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ABSTRACT

This study identified 10 savant with developmental disabilities and an exceptional ability to calculate calendar dates. These "calendar calculators" were asked to demonstrate their abilities, and their strategies were analyzed. The study found that the ability to calculate dates into the past or future varied widely among these calculators. Three calculating strategies or approaches were evident. The simplest strategy involved using rote memory to recall specific dates and/or using memorized key dates as reference points. The second strategy made use of the repeated trends and rules governing the calendar; however the knowledge of "leap centuries" was absent. Two subjects used a third strategy which took into account leap centuries, and one of these subjects was able to correctly calculate dates into the far future and past. The calendar calculators were characterized by an exceptional memory, a compulsive and rigid handwriting style, and an ability to focus their attention. Cognitive limitations in understanding questions appeared to limit the calendar calculation abilities of some of the savants. (DB)

"Autistic Savant Calendar Calculators"

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INTRODUCTION

Historically the term "idiot savant" has been used to describe individuals who possess one or more highly developed skills or talents that are in marked contrast to their otherwise limited intellectual capacity (for literature reviews see Peterson, 1896; Tredgold, 1914; Rimland & Hill, 1984; Treffert, 1988, 1989; and Howe, 1989). The term "idiot" is both pejorative and archaic; in addition, most of the reported cases in the literature are of individuals who have IQs of 40 or above. The term "savant" will hereafter be used to describe these individuals.

According to the reported sources, the percentages of developmentally disabled individuals possessing exceptional talents or skills (savant abilities) has ranged from 0.6% (Hill, 1977) up to 9.8% with autism being the most prevalent diagnostic feature of the reported savants (Rimland, 1978). Of the savant abilities, several categories of skills have been identified and reported (see Hill, 1974) and include the rapid calculation of numbers and dates, artistic and musical talents, mechanical abilities, advanced word recognition without comprehension (hyperlexia) and memories for specific information.

Calendar calculation has been one of the most common reported savant abilities and has been the subject of recent investigations (Hill, 1975; O'Connor & Hermelin, 1984; Hermelin & O'Connor, 1986 ; Howe & Smith, 1988;). The most famous and frequently cited cases of calendar calculators are the twins, George and Charles (see Horowitz, Kestenbaum, Person, & Jarvik 1965; Horowitz, Deming, & Winter 1969). Their amazing ability to recall people, dates and events as well as the weather has been cited in many of the reports on "idiots savants".

METHODS AND PROCEDURE

This research project is being conducted by the author and is investigating individuals with developmental disabilities who possess on or more exceptional skills that would not generally be present without formal training. Ten "calendar calculators" (9 males, 1 female) ranging in age from 20 to 51 have currently been identified and the preliminary findings are included in this paper.

Each calendar calculator was asked to demonstrate their ability to give the day of the week that a particular date has fallen or will fall, indicate the dates of a selected month in a calendar year, and calculate the specific date when a given a particular day of the month and year. Their responses to different calendar dates were collected over one or more sessions, and in most cases a video-recording of their performance and behavior was made. A summary of the collected data for each calendar calculator is presented below in Table 1.

Insert Table 1 About Here

RESULTS

The preliminary findings based on the data from the ten calendar calculators revealed differences in their calculating strategies and methods. The results indicated the range of the ability to calculate dates into the past or future varied widely between these calculators. Three calculating strategies or approaches were evident and are proposed to explain the reasons for such a disparity (see Table 2). In two cases (George and T.H.), the range of their ability was virtually unlimited and errors occurred only with some dates 10,000 years into the future.

Insert Table 2 About Here

In stage 1, calendar calculators with "limited " ranges were found to use their rote memory to recall specific dates (Vera, A.M., and T.J.). Another calculator (S.M.) memorized key dates and counted off from these reference points to arrive at a date. It was evident based upon S.M.'s slower recall that some degree of counting to arrive at a date was evident, but true calculating did not appear to be occurring. From the results, it was evident that calculators in this stage can immediately recall a date if it is within their range. If a date was out of their range, they would either offer a "guess" based on present known information or refuse to answer which occurred in two of the cases.

The calculators using stage 2 strategies with extended ranges over 100 years (Richard, Mark, and T.H.) were able to both memorize and calculate dates into the past or future using the repeated trends and rules governing the calendar. A knowledge of "leap centuries" however, was absent and resulted in consistent "uncorrected" dates before the year 1900 and after the year 2100. These calculators were not aware that the years 1900, 1800, 1700, 2100, 2200 and 2300 are not leap years and were "off" by plus or minus 1, 2, or 3 days when calculating dates prior to January 1900 or after January 2100. The results from the four calendar calculators indicated that their calendar year ranges varied widely and appeared to be a function of the complexity of the arithmetic calculations needed to arrive at a day or date. With dates after a leap century, a consistent "uncorrected" date was calculated. Taking into account these "uncorrected" dates from the collected data were factored in as "correct" and

were positively reflected in the accuracy percentages of Table 1 since they were viewed as a constant.

Only George and Charles took into account "leap centuries" and were able to correctly calculate dates into the past or future, although Charles was limited to only 200 years whereas George was able to apply these rules to any past or future year. Only one other documented case, has been reported of a calendar calculator who took into account "leap centuries" (a stage 3 strategy) when calculating dates into the distant past or future (refer to LaFontaine (1974) for the description of "Irwin").

DISCUSSION AND CONCLUSIONS

The present findings from the sample of ten calendar calculators revealed a number of behavioral features and characteristics that were prevalent in this group. An exceptional memory (a common trait in all savants) was evident in the 10 calendar calculators. They displayed the ability to recall calendar dates as well as other specific information that was of interest to them (see Table 1). From the data, a compulsive and rigid handwriting style was also evident in many of the calendar calculators when they wrote down their answers for different days and dates. They displayed an ability to focus their attention on recalling a day or date and write it down in almost a mechanical fashion and then attend to the next calendar date. Also from the preliminary findings was the observation that calculators with extended calendar ranges tended to have higher IQs than those with limited calendar ranges (see Table 1). Cognitive limitations and the ability to comprehend or understand questions for various calendar calculations appears to be a factor which may limit the range of an individual with this ability.

The condition of autism was a predominant trait across this group and was formally diagnosed in 6 of the 10 calendar calculators. With the remaining 4 calculators, autistic features in their speech and interpersonal behavior were evident however a formal diagnosis of autism had not been given. The incidence of males (9) to females (1) in the present sample is consistent with the higher sex ratio of males to females both for autism and for savant ability. Additionaliy, "hyperlexia" as a true savant ability was confirmed in one calculator and was proposed in 4 other calculators. Overall, this data clearly supports the close association and higher incidence of individuals with savant abilities and autism that has been reported in the literature.

The objective of this on-going project is to locate and evaluate the few children and adults with developmental disabilities who possess exceptional savant abilities in order to better understand the reasons why and how these abilities exist. With a greater understanding, programs can be designed to allow for these special abilities to be channeled in a more constructive and functional manner.

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Table 1
Summary of Autistic Calendar Calculators

Name	Age	Sex	IQ	Dx of Autism	Calendar Range(Years)	Accuracy Percentage	Other Savant Skills
George[a]	51	Male	73	?	Unlimited	92%	memory for people, the weather, dates & events; calculates prime numbers
Charles[a]	51	Male	66	?	200	92%	memory for people, the weather, dates & events; calculates prime numbers
Richard	37	Male	67	Yes	5000	82%	memory for people and events; (hyperlexia[b])
Mark	42	Male	68	Yes	2500	85%	memory for people and events; (hyperlexia[b])
Vera[c]	22	Female	49	Yes	12	93%	memory for sports trivia lightning math calculator hyperlexia
T.H.	31	Male	48?	Yes	Unlimited	97%	memory for music trivia lightning math calculator (hyperlexia[b])
S.M.	42	Male	67	?	70	97%	memory for people, dates and events
A.M.	20	Male	48	Yes	11	89%	memory for people, places & music trivia (hyperlexia[b])
S.S.	30	Male	42	Yes	50	92%	Unknown
T.J.	24	Male	NA	NA?	20	69%	Unknown

[a] first reported by Horowitz et al, 1965, 1969; [b] the presence of hyperlexia is proposed for these individuals based on their higher reading & spelling scores compared to their receptive/reading comprehension abilities; [c] first reported by Patti & Lupinetti, 1993.
? Although no formal diagnosis of Autism or Autistic Disorder was given to the these individuals, they do meet the diagnostic criteria for Autistic Disorder as outlined in the DSM III-R.
NA data not available

Table 2
Calendar Calculating Strategies or Approaches for Computing Dates

Stage 1: Dates are rotely learned and retained in Memory
(Used by Calendar Calculators with a limited range of < 50 years)
In this stage, scanning, memorization and the ability to recall days, weeks and months in one or more calendar years are employed. Through repeated exposure, scanning, and practice, the organization of the weeks and months in a calendar year are rotely learned or "known". Key dates (i.e. January 1, a birthday) or other references points in calendar years are used to arrive at dates or days. A knowledge and awareness of important holidays and events are memorized and can be recalled with little difficulty.

Stage 2: Dates are calculated using basic Arithmetic and the General Rules governing the Calendar - Leap Years only. *(Used by Calendar Calculators with extended ranges over 100 years)*
In this stage, memorized dates and years, and arithmetic calculations are used to arrive at more distant past or future dates. A knowledge and awareness of "leap" years and the repeating trends in calendar are present although the calendar calculator may not be able to verbalize these differences. Absent is the knowledge of "leap centuries" which occur every 400 years.

Stage 3: Dates are calculated using basic Arithmetic and the General Rules governing the Calendar - Leap Years and Leap Centuries. *(Used by Calendar Calculators with extended ranges over 100 years)*
In this stage, individuals possess a full knowledge of the rules governing the calendar and the existence of "leap centuries.