

Middlesex University Research Repository

An open access repository of

Middlesex University research

<http://eprints.mdx.ac.uk>

Dhami, Mandeep K. ORCID logo ORCID: <https://orcid.org/0000-0001-6157-3142>, Belton, Ian, Merrall, Elizabeth, McGrath, Andrew and Bird, Sheila M. (2020) Criminal sentencing by preferred numbers. *Journal of Empirical Legal Studies*, 17 (1) . pp. 139-163. ISSN 1740-1453 [Article] (doi:10.1111/jels.12246)

Final accepted version (with author's formatting)

This version is available at: <https://eprints.mdx.ac.uk/28441/>

Copyright:

Middlesex University Research Repository makes the University's research available electronically.

Copyright and moral rights to this work are retained by the author and/or other copyright owners unless otherwise stated. The work is supplied on the understanding that any use for commercial gain is strictly forbidden. A copy may be downloaded for personal, non-commercial, research or study without prior permission and without charge.

Works, including theses and research projects, may not be reproduced in any format or medium, or extensive quotations taken from them, or their content changed in any way, without first obtaining permission in writing from the copyright holder(s). They may not be sold or exploited commercially in any format or medium without the prior written permission of the copyright holder(s).

Full bibliographic details must be given when referring to, or quoting from full items including the author's name, the title of the work, publication details where relevant (place, publisher, date), pagination, and for theses or dissertations the awarding institution, the degree type awarded, and the date of the award.

If you believe that any material held in the repository infringes copyright law, please contact the Repository Team at Middlesex University via the following email address:

eprints@mdx.ac.uk

The item will be removed from the repository while any claim is being investigated.

See also repository copyright: re-use policy: <http://eprints.mdx.ac.uk/policies.html#copy>

RUNNING HEAD: SENTENCING

In press: *Journal of Empirical Legal Studies*

Criminal Sentencing by Preferred Numbers

Mandeep K. Dhami¹, Ian K. Belton², Elizabeth Merrall³, Andrew McGrath⁴, and Sheila Bird⁵

¹Middlesex University, UK

²University of Strathclyde, UK

³S-cubed ApS, Denmark

⁴Charles Sturt University, Australia

⁵University of Cambridge, UK

Send correspondence to:

Mandeep K. Dhami

Department of Psychology

Middlesex University

The Burroughs, Hendon

London, UK

NW4 4BT

E-mail: m.dhami@mdx.ac.uk

Acknowledgements

We would like to thank the Sentencing Council for England and Wales, Ministry of Justice and the New South Wales Bureau of Crime Statistics and Research for providing access to the data sources. We would also like to thank John Irwin for his feedback on a draft of the manuscript. The dataset for England and Wales (but not all of the analyses) presented here formed part of the third author's PhD thesis (Merrall, 2012).

Abstract

Criminal sentencing is a complex cognitive activity often performed by the unaided mind under suboptimal conditions. As such, sentencers may not behave according to policy, guidelines and training. We analyzed the distribution of sentences meted out in one year in two different jurisdictions (i.e., England and Wales, and New South Wales, Australia). We reveal that sentencers prefer certain numbers when meting out sentence lengths (in custody and community service) and amounts (for fines/compensation). These ‘common doses’ accounted for over 90% of sentences in each jurisdiction. The size of these doses increased as sentences became more severe, and doses followed a logarithmic pattern. These findings are compatible with psychological research on preferred numbers and are reminiscent of Weber’s and Fechner’s laws. Our findings run contrary to arguments against efforts to reduce judicial discretion, and potentially undermine the notion of individualized justice, as well as raise questions about the (cost) effectiveness of sentencing.

Keywords: Sentencing; courts; judges; decision-making

Introduction

Criminal sentencing represents a key stage of the criminal justice process where the courts dispose of offenders who have pled guilty to an offence or been convicted of one. The punishments meted out to offenders may give them their just deserts, incapacitate or deter them from committing crimes in the future, rehabilitate them, or enable them to make reparations. Consequently, sentencing is often predicated on the principle that each case is unique and so dealt with on its own merits. This notion of ‘individualized justice’ is fundamental to the sentencing framework of many jurisdictions. The United States Sentencing Commission (2018, p. 14) holds to the belief that sentences are based on the “individualized facts of the case”. The Sentencing Council for England and Wales (2015) declares that “[i]t is important to note that **every criminal case is unique**” (p. 9; boldface as in source). Finally, the New South Wales, Australia sentencing bench book (Judicial Commission of New South Wales, 2014) quotes the court in *R v Engert* (1995) as stating that “In every case, what is called for is the making of a discretionary decision in the light of the circumstances of the individual case” (p. 2010).

Indeed, judicial discretion is considered essential for producing individualized justice, and jurisdictions differ in how much discretion is afforded to sentencers. In some jurisdictions, such as in the US, sentencers are expected to follow highly structured, numerical, grid-based guidelines that specify the factors which should determine a sentence (e.g., offence seriousness and criminal history) and constrain the sentences that are meted out (see Dhami, Belton, & Goodman-Delahunty, 2015). Other jurisdictions, such as England and Wales, have opted for more flexible, text-based guidance that leave room for the exercise of discretion in an apparent effort to enable individualized justice (Gage, 2008). Yet,

in other jurisdictions such as in Australia, sentencers have eschewed guidelines altogether (beyond guideline judgments) because they do not sufficiently prioritize individualization (Australian Law Reform Commission, 2006).

The exercise of discretion may, however, be problematic. Sentencers must search for and attend to relevant information (e.g., harm caused, culpability of the offender), weight it appropriately, and integrate it in order to determine a sentence. As such, sentencing is a cognitive activity that may be affected by the attentional, memory and processing limitations of the human mind. Indeed, research has found that sentencers may ignore or take insufficient account of legal factors (Konečni & Ebbesen, 1982; von Helversen & Rieskamp, 2009) and may be unduly influenced by extra-legal factors (e.g., Daly & Bordt, 1995; Mitchell, 2005; Steffensmeier, Ulmer & Kramer, 1998). Sentencers may also be biased by irrelevant demands or anchors (Englich, Mussweiler & Strack, 2006; Guthrie, Rachlinski & Wistrich, 2007), the order in which cases are presented, and even the gradation of the custodial sentencing scale used (Rachlinski, Wistrich, & Guthrie, 2015).

In the present research, we explore the idea that sentencing decisions may be unduly influenced by the sentencing options available to the sentencer. Sentencing options are typically measured on continuous scales, namely length of time (e.g., custody, community sentence) and amount of money (i.e., fine, compensation). There is a growing body of psychological literature on how people use continuous scales, and we consider the implications of this for criminal punishment.

Preferred Numbers, Just Noticeable Differences and Logarithmic Scaling

Psychological research has established that people use certain numbers much more frequently than others when they are estimating the level of a stimulus (Baird, Lewis, &

Romer, 1970; Baird & Noma, 1975; Stevens, 1975). For example, when asked to generate numbers between 1 and 100, multiples of five and 10 are more commonly selected than other numbers (Baird & Noma, 1975; Plug, 1977). Multiples of five and 10 also occur more frequently on the internet (all websites) than other numbers; stock prices and trade amounts tend to cluster around them; and corporate managers rely on them when setting dividend amounts (Aerts, Van Campenhout & Van Caneghem, 2008; Converse & Dennis, 2018; Dorogovtsev, Mendes & Oliveira, 2006; Gu, Chen & Zhou, 2008; Harris, 1991).

In fact, preferred number series can be predicted quite accurately. Noma and Baird (1975) proposed an equation i.e., $PN = kB^n$, where PN is a preferred number, k is an integer between 1 and $B-1$, B is the base used, and n is an integer exponent ≥ 0 , that predicts preferred number choice in a base 10 context and can be used to calculate preferred numbers using other bases. Albers (2001) presented a similar equation (for base 10 only) that produces a slightly finer series: $PN = a \times 10^i$: $a \in \{1, 1.5, 2, 3, 4, 5, 7\}$, where i is a natural number.

The equations proposed by Noma and Baird (1975) and Albers (2001) both generate series of numbers with increments that increase in proportion to the size of the numbers. This suggests that in addition to having a preference for certain numbers, people may use numerical scales with increments that increase in proportion to the size of the numbers involved (Dotan & Dehaene, 2016). A related phenomenon in psychophysics is called Weber's law. Weber (1846) first observed that in order for a change in stimulus to be perceptible (a 'just noticeable difference' or JND), the stimulus needs to change more at the higher end of the scale on which it is measured than the lower end. Weber's law can be

expressed by the equation $\Delta I = kI$, where ΔI is a just noticeable difference in stimulus I , and k is a constant whose value depends on the dimension under study.

Albers (2001, p. 309) also argued that humans perceive numerical values logarithmically, suggesting that numerical stimuli may produce “emotionally perceived reactions similar to those caused by the brightness of light or the loudness of sounds.” Indeed, Fechner (1860) proposed that Weber’s law leads to a roughly logarithmic transformation scale for JND increments (viz. e.g., decibels, which are on a logarithmic scale). Logarithmic patterns have been observed, with some exceptions, for all sensory modalities (Gescheider, 1997). There may even be a neurobiological basis for Fechner’s law – Nieder and Miller (2003) identified logarithmic patterns in primate neuronal representations of numerosity. Sun, Wang, Goyal and Varchney (2012) recently demonstrated that seeing the world in a logarithmic way is probabilistically efficient (i.e., Bayes-optimal), and makes evolutionary sense, given the distribution of stimuli in the natural environment (see also Portugal & Svaiter, 2011).

Implications for Criminal Sentencing

The above research has potential implications for our understanding of sentencing practice. Specifically, we might expect sentencers to demonstrate the phenomena of preferred numbers and JND, and we might expect these to follow a logarithmic pattern. In fact, over 130 years ago, Edmund du Cane (1883) and Sir Francis Galton (1895) observed that custodial sentence lengths in England and Wales were constrained such that certain custodial sentence lengths were more common than others. Galton additionally noted that there were larger gaps between very long custodial sentences.

Nearly 100 years later, Pease and Sampson (1977) examined a sample of 700 cases obtained from two Probation and After-Care Services in England, local newspapers, appeals cases reported in the Criminal Law Reports, and cases involving a barrister friend, all involving an immediate custodial sentence of between one and 48 months. They found an aggregation of sentences around three, six and 12 months, and their multiples, with increments between these 'preferred' sentences increasing along with sentence length (see also Fitzmaurice & Pease, 1986).

More recently, a handful of studies in North American jurisdictions have also observed preferred numbers and JND in custodial sentencing (Jones & Rankin, 2014; Ostrom & Ostrom, 2002; Wiseman, Fisher & Connelly, 2006). Ostrom and Ostrom (2002) found that, despite having discretion, judges used 10 custodial sentence lengths for 78% of 9,586 offenders sentenced in the US State of Michigan in 1995. The intervals between the 10 preferred sentence lengths increased along with the sentence lengths, and the majority of sentence lengths were multiples of 12 months; all were even numbers. Wiseman et al. (2006) studied 23,000 custodial sentences that were followed by a period of 'extended supervision' in Wisconsin from 2003 to 2004. Despite having 108 sentencing options available to them, sentencers used 10 sentences for 88% of cases (excluding sentences that accounted for one percent or fewer cases). The gap between what they call 'prominent' or 'standard' sentences increased with the severity of the sentence, and seven of the 10 sentences were in multiples of 12 months; all but one, were even numbers. Finally, Jones and Rankin (2014) reviewed sentencing decisions recorded in a legal database from 1990 to 2012 on Canadian cases of second degree murder, which has a mandatory sentence of life imprisonment with a partial discretionary period of parole ineligibility of between 10 and 25 years. They found that

parole ineligibility periods for 222 (out of 477) decisions were characterized by a preference for multiples of five, and were even numbers for 62% of decisions. All but seven decisions were integers (e.g., one or two years rather than 1.5 years). There was also a statistically significant chance of decisions reflecting 12 year periods. Jones and Rankin describe this behaviour as ‘rounding off’.

The Present Research

In the present paper we build on past research, and examine the distribution of criminal sentences in order to answer the following questions:

- (1) Are the distribution of both custodial and non-custodial sentences characterized by preferred numbers and JND?
- (2) Do preferred custodial and non-custodial sentences follow a logarithmic pattern?
- (3) What is the distribution of sentences passed in the lower and higher tier criminal courts, as well as sentences meted out for different classes of offence?
- (4) Do the findings of preferred custodial sentences lengths and JND observed in the past in England and Wales replicate in the new millennium? And, do the findings generalize to a previously unexamined jurisdiction i.e., New South Wales, Australia?

To-date, no research has considered the possibility of non-custodial sentences also being characterized by preferred numbers and JND as we do. By contrast to custodial sentences which are measured in terms of length of time, fine/compensation amounts are measured on a monetary scale. It is important to know if the use of preferred numbers in sentencing depends on the nature of the scale used.

Although some of the past studies have reported that intervals between (custodial) sentence lengths increase along with the severity of the sentence, they did not examine, as

we do, if preferred sentences follow a logarithmic pattern. A logarithmic pattern would imply that offenders sentenced for more serious offences (which have higher maximum penalties attached to them) will receive rougher justice, since the increments between preferred sentence lengths/amounts for these offenders would be much greater than for those who committed less serious offences (which have lower maximum penalties).

The past studies also do not differentiate between the sentencing behavior of higher and lower tier criminal courts, and nor do they examine different classes of offence (with the exception of Wiseman et al. (2006) who compared violent and non-violent offences). Sentencing in the higher and lower tier courts may vary because of differences in the training and experience of the sentencer, the types of cases that are brought before the court, and the extent of the court's sentencing powers. Similarly, sentencing for different offence classifications may vary because of differences in the maximum penalties attached to them, as well as differences in the courts that deal with these offences. If sentencing behavior is shaped by the limitations of the sentencing mind then one would expect similarities rather than differences in sentencing patterns for different court types and offence classifications. We examine this possibility.

Finally, although the phenomena of preferred numbers and JND have been observed for custodial sentencing in four different jurisdictions to date (i.e., England and Wales, Canada, Michigan and Wisconsin) as well as over time within one jurisdiction (i.e., England and Wales), it is prudent to establish the replicability and generalizability of the phenomena across different jurisdictions as well as to continue tracking it within jurisdictions over time (as sentencing laws and training evolve). The present study uses a much larger sample than past studies on England and Wales. The present study also extends the analysis to another

jurisdiction (i.e., New South Wales, Australia; each state and territory in Australia is considered a separate jurisdiction, although certain offences are subject to Federal jurisdiction). As mentioned earlier, the Australian state/territory and federal jurisdictions have resisted the introduction of sentencing guidelines partly in a desire to prioritize individualized justice (Australian Law Reform Commission (2006), and some would argue that sentencers there have unfettered discretion (Krasnostein & Freiberg, 2013).

We describe the relevant features of these two sentencing systems at appropriate points below (for other information on these two systems see Ashworth & Roberts, 2013 and Edney & Bagaric, 2013; see also Dhami et al., 2015). Replication across time within a jurisdiction and generalizability across jurisdictions can serve to reduce the potential for our findings being explained by legal factors such as sentencing laws and/or their interpretation by sentencers, and instead increase support for the idea that even a complex socio-legal function such as criminal punishment is ultimately bound by simple psychological heuristics.

Following the research reviewed above, we expected that both non-custodial and custodial sentences would be characterized by preferred numbers and JND, and that these would follow a logarithmic pattern. We also expected that these preferred numbers, JND, and logarithmic patterns would apply equally well to both the higher and lower tier criminal courts as well as to a variety of different classes of offence. Finally, we expected to observe the aforementioned findings in both England and Wales, and New South Wales, Australia.

Datasets

We used two datasets, one obtained from the Sentencing Council for England and Wales (and UK Ministry of Justice) and the other from the New South Wales (Australia) Bureau of Crime Statistics and Research. The dataset for England and Wales represented

sentences meted out in 2004 (i.e., before sentencing guidelines were introduced). The dataset for New South Wales, Australia, where guidelines exist only for a limited number of offences¹, refers to sentences meted out in 2012. Neither of the datasets included plea bargained cases, thus the sentence was up to the discretion of the court. Both datasets enable us to examine the exercise of judicial discretion in sentencing.

England and Wales

The England and Wales dataset comprised 223,207 cases of adults (aged 21 or over) sentenced at a magistrates' Court or the Crown Court after being convicted of, or pleading guilty to, one of 18 offences which could be classified as property offences, violent offences, driving offences or drugs offences.² The datasets compiled by the courts only provide information on the so-called 'principal' offence, which for multiple-offence cases is officially defined as that given the highest sentence, and in the event of a tie, that which carries the higher legal maximum penalty. Because of the lack of data on multiple-offence cases, our analysis focuses on single-offence cases. Seventy-two percent of the cases in the dataset ($n = 161,385$) received a single sentence (hereafter called disposal). The majority (61%; $n = 98,818$) of these single disposal cases received one of three³ disposals: custody,

¹ High range PCA (driving with a prescribed concentration of alcohol), break-enter-and-steal, armed robbery, and dangerous driving.

² Property offences include theft from shop, theft from person, handling of stolen goods, obtaining property by deception, criminal damage, burglary in a non-dwelling, burglary in a dwelling, aggravated vehicle taking. Violent offences include common assault, actual bodily harm, grievous bodily harm (GBH), GBH with intent, fear or provocation of violence, robbery, sexual assault. (We recognize that typically this classification excludes fear or provocation of violence and sexual assault. However, when we looked at these two principal offences as separate classifications, we observed similar sentencing behavior. Therefore, for present purposes, we amalgamated these with the violence classification.) Driving offences include driving whilst disqualified, and dangerous driving. Drugs offences refer to supply and possession of drugs. Finally, offences had statutory maximums, they did not all have mandatory minimums.

³ A variety of community orders were also meted out to approximately 21,000 cases, however, these were in a mix of units (i.e., number of sessions, hours, days and months), and so we do not report them here, although our analyses of the individual units (i.e., subsets of community orders) suggest that the findings are consistent with those reported in the present paper.

community rehabilitation order (i.e., community sentences), and fine/compensation order. Males accounted for 86% ($n = 85,470$) of single disposal cases that received one of these three disposals. Therefore, we focused our analyses on the latter cases (noting that the subset of female cases would have been too small to allow for reliable quantitative analyses).

New South Wales, Australia

The New South Wales, Australia dataset comprised 104,037 cases of adults (aged 21 or over) in the local courts, District Court or Supreme Court after being convicted of, or pleading guilty to, a principal offence classified as property, violence, driving or drugs.⁴ Fifty-one percent ($n = 52,989$) of these cases received a single disposal. The majority (88%, $n = 46,688$) of these single disposal cases received one of four key disposals: custody, community service order, good behavior bond and fine. Males accounted for 79% ($n = 36,818$; two cases receiving a mandatory life sentence were removed) of the single disposal cases that received one of the four disposals. Therefore, we focused our analyses on the latter cases as they were most similar to those in the England and Wales dataset.

Analyses and Findings

Sentencing in England and Wales

We first plotted the frequencies of custodial and community sentence *lengths* as well as fine/compensation *amounts* for each of the three disposals, regardless of court type and offence classification. Each disposal was examined using the unit of measurement recorded

⁴ Property offences include burglary, unlawful entry with intent, motor vehicle theft, theft from person, theft from retail premises, receiving or handling proceeds of crime, obtaining benefit by deception, forgery and counterfeiting, and deceptive business practices. Violent offences include murder, manslaughter or driving causing death, assault, other acts intended to cause injury, sexual assault, harassment and robbery. Drug offences include import or export of drugs, drug dealing or trafficking, manufacture or cultivation of drugs, and possession or use of drugs. Driving offences include dangerous or negligent operation of a vehicle, driving without a licence or while disqualified, and regulatory driving offences (e.g. speeding, driving while under the influence of alcohol). Finally, all offences had statutory maximums, and some have mandatory minimums.

in the dataset. The units of measurement were days for custody and community rehabilitation orders. Fines/compensation orders were measured in pounds sterling. The frequency distribution plots allowed us to identify commonly used sentence lengths or amounts. Following Wiseman et al. (2006), these common ‘doses’ were defined as custodial and community sentence lengths or fine/compensation amounts that accounted for at least one percent of the total frequency of each disposal. This threshold allows us to account for more of the data in our analyses (e.g., if we had a higher threshold such as 5% of cases then we would be disregarding more data).

Appendix 1 presents the frequency plots of sentence length for cases receiving custody (see Figure 1) and community rehabilitation orders (see Figure 2), as well as sentence amount for cases receiving a fine/compensation (see Figure 3). Common sentence doses are immediately evident for each type of disposal (see the peaks). In fact, 91% (77,840/85,470) of all cases received a common sentence dose, and Table 1 summarizes these common doses.

TABLE 1 ABOUT HERE

Table 1 shows that there were 21 common doses which accounted for 89% of all custodial sentences (which were all determinate). The doses begin with multiples of seven days (i.e., a week or fortnight) up to 56 days (i.e., eight weeks or two months). A notable exception was 30 days, perhaps because it represents around one month. Multiples of 30 days were then used from 60 days up to 180 days (i.e., six months). Following this, multiples of 90 days (i.e., three months) were used up to 540 days (i.e., one year and nine months). Then, multiples of 180 days (i.e., six months) were used up to 1,440 days (i.e., four years). Finally, 1,800 days (i.e., five years) represented the highest common dose of custody.

As can be seen in Table 1, common doses accounted for 99% of all community rehabilitation orders meted out by the courts. These orders were meted out in six doses, and these included multiples of 90 days (i.e., three months) and then 180 days (i.e., six months) up to 1,080 days (i.e., three years; although 900 days is absent in this series).

Table 1 also shows that 89% of fine/compensation amounts were meted out in 16 common doses. These were in multiples of £10 and £25 up to £100, followed by multiples of £50 up to £300. Common doses of £400 and £500 were also applied.

It should be noted that the common doses described above formed relatively regular patterns, with intervals between doses growing as the value of the doses increased. For custody, the doses increased from multiples of seven days, through 30 days, to 90 days, and then 180 days. For community rehabilitation orders, the doses increased from multiples of 90 days to 180 days. Finally, for fine/compensation amounts, the doses increased from multiples of £10 and £25 to multiples of £50. We shall return to these observations below.

Decisions about sentence length or amount are affected by the type of court in which an offender is sentenced (due to the court's sentencing powers) and the type of offence the offender is sentenced for (due to offence-specific maximum penalties). In the magistrates' court, sentences are passed by either a bench of three magistrates (lay judges) or one district (professional) judge, and the maximum sentence that can be meted out is six months' imprisonment for a single offence (or concurrently, if sentencing for more than one offence). In the Crown Court, sentences are passed by professional judges who have no such limits on their sentencing power and so can mete out the maximum penalty associated with an offence. Thus, we also examined the sentences passed (i.e., custody, community rehabilitation order, and fine/compensation order) by court type (i.e., magistrates' court and

Crown court) and principal offence classification (i.e., property, violence, driving or drugs). We performed this analysis where the combination of disposal x court type x principal offence classification had a minimum of 500 cases. These analyses showed the number of common doses that were associated with each of the three disposals by court type and principal offence classification, and the proportion of cases receiving one of the common doses in each type of court and for each principal offence classification.

Table 2 presents the findings of the aforementioned analyses, and several observations can be made. First, common doses accounted for between 89% (fine/compensation) and 99% (community rehabilitation order) of sentences meted out in the magistrates' court. For sentences passed in the Crown court, common doses accounted for between 83% (custody) to 99% (community rehabilitation order) of sentences.

TABLE 2 ABOUT HERE

Second, Table 2 also shows that in the magistrates' court, common doses were applied to at least 92% of offence classifications that were given a custodial sentence (i.e., for violence and up to 93% each for property and driving offences). Ninety-nine percent of all offence classifications (property, violence, driving) given a community rehabilitation order received a common dose (see Table 2). Finally, from 83% (driving) to 92% (drugs) of offence classifications received a common dose associated with a fine/compensation order.

Third, Table 2 similarly shows that in the Crown Court, from 75% (drugs) to 88% (property) of offence classifications received a common dose associated with a custodial sentence. Of those offence classifications given a community rehabilitation order (property, violence and driving), 99% received a common dose.

Fourth, as can also be seen in Table 2, across offence classifications, there were more common doses associated with a custodial sentence in the Crown Court (i.e., 21) than the magistrates' court (i.e., 11). This presumably reflects the greater custodial sentencing range available in the former court. Indeed, where this differential sentencing power is absent (i.e., in the use of community sentences), the number of common doses was the same in each type of court (i.e., 6 doses for community rehabilitation orders).

Finally, as we mentioned above, intervals between doses grew as the value of the doses increased. Regression analysis was used to investigate the extent to which each series of common doses increased on a linear versus a logarithmic scale. The predictor variable was the dose number which is on a linear scale (i.e., there were 21 common doses for custodial sentences meted out in England and Wales, and so the first [lowest] dose was assigned a value of one up until the last [highest] dose being assigned a value of 21), and the outcome variables were the common dose quantities either on the original (actual) scale (Linear Model 1) or the log scale (Log-linear Model 2)⁵.

For each disposal type, the common doses fitted a log-linear model better than a linear model – in each case the Akaike Information Criterion (AIC), which is used to compare the relative fit of different models, was substantially lower for Model 2 than for Model 1 (a lower value indicates a better model; see note to Figure 4 in Appendix 1). Figure 4 shows the common doses found for each disposal type plotted against the log of the dose quantities. Here, the *x*-axis refers to the dose number (or a dose's place in the series of doses for each disposal type), the *y*-axis refers to the log of the dose quantity (or the actual

⁵ Linear Model 1, $y_i = \alpha + \beta X_i + \varepsilon_i$ or Log-linear Model 2, $\log(y_i) = \alpha + \beta X_i + \varepsilon_i$ where y_i is the dose quantity and X_i is the dose for case i ; and, α and β are model parameters to be estimated and ε_i is an error term, which across cases are assumed to be normally distributed with zero mean.

sentence length/amount), and the legend refers to the number of cases to which a dose applies. The linear association between dose and the logarithmically scaled dose quantity in the Figure is clear, and shows that the JNDs in doses are not linear but log-linear. In other words, increments in sentences from one dose to the next are not increasing by a constant k but proportional to the preceding dose (kI)⁶. The number of cases to which a dose applies, however, does not change in any predictable pattern.

Sentencing in New South Wales, Australia

Again, we first plotted the frequencies of custodial sentence, good behavior bond and community service order *lengths* as well as fine *amounts* for each of the four key disposals, across offence classifications. The units of measurement were months for custody and good behavior bonds, hours for community service orders, and Australian dollars for fines. As with the England and Wales sample, the frequency distribution plots allowed us to identify commonly used sentence lengths and amounts. Similarly, these common doses were defined as custodial and community sentence lengths or fine amounts that accounted for at least one percent of the total frequency of each disposal.

Figures 5 to 8 in Appendix 2 present the frequency plots for cases receiving custody, a good behavior bond, community service order, and fine, respectively. Common sentence doses are illustrated by the peaks in the frequency plots. In total, and similar to England and Wales, 92% (33,720/36,818) of all cases received a common dose. Table 3 summarizes these common doses.

TABLE 3 ABOUT HERE

⁶ In Linear Model 1, $Y_i = \alpha + \beta X_i + \varepsilon_i$, an increment in a sentence (Y) from one dose to the next (X to $X+1$) is associated with a mean increase of β whereas in Log-linear Model 2, $\log(Y_i) = \alpha + \beta X_i + \varepsilon_i$, an increment from one dose to the next is associated with a mean increase in $\log(Y)$ of β – which means in terms of Y itself that the mean value of Y is multiplied by 10^β .

Table 3 shows that there were 24 common doses associated with custody, which is not too dissimilar for that observed in England and Wales. The doses accounted for 78% of all custodial sentences (all were determinate). Here, with one exception, one month multiples were used up to 10 months. Thereafter (from 12 months), with a few exceptions, multiples of six months were used up to 72 months (i.e., six years).

As can also be seen in Table 3, there were 13 common doses associated with community service orders, which accounted for 92% of all cases receiving this disposal. These common doses were in multiples of 20 hours from 40 up to 120, and then in multiples of 50 hours from 150 hours to 400 hours.

Table 3 also shows that only six common doses accounted for 97% of all good behavior bonds. These were, with one exception, in multiples of six months from six months to 24 months (i.e., two years). A dose of 36 months (i.e., three years) was also applied.

In addition, and again very similar to that observed in England and Wales, Table 3 shows that 19 common doses were associated with a fine, which accounted for 90% of all cases receiving a fine. Here, the amounts were in multiples of \$50 from \$100 up to \$600. With one exception, the amounts were then in multiples of \$100 up to \$1000. Doses of \$1,200 and \$1,500 were also applied.

As with the England and Wales dataset, the New South Wales dataset revealed that intervals between common doses grew as the value of the doses increased. For custody, the doses increased from multiples of one month to six months. Multiples of 20 hours increased to multiples of 50 hours for community service orders. For good behavior bonds, the doses increased from multiples of 90 days to 180 days. Finally, fine amounts reflected increments from \$50, \$100, through \$200 to \$300.

Given the smaller size of the New South Wales, Australia dataset, there were insufficient cases to allow for a breakdown of the data by court type. We therefore restricted further analyses to sentences passed by offence classification (i.e., property, violence, driving or drugs). As before, this analysis was performed where the combination of disposal x offence classification had a minimum of 500 cases.

Table 4 presents the proportion of cases receiving one of the common doses for each disposal and offence classification. Common doses were applied to from 75% (violence) to 86% (property) of cases within offence classification that were given a custodial sentence. Of those cases given a good behavior bond, from 96% (property, driving and drugs) to 97% (violence) received a common dose. Ninety-three percent of driving offences given a community service order received a common dose. From 88% (driving) to 93% (drugs) of cases within offence classification received a common dose associated with a fine. Thus, the prevalence of common doses within-offence classifications demonstrated the same pattern as in England and Wales.

TABLE 4 ABOUT HERE

Finally, as before, regression analysis was used to investigate the extent to which each series of common doses was linear versus logarithmic. For each disposal type, the common doses fitted a logarithmic scale better than a linear scale. As with England and Wales, Model 2 (log-linear) was a better fit in each case than Model 1 (linear), according to the AIC (see note to Figure 9 in Appendix 2). Figure 9 shows the results of plotting the common doses for each disposal type against the log of the dose quantities.

Discussion

Official summaries of sentencing use descriptive statistics such as means, medians and inter-quartile ranges or grouped frequencies (Merrall, Dhimi & Bird, 2010). Statistical analyses of these datasets by researchers often involve regression analysis (for a review see Dhimi & Belton, 2016). These approaches mask intriguing features in the underlying distribution of sentences. By using simple frequency distribution plots, we revealed that sentencers in two different jurisdictions prefer certain sentence lengths and amounts, which we call ‘common doses’. The increments between these doses increase as the sentence moves along the scale of severity, following the concept of JND. In addition, the pattern of doses is logarithmic, meaning that the increments between doses are small for short sentences and become larger for longer sentences. This latter finding threatens the validity of research (especially that focusing on serious offences which have wider sentencing scales) using linear regression models that assume sentences follow a linear pattern (for further critique see Hester & Hartman, 2017). Overall, the present findings are compatible with past research on preferred numbers and with Weber’s law and Fechner’s law. Below, we summarize our findings before discussing their potential implications and directions for future research.

Despite the continuous nature of the custodial sentencing scale (i.e., length of time), the majority of custodial sentences passed in both England and Wales and New South Wales, Australia were characterized by a relatively small number of doses (whether measured in days or months). Thus, the historical patterns of custodial sentencing observed in England and Wales are replicated in the modern era (du Cane, 1883; Galton, 1895; Pease & Sampson, 1977; see also Fitzmaurice & Pease, 1986). In addition, the phenomena generalize to a hitherto unstudied jurisdiction i.e., New South Wales, Australia.

The evidence for preferred numbers, JND and logarithmic patterns in common doses was also apparent in a variety of non-custodial sentences meted out in both jurisdictions. This included fines and compensation amounts which are measured on a different continuous scale than length of time (i.e., amount of money).

Finally, we revealed that preferred numbers, JND and logarithmic patterns in common doses were applicable to sentences passed in both the higher and lower tier criminal courts in England and Wales, which have different sentencing powers, and in which different types of sentencers make decisions. Similarly, we observed that the aforementioned findings applied to a variety of different classes of offence in both jurisdictions studied (i.e., property, violence, driving and drugs), which have different penalties attached to them.

The application of ‘dose-based’ sentencing to the vast majority (i.e., over 90%) of cases in the two jurisdictions is remarkable. The remaining minority of data could potentially be accounted for by other models or (most likely) unsystematic variation. Our findings point to the ingrained and routine nature of the sentencing behavior observed. The general consistency of findings across jurisdictions, which differ in factors such as sentencing laws and sentencer training, reduces the plausibility of legal factors explaining our observations. Instead, psychological factors may account for the above findings, suggesting that criminal punishment may reflect the limitations of the unaided and unguided sentencing mind.

Potential Psychological Explanations

First, sentencers, like all people, simply lack the cognitive capacity, in terms of attention, memory and information processing, to analyze complex problems in a fully deliberative way. Second, the complexity of the sentencing task in terms of, for example, multiple (sometimes conflicting) factors, ill-defined laws and competing sentencing goals

impedes deliberative thinking (see also Dhimi et al., 2015 and Hammond, 1996). The unaided mind attempting to solve a complex task such as sentencing will find it difficult to attend to, weight and integrate of all of the potentially relevant information in a case.

Indeed, there is an abundance of research demonstrating that people use intuitive, rule-of-thumb or heuristic strategies that ease mental arithmetic and ignore much of the relevant and available information (see Gigerenzer, Hertwig, & Pachur, 2011; Gigerenzer, Todd, & the ABC Group, 1999; Gilovich, Griffin, & Kahneman 2002; Kahneman, Slovic, & Tversky, 1982; Payne, Bettman & Johnson, 1993). Previous work in the legal domain shows that judges may use heuristic strategies to make a variety of decisions (Dhimi, 2003; Dhimi & Ayton, 2001; Englich et al., 2006; Guthrie et al., 2007; Konečni & Ebbesen, 1982; Rachlinski et al., 2015; von Helverson & Rieskamp, 2009). Evidence from other research and judges' reasons given in court also suggests that sentencing is often approached in a relatively holistic, intuitive and subjective way (Jacobson & Hough, 2007; Millie, Tombs, & Hough, 2007).

This psychological explanation is bolstered by the fact that the doses we identified tended to reflect lengths of time (in custody or community service) and amounts of money (for fines/compensation) that would be easier to manipulate mentally, and therefore would be easily 'cognitively calculable'. All of the common doses were round numbers, and virtually all were even numbers. The doses used for fines/compensation were round numbers that could be multiplied by five, 10, 50 or 100. Similarly, custodial and community sentence doses were also round numbers that could be multiplied by meaningful calendrical units (i.e., days, weeks, months and years).

Potential Implications and Future Research

The present findings have several potential implications. First, one wonders how dose-based sentencing relates to the concept of individualized justice (i.e., the idea that every sentence is tailored to the particular features of the offence and the offender). This is a key principle of criminal punishment in many legal systems (Krasnostein & Freiberg, 2013; Maguire, 2010). One could argue that if cases were truly considered on their own merits then we would have observed a smoother distribution of sentences (rather than the large peaks that we found). On the other hand, one could contend that the observed doses do reflect the diversity of cases being brought before the courts because the majority of cases are similar to one another. Still another stance may be that while dose-based sentencing is incompatible with the concept of individualized justice, the small proportion of cases that did not receive one of the common doses observed, may instead have received a tailored sentence.

The datasets used in the present research did not provide in-depth details of each case for us to test the latter two viewpoints. However, it is arguably highly improbable for hundreds of cases to be exactly the same in terms of 'legally' relevant sentencing factors such as offence severity and prior record (and the diversity in terms of extra-legal factors, which we know judges are sometimes swayed by, would be even greater). Indeed, judgments of both of the aforementioned legally relevant factors alone are themselves typically based on multiple lower-level factors (see e.g., Dhimi, 2013a, 2013b). For example, offence severity may be based on factors such as offender culpability and harm caused that are each based on a host of lower-level factors, and prior record comprises factors such as number of previous convictions as well as previous offence types. The number of possible combination of factors is high, and it would be unlikely that the vast majority of cases could be so similar on all of their facts that they naturally require one of only a few sentences.

Dose-based sentencing may also have implications for how we respond to arguments against reducing judicial discretion. Numerical, grid-based sentencing guidelines such as those used in many US jurisdictions have, to-date, been successfully resisted in England and Wales and Australia. It has been argued that these would be too crude, narrow and blunt to allow truly individualized sentencing, and would result in inappropriate uniformity in sentences (e.g. Australian Law Reform Commission, 2006; Council of HM Circuit Judges, 2008; Judiciary of England and Wales, 2008; Schulhofer, 1992; Wasik, 2008). Critics of guidelines that curb discretion have additionally been concerned about them deskilling sentencers (Ruback & Wroblewski, 2001), and leaving “little room for creativity” (Wasik, 2008, p. 201). The present findings appear to run contrary to such arguments.

However, guidelines themselves may not remedy the situation. The dataset for England and Wales used in the present study was from the pre-guidelines era. In policy-makers’ efforts to maintain consistency in sentencing before and after guideline implementation, the sentencing ranges used in the guidelines reflect pre-guideline sentencing practice (see Dhami et al., 2015). The fact is that development of the guidelines was based on, and therefore biased by, existing practice. Indeed, some have raised concerns about whether the guidelines enable courts to tailor sentences to the circumstances of individual offences and offenders (Roberts, Pina Sanchez & Marder, 2018).

Finally, dose-based sentencing also raises questions about the (cost-) effectiveness of sentences. Sentencing has direct implications for the work of probation, prison and parole bodies, and these agencies may be wasting limited resources. Prison, in particular, is hugely expensive (in England and Wales, the annual cost per prison place in 2017 to 2018 was £40,843; Ministry of Justice, 2018). The costs of imprisonment are unjustified if offenders

are given longer custodial sentences than warranted. Similarly, if offenders are receiving the nearest preferred sentence to that which fits their crime, then they are not, strictly speaking, receiving their just deserts. Furthermore, given the larger increments between doses for longer sentence lengths, offenders could be receiving longer (or shorter) prison sentences than are necessary to punish, deter and/or incapacitate them, or a more (or less) severe non-custodial sentence than is necessary for their rehabilitation and/or addressing victim reparation. It is difficult to see how dose-based sentencing can achieve the goals of criminal punishment.

It would be useful to examine the generalizability of the present findings to cases involving plea bargaining, and to cases involving female offenders, as well as cases involving multiple offences. Plea bargaining was not a common feature of the two jurisdictions that we studied, and so future research on this could be based in other jurisdictions such as in the US. Although the psychological literature on preferred numbers would lead us to suggest that the initial sentence selected in a plea bargained case would demonstrate the use of common doses, it is unclear how the final sentence in such cases may be affected by the subsequent process of negotiation.

Similarly, there is no reason to believe that the observed dose-based sentencing practice would not be evident for female offenders. However, researchers would need to examine datasets with a sufficient number of cases (e.g., over multiple years) to enable reliable analyses, especially within offence and court types.

Finally, a study of multiple offence cases would also require employing other methods such as examination of court files to identify such cases (and so might involve small and potentially unrepresentative samples). In multiple offence cases, currently,

sentencers in England and Wales for example, are first required to choose a sentence for each offence (Sentencing Council, 2012). Then, they must decide if the sentences should to be served concurrently or consecutively. Finally, sentencers are required to “test the overall sentence(s) against the requirement that they be just and proportionate” (p. 8). Here, application of the ‘totality’ principle means that the single sentences are not simply added together. Based on the present findings, we hypothesize that dose-based sentencing would be evident in the first step of this process. Whether application of the totality principle in the final step is also subject to the phenomenon of preferred numbers is unclear, although the lack of clear guidance leaves open the possibility that sentencers may employ some sort of heuristic approach.

Conclusion

Some have described the application of judicial discretion in sentencing as “simply no more than an emotional, gut reaction to the offence and offender” (Edney, 2005, p. 57), while others “wonder whether figures have not just been plucked out of the air” (Judge Hulme in *R v. Markarian*, 2003 at [33]). We show that discretion is shaped by the phenomena of preferred numbers, JND and logarithmic patterns. Some may consider this to be ‘rough justice that gets rougher.’ If this is unpalatable, then we suggest that the role of judicial discretion in sentencing should be re-examined urgently, and efforts made to more suitably guide and aid sentencers.

References

- Aerts, W., Van Campenhout, G., & Van Caneghem, T. (2008). Clustering in dividends: Do managers rely on cognitive reference points? *Journal of Economic Psychology*, 29(3), 276-284. DOI: 10.1016/j.joep.2007.10.003
- Albers, W. (2001). Prominence theory as a tool to model boundedly rational decisions. In G. Gigerenzer & R. Selten (Eds.). *Bounded rationality: The adaptive toolbox* (pp. 297-317). Cambridge, MA: MIT Press.
- Ashworth, A., & Roberts, J. (2013). *Sentencing guidelines: Exploring the English model*. Oxford: Oxford University Press.
- Australian Law Reform Commission (2006). *Same crime, same time: Sentencing of federal offenders (Report 103, April 2006)*. Retrieved from <http://www.alrc.gov.au/sites/default/files/pdfs/publications/ALRC103.pdf>
- Baird, J. C., Lewis, C., & Romer, D. (1970). Relative frequencies of numerical responses in ratio estimation. *Perception & Psychophysics*, 8(5), 358-362. DOI: 10.3758/BF03212608
- Baird, J. C., & Noma, E. (1975). Psychophysical study of numbers: I. Generation of numerical responses. *Psychological Research*, 37(4), 281-297. DOI: 10.1007/BF00309723
- Converse, B. A., & Dennis, P. J. (2018). The role of “prominent numbers” in open numerical judgment: Strained decision makers choose from a limited set of accessible numbers. *Organizational Behavior and Human Decision Processes*, 147, 94-107. DOI: 10.1016/j.obhdp.2018.05.007

- Council of HM Circuit Judges (2008). *A sentencing commission for England and Wales: Observations of the council of HM circuit judges*. Retrieved from http://www.judiciary.gov.uk/JCO%2FDocuments%2FConsultations%2Fresponse_cj_sentencing_commission.pdf
- Daly, K., & Bordt, R. L. (1995). Sex effects and sentencing: An analysis of the statistical literature. *Justice Quarterly*, *12*(1), 141-175. DOI: 10.1080/07418829500092601
- Dhami, M. K. (2003). Psychological models of professional decision-making. *Psychological Science*, *14*, 175-180.
- Dhami, M. K. (2013a). A 'decision science' perspective on the old and new sentencing guidelines in England and Wales. In A. Ashworth & J. V. Roberts (Eds.), *Structured sentencing in England and Wales: From guidance to guidelines* (pp. 165-181). Oxford: Oxford University Press.
- Dhami, M. K. (2013b). Sentencing guidelines in England and Wales: Missed opportunities? *Law and Contemporary Problems*, *76*, 287-305.
- Dhami, M. K., & Ayton, P. (2001). Bailing and jailing the fast and frugal way. *Journal of Behavioral Decision Making*, *14*(2), 141-168. DOI: 10.1002/bdm.371
- Dhami, M. K., & Belton, I. (2016). Statistical analyses of court decisions: An example of multilevel models of sentencing. *Law and Method*. DOI: 10.5553/REM/.000019.
- Dhami, M. K., Belton, I., & Goodman-Delahunty, J. (2015). Quasi-rational models of sentencing. *Journal of Applied Research on Memory and Cognition*, *4*, 239-247. DOI: 10.1016/j.jarmac.2014.07.009

- Dorogovtsev, S. N., Mendes, J. F. F., & Oliveira, J. G. (2006). Frequency of occurrence of numbers in the world wide web. *Physica A: Statistical Mechanics and its Applications*, 360(2), 548-556. DOI: 10.1016/j.physa.2005.06.06
- Dotan, D., & Dehaene, S. (2016). On the origins of logarithmic number-to-position mapping. *Psychological Review*, 123(6), 637-666. DOI: 10.1037/rev0000038
- Du Cane, E. F. (1883). The duration of penal sentences. *Fortnightly Review*, 33, 856-863.
- Edney, R. (2005). Still plucking figures out of the air?: *Markarian* and the affirmation of the instinctive synthesis. *High Court Quarterly Review*, 1(2), 50-57. Retrieved from <http://www.sandstoneacademicpress.com.au/index.php?page=high-court-quarterly-review>
- Edney, R., & Bagaric, M. (2013). *Sentencing in Australia*. Australia: Thomson Reuters.
- Englich, B., Mussweiler, T., & Strack, F. (2006). Playing dice with criminal sentences: The influence of irrelevant anchors on experts' judicial decision making. *Personality and Social Psychology Bulletin*, 32(2), 188-200. DOI: 10.1177/0146167205282152
- Fechner, G. (1860). *Elemente der psychophysik. Erster teil* [Elements of psychophysics. Pt. 1]. Leipzig, Germany: Breitkopf und Härtel.
- Fitzmaurice, C., & Pease, K. (1986). *The psychology of judicial sentencing*. Manchester: Manchester University Press.
- Gage, W. (2008). *Sentencing commission working group. Sentencing guidelines in England and Wales: An evolutionary approach*. London: Sentencing Commission Working Group.
- Galton, F. (1895). Terms of imprisonment. *Nature*, June, 174-176.

- Gescheider, G. A. (1997). *Psychophysics: The fundamentals (3rd Edition)*. Mahwah, NJ: Lawrence Erlbaum Associates.
- Gigerenzer, G., Hertwig, R., & Pachur, T. (Eds.). (2011). *Heuristics: The foundations of adaptive behavior*. New York: Oxford University Press.
- Gigerenzer, G., Todd, P. M., & the ABC Research Group (1999). *Simple heuristics that make us smart*. Oxford: Oxford University Press.
- Gilovich, T., Griffin, D., & Kahneman, D. (Eds.).(2002). *Heuristics and biases: The psychology of intuitive judgment*. New York, NY: Cambridge University Press.
- Gu, G.F., Chen, W., & Zhou, W.X. (2008). Quantifying bid-ask spreads in the Chinese stock market using limit-order book data. *The European Physical Journal B*, 57(1), 81-87. DOI: 10.1140/epjb/e2007-00158-7
- Guthrie, C., Rachlinski, J. J., & Wistrich, A. J. (2007). Blinking on the bench: How judges decide cases. *Cornell Law Review*, 93, 1-44. Retrieved from <http://cornelllawreview.org/>
- Hammond, K. R. (1996). *Human judgment and social policy: Irreducible uncertainty, inevitable error, unavoidable injustice*. New York, NY: Oxford University Press.
- Harris, L. (1991). Stock price clustering and discreteness. *Review of Financial Studies*, 4(3), 389-415. DOI: 10.1093/rfs/4.3.389
- Hester, R., & Hartman, T. K. (2017). Conditional race disparities in criminal sentencing: a test of the liberation hypothesis from a non-guidelines state. *Journal of Quantitative Criminology*, 33, 77-100. DOI: 10.1007/s10940-016-9283-z
- Jacobson, J., & Hough, M. (2007). *Mitigation: The role of personal factors in sentencing*. Retrieved from

<http://www.prisonreformtrust.org.uk/Portals/0/Documents/mitigation%20-%20the%20role%20of%20personal%20factors%20in%20sentencing.pdf>

Jones, C., & Rankin, M. B. (2014). Justice as a rounding error? Evidence of subconscious bias in second-degree murder sentences in Canada. *Osgoode Legal Studies Research Paper Series*. 81. Retrieved from <http://digitalcommons.osgoode.yorku.ca/olsrps/81>

Judiciary of England and Wales (2008). *Presiding judge's response: A structured sentencing framework and sentencing commission*. Retrieved from http://www.judiciary.gov.uk/JCO%2fDocuments%2fConsultations%2fresponse_request_spj_sentencing_commission.pdf

Judicial Commission of New South Wales (2014). *Sentencing Bench Book*. Retrieved from https://www.judcom.nsw.gov.au/wp-content/uploads/2016/07/Sentencing_Bench_Book.pdf

Kahneman, D., Slovic, P. & Tversky, A. (1982). *Judgement under uncertainty: Heuristics and biases*. Cambridge: Cambridge University Press.

Konečni, V. J., & Ebbesen, E. B. (Eds.). *The Criminal Justice System - A Social-Psychological Analysis*. 1982. San Francisco: Freeman.

Krasnostein, S., & Freiburg, A. (2013). Pursuing consistency in an individualistic sentencing framework: If you know where you're going, how do you know when you've got there? *Law and Contemporary Problems*, 76, 265-288. Retrieved from <http://scholarship.law.duke.edu/lcp/>

Maguire, N. (2010). Consistency in sentencing. *Judicial Studies Institute Journal*, 2, 14-54. Retrieved from <http://www.jsijournal.ie/>

- Merrall, E. L. C., Dhami, M. K., & Bird, S. M. (2010). Exploring methods to investigate sentencing decisions. *Evaluation Review*, 34, 185–219. DOI: 10.1177/0193841X10369624
- Millie, A., Tombs, J., & Hough, M. (2007). Borderline sentencing: A comparison of sentencers' decision making in England and Wales, and Scotland. *Criminology and Criminal Justice*, 7, 243-267. DOI: 10.1177/1748895807078866
- Ministry of Justice (2018). *Costs per place and costs per prisoner. HM Prison & Probation Service annual report and accounts 2017-18, management information addendum*. Retrieved from https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/750185/costs-per-place-costs-per-prisoner-2017-2018-summary.pdf
- Mitchell, O. (2005). A meta-analysis of race and sentencing research: Explaining the inconsistencies. *Journal of Quantitative Criminology*, 21, 439-466. DOI: 10.1007/s10940-005-7362-7
- Nieder, A., & Miller, E.K. (2003). Coding of cognitive magnitude: Compressed scaling of numerical information in the primate prefrontal cortex. *Neuron*, 37(1), 149-157. DOI: 10.1016/S0896-6273(02)01144-3
- Noma, E., & Baird, J. C. (1975). Psychophysical study of numbers: II. Theoretical models of number generation. *Psychological Research*, 38(1), 81-95. DOI: 10.1007/BF00308940
- Ostrom, B. J., & Ostrom, C. W., Jr. (2002). A new look at sentence severity. In C. Tata & N. Hutton (Eds.), *Sentencing and society: International perspectives* (pp. 277-307). Burlington, VT: Ashgate Publishing.

- Payne, J. W., Bettman, J. R., & Johnson, E. J. (1993). *The adaptive decision maker*. Cambridge, UK: Cambridge University Press.
- Pease, K., & Sampson, M. (1977). Doing time and marking time. *The Howard Journal of Crime and Justice*, 16(2), 59-64. DOI: 10.1111/j.1468-2311.1977.tb00333.x
- Plug, C. (1977). Number preferences in ratio estimation and constant-sum scaling. *The American Journal of Psychology*, 90(4), 699-704. DOI: 10.2307/1421743
- Portugal, R. D. & Svaiter, B. F. (2011) Weber-Fechner law and the optimality of the logarithmic scale. *Minds & Machines*, 21, 73. <https://doi.org/10.1007/s11023-010-9221-z>
- R v Markarian* (2003) 137 A Crim R 497.
- Rachlinski, J. J., Wistrich, A. J., & Guthrie, C. (2015). Can judges make reliable numeric judgments? Distorted damages and skewed sentences. *Indiana Law Journal*, 90, 695-739.
- Roberts, J., Pina Sanchez, J., & Marder, I. (2018) Individualisation at sentencing: The effects of guidelines and "preferred" numbers. *Criminal Law Review*, 2. pp. 123-136. ISSN 0011-135X
- Ruback, R. B., & Wroblewski, J. (2001). The federal sentencing guidelines: Psychological and policy reasons for simplification. *Psychology, Public Policy, and Law*, 7(4), 739-775. DOI: 10.1037/1076-8971.7.4.739
- Sentencing Council (2012). *Offences taken into consideration and totality. Definitive guideline*. Retrieved from https://www.sentencingcouncil.org.uk/wp-content/uploads/Definitive_guideline_TICs__totality_Final_web.pdf

- Sentencing Council (2015). *Crown court sentencing survey annual publication 2014*. Retrieved from <https://www.sentencingcouncil.org.uk/wp-content/uploads/CCSS-Annual-2014.pdf>
- Schulhofer, S. J. (1992). Assessing the federal sentencing process: The problem is uniformity, not disparity. *American Criminal Law Review*, 29(3), 833-873.
- Solomon, E., & Silvestri, A. (2008). *Community sentences digest (2nd Edition)*. Retrieved from <https://www.crimeandjustice.org.uk/sites/crimeandjustice.org.uk/files/community-sentences-2008%20blue.pdf>
- Steffensmeier, D., Ulmer, J., & Kramer, J. (1998). The interaction of race, gender, and age in criminal sentencing: The punishment cost of being young, black, and male. *Criminology*, 36, 763–793. DOI: 10.1111/j.1745-9125.1998.tb01265.x
- Stevens, S. S. (1975). *Psychophysics: Introduction to its perceptual, neural, and social prospects*. New Brunswick, NJ: Transaction Publishers.
- Sun, J. Z., Wang, G. I., Goyal, V. K., & Varchney, L. R. (2012). A framework for Bayesian optimality of psychophysical laws. *Journal of Mathematical Psychology*, 56(6), 495-501. DOI: 10.1016/j.jmp.2012.08.002
- United States Sentencing Commission (2018). *Guidelines manual 2018*. Retrieved from <https://www.ussc.gov/sites/default/files/pdf/guidelines-manual/2018/GLMFull.pdf>
- Von Helversen, B., & Rieskamp, J. (2009). Predicting sentencing for low-level crimes; Comparing models of human judgment. *Journal of Experimental Psychology: Applied*, 15(4), 375-395. DOI: 10.1037/a0018024

- Wasik, M. (2008). Sentencing guidelines in England and Wales-State of the art? *Criminal Law Review*, 4, 253-263. Retrieved from <http://www.sweetandmaxwell.co.uk/catalogue/productdetails.aspx?recordid=478&productid=7139>
- Weber, E. H. (1846). Tastsinn und Gemeingefühl [Sense of touch and common feeling]. In R. Wagner (Ed.), *Handwörterbuch der Physiologie mit Rücksicht auf physiologische Pathologie. Band 3, Teil 2* [Concise dictionary of physiology with regard to physiological pathology. Vol. 3, Pt. 2] (pp. 481–588). Braunschweig, Germany: Vieweg.
- Wiseman, A., Fisher, D., & Connelly, M. (2006). Sentencing and conventional number preferences: A research note. *Justice Research and Policy*, 8(1), 67-98.

Table 1. England and Wales – Sentencing Doses Identified for Three Key Disposals

Disposal type	Common doses*	Accounting for % of (<i>n</i>) cases
Custody (days)	7, 14, 28, 30, 42, 56, 60, 90, 120, 150, 180, 270, 360, 450, 540, 720, 900, 1080, 1260, 1440, 1800	89% (<i>n</i> = 45631)
Community rehabilitation order (days)	180, 270, 360, 540, 720, 1080	99% (<i>n</i> = 18238)
Fine/compensation (£)	20, 25, 30, 40, 50, 60, 70, 75, 80, 100, 150, 200, 250, 300, 400, 500	89% (<i>n</i> = 21601)
ACROSS DISPOSALS		91% (<i>n</i> = 85470)

Note. *Common ‘doses’ were defined as sentence lengths or fine/compensation amounts that accounted for at least 1% of the total frequency (see Figures 1 to 3).

Table 2. England and Wales – Use of Common Doses by Court Type and Offence Classification

Court type	Offence	Custody		Community rehabilitation order		Fine/compensation	
		No. of common doses	% of cases receiving a common dose	No. of common doses	% of cases receiving a common dose	No. of common doses	% of cases receiving a common dose
Magistrates' Court	Property (n = 34659)	11	93	6	99	16	90
	Violence (n = 11585)	11	92	6	99	16	89
	Driving (n = 16740)	11	93	6	99	16	83
	Drugs (n = 1145)	-	-	-	-	16	92
	ALL CASES (n = 64129)	11	93	6	99	16	89
Crown Court	Property (n = 9407)	21	88	6	99	-	-
	Violence (n = 7985)	21	77	6	99	-	-
	Driving (n = 1332)	14	85	-	-	-	-
	Drugs						

(n = 997)	17	75	-	-	-	-
ALL CASES						
(n = 19721)	21	83	6	99	-	-

Note. Categories with empty cells contained fewer than 500 cases and so were not analyzed ($n = 1620$).

Table 3. New South Wales, Australia – Sentencing Doses Identified for Four Key Disposals

Disposal type	Common doses*	Accounting for % of (n) cases
Custody (months)	1, 2, 3, 4, 6, 7, 8, 9, 10, 12, 15, 16, 18, 20, 24, 27, 30, 36, 42, 45, 48, 54, 60, 72	78% (n = 2306)
Good behavior bond (months)	6, 9, 12, 18, 24, 36	97% (n = 13999)
Community service order (hours)	40, 50, 60, 75, 80, 100, 120, 150, 200, 250, 300, 350, 400	92% (n = 1092)
Fine (AUS\$)	100, 150, 200, 250, 300, 330, 350, 400, 450, 500, 550, 600, 700, 750, 800, 900, 1000, 1200, 1500	90% (n = 19421)
ACROSS DISPOSALS		92% (n = 36818)

Note. *Common ‘doses’ were defined as sentence lengths or fine amounts that accounted for at least 1% of the total frequency (see Figures 5 to 8).

Table 4. New South Wales, Australia – Use of Common Doses by Offence Classification

	Custody		Good behavior bond		Community service order		Fine	
	No. of	% of cases	No. of	% of cases	No. of	% of cases	No. of	% of cases
	common	receiving a	common	receiving a	common	receiving a	common	receiving a
	doses	common dose	doses	common dose	doses	common dose	doses	common dose
Property (<i>n</i> = 3249)	24	86	6	96	-	-	19	91
Violence (<i>n</i> = 6456)	24	75	6	97	-	-	19	92
Driving (<i>n</i> = 21070)	-	-	6	96	13	93	19	88
Drugs (<i>n</i> = 5014)	-	-	6	96	-	-	19	93

Note. Categories with empty cells contained fewer than 500 cases and so were not analyzed

Appendix 1 – England and Wales

Figure 1. Sentence length frequencies for cases receiving a custodial sentence (Note. To avoid visual distortion of the plots, 157 cases with sentence lengths > 10 years were excluded, including 78 indeterminate sentences.)

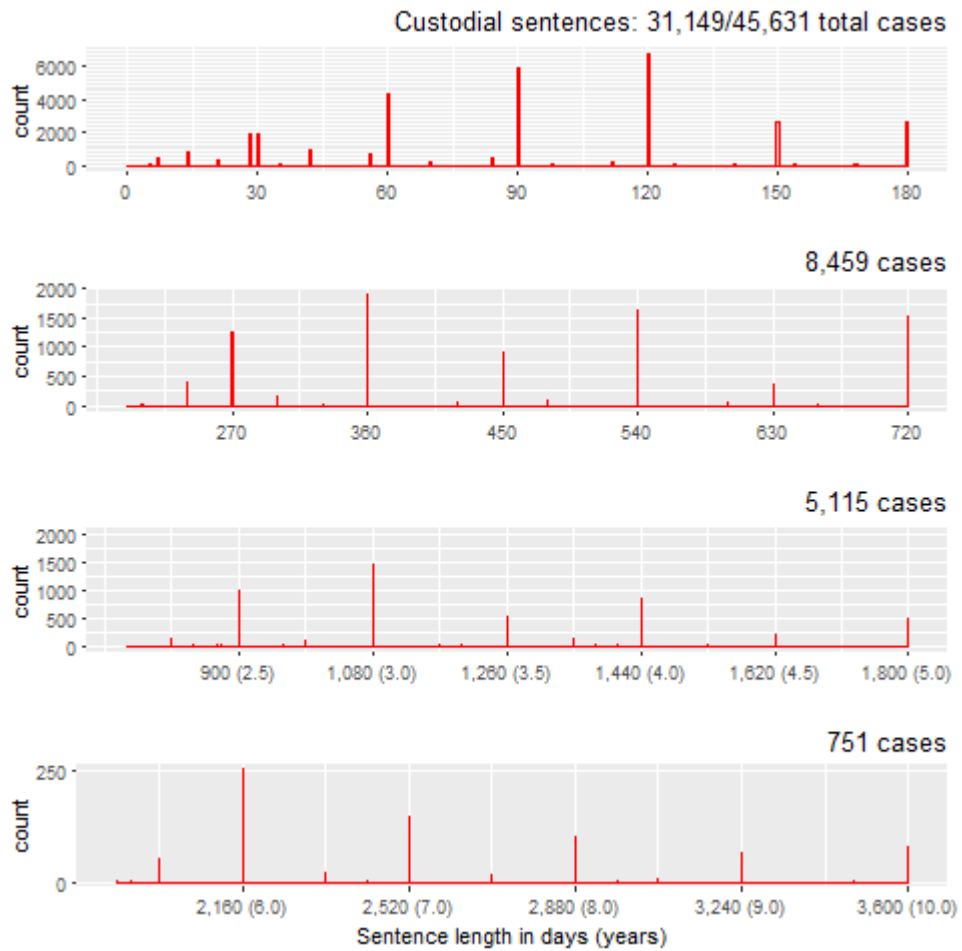


Figure 2. Sentence length frequencies for cases receiving a community rehabilitation order

(Note. These orders involved various requirements including residence at a specified address, attendance at a probation centre, and treatment for drug or alcohol dependency or a mental health problem. The orders could be anywhere between six months and three years [Solomon & Silvestri, 2008]).

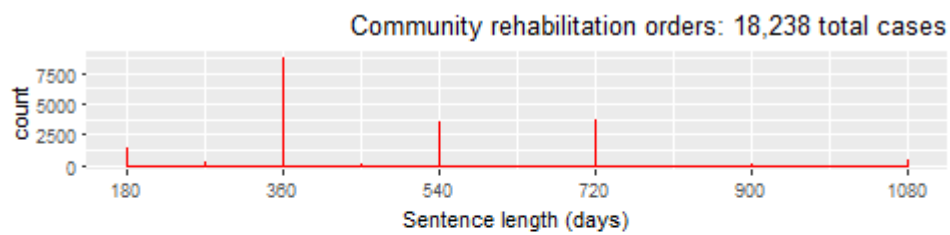


Figure 3. Sentence amount frequencies for cases receiving a fine/compensation order

(Note. To avoid visual distortion of the plots, 94 cases with fine amounts > £1000 were excluded.)

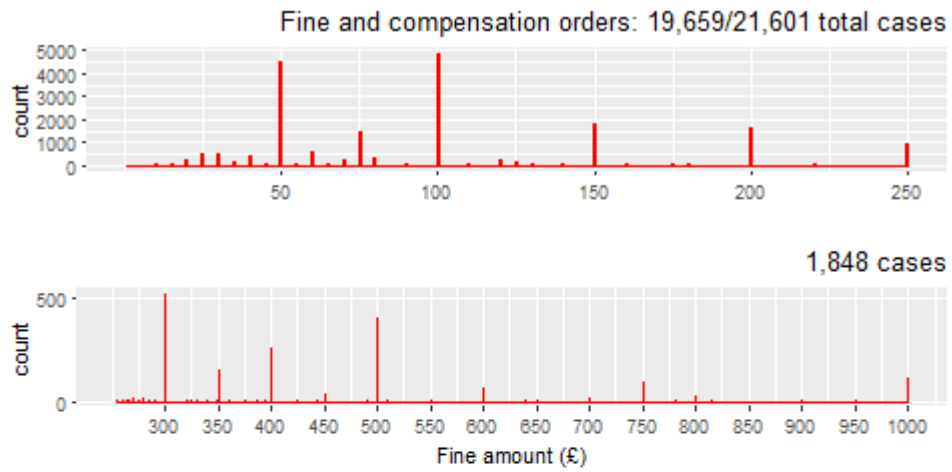
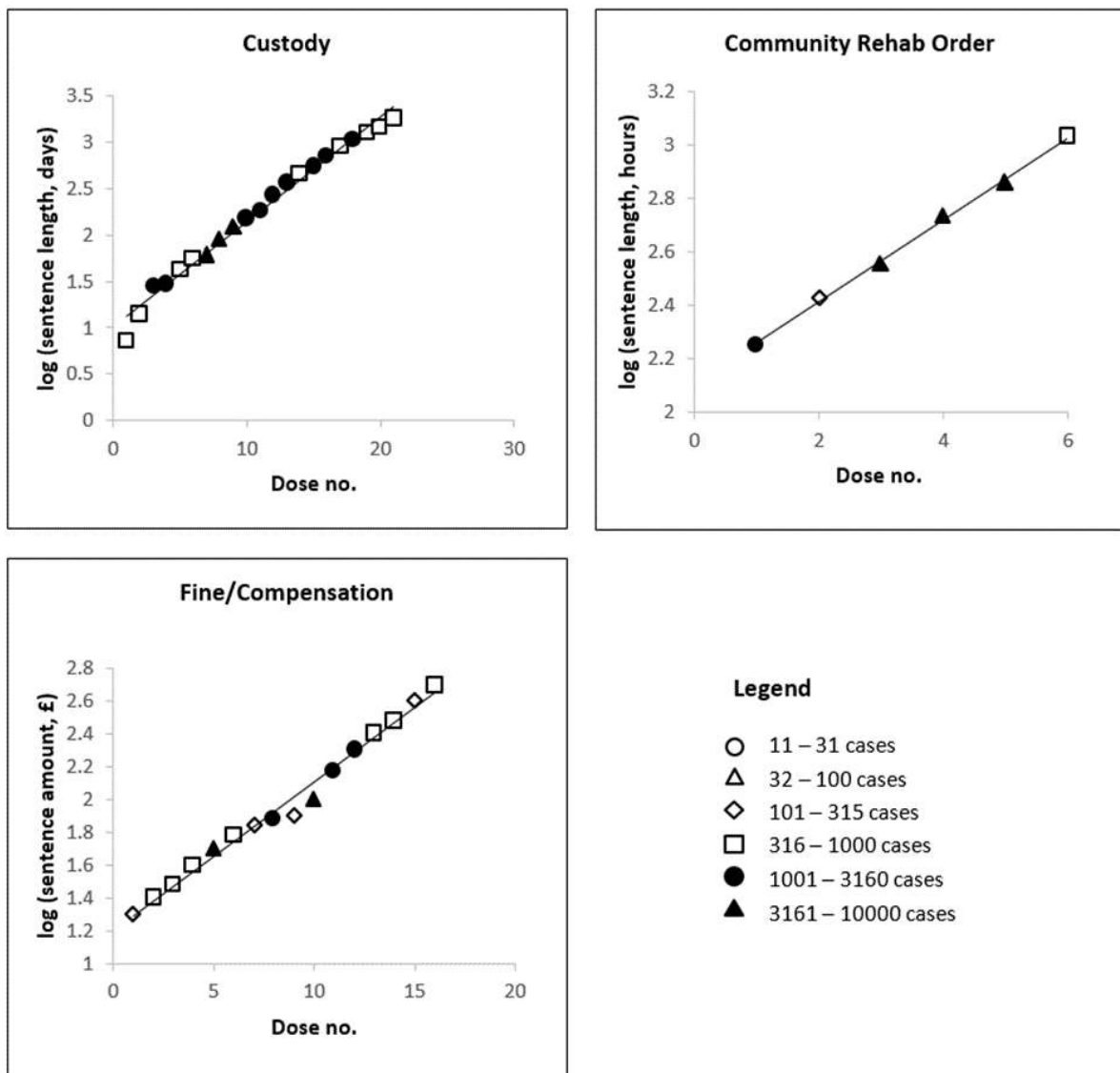


Figure 4. Sentencing doses in England and Wales plotted against the log of the sentence length/amount

(Note. “Dose no.” refers to a common dose’s place in the series of doses for each disposal type [see Table 1]. E.g. for custody, dose no. 1 is 7 days, dose no. 2 is 14 days, and so on. Custody: Model 1 = 294.04 v. Model 2 = -37.34; community rehabilitation order: Model 1 = 75 v. Model 2 = -29.82; fine/compensation: Model 1 = 184.09 v. Model 2 = -45.66). Model 2 (logarithmic model) R^2 values were as follows: for custody, $R^2 = .98$, $F = 1196$, $p < .001$; for community rehabilitation order, $R^2 = .997$, $F = 54.52$, $p = .002$; and for fine/compensation, $R^2 = .99$, $F = 1049$, $p < .001$.)



Appendix 2 – New South Wales, Australia

Figure 5. Sentence length frequencies for cases receiving a custodial sentence (Note. A few custodial sentences were issued in either years (41 cases) or days (59 cases). These were converted to months for inclusion in the analysis. It would not have been possible to convert sentences from months to days as there was no record in the dataset of whether the months concerned contained 31, 30, 29 or 28 days. To avoid visual distortion of the plots, five cases with sentence lengths >360 months [10 years] were excluded.)

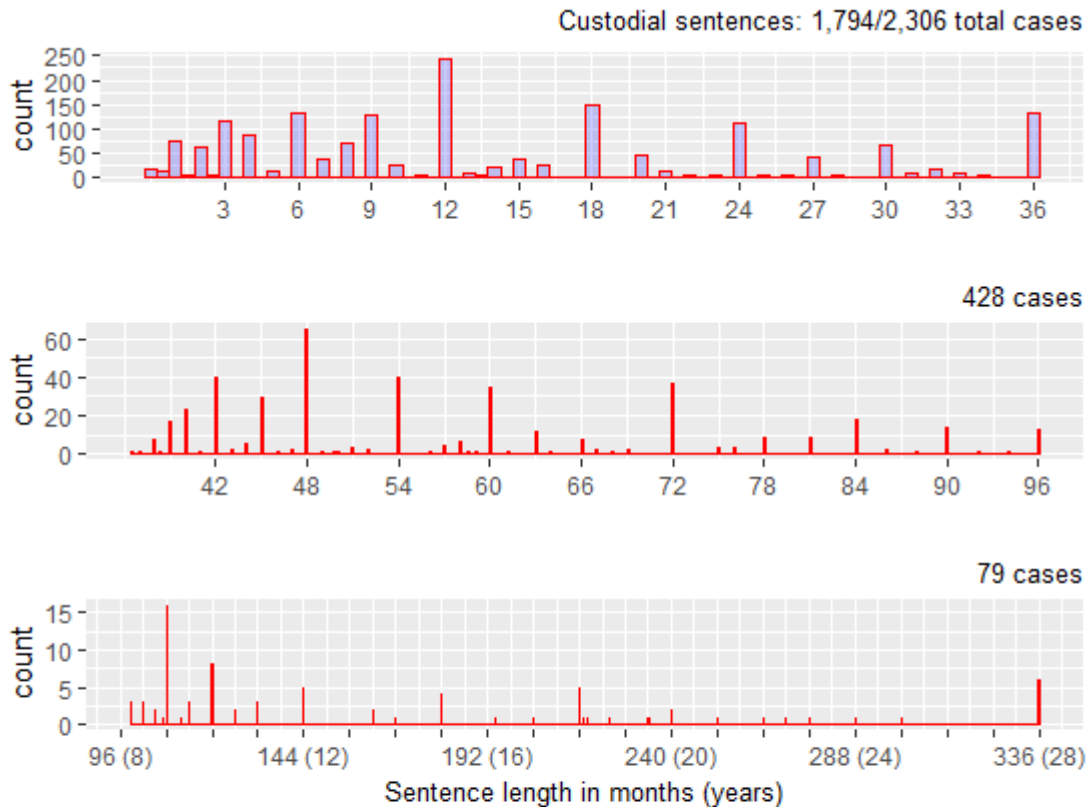


Figure 6. Sentence length frequencies for cases receiving a good behavior bond (Note. This refers to three types of bond [i.e., with supervision, without supervision, and without conviction]. According to the Crimes [Sentencing Procedure] Act 1999, a good behavior bond must not exceed 5 years. A number of (i.e., 2,860) bonds were issued in years, and these were converted to months for inclusion in the analysis.)

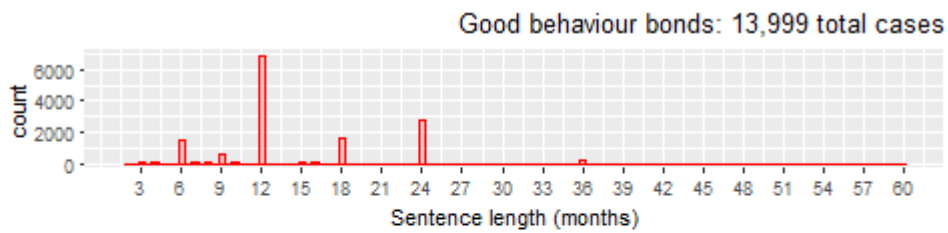


Figure 7. Sentence length frequencies for cases receiving a community service order (Note.

According to the Crimes [Sentencing Procedure] Act 1999, a community service order must not exceed 500 hours.)

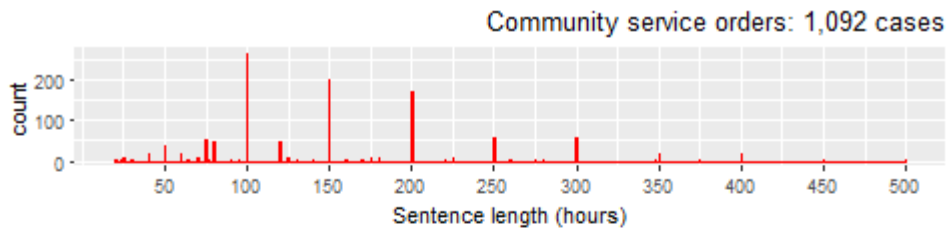


Figure 8. Sentence amount frequencies for cases receiving a fine (Note. To avoid visual distortion of the plots, 31 cases with fine amounts > AUS\$2,500 were excluded.)

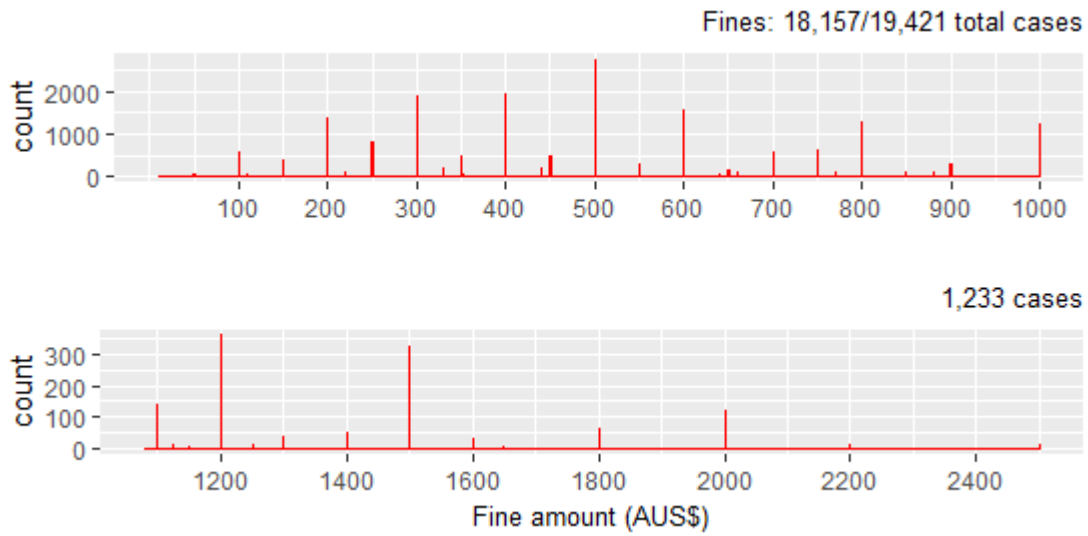
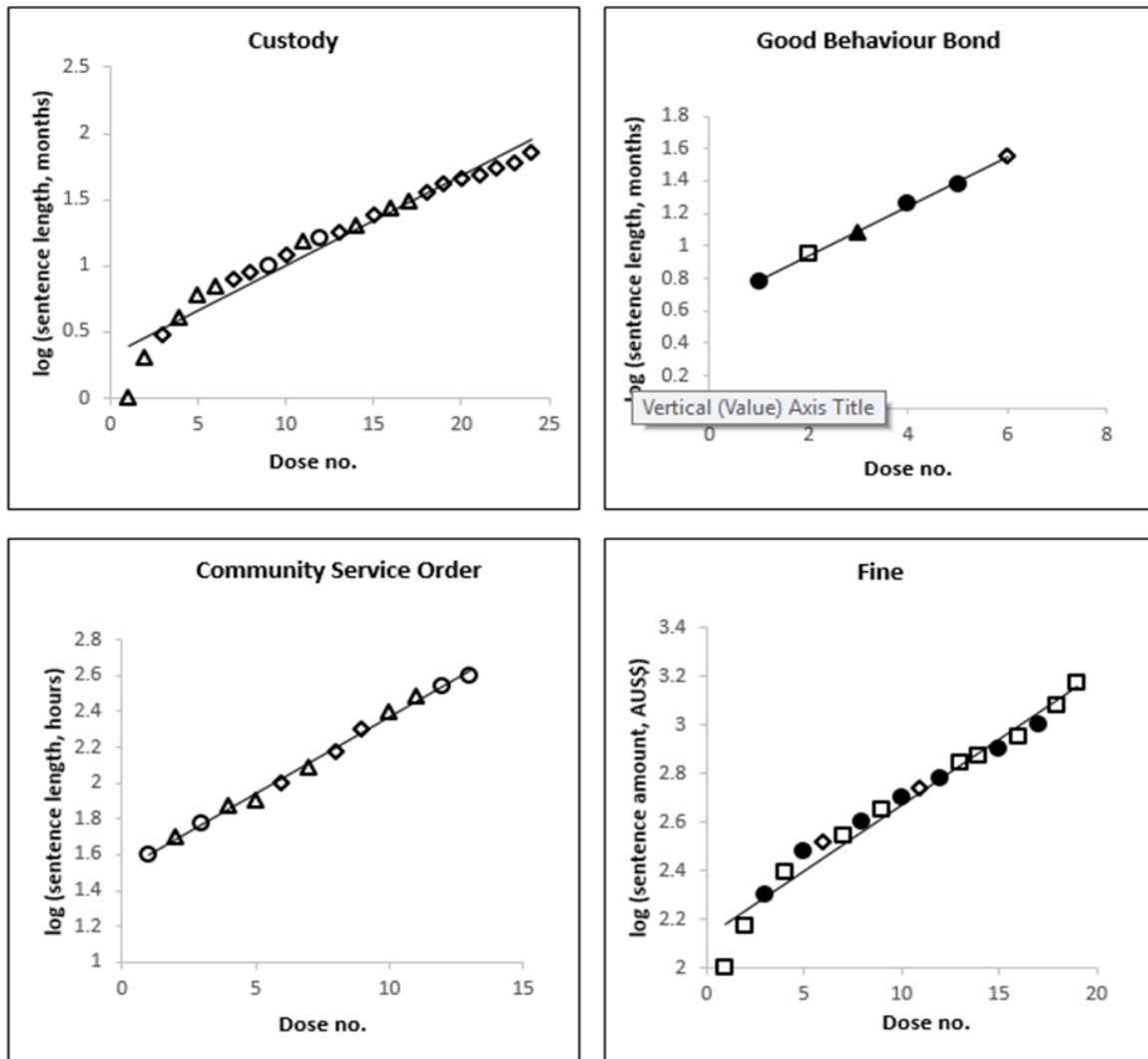


Figure 9. Sentencing doses in New South Wales, Australia plotted against the log of the sentence length/amount

(Note. “Dose no.” refers to a common dose’s place in the series of doses for each disposal type [see Table 3]. E.g. for custody, dose no. 1 is 1 month, dose no. 2 is 2 months, and so on. Custody: Model 1 = 160.61 v. Model 2 = -31.91; good behavior bond: Model 1 = 34.75 v. Model 2 = -29.82; community service order: Model 1 = 134.92 v. Model 2 = -55.76; fine: Model 1 = -237.52 v. Model 2 = -48.74). Model 2 R^2 values were: For custody, $R^2 = .95$, $F = 402.1$, $p < .001$; for good behavior bond, $R^2 = .997$, $F = 1819$, $p < .001$; for community service order, $R^2 = .99$, $F = 2224$, $p < .001$; and for fine, $R^2 = .96$; $F = 457.6$, $p < .001$.)



Legend

- 11 – 31 cases
- △ 32 – 100 cases
- ◇ 101 – 315 cases
- 316 – 1000 cases
- 1001 – 3160 cases
- ▲ 3161 – 10000 cases