How New Graphical EDA Techniques Can Reveal Hidden Relationships Between the Criminal Behavior of Federal Prisoners and Their Thinking Patterns

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Abstract: The purpose of this paper is to show the results of our graphical analysis of a detailed attitude survey conducted of a small group of prison inmates in a medium security federal correctional facility. The goal of our research was to gain insight into the possible relationships between inmates' thinking styles and key criminal patterns. Using new, easy to use, graphical Exploratory Data Analysis (EDA) techniques, we were able to find many factors worth further investigation. In this paper, we show that, for this inmate population, there appear to be key links between criminal behavior and negative attitudes, choice of friends, and "dysfunctional" early childhood experiences. We hypothesize that these criminal attitudes/thought patterns, which also may possibly be linked to a number of key criminal rehabilitation factors, could be learned/changed in intimate social groups.

BACKGROUND NOTE: This paper focuses primarily on the graphical techniques used to analyze these data. This paper highlights how novice subject matter specialists can quickly and easily gain key insights into their data by utilizing the extraordinary power of these easy-to-learn graphical tools and techniques. This paper is an outgrowth of an introductory graduate level EDA statistics class taught by Mr. DesJardins and a term paper written for the class by Ms. Golumbaski.

This is a hands-on class – teaching the SAS® Corporation's point-and-click JMP® software – in addition to the application of that software to the data analysis task using EDA theory .

Introduction: Decades of research into the causes of criminal behavior have produced a vast array of theories, ranging from intuitive reasons such as greed, to more obscure theories, such as demon-possession (Hagan and Sussman, 1988). As Hagan and Sussman (1988) note in their review of criminology, experts have offered other possible factors as explanations for criminal behavior, such as economic inequality, physical and mental differences, and a lack of conformity to societal norms and values. Finally, some theorists suggest that criminal behavior is learned in close personal relationships. These theories are known as social process theories, and point to the family as one of the primary vehicles for learning criminal behavior. In this paper, we use graphical techniques of exploratory data analysis to examine social process theories and their role in criminality.

Beginning with the work of Sutherland (1947), over 5 decades of research has investigated the role of social learning in criminal behavior. Sutherland proposed that criminal behavior is learned within intimate social groups. And, he suggested that not only are the behaviors learned, but also, that the thoughts, attitudes, and motivations associated with criminal behavior are acquired in the same manner.

The family is one example of an intimate social group. As Gorman and White (1995) note, research has shown that parents and guardians influence their children's behavior, which in turn influences the children's choices of friends and other social contacts. Therefore, delinquency and relationships with anti-social peers are part of a developmental process that begins in early childhood (Gorman & White, 1995). In analysis of data gathered from the "National Youth Survey," (Warr & Stafford, 1991) suggest that the behavior of peers has a greater influence on adolescents than do peer attitudes. Similarly, in a longitudinal study of several hundred juveniles in the Netherlands, Junger (1988) found that "delinquency of peers seems to be a result, as well as a cause, of delinquent behavior." In part, this suggests that social learning plays a role in explaining the delinquent behavior of juveniles (Junger, 1988).

As we discussed above, before the work of Yochelson and Samenow (1976), it was theorized that the causes of crime were primarily early emotional trauma or socioeconomic deprivation. Yochelson and Samenow refuted these theories by providing evidence based on over 17 years of research conducted on patients at St. Elizabeth's Federal mental institution in Washington, DC. Yochelson gathered evidence from interviews with

255 psychiatric patients who were criminals, and also interviewed their close friends and family members. The researchers discovered that there were some identical thought patterns among criminals of all educational, social, and economic backgrounds. Yochelson and Samenow created a list of the criminal thought patterns that they uncovered in their research, which includes patterns in expressing fear, anger, and rage, for example.

Samenow (1991) discussed the effect of prison life on criminals' anti-social thoughts and behavior. He suggests that criminals exhibit the same behavior and thought patterns in prison as they did in the free community. He suggests that it is not prison which further corrupts criminals, but that prison only provides them with opportunities to forge new ties with other criminals who support their anti-social thinking and behavior.

Walters & White (1989) also assert that criminal behavior exists because of the thinking styles of criminals. They argued that although a criminal's environment plays a role, the environmental factors are not predictive of criminal behavior. Building on the work of Yochelson and Samenow (1976), Walters (1995) developed the Psychological Inventory of Criminal Thinking Styles (PICTS). Research has confirmed the validity of the PICTS for use with male inmates (Walters, 1995a, 1995b, 1996) and among a group of female inmates (Walters, Elliott, and Miscoll, 1998).

SURVEY DATA:

The present study uses the PICTS (Walters, 1995) to assess the thinking styles of a group of 100 male prisoners participating in a rehabilitation program in a medium security federal prison. Eight-five inmates from the program volunteered to participate. The PICTS is an 80-item self-report questionnaire made up of 2 validity scales, Confusion and Defensiveness, and 8 thinking styles:

(1) **mollification** - pointing out how little control one has over their actions to avoid responsibility

(2) **cutoff** - ability to eliminate deterrents in one's life

(3) **entitlement** - granting oneself permission to engage in negative behaviors

(4) **power orientation** - compensating for weak personal control by exercising control over one's environment

(5) **sentimentality** - deny or minimize harm by performing good deeds to appear kind and generous

(6) **superoptimism** - disregard of the long-term consequences of drug abuse and an attitude of invulnerability

(7) **cognitive indolence** - lazy thinking that leads a person to take short-cuts and create serious future problems

(8) **discontinuity** - difficulty in following through on commitments

Each scale is comprised of eight items. The respondents indicated the number which best represented their level of agreement with each of the items. The levels were: 1 = disagree,

2 = uncertain, 3 = agree, and 4 = strongly agree, except for four of the items on the "confusion" scale and four item on the "discontinuity" scale, which are scored in the reverse direction: 4 = disagree, 3 = uncertain, 2 = agree, and 1 = strongly agree. The scores on each of the items are then totaled within each of the scales. A lower score on a scale indicates that the inmate does not use a particular thinking style very much, and a higher score indicates that the inmate uses the thinking style more frequently.

As part of a demographic questionnaire developed by (Innes, 1997) which was also administered to inmates in this study, subjects were asked to respond to items about their background (e.g. age, race, offense, history of drug abuse, and so on.) Additionally, they were asked about their attitudes concerning situations such as: "what bothers them most about being in prison," "how do they deal with their problems," and, "what would they do if they could get out of prison right now."

Of particular interest to the present study are the relationships that the subjects had before entering prison, either with friends, family, and others with whom they associated. This paper will focus on responses gleaned from the following:

The subjects were asked to circle either "true" or "false" to the following statements which we will refer here to as the "Family Score."

(A.) As a kid, I was often punished by my father/stepfather or my Mom's boyfriend in a way that made me feel ashamed and humiliated.

(B.) If I stayed away from home without telling anyone where I was, they would worry about me.

(C.) I can remember times as a kid when I was left with bruises or hurt from being beat.

(D.) Growing up, I lived in a lot of different places and with a lot of different people.

(E.) At an early age, I started staying away from home as much as I could because I hated being there.

(F.) I always felt that my parents loved me and would support me.

(G.) I never knew when I was a kid what I would get beat for and what I would get away with.

(H.) I learned to feel hate as a kid from the way I was treated at home.

Subjects received 1 point per item for indicating "true" on items A, C, D, E, G, or H, and 1 point per item for indicating "false" on items B or F. If subjects indicated "false" on items A, C, D, E, G, or H, or "true" on items B or F, they received 0 points for each of those responses. The were totaled, and lower scores on the "Family Score" indicate more favorable family situations, while higher scores indicate unfavorable family situations.

Also of interest to us for this particular study are several other questions posed to the inmate subjects.

- "Thinking about <u>all the people you knew</u>, not counting relatives, in the year before you came to prison, how many would you say"
  - "Had a criminal record or were involved in crime?"
  - "How many did not have a criminal record or were not involved in crimes?"

- "Thinking about <u>only your close friends</u>, not counting relatives, during the year before you came to prison, how many would you say"
  - "Had a criminal record or were involved in crime?"
  - "How many did not have a criminal record and were not involved in crime?"
- "On an average day in the year before you came into prison, which of the things below would you say you did for at least an hour or two <u>almost every day</u>?"
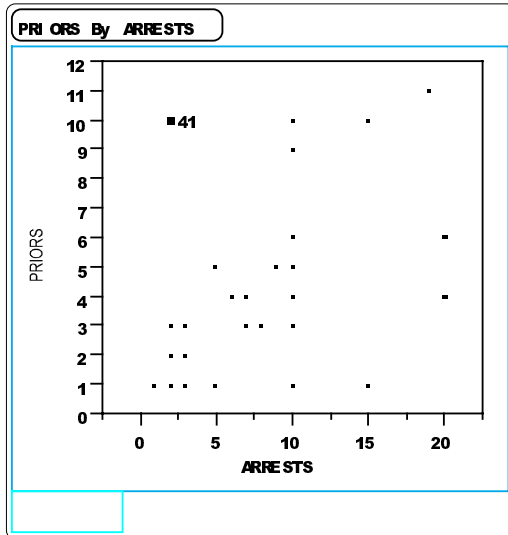
  (1) Doing nothing in particular or waiting for something to happen
  (2) Working or going to school (including homework)
  (3) Relaxing (watching TV, listening to music, or reading)
  (4) Exercising or participating in team sports
  (5) Family responsibilities (shopping, cleaning, or cooking)
  (6) Family activities (going places or spending time together)
  (7) Religious activities (including services and prayer or meditation)
  (8) Hobbies (fishing, woodworking, or art)
  (9) Being active in an organized group (union, church, or service clubs)
  (10) Dating or going to clubs
  (11) Hanging out with friends
  (12) Working on or taking care of your car
  (13) Drinking and/or using drugs
  (14) Planning or doing crimes

USING GRAPHS TO TAKE A FIRST LOOK AT THE DATA:

Graphical EDA techniques provide analysts any number of ways to quickly and easily spot "quality" problems within their data sets. Data editing is, of couse, an essential first step in the data analysis task. Aside from a number of key statistical limitations, the data that we have analyzed for this paper reflects many common reporting errors. For instance:

(a) One prisoner reported an age of 4, another an age of 10;

(b) Figures were commonly rounded by respondents to increments of 5 and 10 for some measures;

(c) As seen for prisoner # 41 (below), with 10 prior convictions and only 2 reported arrests, some data just doesn't make sense.

As was discussed above, this data set is composed of a very extensive/very rich set of questions. As such, it opens the door for us to explore many possible cause-and-effect relationships between these variables. However, there are several key limitations:
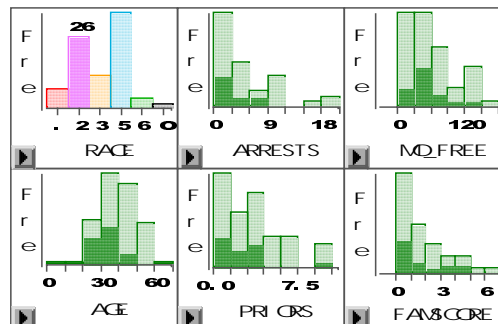
(1) A small number of subjects (85 prisoners) participated in this survey.

(2) Considerable rounding was found. (Rounding is giving a "rough" estimate rather than an "exact" value for a variable – for example, prior arrests.)

(3) The attitudes may not be generalizable to the total inmate population. The participants in this survey were volunteers, and they were in a rehabilitation program in which they decided to participate. Therefore, this group of inmates may be more amenable to receiving treatment, and may actually have better attitudes and more socially acceptable thinking styles than prisoners in the general inmate population who are not participating in this special program.

(4) The results are not generalizable to the general population. (One could argue that prisoners actually wind up in jail because of certain combinations of "good" and "bad" attitudes -- whereas, we really need to understand how these same thinking styles and attitudes translate to the actual behavior of randomly selected individuals we would meet everyday on the street.)

(5) This is self-reported data, taken of prisoners in a controlled environment -- a classic case of a "captive audience". These individuals are, no doubt, highly motivated to say and do all the "right" things to gain their freedom.

(6) In addition, simple good statistical practice requires us to sample on the general population. Further, because this is a survey of inmates participating in a specific rehabilitation program, data regarding the overall inmate population is not available.
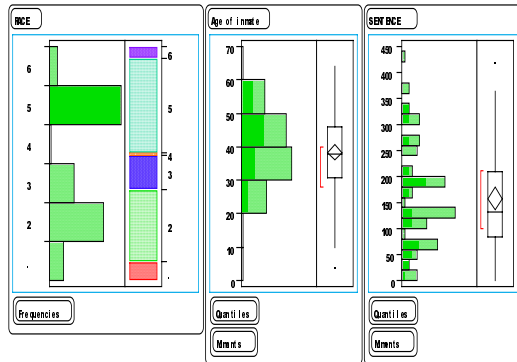
GRAPHIC METHODOLOGY -- TOOLS AND TECHNIQUES -- AN "EDA PLAN OF ATTACK"

In the EDA Statistics class that Mr. DesJardins teaches, he emphasizes an "EDA Plan of Attack". In essence, this is like a war where a battlefield commander should utilize all of his/her resources (e.g., infantry, planes, tanks) to their best possible effect. As such, each graphic form (e.g., boxplot, scatterplot, data profile plot) has its own particular strengths and weaknesses -- and these need to be used in strategic conjunction with one another to achieve the best effect. In addition, just as there are battlefield strategies, these *graphic tools* need to be combined with a set of very powerful *interactive techniques* to bring these graphs to *life* – to force the data to reveal its hidden nuances. The purpose of these interactive techniques is to gain a real understanding of the data -- to not simply produce a single statistic such as a correlation coefficient. Using these EDA tools, in minutes, the analyst can produce literally hundreds of graphical representations of a data set. These techniques bring these data to life – and are far superior to just a few summary statistics and the few "dead" graphs shown in this paper.
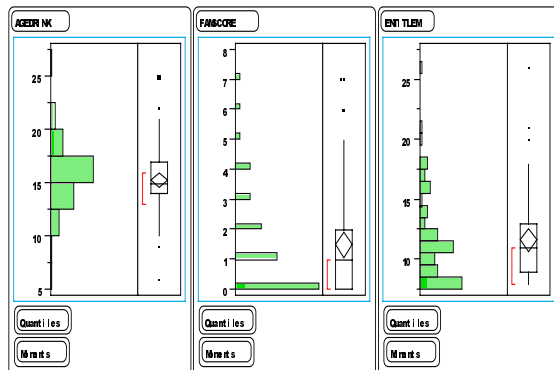
As discussed above, there are a wide number of variables to chose from --and the nature of some of the responses by these prisoners is rather "rough". As such, a good first step in our analysis is to look for general patterns in the data by brushing across sets of simple bar charts of these data. Using this technique, in seconds, we can click on any of the bars in any of dozens of different variables and see if there are any general patterns evident in the data. Here we have clicked on "2" for race (Blacks/African Americans). By looking at the shaded portions in all the other bars, we can see that, generally, they are among the lowest in age, have the least number of arrests, and some of the lowest values in the family score survey (indicating the most favorable family situations). Of course, we are not limited to 6 variables --in our actual analysis, we would view over a dozen variables at a time.

JMP software gives us the capability of interactively adding and subtracting components of each of these displays. In the graphs below, we have selected Race type #5 (whites) -- and again see no clear pattern in sentence length or other variables.

However, we can now quickly explore how these patterns might change for subsets of these individuals (e.g., whites who started drinking before the age of 15). It is a simple matter to control/click on the bars to eliminate the vast majority of these inmates who reported that they started drinking under the age of 18 (below). Here, a key pattern is evident. These individuals all score lowest in the family survey and have the lowest attitude score for entitlement. This is a very effective methodology for dealing with this type of a data set. Accordingly, by using this very powerful interactive tool, an analyst can quickly explore any number of data combinations and subset hypotheses in mere minutes.

MORE ADVANCED GRAPHICAL METHODS:

Because these data are so "rough" -- and because we have so many variables to look at -- the first data editing/analysis steps shown above are highly recommended. Since literally hundreds of possible correlations can be explored in minutes, conventional statistical methodology (such as stepwise regression or correlation coefficients) comes in a poor second in comparison.
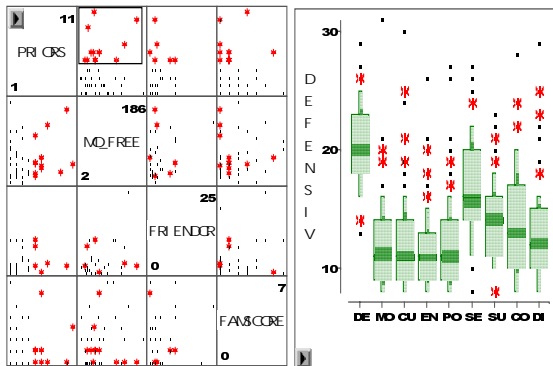
For example, if we looked at correlation coefficients for this data, we could find that several interesting relationships exist or that there are general trends in the data. However, outliers

would confound these data -- and we would also be missing important information that is not revealed in a few simple statistics. To illustrate this point, we can first produce Pearson correlation coefficients. For this demonstration, we decided to look at possible relationships between scores on the PICTS survey measuring criminal thinking styles, and the following factors: # of friends in crime, # of friends not in crime, # of acquaintances in crime, and # of acquaintances not in crime. We found that there were several statistically significant relationships between the reported # of friends in crime and 4 of the scales on the PICTS survey. A correlation significant at the 0.01 level was found between the "# of friends in crime" and the "entitlement" and "superoptimism" scales. There was also a statistically significant relationship at the 0.05 level between the "# of friends in crime" and the scores on the "power orientation" and "mollification" scales. However, we did not find any significant relationships existing between the "# of friends not in crime" and the "# of acquaintances in or not in crime" in respect to the various criminal thinking styles measured by the PICTS.

Also, in producing further Pearson correlation coefficients, we find that there was a statistically significant relationship between prisoners' scores on the family survey and the following scales on the PICTS: "discontinuity," "entitlement," "power orientation," and "mollification." These were all significant at the 0.01 level.

At this point, we have found some interesting correlations. We could stop here, and report our results. But, using SAS JMP, we can easily explore other trends in the data that are not revealed in these correlation coefficients that we provided. Here, we can use another set of important EDA tools and techniques when looking at possible correlations -- the use of symbols/colors in conjunction with a scatterplot matrix. Shown below is a "data profile" plot – a scatterplot matrix in conjunction with box plots. In the scatterplot matrix, it quickly shows the possible correlations between the number of prior convictions, the number of months the prisoner was free since his last conviction, the number of reported friends in crime, and the scores attained on the set of family questions. Highlighted with a "*" are the individuals who have the highest number of prior convictions. It is interesting to note that these individuals generally have the lowest scores on the family survey.

The real power of these EDA tools and techniques can be demonstrated when a large number of these key graphic tools and interactive techniques are used in conjunction with one another. Box plots automatically isolate values that are unusually high or low with respect to a normal distribution of the data set. Here, we see how the above individuals also generally have unusually high responses in the survey measuring criminal thinking styles. Again, by brushing on other combinations, we can interactively explore how these individuals might likewise have the highest sentence levels, the lowest scores on the family survey , and some of the lowest number of friends in crime. It is almost a crime to put this much analytical power into the hands of an analyst!

CONCLUSIONS:

There are any number of significant limitations to a formal statistical analysis of these data. However, in spite of these limitations (like the small sample size, and how a number of these responses simply do not make logical sense), we can still gain important information regarding possible links to inmates' attitudes/styles of thinking to related variables by using innovative graphical EDA techniques. Using these methods, we have assessed key aspects in the data, and have found a number of general relationships among these factors. For instance, we viewed with the data profile plot the general relationship between the "number of prior arrests," and poor thinking styles as measured by the PICTS survey. These would be difficult to observe using more conventional statistical analysis techniques.

This study lends support to the hypothesis that thinking styles of criminals are learned in intimate social groups, in particular, from the family and from friends involved in crime. This research demonstrates the possibility that offenders with less extreme criminal thinking styles (those who were not the outliers shown above) may be more influenced by the negative behaviors of family and friends in crime. On the other hand, those offenders with extremely negative criminal thinking patterns may be less influenced by the actions and attitudes of friends and family members.

BROADER IMPLICATIONS/APPLICATIONS:

These new, very powerful EDA techniques can be quickly and easily learned by Subject Matter Specialists -- even those with limited expertise in statistical analysis. Further, if this easily learned, 3rd generation, point-and-click software is taught in conjunction with a practical, hands-on, EDA course, remarkable breakthroughs in the analysis and understanding of data can be achieved.

By assessing the criminal thinking styles, attitudes, and relationships with a much broader criminal population, the findings of our study can be validated/used to assess options for rehabilitation and offenders' future risk for committing new crimes. It is possible that some offenders, with less extreme criminal thought patterns may be more amenable to change, and may learn more socially acceptable and less criminal approaches to life through close relationships such as those gained through rehabilitation programs. It is possible they have learned their criminal behavior and thinking patterns in the same manner – through close associations with others. However, those with more extreme criminal thinking styles and approaches to life may need to be assessed for other

possible avenues toward reaching rehabilitation, as we demonstrated that their associations with others and their family backgrounds have not provided an explanation for their criminal life styles. As Walters and White (1989) suggest, it may be that a criminal's environment (eg. relationships and so on) plays a role in their criminal behavior, but that these external factors are not the total explanation for criminality. And, as Yochelson & Samenow (1976) suggest, the stronger case may be made for thinking styles as the key factor in explaining criminal behavior.

Note: The viewpoints presented here are the opinions of the authors, and are not necessarily those of the Federal Bureau of Prisons, Freddie Mac, or the U.S. Bureau of the Census.

To ensure anonymity of the participants, data which could specifically identify individual participants was not included in this analysis.

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