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# A Case-Study In Re-Teaching A Traumatically Brain Injured Child Handwriting Skills

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Abstract: The case study details the efforts to re-teach handwriting skills to a child with traumatic brain injury. The intervention focused on practicing handwriting tool, or foundational, skills. The case study took place during occupational therapy while the child attended out-patient sessions at a post acute rehabilitation center. Positive results accompanied the intervention and are discussed.

The long term and delayed effects of traumatic brain injury (TBI) are devastating. Physical, cognitive, psychosocial and behavioral changes affect the majority of persons with severe brain injury (Brown & Nell, 1992 ; Label, 1997). As Bruce (1990) noted:

It seems likely that up to 50 percent of children who recover consciousness after severe head trauma (comas lasting more than 6 hours) will have some intellectual or psychiatric problem that can be identified in the first 1 or 2 years post trauma. (p. 521) Whatever the exact statistic, it is clear that the person with a severe brain injury undergoes a life changing experience along with their loved ones.

Children who acquire head injuries suffer additional consequences. Mira, Tucker, & Tyler (1992) have described ways a brain injury and the subsequent sequelae can also affect the future development of a child. The TBI can alter developmental progress and rate, decrease the ultimate level of skill achievement, and destroy skills already learned (Mira et al.).

Although a traumatically brain injured child will recover some functioning with time, the outcome and rate are influenced by factors that include medical care received, programs delivered through rehabilitation and education, individual resources, and family attitude (Begali, 1987). Thus one way to help maximize the recovery potential of a child with a brain injury would involve advocating researched and data-driven rehabilitation and educational programs or procedures.

With the improvements in medical technology, the accelerating survival rate among children with TBI and the often inadequate medical funding resources has many parents and caregivers looking to alternative treatment placements for their children. Furthermore, the inclusion of traumatic brain injury as a recognized disability in the Individuals with Disabilities Education Act, or IDEA, (Education, 1991) places greater responsibility on the public school system for the delivery of effective educational services.

A child with a traumatic brain injury returning to school faces a variety of educational difficulties, handwriting is one such difficulty. Because many school systems make extensive use of the see/write, hear/write and free/write channels, in acquisition, expression and evaluation of learning, a student needs fluent handwriting (fast, accurate, and legible) for typical instruction.

Handwriting programs used for typically developing children and children with learning disabilities exist (Miller & Engelmann, 1980; Zaner-Bloser, 1984). Students with traumatic brain injuries, however, differ from students with learning disabled in that they have acquired their disabilities (Blosser & DePompei, 1989). Children with an acquired brain injury may recall information learned in previous grades and their premorbid skill level. For instance a student may hold their pencil inappropriately, forget how to form their letters and improvise, write at a very slow pace or write letters inconsistently (Smith, 1988). Children with TBI may have already learned to write and the acquisition of their injury will effect each student in a different manner. Awareness of their change in performance may frustrate and depress the child.

Therefore, many of the methods offered for children with learning disabilities may not be appropriate for children with TBI. For instance teaching relaxation to offset a tight grip or teaching the transition from manuscript to cursive (Reis, 1989) would not be necessary for a child who did not experience grip problems or already knew cursive. A prudent solution calls for analysis of handwriting difficulties on an individual basis with emphasis placed on review of tool, or foundational, skills.

By reviewing tool skill competencies critical information can be gathered. For instance, after determining the learner's tool skill frequency, variables that may create a ceiling effect can be systematically ruled out. This article discusses a case study of the effects of a child with traumatic brain injury who practiced tool skills of handwriting.

## METHOD

### *Participant*

The participant, a 14 year old male (who we will call Byron), had sustained a traumatic brain injury when he was hit by a car while riding his bike. He was unconscious at the accident site and taken to the hospital where he was intubated. Hospital evaluations revealed multiple skull fractures, displacement into the cerebellum, multiple hemorrhages affecting the left frontal and temporal lobes, and the right cerebellum.

After Byron was treated and stabilized, he was transferred to a sub-acute facility where he progressed. During this time he also was weaned from his tracheotomy tube and gained a significant amount of weight. After Byron stabilized, he was discharged to an acute care facility. Shortly afterwards, he was discharged to his home and admitted to the Battle Creek NeuroRehab Center for out-patient, post acute rehabilitation.

Before Byron's traumatic brain injury, he was in a regular education eighth grade class. Academic records report that Byron experienced attention deficit problems prior to the accident, but did not highlight any other skill deficiencies.

### *Setting*

The setting was located at the Battle Creek NeuroRehab Center, a post acute rehabilitation facility, in Battle Creek, Michigan. Sessions were conducted during occupational therapy and were held at either the occupational therapy kitchen or the pediatric common area. Both areas had a circular table and chair where timings were conducted.

Sessions began at 10:00 am and occurred during the occupational therapy regimen. Byron chose the order of occupational therapy activities, hence, there was no preset time when the one minute-timings would occur. The frequency of sessions ranged from 1 to 3 days a week.

### *Measurement*

The materials used during the handwriting sessions were a No. 2 pencil and standard lined notebook paper. A digital stopwatch was used to conduct one-minute timings by the occupational therapist. She would score corrects and incorrects after all of the timings were complete. The data were recorded on Standard Celeration Charts (Penneypacker, Koenig, & Lindsley, 1972).

The participant was given the option to enter data on the chart but preferred "looking at it rather than writing it". This response was most likely based on the participants first attempt to input data on the chart. His ability hold his hand still enough to enter the data were greatly compromised by ataxia.

## PROCEDURES

### *Initial sessions*

All of the sessions were conducted by an occupational therapist who agreed to try a new approach to remediate hand-writing skills by using one-minute timings of tool skills and displaying the data on the standard celeration chart. The first author supervised sessions and made recommendations during the hand-writing portion of therapy.

Before the first session, the participant was asked if he would like to improve his hand-writing through practice. After responding positively he was briefed about the procedure. During each occupational therapy session the participant could choose when the one-minute timings would occur. Once started, he would finish all exercises and then move on to the next activity.

Three tool skills were initially selected out of a list of eight that are recommended for handwriting fluency (Freeman & Haughton, 1993). The three tool skills chosen for practice were drawing continuous, elongated ovals (resembling cursive l's), drawing four vertical lines with a horizontal line through it, and drawing continuous connected lines each at approximately 70 to 80 degrees (Refer to the counted label under each chart following the results section for a visual portrayal of the tools skills).

An additional tool skill was selected from the list after Byron had been practicing, and progressing, with the other three tool skills after four weeks. The tool skill selected looked similar to drawing continuous lower case cursive c's. This was added so that Byron could continue to expand his hand-writing movements.

At the beginning of the session, Byron was given a pencil and standard notebook paper and told that when he began writing the timer would begin. Further instructions were given to write quickly and when the end of a line was reached to move down to the next line, and stop until the alarm sounded (an Ironman® wristwatch was used for timings). The free/write channel was used for each of the tools skills practiced.

Byron practiced each tool skill for one trial. At the completion of all the trials the corrects were scored. A correct was defined as writing the marks within the lines of the notebook paper. After tallying the corrects, the data were charted on a standard celeration chart and Byron received feedback and praise. Byron was given praise for his effort even if the data points were below the last trial.

### *Sprints*

A change was made to the daily sessions. Before the selected tool skill for practice occurred, Byron would do a 10 second "warm-up" or sprint. After the sprint, he would receive feedback from the occupational therapist on his performance. During the sprint phase, all four tool skills were practiced and all were preceded by a ten second sprint.

## RESULTS

Individual Standard Celeration Charts for Byron display the number of correct marks written in a one minute counting period. The initial phase results demonstrate the frequencies of the one minute timing occurring without any intervention. The Sprint phase shows the results of a one minute trial after the sprints were conducted. Data for the ten-second sprint were not recorded.During the initial phase for the handwriting movement that resembled cursive l's, the number of correct movements accelerated by x1.2. When the sprints began the celeration maintained a x1.2 for the phase.

Results for the tally marks with a strike through show that during the initial phase correct movements accelerated by a x1.1. During the sprint phase the celeration path did not change and remained at a x1.1.

The initial phase for the drawing what looked like connected 70-80 degree lines movement displays a x1.05 acceleration. The celeration remained at x1.05 for the sprint phase.

The last phase of drawing what resembles continuous lower case cursive c's was shortest in pre-sprint condition. The data represent a x1.0 celeration. After sprints began, it appears the celeration of corrects jumped up slightly to x1.05.

## DISCUSSION

An important output of handwriting instruction is legibility. Yet without the ability to write at an appropriate frequency, legibility may not serve the author. For instance writing three sentences of legible notes from a half hour presentation would most assuredly include many gaps in the content of the material.

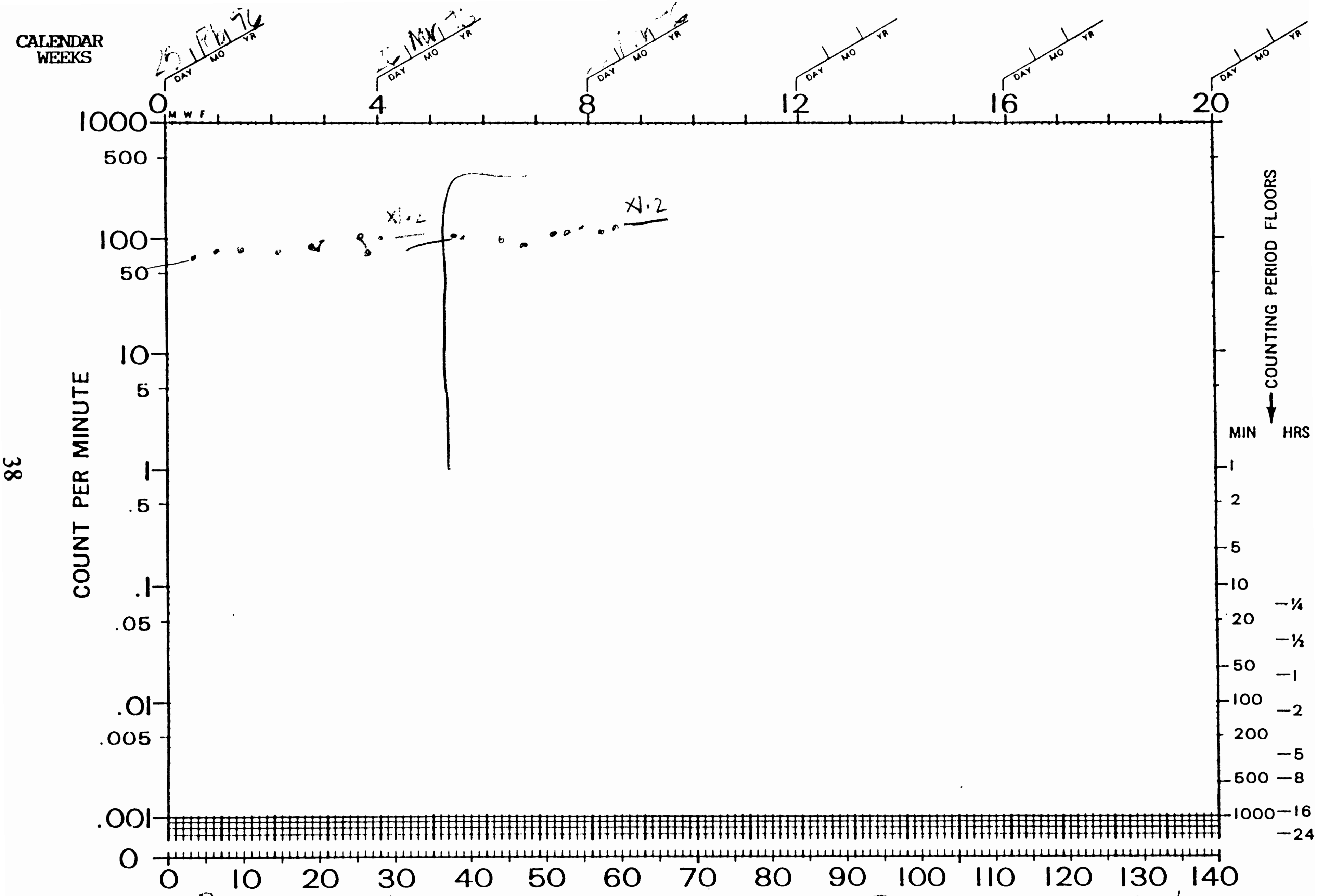
For Byron, both legibility and his writing frequency were negatively affected after his traumatic brain injury. Employing a traditional drill and practice procedure that focused on writing alphabet letters, words, or copying text was not effective. An approach that provided systematic, measurable practice on the component behaviors of handwriting appeared more beneficial. An interesting effect in this study occurred in the difference between see/copy exercises. Before instruction or practice began, a see/copy measure was taken to determine how fast Byron could copy items from a book. Byron copied 8 words in a one minute period. After instruction and practice was concluded, an exit measure on the same see/write exercise revealed that Byron doubled his output to 16 words in a one-minute timing session.

After the intervention, it was clear that the form of Byron's writing vastly improved. In effect, the practice of tools skills of handwriting was accompanied by a doubling in the total amount of words in the see/copy channel, as well as improved legibility in everyday handwriting, a skill not directly addressed.

Another positive effect occurred with Byron's pencil grasp. Given no explicit instruction on holding a pencil or grasp, his form was noted as being "immature" (i.e., thumb and three remaining digits on pencil) at the beginning of therapy. After the study, Byron had normal grasp prehension, thumb opposing two remaining digits. This was another skill that was not directly instructed but emerged after the intervention.

*Limitations:* In applied settings, situations arise where the direction exercised in tightly controlled research settings is not engendered or maintained. Reasons for loss of control stem from time constraints, uncontrollable environmental variables, scheduling problems, or logistical restrictions. This case study was affected by such constraints mainly in two ways.

First, Byron was on a schedule such that consistent sessions could not be attained. Some weeks Byron would engage in three sessions. Other weeks he would engage in only one. This undoubtedly limited the effectiveness of the procedure. Practicing a skill on an inconsistent, and sporadic, schedule is at best, a maintenance of that skill.

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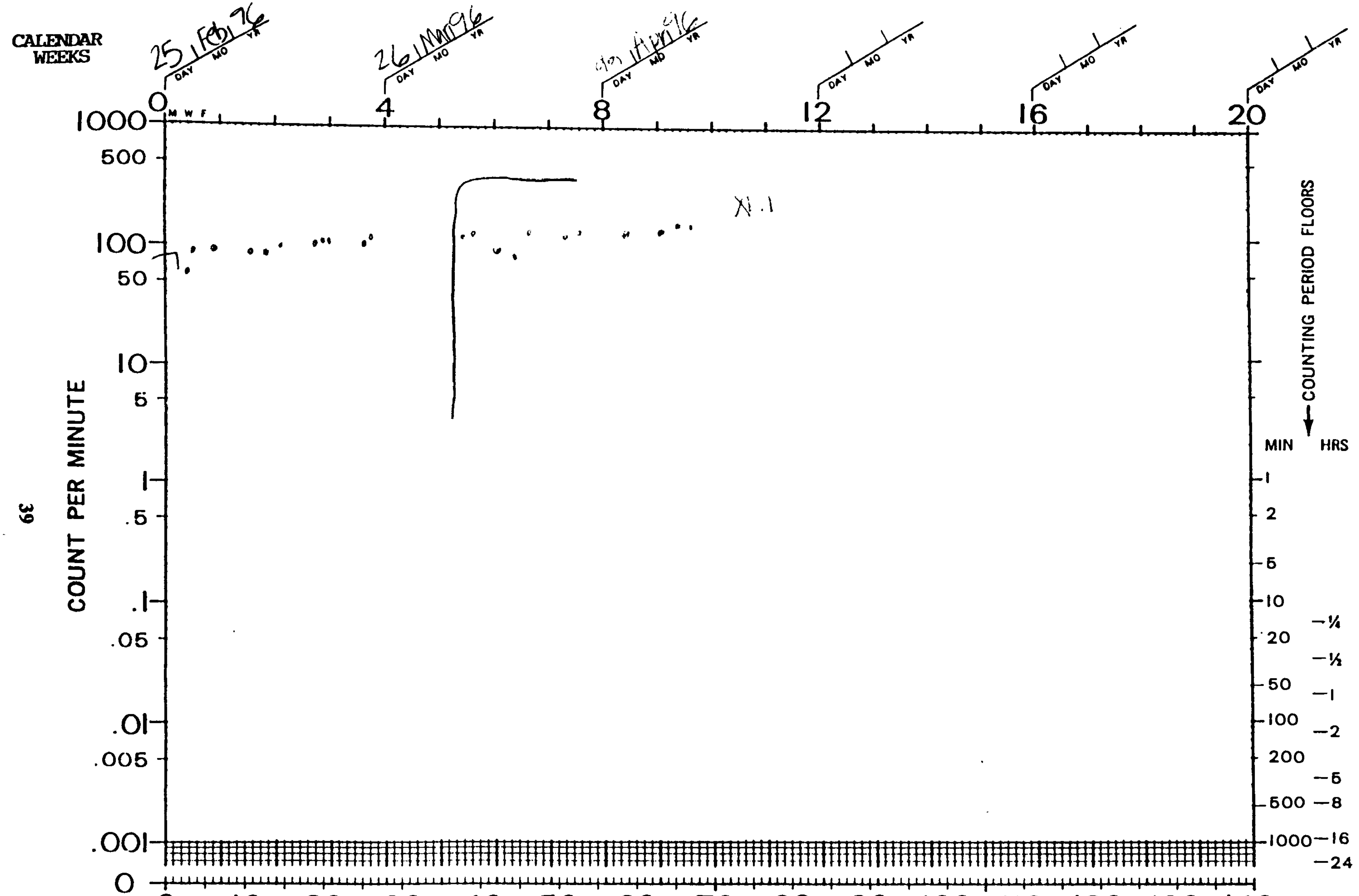
|---|---|
| SUPERVISOR | |
| ADVISER | Rick |
| MANAGER | Rick |
| BEHAVER | Byron |
| AGE | 15 |
| LABEL | TP1 |
| COUNTED | [illegible] |
| DEPOSITOR | |
| AGENCY | B.C. Neurobehavioral |
| TIMER | Diane |
| COUNTER | Diane |
| CHARTER | [illegible] |




| | | | | | | | |
|---|---|---|---|---|---|---|---|
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| SUPERVISOR | ADVISER | MANAGER | | BEHAVER | AGE | LABEL | COUNTED |
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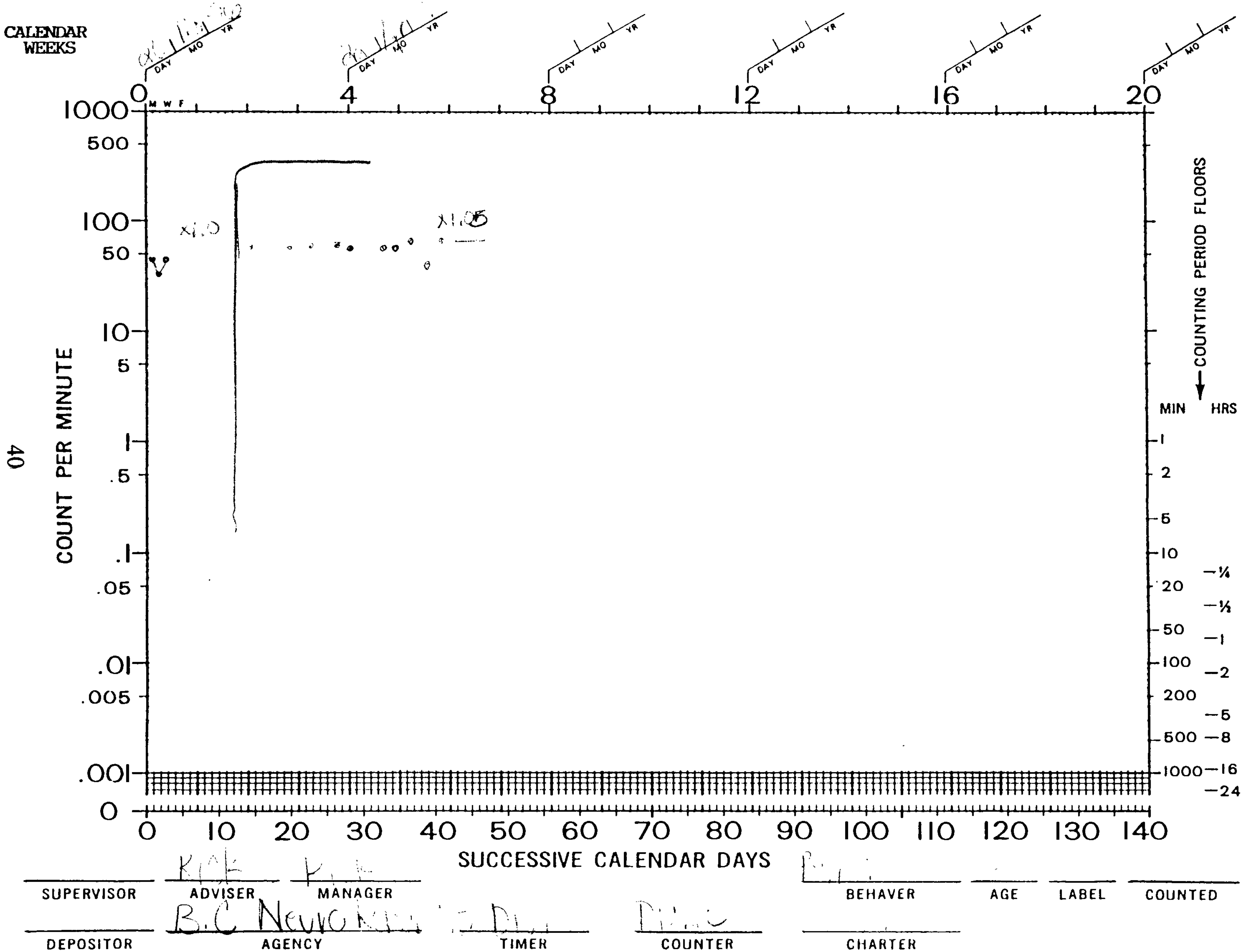
| DEPOSITOR | AGENCY | TIMER | COUNTER | CHARTER | | | |


CALENDAR WEEKS
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COUNTING PERIOD FLOORS
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HRS
SUCCESSIVE CALENDAR DAYS
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140
SUPERVISOR
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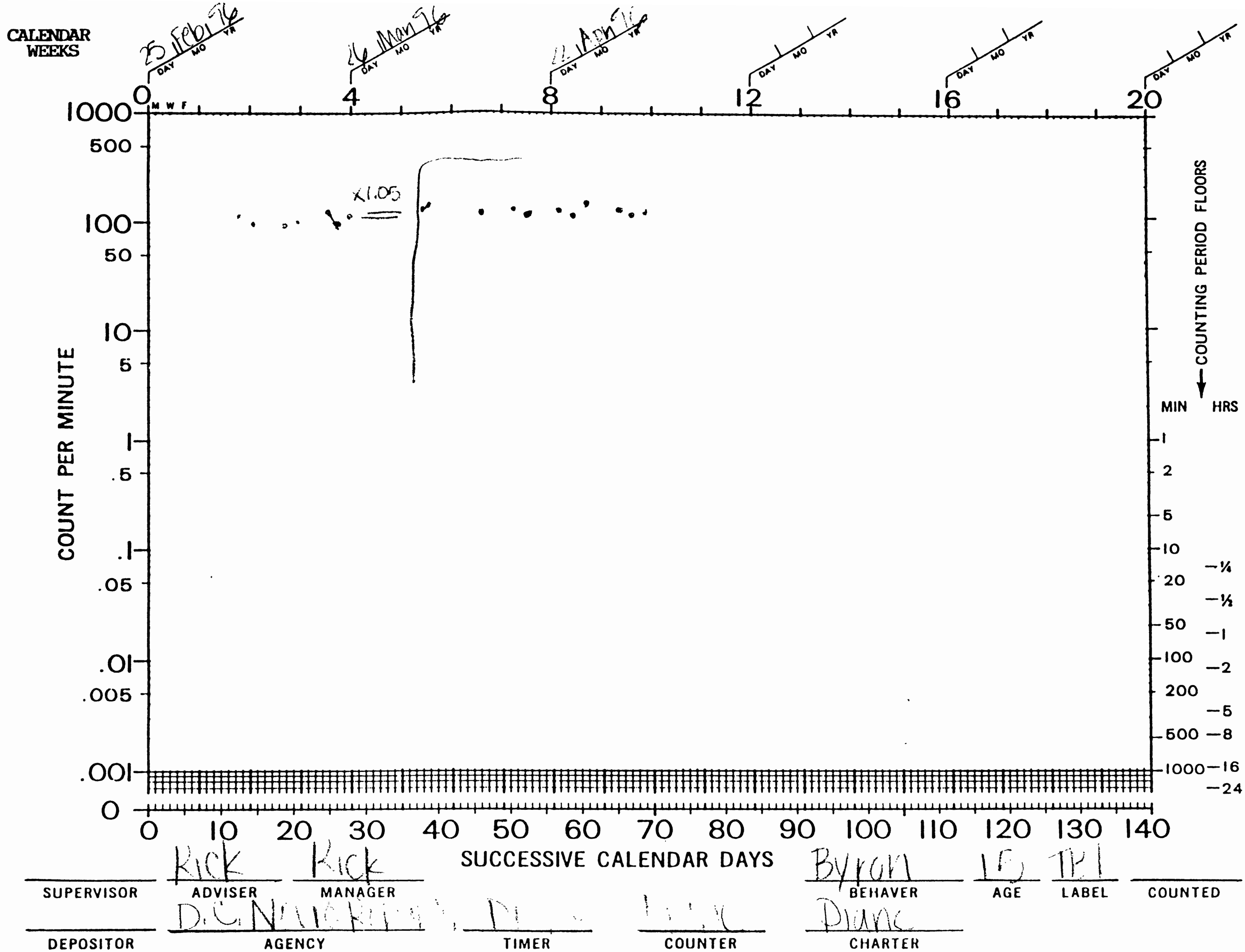
COUNTER
CHARTER
B.C. Neuro

40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DAY MO YR
26 Mar 96
21 Apr 96
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COUNT PER MINUTE
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COUNTING PERIOD FLOORS
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16
24
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140
SUCCESSIVE CALENDAR DAYS
SUPERVISOR
Rick
ADVISER
Rick
MANAGER
Byron
BEHAVER
AGE
LABEL
COUNTED
DEPOSITOR
AGENCY
TIMER
COUNTER
Diane
CHARTER

Second, when delivering therapy there is a limited amount of time the person can receive therapy (e.g., funding restraints). This situation occurred with Byron in that he was discharged before more significant outcomes were attained for the various tool skills that he was practicing. The see/copy aim words from a book or blackboard is 20 to 30 words per minute. Byron's performance of copying words at 16 per minute was below this aim.

Although this case study have several limitations, there are many implications that stem from it. When approaching rehabilitation, assessing the component or tool skills of a behavior should be the first step. Then appropriate instruction can be arranged. In traumatic brain injuries, skills maybe completely "lost", and complicated by physical (e.g., ataxia) and memory factors (e.g., memory loss), and a declination in frequency. Rather than beginning from a forward chaining method, a practical alternative is to practice the tool skills.

In addition, if limitations to therapy arise, steps can be taken to ensure that progress continues. As in the case of Byron, even though he left the facility, the methods were continued at school, and the chart followed him conveying all of his previous efforts.

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