— Enabling Individualized Criminal Sentencing While Reducing Subjectivity: A Tablet-Based Assessment of Recidivism Risk

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SOMMARIO: 1. Quantifying re-offense risk: today. – 2. Quantifying re-offense risk: tomorrow. – 3. Ethical implications in practice.

According to conservative estimates, the country spends a minimum of $25,500-$26,000 per year on each person incarcerated[1]. Incarceration also has long-term costs for both offenders and society. For example, a young person with a prison record may be precluded from becoming a citizen who votes, participates in community-building, and contributes to the community.

Someone's re-offending (i.e., in the case of recidivism, defined broadly as re-offending with any jailable offense) means social resources were squandered without rehabilitating the offender (i.e., without resulting in future behavior for which one could be arrested). Unfortunately, the United States has high rates of recidivism: two separate Bureau of Justice Statistics studies have found that more than 62 percent of offenders released from prison are rearrested within three years[2,3]. Society thus achieves minimal rewards in return for its costly expenses, because nearly two-thirds of convicts re-offend and return to the criminal justice system.

Moreover, incarceration is potentially criminogenic: as a result of foregone employment opportunities and broken social circles, a person sent to prison might be more likely to return to crime after release[4,5]. Specifically, research suggests that offenders who receive a suspended sentence instead of incarceration are less likely to re-offend[5]. Therefore, to make the most

effective use of incarceration and limited social resources, researchers should strive to develop recidivism risk assessment and measurement tools.

Some progress has been made toward this goal with data-driven interview-based questionnaires, but we believe more can be done by harnessing advances from neuroscience and cognitive psychology. We briefly review the history of existing tools and describe our efforts to create a promising assessment battery through Baylor College of Medicine's Initiative on Neuroscience and the Law to measure cognitive and empathetic traits associated with recidivism. In addition to its practical contributions, this project touches on a fundamental ethical question: should individual profiles affect the treatment modalities used for offenders convicted of the same crime? This is a thorny problem, but, ultimately, we believe that, in a criminal justice system that already makes person-by-person judgments, our tablet- and game-based approach will make the process more objective and results-oriented.

1. Quantifying re-offense risk: today.

The risk principle, a widespread tenet in corrections, states that the intensity of supervision or treatment should be modulated based on predictions of an offender's future risk of recidivism. For decades, the United States criminal justice system lacked a formal, data-driven risk assessment system, initially relying on professional judgment. Starting in the early 1980s, in hopes of improving the objectivity of assessments, researchers around the country developed interview-based instruments to better understand the relationship between likelihood of future criminal offending and offenders' characteristics, traits, and behaviors (e.g., age at arrest, prior criminal history, and strength of social circles)[6].

This research formed the basis of structured risk-assessment surveys that were soon deployed in states across the country. These instruments' predictors of recidivism included static (e.g., criminal history), dynamic (e.g., treatment needs and responses), and community-level (e.g., family support and access to services) risk factors[7-14]. The more risk factors an offender has (typically, these can be represented in a "risk score"), the greater the likelihood of future criminal behavior[7]. Subsequent empirical analysis of these assessments has shown that those who score higher on the accumulation of predictors are indeed at an increased likelihood of engaging in future criminal behavior[7-14].

Interview-based risk assessments have improved county officials' (typically forensic psychologists') ability to identify re-offense risk, with risk factors for ORAS (a popular risk assessment system developed in Ohio) showing a correlation with recidivism ranging between 0.30 and 0.44 for women and 0.30 and 0.37 for men[15]. Higher risk scores are typically used to justify higher bonds, eligibility for parole, deferred or suspended sentences, or longer periods of incarceration. Despite the improvements risk-based assessments have brought about, they still suffer from two serious limitations. First, data collection requires a lengthy one-on-one interview, which means use of the instruments is restricted by the availability of expensive and highly trained forensic psychologists. Second, the instruments do not provide an objective measure of individual traits, such as impulsivity and risk taking, with the result that forensic psychologists must rely on *subjective* analysis of interviewee responses to a range of related questions to assess the risk of recidivism.

2. Quantifying re-offense risk: tomorrow.

We are optimistic that our tablet-based approach will address those limitations of interview-based assessments. At Baylor College of Medicine's Initiative on Neuroscience and Law, we have developed a tablet-based and engaging battery of interactive assessments to measure a range of cognitive traits of criminal offenders, including aggression, empathy, planning, executive function, impulse-control, and set shifting. First, our reliance on well-established psychometric assessments provides a direct, objective measure of individuals' decision-making traits associated with re-offense. Second, the use of self-scoring software allows data collection on a large scale – to date, we have assessed nearly 600 offender participants. Specifically, we are using the battery to quantify and compare traits in Houston-area probationers (550 participants) and age- and race-matched controls (150 participants). Ultimately, our hope is that an improved understanding of underlying traits that predispose to criminal behavior will enable not only alternative and more individualized sentencing strategies, but also optimal calibration of punishment severity for each offender in terms of sentence length and eligibility for certain programs.

Several traits are associated with increased criminal behavior, such as empathy deficits[16], reduced impulse control[17], and a propensity to react aggressively to perceived threats[18]. Previous studies have suggested that these traits can be a result of underdeveloped structures or underactive functionality in the brain, particularly in the dorsomedial prefrontal cortex, anterior insular cortex, caudate, and orbitofrontal cortex[19-22]. Although neuroimaging would provide a direct visualization of underdevelopment or hypofunction, the technology is currently too expensive to deploy on a mass scale within the criminal justice system.

Instead, we turned to popular, validated psychometric assessments that provide a score that measures the participant's performance. We then converted them into colorful, engaging iPad games. Our battery includes the Stop-Signal Task (self-control)[17], the Eriksen Flanker Task (attentiveness)[23], the Reading the Mind through the Eyes Task (cognitive empathy)[16], the Point-Subtraction Aggression Paradigm (reactive aggression)[18], the Tower of London Task (planning)[24], and the Balloon Analogue Risk Task (risk-taking)[25-27]. The battery is intended to improve risk assessment by providing a better understanding of the relationship between re-offense and cognitive decision-making traits. If successful in terms of improving risk predictions, this assessment tool could save money and human potential by supporting alternative rehabilitation strategies and allowing for optimization of sentence length (as well as other provided services) based on an offender's likelihood of recidivism.

3. Ethical implications in practice.

Even if it is too soon to know whether our project will bear fruit, it is not too soon to grapple with the underlying ethical questions. Specifically, should people be treated differently by the criminal justice system because of their decision-making profiles?

We first note that there remains a disagreement about the purpose of punishment within the criminal justice system. The minority opinion is held by those who ascribe to "an eye for an eye" and therefore argue that sentences should be retributive, even if they also increase criminogenesis[28]. They argue that the purpose of the criminal justice system is "to administer justice, not treatment" and that individualized treatment "muddles the message of punishment"[29]. The majority opinion appears to be relatively equally split between those who emphasize

sentencing as a deterrent to other would-be criminals and those emphasizing individual rehabilitation[30].

We believe that individual rehabilitation and societal deterrence go hand-in-hand, because crime is committed in large part by *re*-offenders[3]. Reducing *each* offender's risk of re-offense through individualized sentences for the same crime should reduce aggregate crime, thus benefiting society. If the purpose of the criminal justice system is to reduce aggregate crime, then we should therefore work to create a system that privileges individual rehabilitation over retributive justice.

Returning to the question of tailoring individual sentencing, we believe it is improper to evaluate reforms and new ideas in a vacuum and that a true analysis requires a comparison against the status quo. So should individualized sentences be based on offenders' decision-making profiles? It is critical to understand that our criminal justice system already modulates sentencing and has since at least 1987, when a federal agency, the United States Sentencing Commission, developed the *Guidelines Manual*. This manual uses a series of tables to provide the judge with an appropriate sentencing range based on the present offense and the defendant's criminal history[31]. Use of the manual was considered mandatory until a 2005 Supreme Court decision changed it into an advisory guide[32].

Whether mandatory or advisory, the *Sentencing Guidelines Manual* places authority in the hands of individual judges. For example, for first-time offenders who are convicted of assault (one of the most common crimes) there is a wide sentencing range of 0-14 months[31]. The judge selects an appropriate sentence within the range after weighing a large variety of subjective factors, including the "nature and circumstances of the offense" along with "the history and characteristics of the defendant"[33].

In the abstract, it might seem beneficial to vest this authority in the hands of judges, who presumably would deliver individual sentences reflecting their relevant experience as society's gatekeeper for the prison system. In practice, however, judges deliver disparate and potentially discriminatory sentences for the same offenses[18,34]. Moreover, the decisions appear to be heavily affected by nonlegal factors. For example, gender[35] and race[36] are correlated with disparate outcomes. The individual judge's punishment philosophy also affects sentencing, with judges in a large urban county (who typically focus on rehabilitation) arriving at the least severe sentences and judges in a suburban county (who tend to focus instead on deterrence and retribution) providing the most severe sentences[37]. As an example, one study quantified the differences and found that the incarceration rate for offenders arrested for burglary diverged greatly in nine counties in three states. The incarceration rate ranged from 26 percent in DuPage County, Illinois, to 52 percent in Erie County, Pennsylvania, to 75 percent in Kalamazoo County, Michigan—all for the same crime[34].

Drug possession arrests, arguably the most common jailable offense in our criminal justice system, provide another stark example of the disparity driven by the subjective factors in the US *Sentencing Guidelines Manual*. A study of 12 judges in Cook County, IL (Chicago) explored convictions of offenders with prior felony convictions. The rate of incarceration ranged from 37.5 percent to 90 percent. The average sentence also ranged from 14.5 months to 42 months[18].

Perhaps the most striking example of the impact of nonlegal factors on judicial decision making is a 2011 study of offenders' chances of receiving parole. The single most important factor was not the offender's prior criminal history or behavior during detention but whether the decision

was made before or after the decision maker's lunchtime, with the percentage of "favorable rulings" dropping from approximately 65 percent to nearly 0 percent before a lunch break and then afterwards returning abruptly to approximately 65 percent[38]. The status quo, therefore, *already* modulates sentencing by vesting discretion in the judge. Moreover, the current system appears to be doing so poorly, given the tremendous amount of variation in punishment severity for the same offense. To be clear, offenders are assigned to judges at random, which means chance – and not a measured, objective analysis of defendant characteristics – is currently playing an outsized role in determining offender punishment.

An emphasis on psychometric assessments holds the promise of returning objectivity to this flawed process. Given that the criminal justice system already allows for a range of sentencing for the same crime, we believe it is both proper and more efficient to limit the role of chance by developing evidence-based, data-driven sentencing.

Some have expressed concerns that our tablet software will lead to "pre-crime" investigations or the detainment of innocent people only on the basis of their score instead of their behavior. We consider this scenario highly unlikely, because the Bill of Rights protects against such scenarios. The Fourth Amendment states that persons cannot lose their rights "to be secure in their persons, houses, papers, and effects" without probable cause, which in essence requires real evidence that a crime has already been committed (not that one may be committed in the future). The Fifth and Sixth Amendments, in turn, set forth specific procedural requirements, including the right to "a speedy and public trial," before being deprived of "life, liberty, or property"[39]. Overcoming these protections would require a groundswell in popular opinion leading to a new amendment to the Constitution.

We intend to release the tablet software for academic and educational use. For physicians, the software will enable a novel way to track patient recovery via previously unavailable continuous and objective measures. Specifically, it will provide physicians with the ability to administer established and validated neurocognitive tests – typically only available to clinical neuropsychologists – to quantify patients' response to treatments, therapies, and new medications.

Ultimately, we seek to foster scientifically based social policy, with the goal of diminishing rates of incarceration and providing novel, evidence-based options for assessing and managing criminal offenders. In practice, we hope our ongoing research project will allow policymakers to base sentencing decisions on direct, proven, open-source assessments of criminal propensity.

REFERENCES

1. SCHMITT J, WARNER K, GUPTA S. *The high budgetary costs of incarceration*. Washington, DC: Center for Economic and Policy Research; 2010. http://cepr.net/documents/publications/incarceration-2010-06.pdf. Accessed February 3, 2016.
2. BECK AJ, SHIPLEY B. *Recidivism of prisoners released in 1983*. Washington, DC: Bureau of Justice Statistics; 1989. http://www.bjs.gov/content/pub/pdf/rpr83.pdf. Accessed February 3, 2016.
3. DUROSE MR, COOPER AD, SNYDER HN. *Recidivism of prisoners released in 30 states in 2005: patterns from 2005 to 2010*. Washington, DC: Bureau of Justice Statistics; 2014. http://www.bjs.gov/content/pub/pdf/rprts05p0510.pdf. Accessed February 3, 2016.
4. VIERAITIS L, KOVANDZIC TV, MARVELL TB. The criminogenic effects of imprisonment: evidence from state panel data, 1974-2002. Criminol Public Policy. 2007;6(3):589-622.
5. CID J. *Is imprisonment criminogenic? A comparative study of recidivism rates between prison and suspended prison sanctions. Eur J Criminol*. 2009;6(6):459-480.
6. ANDREWS D, BONTA J. *The Psychology of Criminal Conduct*. 4th ed. Cincinnati, OH: Anderson; 2006.
7. ANDREWS D, BONTA J. *The Psychology of Criminal Conduct*. 2nd ed. New York, NY: Routledge; 1994.
8. ANDREWS DA, BONTA J, HOGE RD. *Classification for effective rehabilitation: rediscovering psychology. Crim Justice Behav*. 1990;17(1):19-52.

9. Benedict WR, Huff-Corzine L. *Return to the scene of punishment: recidivism of adult male property offenders on felony probation.. J Res Crime Delinq.*. 1997;34(2):237-252.

10. Bonta J, Law M, Hanson K. *The prediction of criminal and violent recidivism among mentally disordered offenders: a meta-analysis. Psychol Bull.* 1998;123(2):123-142.

11. Brown SL, St. Amand MD, Zamble E. The dynamic prediction of criminal recidivism: a three-wave prospective study. Law Hum Behav. 2009;33(1):25-45.

12. Dow E, Jones C, Mott J. An empirical modeling approach to recidivism classification. Crim Justice Behav. 2005;32(2):223-247.

13. England RW. A study of post probation recidivism among five hundred federal offenders. Fed Probat. 1955;19:10-16.

14. Gendreau P, Little T, Goggin C. A meta-analysis of predictors of recidivism: what works. Criminology. 1996;34(4):575-608.

15. Latessa E, Smith P, Lemke R, Makarios M, Lowenkamp C. Creation and validation of the Ohio Risk Assessment System: final report. University of Cincinnati School of Criminal Justice; 2019:44. http://www.ocjs.ohio.gov/ORAS_FinalReport.pdf. Accessed February 3, 2016.

16. Wilson K, Juodis M, Porter S. Fear and loathing in psychopaths: a meta-analytic investigation of the facial affect recognition deficit. Crim Justice Behav. 2011;38(7):659-668.

17. Pratt TC, Cullen FT. The empirical status of Gottfredson and Hirschi's general theory of crime: a meta-analysis. Criminology. 2000;38(3):931-964.

18. Monahan KC, Steinberg L, Cauffman E, Mulvey EP. Trajectories of antisocial behavior and psychosocial maturity from adolescence to young adulthood. Dev Psychol. 2009;45(6):1654-1668.

19. Jankowiak-Siuda K, Zajkowski W. A neural model of mechanisms of empathy deficits in narcissism. Med Sci Monit. 2013;19:934.

20. Siever LJ. Neurobiology of aggression and violence. Am J Psychiatry. 2008;165(4):429-442.

21. Rosell DR, Siever LJ. The neurobiology of aggression and violence. CNS Spectr. 2015;20(3):254-279.

22. Stein DJ, Hollander E, Liebowitz MR. Neurobiology of impulsivity and the impulse control disorders. J Neuropsychiatry Clin Neurosci. 1993;5(1):9-17.

23. Meier NM, Perrig W, Koenig T. Neurophysiological correlates of delinquent behaviour in adult subjects with ADHD. Int J Psychophysiol. 2012;84(1):1-16.

24. Morgan BA, Lilienfeld SO. A meta-analytic review of the relation between antisocial behavior and neuropsychological measures of executive function. Clin Psychol Rev. 2000;20(1):113-136.

25. Lejuez CW, Read JP, Kahler CW, et al. Evaluation of a behavioral measure of risk taking: the Balloon Analogue Risk Task (BART). J Exp Psychol Appl. 2002;8(2):75-

26. Lejuez CW, Aklin WM, Zvolensky MJ, Pedulla CM. Evaluation of the Balloon Analogue Risk Task (BART) as a predictor of adolescent real-world risk-taking behaviours. J Adolesc. 2003;26(4):475-479.

27. White TL, Lejuez CW, de Wit H. Test-retest characteristics of the Balloon Analogue Risk Task (BART). Exp Clin Psychopharmacol. 2008;16(6):565.

28. Mackenzie DL. Sentencing and Corrections in the 21st Century: Setting the Stage for the Future. College Park, MD: University of Maryland Department of Criminology and Criminal Justice, Evaluation Research Group; 2001. https://www.ncjrs.gov/pdffiles1/nij/189106-2.pdf. Accessed February 3, 2015.

29. Logan CH, Gaes GG. Meta-analysis and the rehabilitation of punishment. Justice Q. 1993;10(2):245.

30. McFatter RM. Sentencing strategies and justice: effects of punishment philosophy on sentencing decisions. J Pers Soc Psychol. 1978;36(12):1490.

31. United States Sentencing Commission Guidelines Manual. 2008. http://www.ussc.gov/sites/default/files/pdf/guidelines-manual/2008/manual/GL2008.pdf. Accessed February 3, 2016.

32. United States v Booker, 543 US 220, 125 SCt 738, 160 LEd 2d 621 (2005).

33. United States Sentencing Commission, 402.

34. Spohn CC. How Do Judges Decide?: The Search for Fairness and Justice in Punishment. 2nd ed. Thousand Oaks, CA: Sage Publications; 2008.

35. Gross SR, Mauro R. Death and Discrimination: Disparities in Capital Sentencing. Boston, MA: Northeastern University Press; 1989.

36. Abrams D, Bertrand M, Mullainathan S. Do judges vary in their treatment of race? J Legal Stud. 2012;41(2):347-383.

37. Ulmer JT. Social Worlds of Sentencing: Court Communities under Sentencing Guidelines. Albany, NY: State University of New York Press; 1997.

38. Danziger S, Levav J, Avnaim-Pesso L. Extraneous factors in judicial decisions. Proc Natl Acad Sci USA. 2011;108(17):6889-6892.

39. Bill of Rights. http://www.archives.gov/exhibits/charters/bill_of_rights_transcript.html. Accessed February 3, 2016.

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