Sciences and Biotechnology, University of L'Aquila, Italy.*

[3]*Association, ABA Autismo, Italy.*

[4]*University of Essex, England.*

[5]*Regional Centre for Autism, Abruzzo Region Health System, L'Aquila, Italy.*

ABSTRACT

Early intensive behavioural interventions for children diagnosed with autism spectrum disorder follow different clinical models. A main component of most of these models is some form of stimulus preference assessment to identify stimuli preferences. An effective assessment of preferred stimuli allows for fluent skill-acquisition and effective mand training, as well as efficient behavior reduction programs.

The purpose of the current study was to evaluate the effectiveness of a free-operant preference assessment on the establishing operations governing mands emitted by a 5-year old girl diagnosed with autistic spectrum disorder. During baseline, the participant emitted mands only for potato chips. The independent variable consisted of a Free-operant preference assessment as described by Roane et al. (1998). At post-intervention, the participant reached a cumulative repertoire of 73 different mands. Results suggest that the exposition to new stimuli via regular Free-operant preference assessment procedures might enhance establishing operations to interact with new items, therefore increasing the opportunities to teach an enhanced mand repertoire. Based on these results, a frequent Free-operant preference assessment could be recommended to applied behaviour professionals concerned with increasing communication.

Keywords

Introduction

Stimulus Preference Assessment (SPA) is a relevant component of the Applied Behaviour Analysis (ABA) programs as it permits reliable identification of the preferences of people with disabilities.

The identification of preferred stimuli enables researchers to discover potential reinforcers that can then be adopted into educational interventions based upon a positive-reinforcement paradigm. Therefore, an effective intervention can be implemented with the capacity to increase functional behaviours and the acquisition of new abilities, as well as reduce challenging behaviours. The previous literature features numerous studies on different types of SPA, which can be grouped into trial-based assessments and free operant assessments [1].

During the trial-based preference assessment, stimuli are presented in a series of trials. The results of these assessments are represented in the percentage of trials in which each stimulus was selected,

creating a rank order of preferences from most-liked stimulus to the least-liked stimulus. The most frequently utilized SPAs are as follows: Paired-stimulus [2], in which stimuli are presented in pairs so that each item is available, with all the other stimuli chosen during the assessment; Multiple-stimulus [3], in which the participant must choose one among six types of stimuli in each trial. This type of assessment was elaborated upon in a study conducted by De Leon & Iwata [4], who developed the Multiple-stimulus-without-replacement (MSWO), an assessment in which the stimulus selected in the set is subsequently removed in the following test.

On the other hand, Free Operant Assessments are based upon responses given at any time by participants and are not dependent on prompts offered by others. During the Brief Free-Operant (FO) developed by Roane, Vollmer, Ringdahl and Marcus [5], a set of stimuli are presented for 5 minutes. By measuring partial intervals of 10 seconds, the subject's interaction with the stimuli is recorded. However, a shortcoming of this type of assessment lies in the fact that the participant may interact with only one or two stimuli within the set. Consequently, the participant may not interact with all of the selected stimuli, thereby limiting the accuracy of registering what the subject's preferences are. Although the data provided by this assessment does not result in a clearly delineated hierarchy between each preference, there are nonetheless some significant advantages in this type of assessment. For instance, this assessment is associated with a low probability of evoking challenging behaviour maintained by positive reinforcement [6].

Response-restriction analysis (RR) from Hanley, Iwata, Lindberg and Conners [7] combines the properties of two typologies of SPA. Indeed, this approach is characterised by the presentation of a set of stimuli for 2 minutes. Subsequently, the most frequently selected stimulus is then excluded from the next test set.

Reliably identifying the subject's individual preferences is fundamental to recognising the appropriate establishing operation (EO) required for teaching adequate communication abilities. EO itself refers to any environmental change that increases the temporary efficacy of certain stimuli, objects or events, such as reinforcers which will increase the frequency of certain types of behaviours [1]. The verbal operant, in which a response is reinforced by a particular consequence and therefore is under the functional control of the EO, is referred to as mand [1].

The mand benefits the subject by permitting them to access the desired reinforcer. Sundberg and Michael [8] observed that the mand is the first verbal operant that a child acquires. In particular, the mand permits the speaker to exert control part of their social environment. Therefore, Sundberg and Michael emphasise the obvious importance that mand training should have in behavioural interventions.

The present study aimed to expand upon the FO preference assessment [5], by examining the effects of the SPA on the EO during the subject's requesting of new stimuli. Our research hypothesis was that periodic exposure to new items could contribute to an increased interest in interacting with novel stimuli, thereby increasing the variety of mand.

In order to increase the variety of mand, it is necessary to have active EOs for the various preferred stimuli. Beyond identifying relevant preferences, an SPA paradigm could represent a tool that allows subjects to be exposed to new stimuli and that creates an EO for different requests.

Method
Participant, setting and Materials
The participant of the present study was Sara, a child of 5 years old with a diagnosis of autism spectrum disorder. The diagnosis was provided by a developmental neuropsychiatric panel who used the following assessment protocols: Griffiths Scale (IQ of 70 and developmental age of 18 months), Autism Diagnostic Observation Schedule-Second Edition (score of 19) and the Autism Diagnostic Interview-Revised (score of 16 in the qualitative anomalies of social interaction, and a score of 14 in the qualitative anomalies of communication).

Prior to the present study, the child was undergoing an educational intervention based upon an ABA paradigm in a rehabilitation centre for 8 hours per week. The therapist was undergoing a first level Master's degree course under the same therapeutic approach. During the course, she was being supervised by a case manager for 20% of the total hours of therapy. The comprehensive intervention included the following teaching programs: imitation (gross-motor, fine-motor and graph-otor skills); associations of images by categories; discrimination of instructions as objects and parts of the body and a turn-based teaching program. The child's parents participated in a parental training program (20 hours of training that mainly included topics such as: behavioural teaching procedures, verbal-behaviour approach, analysis strategies and problem behaviour management). The child's abilities prior to the implementation of this intervention were evaluated by a supervisor who performed a constant functional evaluation based on the Verbal Behavior-Milestones Assessment Placement program (VB-MAPP).

At the time of the intervention, Sara communicated by exchanging pictures contained in a personal notebook, using a selection-based system [9]. The notebook was produced according to the description in the Picture Exchange Communication System manual [10]. The images contained in the notebook represent pictures of printed and plasticised items of 4x4 cm. The pictures are displayed within the notebook's pages. The picture "I want" is featured on the cover of the notebook, while all pictures of the stimuli are displayed on the inside pages. On the first page, there are pictures related to the items presented in the FO preference-assessment. On the remaining pages, the other stimuli are divided into categories (food and drink, games, books, sensory games, songs and playroom games).

At the end of the notebook, there is a sentence strip in which the child can construct sentences through combining the object-

picture with the phrase "I want" and present this to the therapist. Sara was selected for the study because prior to the interventions, she would mand only for one stimulus: crisps. Each session lasted for two hours each, and each session was located in two different rooms. One hour would be conducted in a one-to-one room (a highly structured environment), in which the FO preference assessment had been administered. The second hour would be held in the playroom, in which other children and therapists were present. In the one-to-one room, Sara received instruction in all of the skills previously mentioned. In the playroom, the focus was on teaching both social and play skills. Materials such as a table, chairs, wardrobes/closets and shelves with games in sight (but unreachable to the participant) were present in both environments.

Data recording

The data on the mand requested by Sara were collected by her therapist by means of paper and pencil, and a data sheet that was provided by the supervisor. It should be noted that Sara would already spontaneously orientate toward the communication notebook to compose the sentence: "I want" + "item" (IV phase of the PECS manual). Therefore, all the mands recorded were in relation to this sentence structure. No errors were observed in constructing the sentences. Sara approached the therapist correctly by showing the communication strip and indicating the two images. At the end of each session, only the categories of different stimuli requested were reported on the data sheet, not as separate incidences. For example, if the child spontaneously asked once for the first stimulus (sand), twice for the second (colours), and four times the third (a doll), then '3' was recorded as the total of stimuli. Since, at the time of the study, the child initially only requested crisps, the primary aim at this stage was to develop a desirable differentiation of requests for multiple categories. As such, the data on the frequency of requests were not included in the analysis. To clarify, if a stimulus was requested more than once during the session, this was counted only as a single incidence.

Experimental design and procedures

A withdrawal design was chosen according to the following scheme: ABACAC. Under this scheme, 'A' represents the baseline and 'B' the intervention with daily FO preference assessment associated with non-contingent reinforcement (NCR). The second 'A' represents the inversion phase while 'C' represents the intervention phase in which weekly FOs were performed without NCR.

At the beginning of the study, we conducted three baseline sessions lasting two hours each (phase A). Eight randomly ranged stimuli were placed within the child's range on a table adjacent to the table where educational activities were carried out (2 edible, 3 sensory, 2 cause-effect, and 1 symbolic). Sara could gain access to these stimuli by correctly composing the sentence "I want" + "item" using her communication notebook. The sessions were held as usual, both in the one-to-one room and in the playroom, without modifying the setting described above. No other clinical intervention was introduced, except the on-going behavioral therapy that the child was already undergoing.

The intervention stage (phase B and C of the study) consisted in the implementation of an FO preference assessment as described by Roane et al. [5]. This type of SPA was chosen because of its brevity and its association with low response effort and low levels of challenging behaviour. Furthermore, the setting in which it was implemented is similar to that of the subsequent mand training, in which there were a variety of stimuli placed out of reach of the participant. In accordance with this procedure, each FO was conducted by proposing 7 or 8 stimuli that were considered to be potential reinforcers. The stimuli were chosen based upon interviews with the child's parents. The evaluation of stimuli included: foods, sensory stimuli (e.g. gel balls, foam, slime), games (e.g. cause-effect, musical, symbolic) and books. The evaluation of preferences lasted 5 minutes and the stimuli were placed in a circular formation on a table.

For the entirety of the assessment, the participant had open access to all stimuli. She could interact with several stimuli simultaneously or, conversely, with none of them. If a particular type of food was extinguished before the 5 minutes had elapsed, another type of food would be made available. Before the evaluation commenced, the therapist showed the child how to use each stimulus correctly. Then, she provided the instruction: "You can play/choose whatever you want" while using a stopwatch to time the interactions. The therapist recorded the manipulation of stimuli through the 10-second partial-interval measurement procedure as suggested by Roane et al. [5]. This manipulation has been defined as the contact between the participant's hand and the stimulus.

At the end of the observation, the measurements were converted into percentages of intervals spent manipulating each selected item. Exclusively during phase B of the study, a NCR procedure was implemented. Therefore, the crisps were not included in the stimulus set but were instead provided for a 10-second fixed-time scheme. In doing so, it was hypothesized that the crisps would not limit the subject's interaction with the other stimuli presented in the assessment. After the inversion phase (phase C), the procedure for implementing the FO preference assessment was modified, as no increase in the variety of requests was observed. During the assessment, crisps were included within the stimulus set.

All of the steps indicated by Pence, Peter & Tetreault [11] were followed in order to execute the evaluation in an optimal approach: the stimuli were presented equally spaced and in proximity to the child; a discriminatory stimulus was provided. In addition, we also followed recommendations to: stay oriented towards the student; do not stop attempts to select more than one stimulus; allow time to manipulate or consume a stimulus; supply the edible stimuli that are consumed; reposition the items that have been moved near the student; provide prompts if the student does not choose any stimulation. The implementation of an RR procedure was pre-planned in the event crisps were the only stimulus selected during the FO; however, this was not necessary.

According to the criterion first outlined by Hanley et al. [7], the crisps had to be excluded from any subsequent evaluation in the

event that they were chosen for 60% of intervals or more during two consecutive observations. In phase B of the study, the FO preference assessment was performed at the beginning of each session. Conversely, during phase C of the study, the FO was conducted during the first session of each week. This alteration was introduced due to the difficulty encountered in finding novel stimuli for each new session.

The dependent variable consisted of the number of different mand issued spontaneously, without prompts, through a selection-based communication system (SB).

Results

The most relevant result of the study was the increase in the variety of mand issued by Sara, which reached a repertoire of 73 cumulative mand.

During the first baseline (1°-3° week), the child asked solely for one item: crisps. After having introduced the daily FO + NCR (4° e 5° week), Sara then asked for 3 different stimuli. As can be observed from the results, during the inversion phase (6°- 8° week), the participant requested 14 new stimuli. When a weekly FO preference assessment associated with NCR (9°- 14° week) was performed, Sara expanded her repertoire to 22 mand. During the third phase of the baseline return, Sara issued 4 new mands. At this stage, the study was interrupted for approximately 20 days due to the centre's Christmas leave. In the last intervention phase (18°- 24° week), the child used 28 new mands. These results are displayed in (Figure 1).

For greater clarity, the graph shows the weekly average of the different mand issued in all phases of the study (Figure 2).
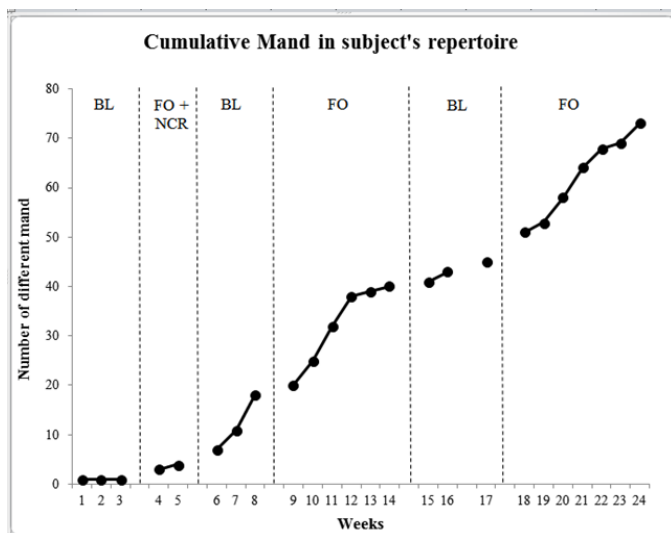

Figure 1: Mand in Sara's repertoire during the course of the study.

In the first baseline, the average is 1 mand for all three weeks. In the 4th week the average of the mand variety is 1 and in the 5th week is 1.6.
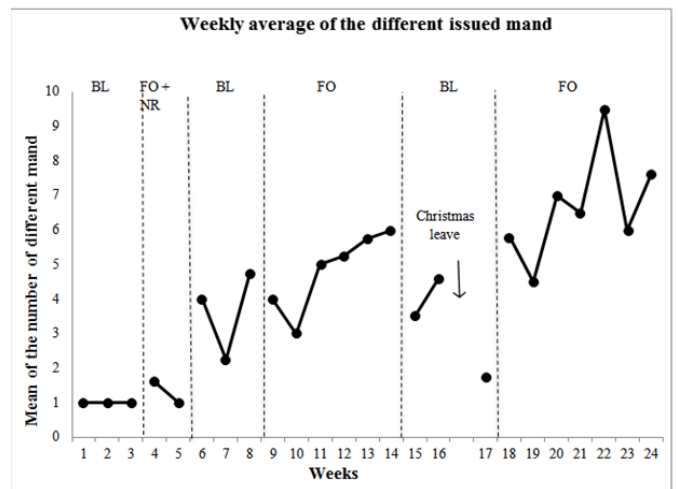

Figure 2: Weekly average of the different mand issued by Sara during the study.

In the inversion phase, Sara asked for an average of 4 different items on the 6th week, issued an average of 2.25 different mands during the 7th week and 4.75 during the 8th week. With the reintroduction of the FO preference assessment not associated with the NCR, the mean of the variety of requested items initially remained close to that of the inversion phase.

This is observable for the values of 4 in the 9th week, 3 during the 10th and 5 in the 11th. From the 12th week, however, the values increase up to an average of 6 different mands issued during the 14th week. In the baseline return phase, the values are at a lower level than in the previous phase.

In fact, the average was 3.5 in the 15th week and 4.6 in the 16th week. When the child returned, the mand variety mean decreased to a value of 1.75. With the restoration of the FO preference assessment, the mean values of the mand variety range from 5.8 (18th week) to 7.6 (24th week, the last).

Discussion

Identifying potential reinforcers through the stimulus-preference assessment within ABA-based educational programs allows for successful interventions for the acquisition of skills and the reduction of maladaptive behaviours. Identifying the preferences of people with disabilities is difficult; it is for this reason that many researchers have developed distinct methodologies for achieving this goal [5]. Determining the best reinforcers enable practitioners to implement interventions that will develop and enhance communication skills. By manipulating the EOs (which are the mand control variables), effective mand training can be fulfilled [10].

In this study, the stimulus preference assessment (in particular, the free operant preference assessment) was implemented with the aim of exposing the participant to new stimuli. This was accomplished through examining the effects of the exposure on the variety of mand issued by the participant. It has been hypothesized that

exposure to new stimuli recurrently, free from any type of request (as in the FO preference assessment), increases the EO and causes subjects to interact with a greater variety of items. This could have led the participant to issue a greater variety of mands since, during the baseline, Sara had only asked for crisps. During the course of the study, the participant increased her mand repertoire to a cumulative total of 73 mands for a number of different stimuli. The results of the current study reveal that the exposure to new stimuli through the FO preference assessment can help to increase the EO and the repertoire of mand.

A possible limitation of the present study may lie in its implementation of the FO preference assessment, which was initially associated with the NCR procedure. It was hypothesised that if the crisps were included in the item set, they could have unilaterally seized the attention of Sara to the detriment of her desire or ability to interact with other stimuli. On the other hand, it the crisps were not included in the set, the participant would have requested them, thereby hindering the assessment. However, as the results did not confirm this hypothesis, the NCR was suspended. Even if the NCR component is considered as a limitation of the present study, it is possible that it also provides a conceptually systematic explanation for the increase of the requests in the second A phase (return to baseline).

A pairing process could have been triggered between the crisps delivered according to a fixed-time scheme during the FO preference assessment, and the stimuli used during the same assessment. This may somewhat explain the slight increase in mand during the inversion phase. Indeed, it is not clear why the values of the dependent variable in the inversion phase, while remaining at a low level, are higher than the baseline and those recorded during the previous phase. To replicate this study, we suggest following the guidelines indicated by Pence et al. [11] to guarantee the integrity of the treatment. The experimental control may have been limited by the different therapeutic settings, which may have in turn contributed to broadening the variety of mands in the repertoire. Specifically, during the therapy sessions carried out during the intervention, the stimuli were placed on shelves and inside the closets so that they were not accessible by the child.

This environmental structure could have acted as an EO to the issuing of mand. It must be noted that in the baseline phases the preferred stimuli were arranged on an easily accessible table, which was located next to the one on which the usual educational activities took place. Although the child has cumulatively increased the number of requests, the weekly mean remained quite low. This suggests we must interpret the results with caution. A further methodological limitation of the present study is the absence of an interobserver agreement.

Verriden and Roscoe [6] recommend repeating frequent SPAs in order to ensure that the reinforcements used are effective during the skill acquisition programs. Indeed, the results of this study suggest that it is advantageous to conduct frequent assessments, as repeated evaluations have enabled us to capture changes in EO for different stimuli and to conduct a more effective training mand. Future research should include data on the occurrence of challenging behaviours maintained by socially-mediated positive reinforcement, to see if such behaviours are reducible with the increase of mand and their variety.

References

1. Cooper JO, Heron TE, Heward WL. Applied Behavior Analysis Second Edition. Pearson New International Edition. 2014.
2. Fisher W, Piazza CC, Bowman LG, et al. A comparison of two approaches for identifying reinforcers for persons with severe and profound disabilities. Journal of Applied Behavior Analysis. 1992; 25: 491-498.
3. Windsor J, Piche LM, Locke PA. Preference testing A comparison of two presentation methods. Research in Developmental Dis-abilities. 1994; 15: 439-455.
4. DeLeon IG, Iwata BA. Evaluation of a multiple-stimulus presentation format for assessing reinforcer preferences. Journal of Applied Behavior Analysis. 1996; 29: 519-533.
5. Roane HS, Vollmer TR, Ringdahl JE, et al. Evaluation of a brief stimulus preference assessment. Journal of Applied Behavior Analysis. 1998; 31: 605-620.
6. Verriden AL, Roscoe EM. A comparison of preference-assessment methods. Journal of Applied Behavior Analysis. 2016; 49: 265-285.
7. Hanley GP, Iwata BA, Lindberg JS, et al. Response-restriction analysis I Assessment of activity preferences. Journal of Applied Behavior Analysis. 2003; 36: 47-58.
8. Sundberg ML, Michael J. The benefits of Skinner's analysis of verbal behavior for children with autism. Behavior Modification. 2001; 25: 698-724.
9. Michael J. Two kinds of verbal behavior plus a possible third. The Analysis of Verbal Behavior. 1985; 3: 1-4.
10. Frost L, Bondy A. Il manuale del Picture Exchange Communication System Seconda Edizione. Pyramid Educational Consultants, Inc.
11. Sacha T Pence, Claire C St. Peter, Allison S Tetreault. Increasing accurate preference assessment implementation through pyramidal training. Journal of Applied Behavior Analysis. 2012; 45: 345-359.