Homework 1

Miaohan Wang

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Question 1

Theory I describes deviant aggressive behavior (DAB) to be learned from rewarding and punishing experiences, resembling operant conditioning. Assuming that Theory I is correct, people exhibited DAB because they found it to be rewarding rather than punishing. Even if there were concrete punishments for DABs, the individuals conducting these behaviors might determine that the rewards outweigh the punishments. The key to reducing DAB in this scenario would be to reduce the rewards and increase the punishments an individual would receive from DABs. Hence, a possible social policy for this problem could be increasing the penalty an individual would receive for DABs by altering the criminal law. Nevertheless, we have to consider that there exist people having wishful thinking that they would never be caught with DABs and those who disregard the law from all respect. Therefore, we would have to work on reducing possible rewards for DABs. A social policy such as a nationwide education that promotes the negative consequences of DABs (and denies its rumored benefits) would weaken the bond between DAB and positive experiences, thus reducing the reward individuals expect from DABs.

Theory II associates DAB with personal frustrations held by an individual, who in turn convert frustration into indignation toward his/her "personal authority figure." In the end, the theory expects the individual to reveal his/her anger in the form of DABs. If Theory II were to be correct, the individual frustration becomes the root cause of DABs. A social policy that effectively removes such frustrations is required to be put into action. For instance, the local council could initiate a foundation providing its citizens with easy access to mental health services. At the same time, the foundation should promote to the citizens the benefits of seeing a mental health professional, such as how an individual's feelings of frustration and anger might endanger their physical health in the long run. Such reasoning would motivate citizens to use mental health services more frequently. When an individual's frustrations and resentments (toward his/her authority figures or not) were properly resolved by mental health professionals, his/her DABs would reduce in numbers given that its roots were largely eliminated. On a societal level, if more and more receives mental help, DAB would become much less a problem than before.

Theory III explains DAB as a consequence of discriminative social rules, that people will not conform to the social rules if they do not find profit from them. If Theory III were to be correct, then the root cause of DAB is the disparity between the individual's will and the will of the social rules. In this case, a proper social policy would be one that delivers individual voices to the government. When a number of individuals express the same discontent, the government should act on moderating relevant laws or policies. If such moderation is not possible or the individual's discontent does not make common sense, then a government should work on an education campaign that informs the reasoning/cultural logic behind the social rules these individuals dissent to. In the end, more understanding between the individual and the government would help overcome the discontent where the social rules do not profit the individual, reducing DABs overall.

Theory IV implies that DAB originates from contact with "a deviant subculture," that an individual conducting DAB is "socialized" into conducting this behavior. If Theory IV is true, then an individual's contact with relevant deviant subcultures needs to be maximally reduced. Hence, a social policy such as limiting access to media (e.g., TV shows, websites) promoting relevant deviant subcultures should be enforced. An individual who does not have discerning abilities to realize a subculture is deviant should potentially be banned from such media (e.g., having a government-enforced kid's mode). In addition, more education on discerning deviant qualities of a subculture should be popularized, so that fewer people go into socializing with such subcultures.

Question 2

(a) Drawing examples from personal experience, the observation is true because an individual (such as myself) can be distracted or pulled away from finishing a piece of work early for many reasons. My problem is that I do not possess good time management skills, where I would underestimate the time I need for an assignment. I might have planned to finish the assignment 3 hours before the deadline, but in the end, I would use up all those 3 hours and hand in the assignment last minute. Apart from my internal explanations, the given observation can be measured externally in a classroom environment. If we track the activities on a class discussion forum (e.g. piazza, canvas), we might find that the number of log-ins, posts, and other site activities peaks when it is closer to the deadline. Right after the deadline, we might note that the same activities plummet in number. Another way of measurement is to gather assignment submission timestamps from all over the campus. If we are to plot a histogram for the time differences between submissions and deadlines, we might discover that the histogram peaks near zero.

(b) We will assume that a person's "do things last minute" behavior results from the person's level of time management skills. The less time management

skills a person has, the more likely the person is going to miscalculate the time a task needs, the more the person does things last minute. We will also assume that a significant proportion of people in our society run short of time management skills, which makes "doing things last minute" a more or less common phenomenon, hence resulting in the observation given.

(c) Alternatively, we will assume that people do things last minute because the anxiety associated with the work, for example, an assignment, dis-enabled them from being motivated to complete the work. Some assignments that are too important to one's grade or too difficult to complete might prompt an enormous amount of anxiety that crushes on to the individual so that the individual would feel incredible physical hardships (e.g. difficulty breathing, panic attacks) whenever he/she works on the assignment. As completing the work involves physical unease, the individual would try to avoid the work whenever possible, until it is too close to the deadline that the individual has to complete it, hence resulting in a last-minute submission. On a larger scale, the level of anxiety in a community would affect how prevalent "do things last minute" behaviors are among the members of the community. Since stress level relates to anxiety level, the general stress level of a community would predict the prevalence of "do things last minute" in the community.

(d) For the model in (b), we predict that the more time management skills a person has, the more organized his/her work schedule would be. Given the person has a good schedule overall, we expect the person to be barely doing anything last-minute. All submissions of a student with great time management skills, for instance, would be submitted in a very timely fashion, that is, long (at least an hour) before the deadline. For a person lacking good time management skills, we can expect almost all of his/her work to be last-minute. Since the person always miscalculates the time, we can expect his/her submissions to be on average later than a person with great time management skills.

For the model in (c), we can expect the more stressful, anxious a person feels toward an assignment, the more possible that the person would submit this assignment later than his/her average submission time. A more anxiety-inducing community, such as a top university like UChicago, would have a higher prevalence of "do things last minute" behaviors than a relatively stress-free university, as predicted by this model.

Question 3

Part 1

(a) Flexible better than inflexible. When the number of predictors is small and the sample size is extremely large, overfitting would have very little possibility to occur. Therefore, a statistical learning method that fits better the large data is better

(b) Flexible worse than inflexible. Contrary to the situation in (a), a small amount of data and a large number of predictors greatly increase the possibility for the model to over-fit the data. Hence a less flexible method would have better generalizability.

(c) Flexible better than inflexible. When the relationship is highly non-linear, we are sure that an inflexible linear model would not be a good fit. When we are no sure of the order of the model, having a flexible method would have more fitting results.

(d) Flexible worse than inflexible. When the variance of the data is too high, a flexible method might take the variability as part of the model. When the model later meets a data-set with less variance, the variability will be wrongfully used as predicting factors, the R squared would be low, altogether leading to a bad generalizability of the model.

Part 2

The bias curve will monotonically decrease because when the model better fits the data, the $\hat{f}$ will aim better at the real f, thus reducing the bias curve.

The variance curve will monotonically increase because when we build model on different data-sets, the flexible method will fit the data-sets each on its own characteristics more than the inflexible method. Given two fixed data-sets with predicted $\hat{f}_1$ and $\hat{f}_2$, a flexible method would result in greater disparity between $\hat{f}_1$ and $\hat{f}_2$ because the method explain more the differences between the two data-set than an inflexible method would do. Therefore, a more flexible method will yield greater variability between data-sets, yielding higher variance.

The training error decreases monotonically because the more flexible a method is, the better it fits the data used to train the model. When the model fits better and better, the error decreases more and more.

The test error curve increases first because the more flexible the model, the better the model fits the data, thus better representing the phenomenon. However, after a certain point, over-fitting occurs and the model no longer possesses good generalizability. Hence, when met with new data in the test set, the over-fitted model works badly, yielding high test error.

The irreducible error represents the error that will always take place in measurement no matter what data and what method we use, hence the value of irreducible error is constant, resulting in a horizontal line.