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Sleepy Punishers Are Harsh Punishers: Daylight Saving Time and Legal Sentences

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Abstract

The degree of punishment assigned to criminals is of pivotal importance for the maintenance of social order and cooperation. Nonetheless, the amount of punishment assigned to transgressors can be affected by factors other than the content of the transgressions. We propose that sleep deprivation in judges increases the severity of their sentences. We took advantage of the natural quasi-manipulation of sleep deprivation during the shift to daylight saving time in the spring and analyzed archival data from judicial punishment handed out in the U.S. federal courts. The results supported our hypothesis: Judges doled out longer sentences when they were sleep deprived.

Keywords

sleep, daylight saving time, third-party punishment, moral judgment, legal sentencing

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Third-party punishment involves the assignment of punishment to moral offenders by third parties not directly involved as an offender or victim (Henrich et al., 2006). Moral deservingness theory maintains that the severity of punishment should be proportional to the magnitude of harm caused by the transgressors (Carlsmith, Darley, & Robinson, 2002). When administered fairly, third-party punishment restores victims' sense of justice (Tetlock et al., 2007). However, we predicted that even a little sleep deprivation could disrupt the punishment-calibration process.

Sleep entails physiological restorative processes for optimal brain functioning (Hobson, 2005). Sleep deprivation decreases working memory capacity (Chee & Choo, 2004) and has an especially detrimental effect on complex cognitive functions (Harrison & Horne, 2000). For example, sleep-deprived individuals have difficulty optimally evaluating financial losses and gains (Venkatraman, Chuah, Huettel, & Chee, 2007), regulating stereotypes and prejudices (Ghumman & Barnes, 2013), and solving logically demanding tasks (Lim & Dinges, 2010).

We posited that sleep deprivation can distort how individuals calculate transgressors' deservingness of punishment in relation to their moral transgressions. First, sleep deprivation can augment negative responses to transgressions. Sleep-deprived individuals have lower inhibition toward negative stimuli than non-sleep-deprived individuals (Anderson & Platten, 2011). Their responses are more impulsive than those of non-sleep-deprived people. The target range of amplified negative responses can be even wider when fairness is violated. Barber and Budnick (2015) demonstrated that sleep-deprived individuals tend to misinterpret ambiguous social cues as a threat when fairness is violated. These findings suggest that sleep-deprived people are especially likely to perceive transgressions as more negative and menacing.

Second, sleep deprivation impairs emotional regulation. Sleep deprivation is positively correlated with emotional imbalance (Benca, Obermeyer, Thisted, & Gillin, 1992; Goldstein & Walker, 2014). In particular, a study involving sleep-deprived subjects viewing aversive pictures showed that functional connectivity between the amygdala and the prefrontal cortex is weakened under sleep deprivation (Yoo, Gujar, Hu, Jolesz, & Walker, 2007).

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These findings indicate that sleep-deprived individuals have particular difficulty regulating negative emotional responses to aversive stimuli.

Finally, Danziger, Levav, and Avnaim-Pesso (2011) demonstrated that extraneous factors can sway judicial decisions. They found that, over the course of a day, approval of parole requests drops gradually from approximately 65% to nearly zero before a food break. The percentage then abruptly returns to the initial level after the break. This finding is consistent with our prediction that even a small amount of sleep deprivation could influence judicial decisions. We predicted that sleep-deprived people would mete out harsher punishment against transgressors than would people who were not sleep deprived.

Method

We conducted a quasi-experiment using the nationwide shift to daylight saving time in the United States (for further details, see Wagner, Barnes, Lim, & Ferris, 2012). As noted by Barnes and Wagner (2009), the shift to daylight saving time in the spring leads to approximately 40 min of lost sleep on Sunday night (meaning that on Monday, individuals are sleep deprived). Despite the fact that the clock change technically occurs early Sunday morning, individuals tend to have more flexibility in their sleep and activity schedules on weekends than during the week. Thus, sleep deprivation is more likely to occur on Sunday night; consequently, the effects of being sleep deprived are typically experienced on Monday. Despite the small amount of lost sleep, this sleep deprivation has been shown to affect a variety of sleep-related outcomes on such Mondays (e.g., traffic accidents; Coren, 1996; Varughese & Allen, 2001). Following this precedent, we examined the Monday after the change to daylight saving time in the spring (the day on which individuals would be influenced by sleep deprivation associated with the time change—i.e., the "sleepy Monday") and compared the length of imprisonment in sentences rendered on that day with lengths of sentence from the previous and following Mondays.

The dependent variable was the length of imprisonment (in months) between 1992 and 2003 as recorded in the data set from the U.S. Sentencing Commission.[1] We limited our analysis to defendants who were U.S. citizens because defendants who were not U.S. citizens might also be affected by actions taken by foreign governments and groups (Steffensmeier & Demuth, 2000).

Procedure

Because the data were nested within judicial districts, the cases were not independent. Therefore, we conducted the analyses within a hierarchical linear modeling framework. Using judicial district as a binding variable at Level 2 enabled us to control for differences among judicial districts. This is important because some judicial districts (e.g., Washington) tend to mete out harsher punishments than other judicial districts, even for the same offense (Steffensmeier & Demuth, 2000).

Between 1992 and 2003, the total number of sentencing outcomes rendered on sleepy Mondays, as well as the Mondays before and after a sleepy Monday, was 4,037. Among them, 1,252 cases were in the treatment condition (on sleepy Monday), and 2,785 cases were in the control condition (the preceding and following Mondays).

Sleep deprivation

We created a dichotomous variable indicating whether the sentencing was rendered on sleepy Monday (1) or on a comparison Monday (0). However, because Arizona, Hawaii, and Indiana[2] do not participate in daylight saving time, all cases from those three states were coded as 0 for this variable. This reduced the number of judicial districts to 90.

Punishment

Our measure of punishment was the length of the sentence (in months) that was not combined with alternative punishment (e.g., community confinement, probation). Sentence length was not normally distributed. Therefore, following the method of prior studies (e.g., Blair, Judd, & Chapleau, 2004; Steffensmeier & Demuth, 2000), we performed a log transformation. Because a sentencing length longer than 470 months (inclusive) was the same as a life sentence (Johnson, Ulmer, & Kramer, 2008), any sentence length longer than 470 months was capped at 470.

Control variables

We controlled for the yearly trend in sentencing decisions. We also controlled for trial and offender characteristics, such as criminal history, offense level, type of trial (i.e., trial, plea), number of convictions, age, gender, race (i.e., White vs. Black), and education. Judges determined defendants' sentences on the basis of federal guidelines that take into account criminal history and offense levels (Steffensmeier & Demuth, 2000).

Results

As we predicted, results showed that sentences rendered on sleepy Mondays were approximately 5% longer than those rendered on comparison Mondays, $\gamma = 0.06$, $SE = 0.02$, $p = .005$ (see Table 1).[3]

Table 1. Direct Effect of Daylight Saving Time on Length of Prison Sentences

	Punishment			
	Model 1: control variables only (deviance = 400,811.00)		Model 2: full model (deviance = 5,317.27)	
Predictor	Coefficient	*SE*	Coefficient	*SE*
Intercept	2.89**	0.03	2.92**	0.07
Level 1: control variables				
Sentence year	0.00	0.00	–0.01**	0.00
Criminal history[a]				
Category 2	0.21**	0.01	0.18**	0.04
Category 3	0.36**	0.01	0.35**	0.03
Category 4	0.57**	0.01	0.57**	0.03
Category 5	0.76**	0.01	0.70**	0.06
Category 6	0.81**	0.01	0.76**	0.04
Offense level	0.10**	0.00	0.10**	0.00
Type of trial	0.22**	0.01	0.11**	0.02
Number of convictions	0.24**	0.01	0.25**	0.03
Age	0.00**	0.00	0.00	0.00
Gender	0.27**	0.01	0.24**	0.04
Race	0.03**	0.01	0.08**	0.02
Education[b]				
High school graduate	0.11**	0.01	0.15**	0.05
Some college	0.08**	0.01	0.13**	0.04
College graduate	0.03**	0.01	0.10	0.04
Level 1: independent variable				
Sleepy Monday[c]			0.06**	0.02

[a]The reference group for this variable was Category 1. Defendants' final criminal history categories were determined by the court.
[b]The reference group for this variable was having less than a high school education.
[c]Sleepy Mondays (experimental condition) were coded as 1, and other days of the week (control condition) were coded as 0.
*$p < .05$. **$p < .01$.

Robustness-check analyses

To support the main finding, we conducted two robustness checks (for descriptive analysis, see Table S4 in the Supplemental Material available online).

First, we compared the length of sentences doled out on a sleepy Monday with those doled out on the other days of the same week. Sentence lengths rendered on a sleepy Monday were significantly longer than those rendered on the Tuesday of the same week, albeit only marginally so, $\gamma = 0.06$, $SE = 0.03$, $p = .079$ (for detailed results, see Table S5 in the Supplemental Material). Sentences meted out on a sleepy Monday were also significantly longer than those rendered on Wednesday, $\gamma = 0.10$, $SE = 0.04$, $p = .009$ (for detailed results, see Table S6 in the Supplemental Material), or Thursday, $\gamma = 0.09$, $SE = 0.03$, $p = .006$ (for detailed results, see Table S7 in the Supplemental Material), of the same week. We found that sentence lengths rendered on Friday were not significantly different from those doled out on a sleepy Monday of the same week, $\gamma = 0.02$, $SE = 0.03$, $p = .584$ (for detailed results, see Table S8 in the Supplemental Material). The extant literature suggests that individuals have restricted sleep during weekdays (Dawson & McCulloch, 2005). It may be that the sleep debt accumulated to a significant level on Thursday night, thereby affecting cognitive performance on Friday.

To perform another robustness check, we used the same method to compare sentence lengths rendered on other business days in the week of a sleepy Monday with sentence lengths rendered 1 week before or after those business days. For example, we compared the Tuesday after a sleepy Monday with the Tuesdays 1 week before and 1 week after.

First, given that there was no significant difference between the length of sentences rendered on Tuesdays 1 week before and 1 week after the target Tuesday, $\gamma = 0.03$, $SE = 0.03$, $p = .232$, we aggregated them to form a control condition. Unlike sleepy Monday, the target Tuesday and the control group showed no significant difference in sentence lengths, $\gamma = -.02$, $SE = 0.02$, $p = .527$ (for detailed results, see Table S9 in the Supplemental Material).

Second, we compared the lengths of sentences rendered on the Wednesdays 1 week before and 1 week after the Wednesday in the same week as the sleepy Monday. Given that there was a significant difference between the two comparison Wednesdays, we were not able to form a single control condition for Wednesdays. Therefore, we ran two separate models: In the first model, we compared the target Wednesday with the Wednesday 1 week before, $\gamma = 0.02$, $SE = 0.04$, $p = .553$ (for detailed results, see Table S10 in the Supplemental Material); in the second model, we compared the target Wednesday with the Wednesday 1 week after, $\gamma = -.03$, $SE = 0.03$, $p = .356$ (for detailed results, see Table S11 in the Supplemental Material).

Third, we compared the length of sentences rendered on the Thursdays 1 week before and 1 week after the Thursday in the same week as the sleepy Monday and found that there was no difference, $\gamma = -.03$, $SE = 0.03$, $p = .321$. We therefore aggregated the data for these Thursdays to form a control condition. Unlike sleepy Monday, the target Thursday and the control days showed no significant difference in sentence lengths, $\gamma = -.03$, $SE = 0.02$, $p = .251$ (for detailed results, see Table S12 in the Supplemental Material).

Fourth, we compared the length of sentences rendered on the Fridays 1 week before and 1 week after the Friday in the same week as the sleepy Monday and found that there was no difference, $\gamma = -.02$, $SE = 0.03$, $p = .385$. We therefore aggregated the data for these Fridays to form a control condition. Unlike sleepy Monday, the target Friday and the control days showed no significant difference in sentence lengths, $\gamma = 0.03$, $SE = 0.02$, $p = .073$ (for detailed results, see Table S13 in the Supplemental Material).

Supplemental analyses

We conducted three supplemental analyses. First, we compared the length of sentences meted out on sleepy Monday with the length of those handed out on the remaining days, controlling for federal holiday, day of the week, and week of the year (for further details, see Barnes & Wagner, 2009). Second, we compared sentence lengths doled out on sleepy Monday with those doled out on all other Mondays (except for federal holidays, sleepy Monday, Mondays 1 week before and 1 week after sleepy Monday, the Monday after the shift back to standard time, and the Mondays 1 week before and 1 week after the first standard-time Monday). The number of cases rendered on federal holidays was 831. Among 53 weeks in a year,[4] we compared sentence lengths rendered on 37 Mondays with those rendered on sleepy Monday. As in the main analyses, Sleepy Monday was dummy coded as 1. We found that judges meted out longer sentences on sleepy Monday than on the remaining days, $\gamma = 0.05$, $SE = 0.02$, $p = .010$ (see Table S14 in the Supplemental Material). In addition, they handed out longer sentences on sleepy Monday than on all of the other Mondays ($\gamma = 0.05$, $SE = 0.02$, $p = .004$; for the descriptive statistics, see Table S15 in the Supplemental Material; for detailed results, see Table S16 in the Supplemental Material).

Third, we examined whether the shift back to standard time in the fall influenced the severity of punishment. We compared the length of sentences rendered on the Monday immediately after the shift back to standard time with the length of sentences rendered on the Mondays 1 week before and 1 week after the shift. The length of sentences rendered on the Mondays 1 week before and 1 week after the Monday of the shift to standard time were not significantly different, $\gamma = -.02$, $SE = 0.02$, $p = .308$, so we treated them as control days. There was no significant difference between sentences rendered on the Monday immediately after the shift back to standard time and those rendered on the Mondays 1 week before and 1 week after the shift, $\gamma = -.03$, $SE = 0.02$, $p = .062$; see Table S17 in the Supplemental Material). These findings are consistent with previous research indicating that when people have an extra hour associated with the change back to standard time, they do not use it for sleep (Barnes & Wagner, 2009).

General Discussion

As we predicted, we found a direct effect of sleep deprivation on third-party punishment. Sleep-deprived judges handed out 5% longer sentences than non-sleep-deprived judges. Our finding suggests that a nationwide policy can unexpectedly undermine the justice system. Previous scholars have proposed that third-party punishment enables large-scale cooperation beyond direct-exchange relationships because individuals expect to be caught if they violate the norm of reciprocity (Buckholtz & Marois, 2012; Dickinson, Dutcher, & Rodet, 2015; Henrich et al., 2006). However, questioning fairness in third-party punishment can erode its deterrent and retributive functions. We have demonstrated that even a small amount of sleep deprivation can disturb judges' decisions on punishments. In addition, our finding demonstrates that sleep deprivation has a detrimental effect on complex yet rule-based judgment. Although the sleep literature has demonstrated that a lack of sleep impairs cognitive functioning, the magnitude of the effect varies across cognitive domains (Lim & Dinges, 2010). For example, sleep deprivation is detrimental to complex tasks, but not to rule-oriented tasks (Harrison & Horne, 2000). Given that moral judgment is rule oriented, yet highly complex, our finding suggests a new direction for sleep research.

Although we established a quasicausal relationship between sleep deprivation and third-party punishment, a tightly controlled experiment would help to corroborate our finding. Anderson and Dickinson (2010) introduced a total sleep deprivation protocol that could be useful. An experiment of total sleep deprivation can exclude possible alternative accounts and find a causal mechanism for the main effect. We speculate that moral clarity (i.e., the degree of certainty that individuals perceive when judging whether behaviors are right or wrong; Wiltermuth & Flynn, 2013) may account for some of the effect.

In conclusion, we found that physiological states of third parties affect their disciplinary decisions, and that, consequently, such decisions may go beyond or be unrelated to the characteristics of the actual transgression being judged. Given that there are numerous forms of third-party punishment, our finding has a wide range of implications.

Action Editor

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Author Contributions

K. Cho developed the study concept and study design. K. Cho performed the data analyses with the assistance of C. M. Barnes and C. L. Guanara. K. Cho drafted the manuscript, and C. M. Barnes and C. L. Guanara reviewed and revised it. All the authors approved the final version of the manuscript for submission.

Declaration of Conflicting Interests

The authors declared that they had no conflicts of interest with respect to their authorship or the publication of this article.

Supplemental Material

Additional supporting information can be found at http://journals.sagepub.com/doi/suppl/10.1177/0956797616678437

Open Practices

The data sets contain defendants' personal information, such as their date of birth, gender, and age, and details about the judicial decisions. Because of privacy issues, we choose not to post the data. However, the original data sets from the U.S. Sentencing Commission are publicly available at http://www.icpsr.umich.edu/icpsrweb/ICPSR/series/83. We fully support the idea of Open Practices, and our data analyses, strategies, codebooks, and SPSS syntax are available upon request.

Notes

1. The data sets are available from http://www.icpsr.umich.edu/icpsrweb/ICPSR/series/83. Since 2003, the U.S. Sentencing Commission has not publicly disclosed the exact date on which sentencing outcomes are rendered. Therefore, we were not able to include data from 2003 or later into our analyses.
2. Indiana did not observe daylight saving time from 1970 through 2006.
3. We report descriptive statistics (e.g., mean and standard deviation) for the main analysis (see Supplemental Tables S1 and S2). Following the reviewers' suggestion, we conducted a preliminary analysis. Without the control variables (i.e., sentence year, criminal history, offense level, type of trial, number of convictions, age, gender, race, and education), 1 hour of sleep deprivation caused by the clock change in the spring did not significantly affect sentence length (for detailed results, see Table S3 in the Supplemental Material).
4. In the U.S. calendar system, weeks run from Sunday through Saturday. Usually, a year has 52 weeks. However, because neither 365 nor 366 is evenly divisible by 7, some years have 53 weeks.

References

Anderson, C., & Dickinson, D. L. (2010). Bargaining and trust: The effects of 36-h total sleep deprivation on socially interactive decisions. *Journal of Sleep Research*, *19*, 54–63.

Anderson, C., & Platten, C. R. (2011). Sleep deprivation lowers inhibition and enhances impulsivity to negative stimuli. *Behavioural Brain Research*, *217*, 463–466.

Barber, L. K., & Budnick, C. J. (2015). Turning molehills into mountains: Sleepiness increases workplace interpretive bias. *Journal of Organizational Behavior*, *36*, 360–381.

Barnes, C. M., & Wagner, D. T. (2009). Changing to daylight saving time cuts into sleep and increases workplace injuries. *Journal of Applied Psychology*, *94*, 1305–1317.

Benca, R. M., Obermeyer, W. H., Thisted, R. A., & Gillin, J. C. (1992). Sleep and psychiatric disorders: A meta-analysis. *Archives of General Psychiatry*, *49*, 651–668.

Blair, I. V., Judd, C. M., & Chapleau, K. M. (2004). The influence of Afrocentric facial features in criminal sentencing. *Psychological Science*, *15*, 674–679.

Buckholtz, J. W., & Marois, R. (2012). The roots of modern justice: Cognitive and neural foundations of social norms and their enforcement. *Nature Neuroscience*, *15*, 655–661.

Carlsmith, K. M., Darley, J. M., & Robinson, P. H. (2002). Why do we punish? Deterrence and just deserts as motives for punishment. *Journal of Personality and Social Psychology*, *83*, 284–299.

Chee, M. W., & Choo, W. C. (2004). Functional imaging of working memory after 24 hr of total sleep deprivation. *The Journal of Neuroscience*, *24*, 4560–4567.

Coren, S. (1996). Daylight savings time and traffic accidents. *New England Journal of Medicine*, *334*, 924–925.

Danziger, S., Levav, J., & Avnaim-Pesso, L. (2011). Extraneous factors in judicial decisions. *Proceedings of the National Academy of Sciences, USA*, *108*, 6889–6892.

Dawson, D., & McCulloch, K. (2005). Managing fatigue: It's about sleep. *Sleep Medicine Reviews*, *9*, 365–380.

Dickinson, D. L., Dutcher, E. G., & Rodet, C. S. (2015). Observed punishment spillover effects: A laboratory investigation of behavior in a social dilemma. *Experimental Economics*, *18*, 136–153.

Ghumman, S., & Barnes, C. M. (2013). Sleep and prejudice: A resource recovery approach. *Journal of Applied Social Psychology*, *43*, E166–E178.

Goldstein, A. N., & Walker, M. P. (2014). The role of sleep in emotional brain function. *Annual Review of Clinical Psychology*, *10*, 679–708.

Harrison, Y., & Horne, J. A. (2000). The impact of sleep deprivation on decision making: A review. *Journal of Experimental Psychology: Applied*, *6*, 236–247.

Henrich, J., McElreath, R., Barr, A., Ensminger, J., Barrett, C., Bolyanatz, A., . . . Ziker, J. (2006). Costly punishment across human societies. *Science*, *312*, 1767–1770.

Hobson, J. A. (2005). Sleep is of the brain, by the brain and for the brain. *Nature*, *437*, 1254–1256.

Johnson, B. D., Ulmer, J. T., & Kramer, J. (2008). The social context of guideline circumvention: The case of federal district courts. *Criminology*, *46*, 737–783.

Lim, J., & Dinges, D. F. (2010). A meta-analysis of the impact of short-term sleep deprivation on cognitive variables. *Psychological Bulletin*, *136*, 375–389.

Steffensmeier, D., & Demuth, S. (2000). Ethnicity and sentencing outcomes in U.S. federal courts: Who is punished more harshly? *American Sociological Review*, *65*, 705–729.

Tetlock, P. E., Visser, P. S., Singh, R., Polifroni, M., Scott, S., Elson, S. B., . . . Rescober, P. (2007). People as intuitive prosecutors: The impact of social-control goals on attributions of responsibility. *Journal of Experimental Social Psychology*, *43*, 195–209.

Varughese, J., & Allen, R. P. (2001). Fatal accidents following changes in daylight savings time: The American experience. *Sleep Medicine*, *2*, 31–36.

Venkatraman, V., Chuah, L., Huettel, S., & Chee, M. (2007). Sleep deprivation elevates expectation of gains and attenuates response to losses following risky decisions. *Sleep*, *30*, 603–608.

Wagner, D. T., Barnes, C. M., Lim, V. K., & Ferris, D. L. (2012). Lost sleep and cyberloafing: Evidence from the laboratory and a daylight saving time quasi-experiment. *Journal of Applied Psychology*, *97*, 1068–1076.

Wiltermuth, S. S., & Flynn, F. J. (2013). Power, moral clarity, and punishment in the workplace. *Academy of Management Journal*, *56*, 1002–1023.

Yoo, S. S., Gujar, N., Hu, P., Jolesz, F. A., & Walker, M. P. (2007). The human emotional brain without sleep—a prefrontal amygdala disconnect. *Current Biology*, *17*, R877–R878.