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Forensic Psychology Topics

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1. KIRK AND REID (2001): DYSLEXIA AND YOUNG OFFENDERS

Fifty voluntary young offenders took the "Quickscan" test for dyslexia [1]. The sample was "largely determined by prison management" at the largest young offenders' institution in Scotland. It included a variety of inmates - some short-term, some more serious crimes.

Limited time was available with the offenders, which included a pre-test outline of ethics - anonymity, right to non-participation and withdrawal, and entitlement to the results.

"Quickscan" is a computerised self-assessment screening test [2] for dyslexia that required only "yes" or "no" answers [3]. It was developed with 2000 students (Zdzienski 1997), so certain words changed to make it appropriate to young offenders. Kirk and Reid (2001) explained that "changes were made and carefully checked so as to ensure that the sense of the question remained unaltered. One example of the linguistic difference is that the word 'task' has different connotations in England and was replaced by the more familiar word 'job'. All the changes were approved by the author of QuickScan" (p79).

Eight of the 24 performance categories of the "Quickscan" were assessed (table 1.1).

- Do you find it difficult to learn facts? (memory category)
- When making phone calls do you sometimes forget or confuse the numbers? (sequencing category)
- Do you sometimes confuse left and right? (laterality difficulties category)

(Source: Wood et al 2006 pp36-37)

Table 1.1 - Example of "Quickscan" items.

Half the sample showed "at least borderline indicators of dyslexia" (which compares to around 10% in the general population), and this included three participants who showed most indicators, three showed many, and seventeen seom of them (Kirk and Reid 2001).

"Quickscan" was not an exact diagnosis of dyslexia. "However, given the time restrictions imposed by the

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[1] This research was part of a television documentary.

[2] A computerised test was used as the researchers "judged that the young offenders might respond more positively to this method of testing than to paper and pencil tests, with which they may have had negative experiences at school" (Kirk and Reid 2001 p79).

[3] More information at http://netquickscan.co.uk/.

prison management..., it was considered the most
effective available tool for a study whose purpose was to
find out how many young men in a sample of 50 manifested
indicators of dyslexia" (Kirk and Reid 2001 p79).

The prevalence figure of Kirk and Reid (2001) is
much higher than 17.5% of inmates at Feltham Young
Offenders' Institution (London) who "met stringent
criteria for dyslexia" (Turner 2000) (appendix 1A).
Miles (2001) commented on the figures due to
different criteria for dyslexia - "What is needed, I
suggest, is not simply agreement to define dyslexia
in a certain way, as that would not guarantee a good
definition, but operational criteria which pick out all
those — and only those — who would be recognised as
dyslexic by the dyslexia community. By 'the dyslexia
community' I mean those who are dyslexic themselves and
their families, along with the growing number of
individuals who have assessed, taught or counselled them.
These are the people who know at first hand what dyslexia
is like; and it is my belief that their cumulative wisdom
can lead to the best taxonomy (classificatory principle),
and hence to the best basis for scientific advance. In
the absence of such criteria, discrepant figures for the
percentage of dyslexics in prison are hardly surprising"
(p57).

Lindsay Peer (Peer and Turney 2001), a dyslexic ex-
prisoner who became a probation officer, pointed out that
"dyslexia on its own is insufficient as an explanation of
criminal behaviour, as the number of dyslexics who turn
to crime is relatively small. It follows that we need to
know not only what are the necessary conditions for
criminal behaviour but what are the sufficient conditions
— those which, if present in particular combinations,
will lead ineluctably to crime" (Miles 2001 p58)
(appendix 1B).
Kirk and Reid (2001) gave a "common-sense
explanation", that "having received no help with their
dyslexia at school and in many cases no support in the
home, they turn to crime as a way of 'getting their own
back' on society — a society which, in their view, has
failed to meet their needs" (Miles 2001 p58).

APPENDIX 1A - CROSS-CULTURAL RESEARCH

Ninety-one young offenders in eight institutions in
Kuwait were given a series of tests by Elbehari et al
(2009), which included measures of dyslexia in the Arabic
language. The tests included reading comprehension,
spelling, non-word reading, and working memory tasks.
Fifty-three of the participants completed all the
tasks, and the analysis was divided into two groups based

on age (30 x below 16 years old and 23 x 16 years and above). Eleven individuals (around 20%) "fulfilled the criteria of deficits in more than one area of ability associated with dyslexia" (Elbehari et al 2009 p96).

This compares with 6% of the Kuwaiti general population, around in non-English speaking general cohorts, and 4-10% in English-speaking general population studies (Elbehari et al 2009).

APPENDIX 1B - HEALTH NEEDS

The assessment of the health needs of a family, community, or population helps to target resources at those who need them. Buchan et al (1990) used this economic definition, for example: "People in need of a health service are defined as those for whom an intervention produces a benefit at reasonable risk and acceptable cost" (quoted in Bowling 2014).

However, it is a contentious area, and "there are multiple perspectives of need to incorporate: perceived and expressed needs of the profiled population; perceptions of professionals providing the services; perceptions and priorities of managers of commissioner/provider organisations (regarding national, regional or local priorities)" (Bowling 2014 pp73-74).

The measurement of need requires information about the size of the health problem (ie: the level of morbidity), which is done through epidemiology and demographics.

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2. "CRIME GUNS" IN THE USA

2.1. TOPIC OVERVIEW

Cook and Pollack (2017) describing reducing "gun violence" in the USA as "a matter of social justice": "Among males age fifteen to twenty-four in the United States, homicide is the fourth leading cause of death for non- Hispanic whites and the second for Hispanics. Among black males in this age group, it is the leading cause of death and claims more lives than the nine other leading causes combined" (pp2-3).

Over 36 000 people die each year in the USA from firearm-related injury (of which suicide is the leading cause), while more than 80 000 individuals suffer non-fatal injury (Azrael et al 2017).

Though gun ownership is widespread, and there are many guns in circulation (an estimated 270 million [4]), a "great majority of adults (78%) do not in fact own one" (Cook and Pollack 2017 p3) [5]. Cook and Pollack's (2017) point was that the "main concern should be less about the current stock of guns in private hands and more about the flow of guns: the ease of obtaining one for criminal purposes" (p3).

Guns used in crime have "typically not been in the hands of the offender for long", and involve individuals disqualified from legal gun ownership (eg: "felon in possession") (known as the "underground gun market") (Cook and Pollack 2017).

Robberies, for example, involving guns are three times more likely to end in fatalities than with knives, and ten times more than robberies with other weapons (Cook and Pollack 2017).

Researchers have argued over the intention of offenders in such situations. One argument is that if guns were not available, would-be killers would still

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[4] Based on responses to the annual General Social Survey in 2014 (Smith and Son 2015).

[5] "The notable population-level trends are the decline in the prevalence of gun ownership, coupled with the 'deepening' of ownership by those who do keep guns" (Cook and Pollack 2017 p4).

kill using a different weapon (eg: Wolfgang's (1958) study in Philadelphia) (the intent argument). On the other hand, fatal or non-fatal attacks depend on the weapon used. For example, Zimring (1972) pointed out that "in many cases the assailant is drunk or enraged, unlikely to be acting in a calculating fashion. Whether the victim lives or dies then depends on the lethality of the weapon with which the assailant strikes the initial blow" (Cook and Pollack 2017 p12) (the instrumentality argument).

Cook et al (2015) outlined a chain of transactions to show how a legally purchased gun can get into the hands of an offender (ie: secondary transactions). These secondary transactions include private sales between individuals, gifts to family members, or sharing between friends. "At some point, a transaction — possibly a theft or a sale — may transfer the gun to the hands of someone who is proscribed from gun possession on the basis of criminal record or youth" (Cook and Pollack 2017 21).

Cook and Pollack (2017) reported that government surveys of gun-involved inmates of state and federal prisons found that only 10% of the weapons were directly from the formal market (ie: licensed gun stores). The majority of cases were social connections or "street sources", and only about half of the transactions involved cash. Temporary arrangements, like borrowing, renting or holding a gun, were used (Cook and Pollack 2017).

Surveying the research on gun availability and crime, Cook and Pollack (2017) pointed out that it is "worth emphasising that the conclusion from this line of research is not 'more guns, more crime'. Gun prevalence is unrelated to the rates of assault and robbery... The strong finding that emerges from this research is that gun use intensifies violence, making it more likely that the victim of an assault or robbery will die. The positive effect is on the murder rate, not on the overall violent-crime rate" (p25).

In terms of regulation, Cook and Pollack (2017) saw benefits to expanding the categories of people disqualified from owning guns, for example. They stated: "gun regulations have in various instances been carefully evaluated and shown effective at reducing criminal misuse of firearms. The lesson is not that all such regulations are effective, but rather that regulation can be effective and should not automatically be written off as futile given the alleged efficiency of the underground market. But there is no such thing as a free lunch when it comes to regulatory effectiveness, and in particular jurisdictions that adopt regulations but do not enforce them will be disappointed" (Cook and Pollack 2017 p27).

Studies on the illegal supply of guns suggest a

number of conclusions, including (Braga 2017):

- Some licensed firearm retailers are disproportionately frequent sources of traced guns by the Bureau of Alcohol, Tobacco, Firearms and Explosives (ATF).

- New guns are involved in many crimes (eg: 4% of gun-using male inmates surveyed had stolen that weapon; Cook et al 2015). "Time-to-crime" is fast if less than three years between purchase new and use in crime, according to ATF (Braga 2017).

- "Crime guns" are trafficked from states with weaker regulations to those with stronger gun regulations (known as the "Iron Pipeline" - from south-east to north-east states; Cook and Braga 2001).

"Unlike other contraband, the illegal supply of guns does not begin with illegal smuggling or in clandestine factories. Virtually every crime gun in the United States starts out in the legal market" (Braga 2017 p76). Braga (2017) suggested "side-supply" controls, like increasing the price of guns, particularly sold to disqualified individuals. "The benefit of this approach would be an increased incentive for criminals and juveniles to economise on gun possession and use" (Braga 2017 p77).

2.2. DATA SOURCES

The General Social Survey (and other general surveys) tend not to ask about the number of firearms owned, "let alone more detailed information about these firearms and the people who own them, such as reasons for firearm ownership, where firearms were acquired, how much firearms cost, whether they are carried in public, and how they are stored at home" (Azrael et al 2017 p39).
Specialist surveys like the National Firearms Survey (NFS) 2004 (Hepburn et al 2007) involved a random-digit dialling telephone sample. So, it covered only those with landlines who answered their phones.
Other data comes from firearm manufacturers on number of new guns purchased, and ATF records the number of adults undergoing a background check before acquiring a gun. The National Crime Victimisation Survey collects data on firearm theft (Azrael et al 2017).

The NFS 2015 (Azrael et al 2017) was undertaken to overcome the above limitations. It involved an online survey of a nationally representative panel of respondents (n = 3949).
The findings can be summarised thus:

a) Gun stock - 22% of the sample owned a gun, which

was extrapolated to 55 million adults (18 years and over) in the USA population. The mean number of guns owned was 4.8, which was extrapolated to 265 million in the total population.

The number of guns owned by an individual went as high as 140, which meant that 14% of gun owners owned half the guns (extrapolated to 3% of the US population).

b) Demographics - Gun owners overall were more likely to be male, White, older (over 30 years old), non-urban, and live in the Southern USA, but handguns owners were more likely to be female, non-White, and living in urban areas.

c) Reasons for ownership - Protection was most important, followed by hunting and sport.

d) Gun transfers - Purchased from a store was most common, followed by gifts. Around 2.5% of gun owners reported a theft of a gun in the past five years. This figure was extrapolated to half a million annually in the total population.

The data came from 2072 gun owners, who were part of an online panel, and who agreed to participate. Azrael et al (2017) admitted: "Although the NFS is thus likely to produce a good estimate of firearms in civilian hands, as well as to accurately characterise the flow of guns and other characteristics of gun ownership, some gun owners may nevertheless have chosen not to report their gun ownership on a survey, and some non-gun owners may have reported owning guns when in fact they do not. What evidence there is, however, suggests that gun owners appear to respond accurately with respect to their firearm ownership on surveys" (p53). The data did not include firearms possessed illegally by the disqualified individuals.

2.2.1. Firearms Licensee Survey

Licensed firearm retailers (gun dealers and pawnbrokers) can knowingly participate in illegal firearm sales (eg: 3% of them, according to estimates by licensees themselves; Wintemute 2013) [6].
This figure comes from the Firearms Licensee Survey (FLS) in 2011 [7]. "The relevant section of the questionnaire presents this introductory text: 'Shooting Sports Retailer recently published an article about what

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[6] Extrapolated to around 2000 forearm dealers in the USA as a whole (Wintemute 2017).
[7] This involved 1601 licensees who sold fifty or more firearms per year randomly sampled from 43 US states (Wintemute 2017).

they called ''bad apple'' retailers, operating outside the law, who give a black eye to firearms retailers in general'. Subjects were then asked, 'In your opinion, what percentage of licensed retailers might be ''bad apples'' who participate knowingly in illegal gun sales?'" (Wintemute 2017 p60).

Another question asked: "When a straw purchase [8] is taking place, about what percentage of the time, in your opinion, does the salesperson either strongly suspect or know for certain about it, but sell the gun anyway?" (Wintemute 2017 p61). The median estimate was 4.5%.

Wintemute (2017) concentrated the analysis of the FLS on the 535 respondents who were classified as high-trace or high-denial licensees (HTD). These licensees were in the top quartile for guns traced to a crime by the ATF, and denial of sales [9].

Compared to the sample as a whole, HTD licensees were significantly more likely to be pawnbrokers, sell inexpensive handguns, experience straw purchases, report theft of firearms, be located in the Southern USA, and/or in a major metropolitan area. They were less likely to agree with the statement that "there are too many gun control regulations", but more likely to support background check requirements, and to give a larger estimate of retailers who "participate knowingly in illegal sales".

Wintemute (2017) explained that "these findings suggest that some licensees are the focus of an array of efforts to acquire firearms for criminal purchases. Attempted straw purchases and denied sales represent failed efforts; they are, almost certainly, attempted purchases by persons with criminal intent or by prohibited persons. Thefts and, arguably, a substantial portion of sales of firearms that are later used in crime represent successes" (p69). They could be called "bad guy magnate" licensees. Wintemute (2017) continued: "No implication is intended that the HTD licensees among respondents are deliberately involved in any of the illegal activities associated with status as a bad guy magnet. On the contrary, it is clear from the findings presented here and explored further elsewhere that, at

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[8] "A straw or surrogate purchase is one in which the ostensible purchaser is actually buying the firearm for someone else, who typically is a prohibited person or for some other reason wishes not to be recorded as the purchaser of the firearm. Straw purchases are felonies under federal law" (Wintemuth 2017 p60).

[9] Firearms trace data from ATF "may be limited by police decisions on which recovered guns to submit for tracing" (Braga 2017 p77). Collins et al (2017) added that studies using such data will have an inherent bias - police submitting guns "occurs only in a particular set of cases — presumably those believed to be important, and those that they may not be able to solve using other means... Results from guns submitted to be traced may therefore be biased to reflect more serious, complicated cases, rather than a more representative cross-section of violent gun crime" (p99).

least among these respondents, levels of concern about criminal use of firearms and support for efforts to intervene rise with exposure to illegal activity" (p69).

In terms of methodology, Wintemute (2017) admitted that "it is quite plausible that licensees who deliberately participate in illegal commerce are unlikely to participate in a survey such as this. Certainly, respondents in this survey frequently attributed criminal motives to other licensees who have high frequencies of trace requests and denied sales" (pp69-70).

Licensees with less than fifty firearm sales per year were not include, and seven states where data were not available. All data were self-reports with no way of verification.

2.2.2. Boston Police Department

Braga (2017) analysed a database on firearm recoveries by the Boston Police Department (BPD) between 1981 and 2015, and a sub-database on traced recovered handguns between 1991 and 2015.

In total, nearly 25 000 guns, and in the sub-database, around 16 000. The guns recovered over the study period increased in calibre, and in being semi-automatic (eg: 35% of recovered handguns in the early 1980s vs two-thirds by the 2010s). "This transition from revolvers to semi-automatic pistols recovered by law enforcement agencies mirrors national trends in handgun production in the United States between the 1980s and 1990s" (Braga 2017 p92).

During the study period, the BPD instigated "Operation Ceasefire" to focus on illicit firearms trafficking. A fast time-to-crime was halved by this campaign. Despite disagreements, Braga (2017) felt that Operation Ceasefire did have a positive impact.

BPD implemented gun-buy-back programmes for periods in the 1990s and 2000s, where individuals who anonymously turned in guns for destruction were rewarded (eg: gift cards). How the programme was designed was important, but Braga (2017) reported no association with gun violence reductions.

2.2.3. Comparative Analysis

Collins et al (2017) used data from trace studies [10],

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[10] "eTrace", for example, is a web-based firearms trace request system run by the ATF, and used by over 5000 law enforcement agencies (Collins et al 2017).

and gun offender surveys to compare three areas (New Orleans, Chicago, and Prince George's County in Maryland).

The trace data covered 2011-13, and only 60-75% of recovered guns submitted to the ATF were successfully traced. A successful trace was defined as discovering the full name and date of birth of the first legal purchaser. The main reasons for unsuccessful traces included gun sold before record-keeping requirements by licensed dealers (ie: older guns), retail or manufacturer dealer out of business, and serial number of gun missing, invalid, or obliterated.

More guns recovered in Chicago and Maryland (states with stricter gun regulations) came from out-of-state than in New Orleans (weaker gun regulations). New Orleans had a faster time-to-crime, which is often a sign of gun trafficking, and a higher percentage of "possible straw transactions". The researchers were not able to control for variables like the prevalence of gangs in New Orleans.

The gun offender surveys involved 220 inmates in New Orleans, sixty-eight in Maryland, and 138 in Chicago. All samples were convenience, and different questions were asked in the three cases. The researchers "assured respondents that their answers would not be shared with anyone outside the project and gave them ample opportunity to not participate" (Collins et al 2017 p116). The individuals were reported as eager to participate, but the honesty of offenders is always an issue.

The most common means of acquiring a firearm was "on the street" (ie: underground illegal market), or gun theft. Collins et al (2017) observed that "the purchase of guns later recovered in crime did not often originate from gun stores in any of the jurisdictions we studied in any of our data sources. The same purchaser-possessor relationships in the trace data and the infrequent reports of purchasing a gun at a gun store among inmates and arrestees surveyed suggests that enforcement against illegal gun purchases targeted at gun stores may not be the most effective route for police when other enforcement options are possible" (p122).

2.3. INMATES' KNOWLEDGE

One function of the law is deterrence. The "general deterrence theory" (eg: Zimring and Hawkins 1973) "assumes that individuals are aware of what constitutes unlawful behaviour, the risks of apprehension, and the severity of punishment" (Barragan et al 2017 p142). But are offenders aware of the law, particularly in relation to firearms and ammunition?

Barragan et al (2017) interviewed offenders about

their understanding of the complex gun regulations in California (table 2.1). The sample was 140 inmates in the Los Angeles County jail system on gun-related charges. Interviews lasted 45-120 minutes.

- Restriction on firearm purchases (eg: high-powered rifles).
- Additional sentences for convicted crimes with firearm use.

- Leeway in regulation between jurisdictions (ie: city and county governments). "The unevenness of the legal landscape at the local level can have potentially serious implications for the effectiveness of even the clearest, most restrictive, and best enforced laws. For instance, restrictive regulations in one area can be undermined when a prohibited possessor is able to cross into a neighbouring municipality with less restrictive laws in order to purchase ammunition" (Barragan et al 2017 p142) [11].

Table 2.1 - Key aspects of California gun regulations in 2017.

In summary, the researchers stated: "Our respondents revealed a basic, but relatively imprecise knowledge of gun acquisition and possession regulations" (Barragan et al 2017 p149). Concerning gun ownership prohibition by an individual with a criminal record, their knowledge was accurate, and the participants were aware of the requirement of a permit to legally posses a gun. Limited knowledge about ammunition regulations, though [12].

Barragan et al (2017) continued: "Our respondents were able to describe in specific (if not always accurate) terms the punishment they would experience if the police caught them with a gun. Their knowledge of the punishment they might encounter was, in fact, more detailed than that of the underlying gun (and ammunition) regulations for which they might be punished. Respondents' descriptions of legal consequences included knowledge of the specific charges they might face, possible sentencing enhancements, precise sentence lengths, and even the percentage of sentenced time they would likely serve" (p153).

The researchers concluded: "Our findings suggest

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[11] Kennedy (1996) observed that "while criminal justice agencies are very much in the business of, as the phrase goes, 'sending signals', they in practice often send those signals in obscure, incoherent, ineffective, and even self- defeating ways" (quoted in Barragan et al 2017).

[12] For example: "LA is especially restrictive regarding the purchase of ammunition. In the city, ammunition sellers must possess a license, and purchasers are required to provide a valid state ID and leave a fingerprint impression. The seller must also maintain a record of all transactions including the purchaser's personal information (name, date of birth, gender, address, and ID number) as well as the type of and quantity of ammunition purchased. Information on each transaction is entered into an electronic database that is transferred to the police department within five days. The city also imposes restrictions on the sales of certain types of ammunition and prohibits ammunition sales for the week leading up to both the Fourth of July and New Year's Eve" (Barragan et al 2017 p147).

that inconsistent regulations across jurisdictions, a lack of knowledge of some laws, and a willingness to violate them in spite of a perception that the punishment will be certain and severe compromise the practical implementation of deterrence-based firearms prohibitions" (Barragan et al 2017 p160).

2.4. EVALUATING REGULATIONS

Attempts to control the diversion of legally purchased guns into crime include background checks for gun transfers between private parties, regulation of licensed gun dealers, and compulsory reporting of lost or stolen guns by owners (Crifasi et al 2017).

The question with these different regulations is whether they work. Answering, though, is not easy. Crifasi et al (2017) tried with the 2013 Maryland Firearm Safety Act (FSA), which included a number of measures like permit-to-purchase for a handgun from a licensed dealer or private owner (ie: a licence from the police), mandatory reporting of gun theft within 72 hours, and a ban on the sale of assault rifles. The outcome measure was handguns recovered by the police in Baltimore (2007-2015).

Statistical analysis involved the period before the FSA (2007 - end of September 2013) and after the FSA was implemented (1st October 2013 - 30th September 2015). There was a general decline in recovered handguns after the law was passed. "Indeed, the FSA was associated with an 82 percent reduction in the risk of a handgun being recovered from a criminal possessor who was not the retail purchaser less than twelve months after its retail sale in Maryland. The data suggest that the new legislation, most probably the licensing requirement for handgun purchasers, may have also contributed to a reduction in the number of legal purchasers subsequently involved in a crime with the gun" (Crifasi et al 2017 p137).

Crifasi et al (2017) also surveyed 195 men on parole or probation in mid-2016 about the purchasing of a gun "on the streets" since the FSA. Around two-fifths reported more difficulty in obtaining a gun.

Though there were confounders [13], the "FSA appears to have constrained the local supply of illegal handguns in Baltimore" (Crifasi et al 2017 pp139-140).

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[13] For example, in April 2015 there was civil unrest after the death of Freddie Gray in Baltimore police custody.

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3. HATE CRIME

Recorded hate crimes in England and Wales are on average over 110 000 annually in recent years (Williams et al 2020). In official data collected by the Home Office, online hate crimes are a small part of the total recorded hate crime (eg: 2% in 2017-18), but, along with representative surveys, these data "only capture a snapshot of the online hate phenomenon" (Williams et al 2020 p95).

What is the relationship between online hate material and hate crimes "on the streets"? Williams et al (2020) pointed out that "it is worth reminding ourselves that those who routinely work with hate offenders agree that although not all people who are exposed to hate material go on to commit hate crimes on the streets, all hate crime criminals are likely to have been exposed to hate material at some stage" (p98).

Williams et al (2020) analysed data from the Metropolitan Police Service for eight months in 2013-14 for racially and religiously aggravated offences in London [14]. The 6572 offences were coded into three categories - against the person, criminal damage, and harassment.

The other variable was social media posts (of 21.7 million Twitter posts sent in the London area during the same time period), which were classified as "offensive or antagonistic in terms of race, ethnicity or religion".

The main conclusion was that "online hate speech targeting race and religion is positively associated with all offline racially and religiously aggravated offences, including total hate crimes in London over an eight-month period" (Williams et al 2020 pp106-107).

Statistical modelling estimated that an increase of 100 hate tweets correspond to an 0.4% increase in racially or religiously aggravated harassment in a given month, for example.

Bowling (1993) argued that racism should be seen as "a continuity of violence, threat and intimidation". Williams et al (2020) agreed: "We concur that hate crimes must be conceptualised as a process set in geographical, social, historical and political context. We would add that 'technological' context is now a key part of this conceptualisation. The enduring quality of hate victimisation, characterised by repeated or continuous insult, threat, or violence now extends into the online arena and can be linked to its offline manifestation. We

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[14] This study was commissioned by the National Police Chief's Council online hate crime hub, which was established by the Home Office in 2017 (Lu 2019).

argue that hate speech on social media extends 'climates of unsafety' experienced by minority groups that transcend individual instances of victimisation (Stanko 1990). Online hate for many minorities is part and parcel of everyday life — as Pearson et al (1989) state 'A black person need never have been the actual victim of a racist attack, but will remain acutely aware that she or he belongs to a group that is threatened in this manner'. This is no less true in the digital age. Social media, through various mechanisms such as unfettered use by the far right, polarisation, events, and psychological processes such as deindividuation, has been widely infected with a casual low-level intolerance of the racial Other" (pp112-113).

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4. PHYSICAL EXERCISE AND EYE-WITNESSES

4.1. REALISTIC RESEARCH

        Hope et al (2012) asked the question: "Does physical activity facilitate or impede eye-witness memory?" (p386).
        In terms of general memory, McMorris et al's (2011) meta-analysis found that intermediate intensity exercise improved response speed for working memory tasks, but led to reduced memory accuracy [15].

        Hope et al (2012) reported the "first study designed to test eye-witness recall and recognition memory under ecological conditions" (p387). Fifty-two Canadian law-enforcement officers from one city were recruited, and randomly allocated to the experimental or control condition. The independent variable was physical exertion until fatigued by hitting a punch bag or not. The dependent variable was the amount and the accuracy of recall of written information about three armed robberies, and for contents of an inhabited trailer and two individuals there (table 4.1; figure 4.1). One of the individuals was incidental (ie: "bystander") and the other was critical (ie: "criminal").

* 20 cued recall questions about written material.

* Free recall of the trailer contents (eg: four weapons).

* Recognition from a line-up of six photographs of the two individuals seen at the trailer.

Table 4.1 - Key Measures of Memory.

        The participants in the exertion condition had significantly poorer recall of the written information (read before the physical exercise) in response to cued recall questions, and significantly less accurate information about the trailer visited (after the

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[15] "Predominant theoretical accounts of these effects hold that exercise influences various neurobiological mechanisms that support cognition and memory. For example, acute exercise increases levels of brain-derived neurotrophic factor (BDNF), which supports neuronal development and plasticity. It also increases the concentration of neurotransmitters such as dopamine, epinephrine, and norepinephrine, which support the consolidation and regulation of memory" (Palmer et al 2019 p1).
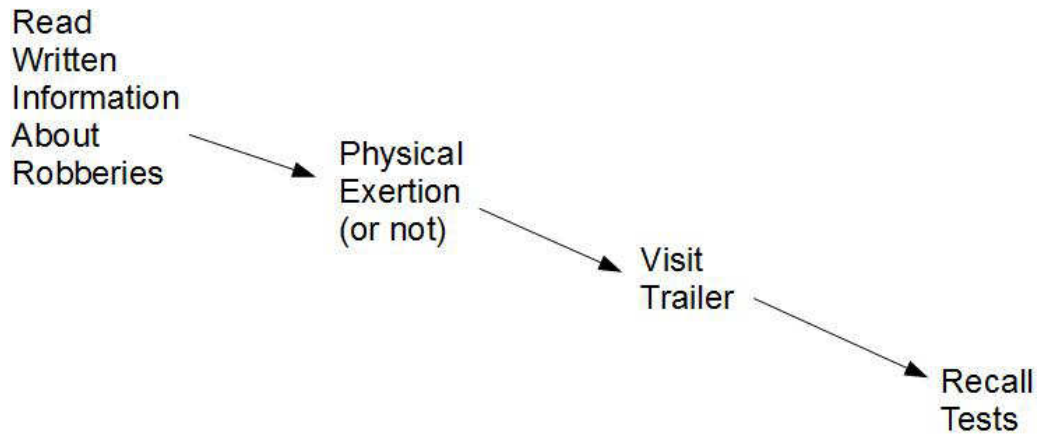
Figure 4.1 - Basic Procedure of the Experiment.

exercise) (figure 4.2).
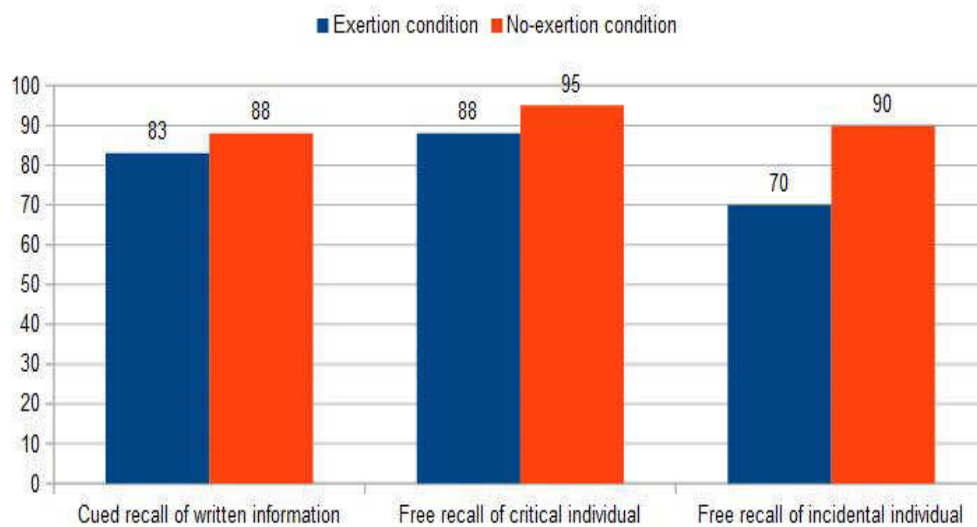
(Data from Hope et al 2012 table 1 p389)

Figure 4.2 - Mean recall accuracy (%).

Hope et al (2012) argued that the findings supported an attentional capacity explanation. Physical exertion reduced the cognitive capacity, which influenced both information encoded before and after the exercise.

Hope et al (2012) ended: "The delivery of justice may depend on the statements and identifications provided by witnesses who have experienced physical exertion, either in the course of their occupational duties or due

to the nature of the crime perpetrated against them"
(p389).

Hope (2016) reflected on the effects of stress and
fatigue on police officer memory generally. She noted
"complex factors underpinning memory impairment as a
result of stress and arousal" (Hope 2016 p240).
For example, emotionally arousing events are
recalled better than neutral ones, but higher levels of
stress disrupt hippocampus function and thus memory
performance. Likewise, low-to-moderate exertion improves
cognitive performance, but high levels of exertion are
detrimental to memory performance (Hope 2016).

Hope (2016) made three recommendations for the
police in relation to recall of stressful events:

i) Realistic training environments - For example,
police officers shooting accuracy in static controlled
shooting tests is over 90%, but less than 50% in real-
life incidents (Hope 2016). So, "police training should
involve simulations that facilitate realistic shoot/no-
shoot decisions and allow realistic shooting responses, as
distinct from static target practice. Although unlikely
to be a panacea, training with threat-induced anxiety
(eg: 'shootback' opponents during simulations) may
improve performance under pressure" (Hope 2016 p241).

ii) Method of obtaining recall from officers - How
police officers give reports after use-of-force
incidents, say, varies between countries (eg: written
statements; interviews by investigators). Whatever method
is used, knowledge of best practice retrieval techniques
would help (eg: use of mental context reinstatement; open
questions).

iii) Timing of obtaining accounts - Again there is
variety between countries as to how soon after an
incident officers recall it. For example, whether a
fatigued individual recalls before or after sleep.
General research suggests that sleep aids memory
consolidation, though there are some disagreements (Hope
2016).

4.2. METACOGNITION

Palmer et al (2019) studied how exercise affects
metacognition (knowledge of memory performance or
judgments of learning (JOLs); Nelson and Dunlosky 1991).
"Good metacognitive monitoring allows people to gauge
accurately what they will remember and what they will
not. This is crucial to many tasks. For example, a
student preparing for an exam must judge what content

has been learned adequately and what content requires more study. A witness to a crime must judge whether he or she will be able to remember important details (eg: a car license number or the appearance of the culprit) or whether more attention must be paid to these things" (Palmer et al 2019 p1).

Metacognition is measured in terms of absolute or relative accuracy. Absolute accuracy is the degree to which metacognition corresponds to actual recall. "This can deviate from perfect in several ways, including overconfidence (whereby the predicted likelihood of remembering is, on average, higher than actual accuracy) and under-confidence (whereby predictions are lower than actual accuracy)" (Palmer et al 2019 p2).

Relative accuracy (or resolution or discrimination) is the ability to distinguish what information will be remembered and what not.

Palmer et al (2019) outlined four possible relationships between exercise, memory and metacognition:

a) Exercise benefits memory and metacognition accuracy (ie: increased relative accuracy).

b) Exercise influences absolute accuracy of metacognition.

c) Exercise enhances memory performance, but not metacognition accuracy.

d) Exercise benefits memory, but impairs metacognition accuracy.

In terms of previous research, Dutton and Carroll (2001) got participants to walk on the spot (or sit) while watching a video. Then JOLs were made about the likelihood of recall of information from the video before a memory test. "Exercise did not influence the accuracy of memory responses or the accuracy of JOLs" (Palmer et al 2019 p2).

Salas et al (2011) used walking briskly for ten minutes as the exercise (or sitting) before or after studying word lists. Only walking before learning improved recall and accuracy of JOLs.

Palmer et al (2019) criticised these two experiments for using low-intensity exercise. So, in their two experiments, moderate intensity exercise was used.

Experiment 1 - The participants were 59 adults in Tasmania, Australia, who were randomly allocated to exercise before learning (exercise-prior condition), exercise after learning but before a recall test (exercise-post condition), or no-exercise (control) condition. The exercise was 30 minutes on a static bike

that produced a heartbeat of sixty beats per minute. The control group watched a thirty-minute video after learning.

Participants learned word pairs (eg: door-bowl) and the recall test was cued (eg: door-?). JOLs were made immediately after learning (JOL1) and before the recall test (JOL2).

Memory performance was best in the exercise-prior condition (mean 48.5% correct) compared to 40% in the exercise-post and control conditions.

All three condition were similar in the absolute and relative accuracy of JOLs immediately after learning. But, for JOL2, exercise after learning led to more overconfidence (ie: predicted recall greater than actual recall).

Experiment 2 - This experiment made some adjustments to the previous methodology. The exercise-post condition was omitted to leave the exercise-prior condition and the control condition (which now involved watching a video before learning). The memory for the word pairs was tested by cued recall as above, and by a recognition test (where four options were offered - eg: door-?: spoon, bowl, choir drill). The participants were thirty-nine more Australian adults.

Memory performance did not vary between the exercise and control groups (both cued recall and recognition tests) [16]. Overconfidence was greater in the exercise than the control condition for cued recall, but JOLs about recognition was improved by exercise (by reducing under-confidence).

Palmer et al (2019) ended: "our results have implications for applied settings, such as students needing to accurately gauge their memory for paired associates in learning tasks, including learning definitions and new languages. Our results show that moderate-intensity exercise around the time of study can impair JOLs for paired-associates. To be clear, we do not suggest that people should avoid exercise for the sake of metacognition. There is overwhelming evidence that ongoing exercise has long-term benefits for health and cognition. Our data in no way challenge these conclusions. However, our results do suggest there is benefit in developing strategies for incorporating acute exercise into study routines in ways that facilitate learning without undermining metacognition. For example, simple interventions such as hypothesis disconfirmation

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[16] Palmer et al (2019) stated: "In our study, exercise before encoding enhanced memory performance in Experiment 1 but not Experiment 2. This difference was not anticipated but might have arisen due to the difference in overall memory performance between the two experiments" (p7).

or delaying JOLs for longer after exercise, may prove
effective in mitigating any tendency for exercise to
inflate JOLs" (p8). This fits, to some degree, with
relationship (d) above.

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5. PREDICTING CRIME

5.1. INTERNET SEARCH DATA

Methamphetamine (eg: "crystal meth") is a popular illicit stimulant drug, particularly in East and South-East Asia, North America, and Central Europe (Gamma et al 2016). Its use has grown rapidly in the 21st century.

Is it possible to predict the use of such drugs? One possibility is via Internet search data and "Google Trends". "'Google Trends' is a web service offered by Google to track the popularity of terms entered in its search engine. It delivers data on the frequencies of search terms broken down by geographical location and time. The data are relativised to the total search volume for that term in the specified region at the specified time. Thus, the data are not absolute, but normalised, numbers" (Gamma et al 2016 p2).

Gamma et al (2016) compared "Google Trends" data on searches for methamphetamine with official drug crime statistics in Switzerland, Germany, and Austria for 2004 to early 2016. The search terms "meth" and "crystal meth" (and variants - eg: "cristal meth") were analysed (table 5.1).

Google data source	Google Trends
Type of Search	Web Search
Query Category	All Categories
Date of access	14.02.2016
Time period	Jan 2004 –Feb 2016
Time division	Month
Search terms:	
Search 1	"meth"
Search 2	"crystal meth" + "cristal meth" + "crystel meth" + "chrystal"

doi:10.1371/journal.pone.0166566.t001

(Source: Gamma et al 2016 table 1)

Table 5.1 - Search parameters used with "Google Trends".

"Overall, criminal offences and police activity related to methamphetamine rose steeply between 2010 and

2014 in German-speaking European countries. Google search interest followed the same general pattern" (Gamma et al 2016 p4). There was some variety between the countries (eg: in Germany there was no association between number of drug lab crimes busts by the police and Internet search volume) (figure 5.1). "Nevertheless, the overall parallelism of drug offences and search interest for methamphetamine on the country level encourages the evaluation of Google Trends by legal and law enforcement authorities as a predictive instrument for drug-related crimes" (Gamma et al 2016 p5).

One problem with the use of Internet search data, Gamma et al (2016) pointed out, is "we do not know what variety of motives underlie the searches we identified: an intent to buy the drug, the curiosity of a potential prospective user, the concern of a parent, or the research of a journalist. While the fact of similar trajectories supports some connection to local availability and use of the drug, we do not know the direction of causality: do internet users search for methamphetamine as a reaction to local media reporting increased drug availability or do they hear about the drug being increasingly offered in clubs and then google it? In the former case, the search volume generated would probably be late with respect to police awareness of the drug. In the latter case, the search activity could precede peaks in drug-related illegal activity and actually be of predictive value to law enforcement. Here, only a finer temporal resolution of crime data matching that of search volume data could provide an answer. Nevertheless, it is probably safe to assume that both mechanisms, and maybe additional ones, are at play to some extent" (pp7-8).

Zheluk et al (2014) studied "krokodil" [17] (desomorphine [18]), "a cheap injectable drug easily synthesised in household kitchens from codeine-containing medication (CCM)" [19], in Russia and related Internet search patterns. The researchers used Google Trends and search results from "Yandex", which is more popular in Russia, for 2011 to 2013. Restrictions on CCM were introduced by the government in mid-2012.

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[17] Street name "krokodil" because tissue around the injection site dies and patches of skin turn greenish grey and scaly, like the skin of a crocodile. Large areas of tissue can rot away to the bone, and the bone can rot away such that limb amputation is required (Ross 2012).

[18] Originally synthesised as a morphine substitute in the USA in 1932, while "[I]n Russia, krokodil or what is termed desomorphine, is an illicit injectable drug domestically manufactured from codeine, iodine, phosphorus, paint thinner, and lighter fuel" (Zheluk et al 2014).

[19] It is the "last resort for people who can't get heroin or other injected drugs" (Kirill Danishevskiy, public health researcher, in Ross 2012). It is cheaper than heroin, but the high is shorter leading to more injections to stave off withdrawal (Ross 2012).

Switzerland

Germany

Austria
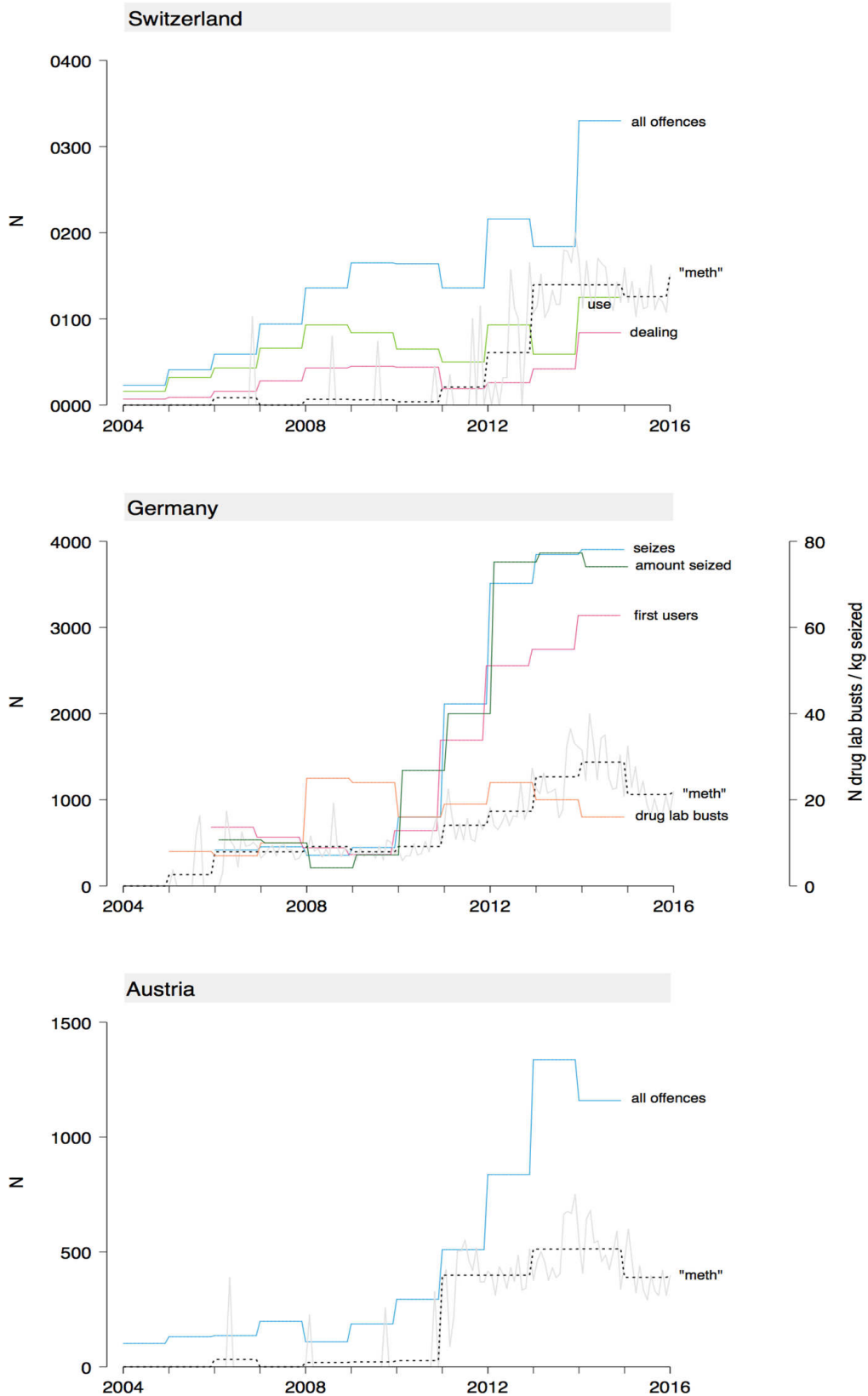
(Source: Gamma et al 2016 figure 1)

Figure 5.1 - Trends of Internet search activity and methamphetamine-based crimes in three countries.

"Google Trends and Google and Yandex related terms suggested consistent public interest in the production and use of krokodil as well as for CCM as analgesic medication during the date range covered by this study" (Zheluk et al 2014). However, the average number of searches for desomorphine- and krokodil-related terms declined after government restrictions were introduced.

There was a correlation between court appearances for krokodil-related charges and Internet searches, but Zheluk et al (2014) urged caution over the court appearance data: "Russian court processes are regarded by researchers and Russian public opinion as likely to produce outcomes favouring police and prosecutors. Both policing and judicial practices may be expected to distort court appearance data".

5.1.1. Opioid Overdoses

In the USA in 2017 there were 70 237 fatal overdoses (ODs) officially recorded, of which opioid ODs were "by far the largest contributor" (Altekruse et al 2020 p2). Rising fatal opioid ODs in recent years "disproportionately but not exclusively" affected certain groups - White, male, middle-aged - and in "poorer" areas (ie: individuals prone to the "deaths of despair"; Case and Deaton 2017) (Altekruse et al 2020).

Official data for opioid OD mortality do not typically analyse detailed information about socio-economic status (SES). Hence Altekruse et al's (2020) study of SES data from the Mortality Disparities in American Communities Study (MDAC), covering 3.9 million individuals. Of these, 3800 were classified as having died from an opioid OD between 2008 and 2015.

The principal finding was the greater risk of fatal opioid OD among individuals of low SES status (based on variables like employment status, educational attainment, and household poverty).

In terms of the individual characteristics, the patterns from previous research were confirmed:

- Age - over 80% of OD cases were 20-59 years old.
- Ethnicity - over 80% White.
- Gender - over 60% male.

Risk of death from opioid OD was also higher for individuals with a disability, divorced, separated or widowed persons, the unemployed, less educated individuals, and those living under the poverty line, for instance.

Altekruse et al (2020) summed up: "While opioid fatalities occurred across SES strata, they were concentrated in lower SES groups" (p12).

The MDAC involved a nationally representative sample followed over a number of years with SES was based on detailed self-reports, and classification of mortality from death certificates, but there was no information about psychiatric diagnoses (Altekruse et al 2020).

5.2. CRIME PREVENTION

Stubbs-Richardson et al (2018) examined Google searches in relation to crime prevention in four ways:

i) "Target hardening" - security products that decrease access to a property (eg: locks).

ii) "Surveillance" - eg: closed-circuit television (CCTV).

iii) "Formal social control" - eg: how to report crimes to the police.

iv) "Informal social control" - eg: neighbourhood watch schemes.

Google search data in the USA for 2003 to June 2017, and FBI property crime data were collected.

The first research question was: "Are higher rates of property crime associated with searches for crime prevention information?" (p4). Google searches for nineteen crime prevention queries significantly positively correlated with four property crime rates at state-level (per 100 000 population) (overall; burglary; larceny-theft; motor vehicle theft). This established the correlational relationship.

The second research question was: "Are increased levels of crime prevention searches associated with reductions in property crime?" (p4). Google searches significantly correlated with reductions in property crime with high correlations for target hardening and surveillance queries. High search states were associated with the greatest drop in property crime.

Stubbs-Richardson et al (2018) concluded: "Our research suggests that Google queries are playing a role in crime prevention. This study demonstrates that crime prevention queries are associated with significant reductions in crime over time" (p7).

There was a key limitation to this study, which Stubbs-Richardson et al (2018) accepted - "we cannot control for non-spuriousness or time order. Due to the cross-sectional nature of data and the fact that our analyses are bivariate, we have no way of knowing whether changes to crime patterns cause searches or whether searches lead to changes in crime patterns. Future

research should control for population size, violent crime rates, and socio-economic characteristics of each state as these factors likely influence this relationship" (p8).

The analysis was at state-level, so there was no information about the individual, particularly their reasons for searching. "For instance, it is unclear whether a person searching for 'gate keypad' as a crime prevention tool, whether a potential offender is searching to identify its vulnerabilities, or something else entirely. Relatedly, Google searches about crime prevention may not always lead to actions" (Stubbs-Richardson et al 2018 p8;10).

The search terms used by the researchers will influence the findings. For example, what is the "everyday language" used for "how to file a police report" (Stubbs-Richardson et al 2018)?

5.3. VIOLENCE

Nurses often experience workplace violence, particularly in emergency departments (EDs), and from patients, or their family members and friends (and typically male) (Luck et al 2007).

Luck et al (2007) developed an indicator of potential violence in EDS based on a case study in an Australian hospital, which included interviews with nurses and participant observation. Five indicators emerged, including from sixteen observed violent events, which were given the acronym "STAMP":

S - staring and eye contact (eg: prolonged glaring).

Eg: "Muriel": "They'll stare you... you get completely stared out to the point where you almost have to cringe as you are walking past the patients, knowing full well that they are starting to get a bit cross" (p15).

T - tone and volume of voice (eg: sarcasm; demeaning; loud).

Eg: "Bea": "If they are getting really wound up, usually their voices will get louder, the pitch will change, their use of language will change as well, you know, they might start off using, you know, normal reasonable language and it will become less reasonable and less pleasant" (p15).

A - anxiety (eg: physical indicators of pain; confusion and disorientation).

Eg: "Pam": "Anything that builds up someone's anxiety levels and inability for them to have control of the

situation is going to make them even more a potential and how they deal with it - so you know any critical situation is going to have family, friends, relatives, potential to go off. Not because they want to - because they just don't know how to deal with the situation" (p16).

M - mumbling (eg: talking "under the breath", usually critical comments).

Eg: "Bea": "They might be muttering amongst themselves and then they might not say anything to you for quite a while - they just do all this staring" (p16).

P - pacing (eg: walking around the waiting room; resistance).

Eg: "Angie": "So if they're not calm, if they are actually moving around agitatedly... in the waiting room or wherever, like they're pacing or just sitting, like just sitting tapping rather than just sitting watching TV or sitting at the bedside" (p17).


5.4. SUICIDAL THOUGHTS

Around one million people in the world kill themselves each year (Schmaal et al 2020). Such a large number has generated interest in finding biological markers of risk of suicide.

One way is to use neuroimaging techniques to find structural and functional brain circuitry correlates of suicidal thoughts and behaviours (STBs). Schmaal et al (2020) reported a review of such studies. One hundred and thirty one articles published before early 2018 were included. "Most studies compared people with a mental disorder and a history of SA (suicide attempters, SAs) to people with a mental disorder and/or healthy controls (HCs) without a history of attempt. Fewer studies focused on SI [suicidal ideation]. Most studies employed a cross-sectional design and a single structural or functional imaging modality" (Schmaal et al 2020 p409).

A pattern appeared to emerge of abnormalities in the ventral prefrontal cortex (VPFC) regions (figure 5.2), in the main [20]. These include areas related to reward, emotion, inhibition/self-control, and decision-making. For example, "SI may convert to lethal actions via decreased top-down inhibition of behaviour or maladaptive, and inflexible decision-making and planning" (Schmaal et al 2020 p418).

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[20] Producing, for example, educed cognitive control of emotion and behaviour, and enhanced negative thoughts about the future (Schmaal et al 2020).

Front
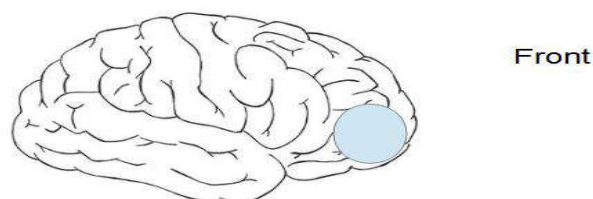
(Original drawing of brain by Magda Kralovenska)

Figure 5.2 - Position of VPFC on right hemisphere.

Though there were many studies included in this review, sample sizes were small in each one, the longitudinal design was rarely used, and other methodological differences included the inclusion/exclusion criteria, imaging method, and the assessment of STB. Few studies involved individuals with multiple mental disorders. Future work that includes "careful consideration of developmental stages, and sex and gender, will facilitate more effectively targeted preventions and interventions to reduce loss of life to suicide" (Schmaal et al 2020 p408).

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6. FORENSIC GENOMICS

6.1. DATA PRIVACY

Many individuals have placed their data on genetic genealogical databases like "MyHeritage" and "Family/TreeDNA". Usually the aim is to help find family members, and when there is a strong match, names and emails are shared (Vaughan 2019) [21].

Edge and Coop (2020) expressed concern that such data could be compromised by "an adversary". They outlined the main ways that genetic privacy could be invaded:

i) By the use of real genotype data obtained from publicly available databases like the "1000 Genomes Project" - use of whole genomes ("IBS tiling") or partial ones ("IBS probing").

ii) By uploading artificial genetic datasets ("IBS baiting").

Edge and Coop (2020) stated: "The attacks we describe require little special expertise in computing; the adversary only needs to be able to procure or create the appropriate data files and to process and aggregate the information returned from the database".

Privacy International (2019) reported that mental health websites were sharing user data with advertisers. A study of 136 population websites in the UK, France, and Germany that provided information and resources about mental health conditions found that three-quarters had third-party marketing trackers. "These collect information about a user and can track them as they browse other sites. This can be combined into a detailed profile" (Lu 2019 p9).

One of the researchers on the Privacy International team stated: "It's currently almost impossible to seek information and help about depression without advertisers knowing... Knowing who is depressed and when allows advertisers to target people when they are at their most vulnerable. Feeling low today? Here are some diet pills" (quoted in Lu 2019).

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[21] Matches are made within the dataset by shared ancestor - "identity by descent" (IBD).

6.2. LAW ENFORCEMENT USE OF GENEALOGICAL DATABASES

In 2018 Joseph DeAngelo was arrested for a number of historic murders (by the "Golden State Killer") through DNA matches [22]. But this was not a comparison of DNA left at the crime scene and that of the suspect [23], rather DNA profiles freely available on a genealogical database called "GEDmatch" were used (Ram et al 2018) (table 6.1) [24] [25]. "The search of a non-forensic database for law enforcement purposes has caught public attention, with many wondering how common such searches are, whether they are legal, and what consumers can do to protect themselves and their families from prying police eyes. Investigators are already rushing to make similar searches of GEDmatch in other cases, making ethical and legal inquiry into such use urgent" (Ram et al 2018 p1078) [26].

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[22] The identification was made by genetic genealogist Barbara Rae-Ventner working with the FBI (Kennett 2019). Genetic genealogy is the combination of genealogical (historical) records and DNA information.

[23] The US police use the Combined DNA Index System (CODIS), which contains over thirteen million individuals, most convicted of a crime. "In a typical case in which law enforcement uses genetic data, the procedure is to genotype a crime-scene sample at the CODIS loci and look for a full or partial match against the CODIS database. If the sample came from a person who is in the CODIS database, he or she is likely to be identified. If there is no match, then the genetic search ends unless other information can be brought to bear" (Edge and Coop 2019 p2).

The CODIS database allows a search for close relatives (parents and siblings), in the main, because of the limited amount of genetic information (eg: thirteen sites on the genome) (Edge and Coop 2019). Such databases that match an individual are like a "postcard" compared to a "novel" with public databases and familial matching (Scudder et al 2019).

[24] Databases like GEDmatch have so much more genetic information for each individual than police databases (table 6.2), and so wider relatives (eg: third or fourth cousins) could potentially be traced. These distant relatives were probably found in the DeAngelo case, and then narrowed down in combination with genealogical information about these relatives to the family and the individual (Edge and Coop 2019).

[25] GEDmatch has also been used to identify an unknown US murder victim from the 1980s (known as "Buck Skin Girl" after her coat) with a first cousin match (Kennett 2019). The search was done by the "DNA Doe Project" which seeks information on missing persons using DNA data. The victim was named as Marcia King (Scudder et al 2019).

The work is done by volunteers. "The use of volunteers is inherently risky because of the lack of accountability and the potential for leaks, such as the disclosure of the victim's GEDmatch ID or information on whether an individual has a match with the missing person. Many missing persons cases involve victims of crime. There is a possibility that the victim or their family might be known to one of the volunteers, which could potentially compromise an investigation, especially if a family member is a suspect" (Kennett 2019 p113).

Kennett (2019) continued: "There is also the risk of misidentification. In adoption searches volunteers have sometimes identified the wrong birth parent. Incorrect family trees could cause confusion and confound investigations. Broken lineages in genealogies due to hidden adoptions or misattributed parentage could potentially lead to incorrect conclusions, putting innocent people under suspicion" (p113).

[26] Also "genomic analysis of particular markers, known as informative markers, can allow prediction of a donor's biogeographical ancestry (BGA) – where their ancestors likely came from – and externally visible characteristics (EVCs), such as natural hair and eye colour variation" (Scudder et al 2019 p195).

- Third cousins, for instance, share one of eight sets of great-
  great grandparents, and less than 1% common DNA. But this is an
  average. "There is a non-trivial chance (about 2%) that you will
  actually share no identical segments of your genome with your
  third cousin — in that case, we say you are genealogical cousins
  but not genetic cousins" (Edge and Coop 2019 p5). With fourth
  cousins and so on, genealogical cousinhood is more likely (figure
  6.1).

- In practice, individuals (genetically) are a beacon who
  illuminates 300 people around them (Erlich et al 2018 in Edge and
  Coop 2019).

Table 6.1 - Matching distant relatives.
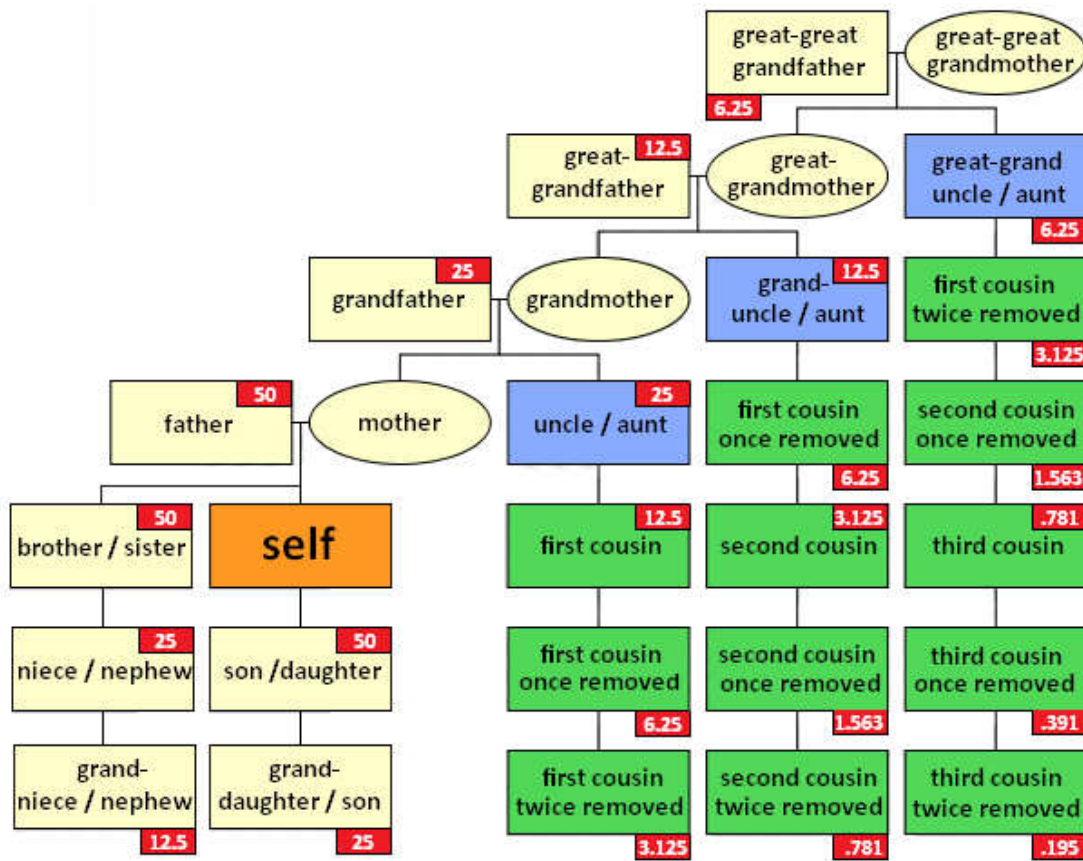
(Source: Dimario; in public domain)

Figure 6.1 - Degree of genetic relatedness (% in red)
between family members.

The term "forensic genomics" has been coined to
describe the "wider exploitation of informative genetic
markers, as a component of legal enquiries" (Scudder et
al 2019 p195).

| Database	Size	Usage
CODIS	16 million STRs	LE
AncestryDNA	15 m SNPs	C
UK DNA Database	5.5 m STRs	LE
23andMe	10 m SNPs	C
GEDmatch	1 m SNPs	both

(LE = law enforcement only; C = consumer only; both = C and LE; SNPs = single nucleotide polymorphisms; STRs = short tandem repeats)

(Source: Kennett 2019 table 1 p109)

Table 6.2 - Size of selected databases (at April 2019).

The most common genetic search methods are mitochondrial DNA (mtDNA) and Y-chromosomal DNA (Y-DNA). The latter is used to find paternal relatives as the Y-chromosome is only carried by males, particularly by linking with surnames. Kennett (2019) suggested a limited success for this approach.

A US survey (Guerrini et al 2018) found support for police use of public genealogy databases to identify perpetrators of violent crime, crimes against children, and to find missing persons, but not for non-violent criminal identification (figure 6.2) (Kennett 2019).
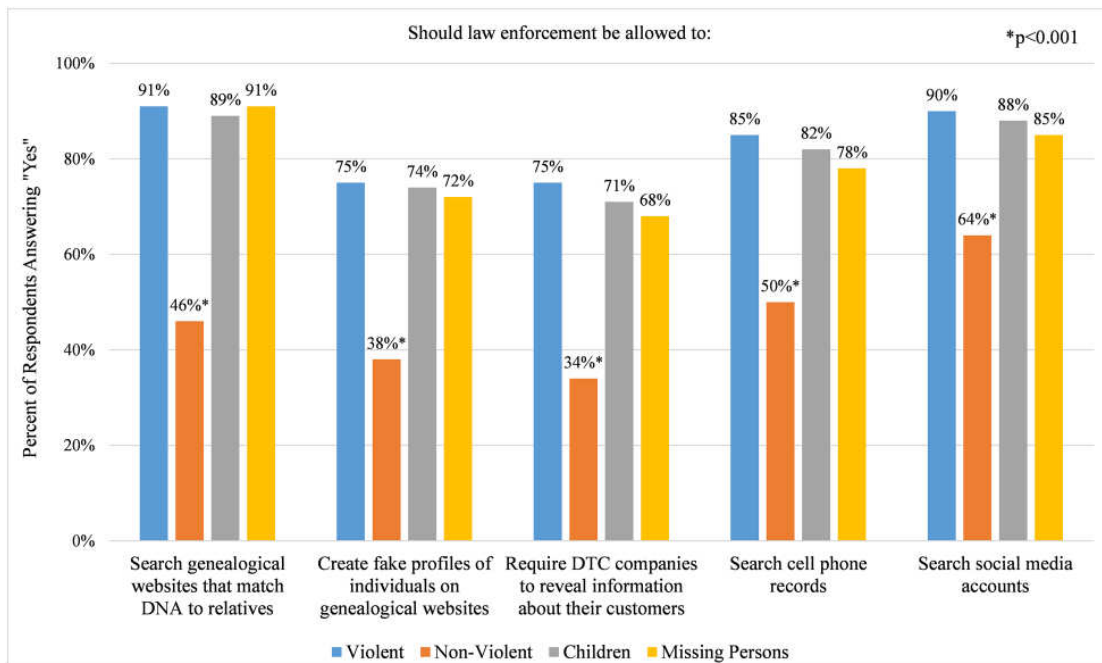
(Source: Guerrini et al 2018 figure 1)

Figure 6.2 - Percentage of agreement for police access to data based on different crimes.

The researchers put a 20-item questionnaire about police access to personal data on Amazon Mechanical Turk in May 2018, and it was completed by 1587 US adults.

"Forensic genetic genealogy" is another term used, and Scudder et al (2019) noted three aspects of data and analysis used by this approach:

i) High-density genotyping" - DNA technology that allows analysis of up to a million genetic markers.

ii) Using genealogy - eg: family trees.

iii) Publicly available genetic datasets.

6.2.1. Issues

Court (2018) was not concerned by this case in the sense of matching DNA to the crime scene, but she did note "an unethical approach, in which law enforcers appear to have bypassed the codes of informed consent by submitting material for DNA analysis under a false name. While 23andMe, for example, make it clear that it is a violation of their terms of service 'for law enforcement officials to submit samples on behalf of a prisoner or someone in state custody who has been charged with a crime' [23andMe website], that does not protect against 'fishing expeditions'" (Court 2018 p203).

She continued: "Few would argue against the forced collection of DNA from arrested individuals, especially when the crime is serious, and searches within a criminal database collection are done routinely because, it is argued, these individuals have forsaken their right to privacy. In contrast, no consent has been given by the contributors to a genealogical collection for their DNA to be used in a way that might implicate their relatives in a committed crime" (Court 2018 p203).

Are donors to genealogical and public databases aware of this risk? "The privacy and governance of genetic collections should be at the forefront of all providers' minds, and information about both the benefits and risks to individuals should be clearly promoted, rather than buried in the small print" (Court 2018 pp203-204) [27].

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[27] "Some researchers have suggested that the best way of protecting the privacy of innocent people and reducing the need for invasive investigative techniques is to implement a universal forensic DNA database" (Kennett 2019 p114). "The idea of a subset of the population being subject to law enforcement scrutiny through familial DNA searching while the remainder of the population are immune starts to diminish the closer we come to a near-to-whole population saturation point" (Scudder et al 2019 p199).

The DeAngelo case was not the first in the USA. In 2014, a partial match between a suspect's (Michael Usry) father's DNA on "Ancestry.com" was made with DNA at a 1996 murder scene [28]. "On the basis of the partial match, police were able to obtain a court order requiring Ancestry.com to disclose the identity of the database DNA match. After mapping out several generations of Usry's father's family, investigators zeroed in on Usry, eventually securing a warrant for his DNA. Ultimately, Usry was cleared as a suspect when his DNA proved not to match the crime scene DNA" (Ram et al 2018 p1078) [29].

The use of non-police databases offers the possibility to solve more crimes, particularly long unsolved ones. "Moreover, expanding law enforcement investigations to encompass genealogical databases may help to remedy the racial and ethnic disparities that plague traditional forensic searches. In accordance with state laws, official forensic databases are typically limited to individuals arrested or convicted of certain crimes. Racial and ethnic disparities throughout the criminal justice system are therefore reproduced in the racial and ethnic makeup of these forensic databases. Genealogical databases, by contrast, are biased toward different demographics. The 23andMe database, for instance, consists disproportionately of individuals of European descent" (Ram et al 2018 p1078).

There are some legal restrictions to police searches of these public databases in the USA, where most of the companies are based, but there are also "legal grey areas" over data. Ram et al (2018) emphasised the importance of establishing a legislative solution that takes "into account public perspectives to clearly delineate acceptable uses and balance the social benefit of solving cases with individuals' interests in avoiding unwarranted government scrutiny" (p1079).

Direct-to-consumer (DTC) companies are there to make a profit, which in this case is through the monetarisation of genetic data (even if anonymised. "The re-identification of anonymised data has already been shown to be possible and remains a current threat until secure and reliable techniques of encryption become available" (Court 2018 p204).

These concerns have to be considered. "Consumers of DTC genealogy tests now have to confront the tension between the need to protect their own privacy and that of their close and distant relatives, and their strong

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[28] "Familial DNA searching" is a "quantum leap" (Murphy 2010) in forensic identification.

[29] "Familial DNA searching" had been tried successfully in the UK in 2004, and in the arrest of the "Grim Sleeper" (serial killer) in California in 2010 (Scudder et al 2019).

desire to use this information for their own genealogical research. It is for them to choose between the two, but they need to be equipped to do so on an informed basis" (Court 2018 p204) [30].

Other issues for Scudder et al (2019) included:

a) Mistaken information provided to the police by the DTC company (eg: wrong home address).

b) "It is important to note that the presence of biological trace material at a crime scene should never be immediately equated with guilt" (Scudder et al 2019 p204). This is an issue for any forensic trace technique.

c) "Family members residing in other countries may be drawn into an investigation... These family members might never have interacted with the online genealogy or genetic platform, with their name simply added to a family tree by a relative. Of course, if the individual does live abroad with no connection to the country in which the crime occurred, they should be quickly eliminated from enquiries" (Scudder et al 2019 p204). But could such a record have unknown consequences for those family members (eg: refused a visa)?

Scudder et al (2019) considered the frameworks for regulating the use of publicly available genetic databases by police authorities. The use could be limited to certain offence types, and how distant a familial relationship used. Transparency, reporting, and oversight are also important, along with training for law enforcement staff.

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[30] "There remain significant privacy and ethical challenges to any increased scope of criminal DNA database, including risks of unintended exposure of health-predictive information. It could prove or disprove parentage or be used to establish or attempt to disprove BGA... Another potential privacy concern would be a temptation towards deliberate analysis of such a genetic dataset to, for example, identify potential offenders a priori by their predicted BGA, or to search for common genetic markers which may be linked to a predisposition to criminality" (Scudder et al 2019 p199).

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7. AN INTEREST IN VIOLENT CRIME AND CRIMINALS

7.1. WOMEN'S INTEREST

Rachel Monroe (2019) confessed: "I am not alone in my appetite for dark stories. The vast majority of violent crimes are committed by men. Most murder victims are also male. Homicide detectives and criminal investigators: predominately male. Attorneys in criminal cases are also mostly men. Put simply, the world of violent crime is masculine, at least statistically. But the consumers of crime stories are decidedly female. Women make up the majority of the readers of true-crime books and the listeners to true-crime podcasts" (p10).

The fascination with the "dark side" can be seen in the Internet adoration for the 1999 Columbine killers (Klebold and Harris). The "fandom", primarily of young women, not only praised them but "swooned over them and pledged their love" (Monroe 2019) (appendix 7A) [31]. Monroe (2019) stated: "People often make the mistake of thinking a crush is about the crush object. Rather, a crush is a way to take up space, and make something about yourself known to the world. And it seemed that being a Columbiner was, more than anything else, about having enormous emotions. Columbiners felt their crushes hugely; many also blogged about their depression and anxiety in the same grandiose terms. Experiencing bullying or social rejection made them want to die, or to kill; to was difficult to tell the difference sometimes. They wallowed in their empathy for Klebold, staying up late weeping into their pillows about how sad he had been, how much they wanted to save him - or was it about how they hoped someone would save them?" (p10) [32].

Monroe (2019) this behaviour (hybristophilia) as "the most reductive and depressing tropes of heterosexuality", and a mirror to contemporary culture. In the first case, "in a world where masculinity meant power and power meant violence, some women would always

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[31] In reference to murderers she had interviewed, Monroe (2019) quoted Simone Weil (1952/1997): "Imaginary evil is romantic and varied; real evil is gloomy, monotonous, barren, boring".

[32] Hybristophiliacs is the term for people who are sexually attracted to violent criminals (Money 1986) (appendix 7B).

opt to align themselves with that violence, and exert their won perverse power through love" (Monroe 2019 p11).

Secondly, Monroe (2019) observed: "Periodically, the culture at large will fixate on a certain crime or grant a murderer celebrity status. These collective obsessions are often dismissed as exploitative, sensationalistic and distasteful. But the murder stories we tell, and the ways that we tell them, have a political and social impact and are worth taking seriously. Lessons are embedded within their gory details" (p10).

In terms of "cultural fascination", one of the best examples has to be "Jack the Ripper" who has enduring interest 140 years later [33]. Peyro (2018) described the "relentless detectives" continuing to find the "true name" of the killer [34]. There were a number of suspects at the time, but "Ripperology" (the study of the Ripper crimes) has expanded the list subsequently with varying degrees of historical accuracy (eg: a conspiracy by the royal family) (Peyro 2018).

7.2. APPENDIX 7A - WOMEN WHO LOVE PRISONERS

Slavikova and Panza (2014) outlined the situation: "Oftentimes media sources reveal that notorious criminals who are serving life sentences in prison receive frequent communications from free women, and at times, these women become romantically involved with the incarcerated men. There have even been cases where women have married incarcerated men despite knowing these men will never be free again. This phenomenon leads to the question of why a woman would consciously choose such a man for a romantic partner" (p885). The everyday response to this question portrays such women as disordered in some way.

But what about the evidence? The problem is that there is little research on the motivation of these women (Slavikova and Panza 2014).

In terms of the research that exists, there is diversity in the characteristics of women in relationships with incarcerated men. However, among the women, "it was fairly common to come from families of origin where criminal behaviour was frequent... It was also common to come from difficult or chaotic upbringings and substantial portions of some of the samples reported a history of childhood abuse, either physical or sexual... Not all studies reported on the mental or physical health of the samples, but in those that did,

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[33] The first victim was found on 31st August 1888 in Whitechapel, London, and murders stopped in November of that year after five victims (Peyro 2018).

[34] The murder of "lower-class women" was not unknown in that area at that time, and other killers were at work (collectively called the "Whitechapel Murders") (Peyro 2018).

there were no notable patterns or trends in terms of mental or personality disorders present" (Slavikova and Panza 2014 p886).

Gelt-Price (2001 quoted in Slavikova and Panza 2014), for example, interviewed twenty-six women in committed romantic relationships with "lifers" or men on "death row". Half of the women reported their upbringing in a family that was tense, angry or chaotic, over three-quarters had a controlling/domineering father and a mother who was submissive, and their own prior marriages showed similar partners (Slavikova and Panza 2014).

This sample was small, and so Slavikova and Panza (2014) looked for a larger number of women with an Internet survey. Recruitment involved advertisements on online forums/chatrooms (table 7.1) for friends and families of incarcerated individuals [35]. The key eligibility criterion was that the relationship had started after the man became incarcerated.

- Observing Internet chatrooms/forums is a new research area in recent years, and Hudson and Bruckman (2004) highlighted the ethical concerns with such research. For example, is it necessary to obtain informed consent beforehand and to announce oneself as a researcher on the forum, or is covert observation acceptable? The answer to questions like this depends upon how the chatroom is viewed (eg: as a public square or as a private meeting room) (Gray 2014).

Table 7.1 - Research using Internet forums and chatrooms.

The online questionnaire asked about demographics, family background, physical and mental health history, and adult attachment style, along with a formal personality test (the Jesness Inventory-Revised; JI-R; Jesness 2003) [36].
Usable data were available for 89 respondents.

a) Demographics - Age ranged from 19 to 62 years old; mostly White and resident in the USA; a range of education levels, employment, and income.

b) Background characteristics - Sixteen women reported having a diagnosis of a mental disorder (depression most commonly), and twenty having received some form of therapy or treatment in the past. Just under half the women had been crime victims previously. A small number had a criminal record themselves (nine respondents), but thirty reported at least one relative

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[35] Women who did not visit such sites and/or did not use a computer would be missed.
[36] This has 160 items covering eleven sub-scales like immaturity, and social maladjustment.

who had been incarcerated.

c) Relationship with inmate - Contact was made by a "Pen Pal" programme (47%), introduction from someone else (46%), or after seeing a documentary about the offender (5%). One-third of the inmates had committed murder, while five of them were on "death row", and twelve of the total were "life-no parole" prisoners.

d) Adult attachment style - Two-thirds of the women rated themselves as securely attached, one-fifth as avoidant, and the remainder as anxious. Only 54 of the respondents completed this section of the questionnaire. The measure of attachment was a "simplistic self-report measure" where participants chose one of three types from a brief description of each (Slavikova and Panza 2014).

e) Personality - Compared to population norms, the women were different on immaturity, social anxiety, social maladjustment, alienation, and withdrawal-depression, for example (figure 7.1).
In terms of personality sub-types, the most common were "Manipulator/Pragmatist" [37], "Neurotic, Anxious/Introspective" [38], and "Immature Conformist/Conformist".

Only fifty-one women completed the JI-R [39]. Slavikova and Panza (2014) explained: "Because of the copyrighted nature of the questions, the JI-R required redirection to a separate website... Therefore, there was a high degree of attrition when it came to these more analytical questions. Possibly, the women tired of answering questions, or perhaps, they balked when feeling they were being analysed in a way that might reveal something beyond what they intended to share. It seems the later

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[37] "This sub-type is characterised by those who spend a great deal of energy trying to maintain a sense of power and control over those with whom they have contact and who tend to use manipulation and deception in their interactions, even when it is to their own disadvantage. Those classified as this type may be seen as adventuresome, risk-taking, emotional, and lenient or accepting of others" (Slavikova and Panza 2014 pp896-897).

[38] This sub-type is characterised by a negative self-image and a viewing of the self as "bad". "They experience anxiety over perceived inadequacies, but externally maintain a façade of self-sufficiency. They often seek out others who will be accepting and understanding and they may be seen by others as thoughtful, sensitive and trusting. A history of family and interpersonal conflicts are common among individuals classified in this sub-type. Interestingly, this fits rather well with the descriptive information provided by respondents in that a high degree of victimisation in the form of abuse as a child was seen in the sample. Also, it could be that women of this subtype may be drawn to this type of relationship because of their need to be with someone who will be highly accepting of them, which is likely to be the case with an inmate who is limited in his options for mate selection" (Slavikova and Panza 2014 p897).

[39] The JI-R was "originally designed for, and most often used with, delinquent adolescents. While it has been validated for use with non-delinquent adults (Jesness 2003), there are always questions about the validity of an instrument and any conclusions made when used with a new population" (Slavikova and Panza 2014 p900).

Legend: Sample (blue), General population (red)
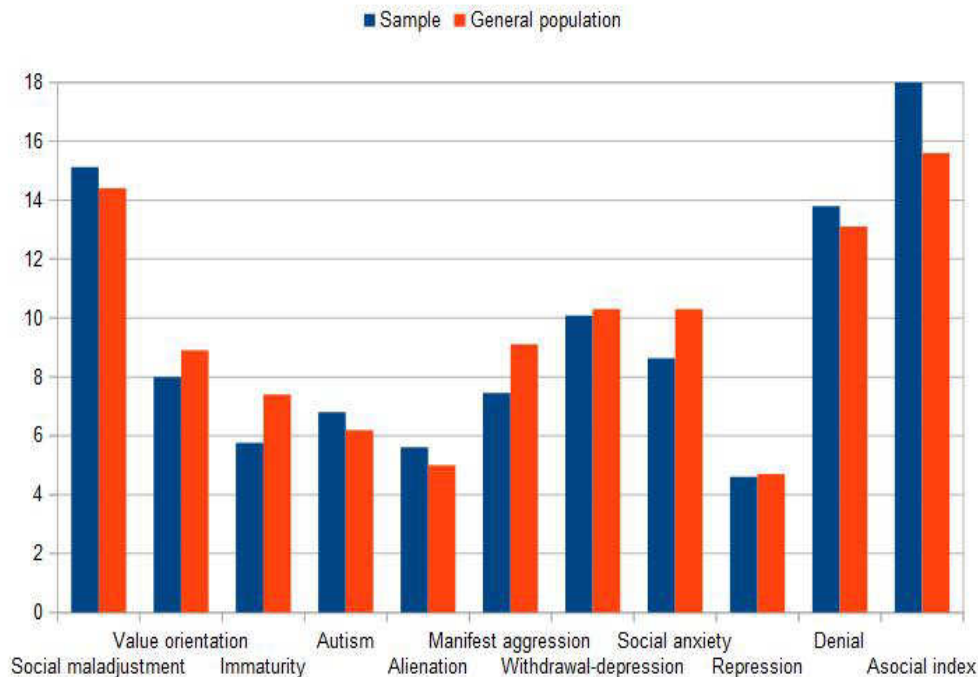
(Data from table 5 p894 Slavikova and Panza 2014)

Figure 7.1 - Mean scores on sub-scales of JI-R compared to population norms (for women aged 18-35 years old).

explanation may be more fitting since the attrition came prior to the completion of the attachment questions, which were very brief and were asked within the survey itself and prior to redirection to the JI-R website. If this is the case, questions remain as to what the results may have looked like had the full sample completed these formal measures" (p896).

Theoretical explanations for romantic relationships with inmates include (Slavikova and Panza 2014):

i) Hybristophilia (Money 1986) - A paraphilia where the women were sexually aroused by men who had committed violent crimes.
Slavikova and Panza (2014) stated: "No support for Money's theory was revealed through the present study as the basis of this theory rests on a high degree of pathology as well as a focus on deviant sexual attraction" (p898).

ii) Isenberg (1991) made a number of suggestions from her studies:

a) The women seek partners who need care-taking and

will be dependent on them.

b) Seeking out men who resemble their fathers.

c) The desire to suffer and such a relationship will create hardships.

d) Attraction to the notoriety of the offender.

Slavikova and Panza (2014) felt that (a) was possibly supported by their data, but the others were neither supported or contradicted.

iii) Willcox-Bailey (1999) reported that "some women may seek partners whose personality characteristics or life circumstances leave them in a place where they are easily manipulated through the use of rewards and punishments and that these women use manipulation of their partners as a means of satisfying their own internal desires related to achieving some sort of control over others" (Slavikova and Panza 2014 p899). This is supported by the most common personality sub-type of "Manipulator/Pragmatist" (fifteen women).

iv) A family home with a history of incarcerated males means that a relationship with an inmate is not unusual (Seka 2000 quoted in Slavikova and Panza 2014). Slavikova and Panza's (2014) data supported this possibility as 45% of the sample grew up with an incarcerated family member-situation.

Slavikova and Panza (2014) ended: "The heterogeneous nature of the sample makes it highly unlikely that one, or even two, explanations will adequately explain the motivations of these women as a group. In fact, it is highly likely that this approach to mate selection is one that is complex, based in part on a woman's experiences in past relationships and perhaps also her family of origin, as well as her present level of functioning and her approach to dealing with the complexities involved in having an intimate connection with someone. As such, it appears that, like in traditional romantic relationships, the choice to become romantically involved with an incarcerated man is not one that is easily explained, but one that certainly warrants further study" (p901).

7.3. APPENDIX 7B - HYBRISTOPHILIA

Two types of hybristophilia have been distinguished. The passive version describes the "murder groupies"

(Sarteschi 2016) [40], who are "usually delusional, believing that they can change the object of their affection" (Pettigrew 2019 p420).

Aggressive hybristophilia is the rarer form and involves individuals who "help their partners perpetuate the crimes, unable to understand that they are being manipulated" (Pettigrew 2019 p420).

Griffiths (2013) described the aggressive hybristophiliac as individuals who "help out their lovers with their criminal agenda by luring victims, hiding bodies, covering crimes, or even committing crimes. They are attracted to their lover's because of their violent actions and want to receive love, yet are unable to understand that their lover's are psychopaths who are manipulating them" (quoted in Pettigrew 2019).

The traditional picture is a male criminal and a female hybristophiliac. Pettigrew (2019) provided a case study of the opposite.

Joanne Dennehy was convicted in February 2014 in London of three murders (among other crimes) (named the "Peterborough Ditch Murders" in the media). Three men were also convicted on related charges (eg: disposal of a body) as her accomplices. For example, one of them ("of previously good character" noted the trial judge) sheltered Dennehy as she avoided the police, and it "served him no purpose other than securing the approval and gratitude of the killer. However, he became 'besotted' with Dennehy, an infatuation that was not in spite of what she had done but because of it. Her character, of a wanted and dangerous woman, enthralled him she, in turn, encouraged the attention, to serve her own ends, to keep her and her primary accomplice safe from arrest" (Pettigrew 2019 p423).

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8. MDMA

8.1. INTRODUCTION

The substance 3,4-methylenedioxymethamphetamine (MDMA or "ecstasy", more commonly [41]) is a popular recreational drug which is rapidly absorbed into the blood after oral administration (ie: detectable within thirty minutes in a blood sample, and the psychoactive effects last for around 2-4 hours) (Dumont and Verkes 2006).

MDMA triggers the release of the neurotransmitter serotonin [42]. "The characteristic psychological effects of MDMA (augmented social interaction, friendliness and empathy towards others) are thought to be caused by the enhanced serotonin neurotransmission" (Dumont and Verkes 2006 p176).

The first international MDMA discussion meeting was held in December 1998, and it summarised the views of the day (Parrott and Marsden 2006). For example, Parrott (2000) stated: "Three aspects of cognitive performance are often affected: reduced memory for new information, impaired higher executive processing, and heightened impulsivity. Performance on other more basic cognitive functions is generally unimpaired" (quoted in Parrott and Marsden 2006). Other abnormalities in neuroendocrine function and sleep architecture were noted, along with the risk of depression, and psychotic disorders. The toxicity of MDMA in animal studies was confirmed, along

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[41] Also called "Molly" (a pure form of MDMA) in recent years on the street (Dolan and Johnson 2020).
[42] The first studies on MDMA and serotonin in animals were published in the mid-1980s (Thomasius et al 2006).

with the difficulties of generalising these findings to humans [43] (Parrott and Marsden 2006).

Parrott and Marsden (2006), summarising ideas from the second international MDMA discussion meeting in December 2004, confirmed the above conclusions. Polydrug use, however, was seen as more important (eg: ecstasy and cannabis co-usage) [44].

Four main areas of interest emerged from the first two international MDMA discussion meetings:

i) The changes in the brain after MDMA use.

ii) The functional effects (eg: memory problems).

iii) Psychiatric problems.

iv) Animal studies, methodology, and applicability to humans.

8.2. BRAIN CHANGES

Daumann et al (2006) reported measures of electrical activity of the brain of eighteen ecstasy users over eighteen months. Auditory evoked potentials (AEPs) were measured for a passive listening task, and these are considered an indicator of serotonin transmission in the brain. The study was unable to show changes in AEPs over the study period, which was contrary to previous studies that had found electrophysiological abnormalities.

The study was hampered by the small sample, drop-out [45], technical problems with the electroencephalography (EEG) equipment, and differences in aspects of ecstasy use. Drug history was self-reported, and all participants were polydrug users.

The participants were recruited from the dance scene in Germany by students, and via the Internet.

Neuroimaging studies of humans has been a large step forward. Because of ethical issues, most studies use volunteers some time after consumption of the drug.

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[43] Colado et al (2001), for example, found that MDMA produced serotonin changes in rats, but dopamine changes in mice.

[44] Gouzoulis-Mayfrank and Daumann (2006) commented on the problem of polydrug use, particularly when trying to compare MDMA users with non-users: "Theoretically, the parallel use of stimulants (amphetamines and cocaine) which are also neurotoxic may act synergistically and enhance the long-term adverse effects of MDMA, while the interactions between MDMA and cannabis use may be more complex" (p189).

[45] Sixty participants began the study, but, by the follow-up, fifteen could not be found, four lost interest in the study, two had developed psychiatric problems, and one was in prison for drug dealing. EEG data on twenty individuals was rejected for technical reasons.

The major finding from early studies using different neuroimaging techniques was a reduction in serotonin transporter (SERT) densities in the cortex in heavy ecstasy users (Reneman et al 2006). "It should be kept in mind, that it is an assumption that a decrease in SERT density directly reflects axonal loss" (Reneman et al 2006 p171).

The major development in recent years has been the increased use of neuroimaging.

Roberts et al (2016a) reviewed such studies on SERT, and found a reduction in eleven of fourteen brain regions investigated.

Muller et al (2019) expanded on this study. Sixteen studies published up to mid-2018 were included in this review. The different measures of lifetime use of MDMA (eg: total number of ingested tablets; total lifetime use in mg; episodes of ecstasy use) were standardised to "episodes of MDMA use".

The studies were divided into three groupings:

a) Using proton magnetic resonance spectroscopy (1H-MRS) - In the five studies using this method, there was no difference between MDMA users and controls in neurochemical changes investigated (eg: N-acetylaspartate; NAA).

b) Cerebral blood flow patterns - No significant differences between users and controls in this measure (using magnetic resonance imaging (MRI) or single photon emission computed tomography (SPECT)).

c) SERT density - Studies using positron emission tomography (PET) found significant reductions in eight of thirteen investigated brain region among users.

"Decreases in SERT density might indeed reflect loss of serotonergic neurons caused by MDMA and this measure has been validated in animals treated with MDMA... However, other reasons are also conceivable, such as MDMA-induced down-regulation of SERT in response to serotonergic stimulation" (Muller et al 2019 p18).

There was some evidence of time of abstinence of MDMA and reversibility of SERT density decline, but the "exclusion of one study had a relative large impact on the result of the meta-regression, so this finding comes with some uncertainty" (Muller et al 2019 p18).

The studies showed heterogeneity due to methodological issues, including:

i) Recruitment of users and controls from different populations (eg: "rave scene" vs general population) rather than the same population.

ii) Controlling for other drug use.

iii) Measure of exposure to MDMA.

iv) The representativeness of heavy users of all users of MDMA. "It has been recently estimated that MDMA users in neuroimaging studies consume approximately seven times more MDMA per year than the average user and that these subjects correspond to the top 5-10% of the Global Drug Survey sample... Therefore, neuroimaging studies might overestimate effects" (Muller et al 2019 p18). More studies with low to moderate users and ex-users recommended by the authors.

v) Confounders like pre-existing psychological and biological differences, quality of ecstasy tablets, and lifestyle factors.

In studies where ecstasy users showed no differences in task performance to controls, neuroimaging studies have shown that they may be "working" harder to maintain their performance (eg: increased blood flow to the prefrontal cortex) (Roberts et al 2016b).

8.3. FUNCTIONAL EFFECTS

Lamers et al (2006) controlled for cannabis (tetrahydrocannabinol; THC) use in their study on the cognitive effects of MDMA. Adults were recruited via local newspaper advertisements in urban Iowa, USA, and based on their self-reported drug history were divided into three groups - ecstasy and cannabis use (MDMA/THC group) (n = 11), cannabis use (THC group) (n = 15), and non-drug use (control group) (n = 15).
Over two hours of testing, measures were taken of cognitive functions and decision-making, and of mood (eg: anxiety and depression). The tests of cognitive functions included:

i) Memory - eg: Rey Auditory Verbal Learning Test (RAVLT): fifteen words are read out and participants recall them immediately or after a time delay.
Immediate recall was significantly poorer in the two drug groups compared to the controls, but there was no difference in delayed recall. "When frequency of alcohol use was introduced as a covariate, this impairment in delayed recall in THC users became significant..." (Lamers et al 2006 p308).

ii) Executive function - eg: Wisconson Card Sorting Task (WCST): matching cards that contain different shapes and colours using certain principles (eg: squares when colour is not blue).

There was no difference between the three groups
(ie: number of errors made). Generally, however, "users
of MDMA/THC and THC users displayed some specific
deficits in executive function. Since performance did not
differ between these groups of drug users, impairment can
not exclusively attributed to use of MDMA. Drug users in
the current study may exhibit problems with psychomotor
speed, concept shifting and response inhibition in
complex situations while abstract reasoning is not
affected" (Lamers et al 2006 p309).

iii) Decision-making - eg: Gambling Task: cards are
presented from four different decks of cards and the pay-
off from choosing each card varies. For example, cards
from "deck A" offer a small gain in most cases and
occasionally a minor loss, and so always choosing them
would lead to a small overall profit. Cards from "deck
D", on the other hand, are high risk with an occasional
high gain, but mostly losses. Overall, always choosing
these cards would result in a loss.
The THC group performed worse than the controls and
the MDMA/THC group (ie: slower to learn to select good
cards over bad ones).

On the self-rated psychological questionnaires, the
MDMA/THC reported more symptoms of anxiety than the other
two groups. Lamers et al (2006) pointed out: "A similar
finding was observed for feelings of depression when we
controlled for frequency of alcohol and THC use,
suggesting that increased feelings of depression related
to use of MDMA, rather than use of alcohol or THC"
(p308).

Causation could not be established, Lamers et al
(2006) admitted, "because substance abuse often co-exists
with psychopathology and cognitive impairment..., we
cannot exclude whether psychopathology antedated drug use
in some participants, eg: attempted self-medication in
subjects with cognitive distress" (p309).
The sample size was small, and the ecstasy users
were not heavy.

In conclusion, Lamers et al (2006) stated: "we
observed that increments in anxiety and depression may be
specific to MDMA users since none of those were observed
in the group of THC users or non-drug controls.
Cognitive impairments were evident in both the MDMA/THC
group and the THC group. Memory disturbances were similar
in both groups of drug users and impaired in regard to
controls. Some impairments, ie: poor decision making and
mental flexibility, appeared specific to the THC group
alone while impaired motor responses were more prevalent
in MDMA/THC users" (p310).

Dumont and Verkes (2006) reviewed the placebo-controlled experiments with healthy human volunteers up to that point (n = 29 articles). Three groups of tests were used in the studies:

i) "Functional" (eg: memory; attention) - "Functional tests were scarce, preventing any meaningful conclusions to be drawn from their evaluation other than that these tests should be incorporated into future acute-effect studies" (Dumont and Verkes 2006 p176).

ii) "Phenomenological" (eg: subjective experiences) - eg: self-reports of euphoria, extraversion, and social interactions were increased relative to placebo.

iii) Physiological - eg: increased body temperature [46], pupil dilation, and cardiovascular effects in some studies [47].

"Psychopharmacological research into the acute effects of drugs in humans is heavily dependent on the tests that are employed" (Dumont and Verkes 2006 p184). Also samples averaged ten participants, and more males than females (ratio 3:1).

However, it was established that "typical MDMA effects are fully expressed at doses above 1.0 mg/kg, at which level the drug's adverse effects will also manifest themselves" (Dumont and Verkes 2006 p185).

A meta-analysis by Verbaten (2003), for example, found problems with immediate and delayed verbal recall, processing speed, and attention among MDMA users. "The effect sizes for immediate and delayed verbal recall indicated a reduction of nearly 40% in memory performance. There was no association between lifetime consumption of ecstasy and cognitive performance. The effect size for delayed verbal recall was no longer significant after controlling for the lifetime cannabis consumption" (Thomasius et al 2006).

Many human studies involve the short-term effects of the drug, whereas longitudinal studies allow for an understanding of long-term consequences.

Thomasius et al (2006) reported one such study with

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[46] In terms of the comparison of humans and non-humans, humans are better able to deal with increased body temperature/overheating (Easton and Marsden 2006).

[47] The acute physiological effects of MDMA reported in human studies generally include "euphoria, increased physical and emotional energy, heightened sexual awareness, decreased appetite and motivation to perform mental and physical tasks, elevated blood pressure and heart rate, nausea, chills, sweating, tremor, jaw clenching, bruxism [teeth grinding], hyperflexia [twitching], urinary urgency, muscle aches or tension, hot and cold flushes, nystagmus [involuntary eye movements] and insomnia" (Easton and Marsden 2006 p194).

participants in Germany over two years. Initially, they were tested (T1) (Thomasius et al 2003), then one year later (T2), and another year on (T3). Complete data were available for eleven heavy current users, ten ex-users, eleven polydrug users (but not MDMA), and fifteen drug-naive controls.

The ex-ecstasy users continued to show impairments in verbal memory and reports of depression over two years after quitting. Current users had differences in serotonin (based on PET scans) linked to amount of use. The role of MDMA as causing the problems could not be fully established because of lack of pre-study data (Thomasius et al 2006).

Another longitudinal study is the NeXT (Netherlands XYC Toxicity) study, which was set up to investigate ecstasy use and effects among young adults. Between 2002 and 2004 188 ecstasy-naive 18-35 year-olds with a high probability of future use of the drug were recruited through sites like dance events, the Internet, and via snowball sampling. Baseline measures were taken of self-rated depression, impulsivity, and sensation-seeking. The users were matched with controls, based on gender, age, IQ, and cannabis use. Follow-up was made 12-24 months later (de Win et al 2006).

Complete data were available on 154 participants, of which ninety-four self-reported as regular ecstasy users and 64 as occasional (incident users).

Depression, impulsivity, and sensation-seeking at baseline did not predict subsequent ecstasy use, which was contrary to previous studies. de Win et al (2006) stated that "our study group, including the control group, is probably not representative of the general population of young adults, because at baseline we selected subjects with a relatively high risk for first time ecstasy use according to their intention to start using ecstasy in the near future and ecstasy use among their friends. Moreover, subjects were willing to take part in a rather challenging research project including brain scanning, neuropsychological examination, and blood sampling" (p232).

Cannabis use during the previous year, however, did predict future ecstasy use.

In terms of the effect of ecstasy, there was only an increase in sensation-seeking between baseline and follow-up, not depression and impulsivity. Again this was contrary to other studies. de Win et al (2006) explained that this "might be related to the fact that in the present study most incident ecstasy users only experimented with ecstasy use on a single or a few occasions and almost no heavy users were involved. Therefore, it is likely that ecstasy-induced depression and impulsivity only becomes apparent after higher cumulative dosages" (p232).

The study sample had disproportionately more university students than the general population, and because of the demands of the study included more motivated individuals. Though there were not heavy users of the drug in the study, the sample may have been more representative of general population use which was occasional in the Netherlands according to official data of the time (de Win et al 2006).

de Win et al (2006) listed another limitation to their study - "the environmental circumstances under which ecstasy was taken and the simultaneous use of other substances in our study was heterogeneous. As the study mainly involved low-dose and moderate ecstasy users, it was impossible to control for patterns of use, although there are indications that this may play a significant role in potential damage... Frequency and amount of drug use were mainly assessed through self-report questionnaires, although abstinence of drug use before measurements were verified by urine analyses. As in other studies, most of the incident ecstasy users also used cannabis and some of them also used cocaine and amphetamine, although we were able to adequately control for these confounders. It is virtually impossible to include only 'pure' ecstasy users, because most of them are polydrug users" (p233).

8.3.1. Executive Functions

Ecstasy-related cognitive dysfunction is not found in all studies, particularly in relation to executive function (EF). The problem may be how EF is conceptualised (Roberts et al 2016b).

Miyake et al (2000), for example, described three elements to it:

- Switching (attention between cognitive tasks)
- Updating (and monitoring new information)
- Inhibition (of inappropriate responses).

Fisk and Sharp (2004) added the fourth component, "access" to semantic memory (Roberts et al 2016b).

Roberts et al (2016b) reviewed thirty-nine studies on EF in ecstasy and polydrug users. Combination of the data in a meta-analysis suggested "an overall executive performance deficit in ecstasy users relative to controls, albeit a small effect" (p1590).

Looking at the individual components of EF, ecstasy users showed impairment in switching, updating, and access compared to controls, but not in inhibition.

Lifetime dose of ecstasy did not predict the magnitude of the EF impairment. It is possible that "there are other ecstasy-using behaviours that have a

stronger impact on behavioural measures, for example, recency of use, frequency of use and higher nightly dose" (Roberts et al 2016b p1592).

The studies included in the meta-analysis and review had methodological differences including:

a) The collection of information about an individual's drug history (eg: first use of ecstasy; use of other drugs).

b) Sample size.

c) Neuroimaging method used.

d) Controlling for alcohol and other drugs.

e) The use of drug-naive controls or drug-taking ecstasy-naive ones.

f) Measurement of EF - eg: Stroop test for inhibition.

8.3.2. Exceptions

Studies have found that there are a small number of individuals who take ecstasy and are "not impaired, or displayed deficits on just a few measures" (Parrott 2006 p148).
Parrott (2006) considered such individuals under four headings:

i) MDMA usage and drug purity (appendix 8A) - One simple explanation is that studies of individuals taking the drug in naturalistic situations are consuming impure pills (ie: little or even none MDMA) [48]. Parrott (2006) dismissed this explanation based on chemical analysis of sampled tablets.
Light (or occasional) users may not be impaired (eg: on cognitive tasks; Halpern et al 2004 [49]) compared to regular/experienced/heavy users and chronic users (ie: large doses each time).

ii) Interaction with other drugs - Ecstasy-cannabis co-usage is common, and studies comparing the single drugs and combined use have found contradictory results for memory deficits, for instance - due to the cannabis vs the ecstasy vs the combination.

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[48] One survey of the chemistry of tablets reported MDMA as high as 200 mg (Roberts et al 2016b).
[49] This study involved young adults in Salt Lake City, USA, who had taken ecstasy less than fifty times in their lives.

The reasons for the difference in findings include the relative use of the two drugs by the participants involved (eg: heavy cannabis use/light ecstasy use or vice versa), and the interactive effects of both drugs. Parrott (2006) concluded that "cannabis and MDMA both contribute to the adverse neuropsychobiological profiles of ecstasy-cannabis polydrug users. Their relative contributions will depend on how much of each drug has been used, along with many other influences" (p152).

Co-usage with alcohol and tobacco have also been studied extensively.

iii) Interaction between external stressors and internal dispositions - McGuire (2000) commented: "Regular MDMA use can be associated with chronic psychiatric symptoms which persist after the cessation of drug use. However, it is difficult to determine whether MDMA use is directly responsible, triggers symptoms in subjects predisposed to mental illness, or is incidental" (quoted in Parrott 2006).

The diathesis-stress model suggests that individuals have a "vulnerability" (internal disposition - eg: proneness to depression) that an external factor triggers (eg: drug use) leading to the adverse consequences. Alternatively, the drug might not be the external trigger, but it causes other stressors (eg: poor sleep; reduced food intake; susceptibility to infections) that trigger the negative consequences.

iv) The environment of ecstasy consumption - In relation to the diathesis-stress model, "dance club" factors may be the external trigger (eg: high temperature; bright lights; prolonged dancing and exertion; loud music). "With reference to the longer-term consequences, many animal studies have shown that the neurotoxic actions of MDMA are exacerbated by environmental stimulation" (Parrott 2006 p157).

8.3.3. Extremes

Kouimtsidis et al (2006) reported the case study of "Mr.A" who had used ecstasy heavily in his 20s, and was estimated to have had a total intake of more than 40 000 tablets [50]. He was 37 years old when seen by the clinicians.

"After three episodes of 'collapsing' at parties, Mr.A finally stopped his ecstasy use. For a few months, he felt as if he was still under the influence of ecstasy and suffered several episodes of 'tunnel vision'. He

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[50] This was the heaviest lifetime intake reported at that time (Kouimtsidis et al 2006).

eventually developed severe panic attacks, recurrent anxiety, depression, muscle rigidity (particularly at the neck and jaw levels), functional hallucinations, and paranoid ideation. His family and before-drug-use psychiatric history were negative" (Kouimtsidis et al 2006 p86) [51]. He was a heavy polydrug user. A structural MRI brain scan showed no "gross cerebral abnormalities".

"Although much information is self-reported and might have been affected by Mr.A's memory impairment, the history given was confirmed by notes from another service he attended just after having stopped ecstasy use" (Kouimtsidis et al 2006 p86).

"The neurocognitive profile here described was very similar to that shown by current heavy ecstasy users; it has been suggested that the extent of memory decline positively correlates with intensity or frequency of ecstasy consumption. It is also confirmed here that selective impairments of neuropsychological performance associated with regular ecstasy use are not reversed by prolonged abstinence" (Kouimtsidis et al 2006 p86).

8.4. PSYCHIATRIC PROBLEMS

A number of studies have found higher depression scores in ecstasy users compared to controls, but some studies have not. The questionnaire used to measure depression seems to be important (Guillot and Greenway 2006).

Guillot and Greenway (2006) used the Beck Depression Inventory-II (BD-II) (Beck et al 1996), which is a well established self-report of the presence and severity of depressive symptoms. The participants were thirty-two ecstasy-using volunteers recruited via word of mouth and the Internet in Louisiana, USA, and thirty-two ecstasy-naive psychology undergraduates at the university of Lafayette. The groups did not differ significantly on the BDI-II scores.

The number of tablets taken by the users would lead to reduced serotonin (5-HT) in animal studies. Guillot and Greenway (2006) tried to explain the non-significant findings: "If humans are as sensitive to the neurotoxic effects of MDMA, then it is possible that many users in this study caused damage to their serotonin pathways as a result of their ecstasy use. In light of this, one may wonder why ecstasy users failed to display higher depression scores than ecstasy-naive controls. Depression is a complex construct and involves more than serotonin functioning alone. Accordingly, the level of 5-HT neurotoxicity possibly experienced by the ecstasy users

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[51] The "tunnel vision" effect during withdrawal was the first time reported (Kouimtsidis et al 2006).

may not have been sufficient to cause decrements in mood. Another potential explanation is that the negative effects of 5-HT neurotoxicity may have been offset by long-term positive effects of MDMA on mood. Some researchers have indicated that some ecstasy users have reported long-lasting improvements in self-awareness, self-esteem, openness in communication and insight into personal problems... Finally, there may be differences in mood between ecstasy users and non-users, but limitations of verbal self-report data may limit the sensitivity of the BDI-II" (p414). Also the ecstasy tablets may not have included MDMA to any degree (Guillot and Greenway 2006).

Interestingly, one-quarter of the ecstasy users reported being diagnosed with a psychiatric disorder, but mostly before ever having taken ecstasy.

8.4.1. Sub-Acute Effects

The acute effects of ecstasy last 3-6 hours, but "surveys of ecstasy users suggest that they generally experience a 24-48 h period characterised by the persistence of the acute effects and the onset of additional effects including: muscle aches, fatigue, depression, irritability, difficulty in concentrating and headache" (Huxster et al 2006 p281). These sub-acute effects continue in a minority of users for three or more days after a single dose. Low mood symptoms are a particular concern (eg: depression four days later) (Huxster et al 2006).

Many human studies of sub-acute effects have no pre-drug baseline data, and "the measures of the psychological state of ecstasy users several days after taking the drug were compared to the same measures recorded while on the drug. Thus, it is not possible to determine if the purported midweek dip in a variety of subjective measures of well-being and cognition were genuine sub-acute effects of ecstasy or more chronic impairments of mood and cognition that may have been masked by the acute effects of taking the drug" (Huxster et al 2006 p282).

Controls are usually drug-naive individuals, whereas it would be better to have ecstasy users who did not take ecstasy as the controls (Huxster et al 2006).

Bearing these issues in mind, Huxster et al (2006) examined the sub-acute effects of MDMA with thirty-eight volunteers at the University of Sussex (southern England). All participants were regular users who agreed to use ecstasy voluntarily (n = 20) or abstain (n = 18) during the study. Multiple questionnaires were completed the day before the drug-taking (Day 1), and for the successive nine days.

Huxster et al (2006) summed up the findings: "After

controlling for past group differences in psychopathology and frequency of ecstasy use the volunteers who opted to take ecstasy reported modest sub-acute effects of ecstasy on negative mood (depression, irritability, rumination and anxiety) and subjective cognition (memory and concentration) compared to controls. The elevation of self-reported impaired cognition returned to baseline within 48 h after use. However, in contrast, after a relatively marked rise in negative mood 24 h after ecstasy use, negative mood then tended to plateau before gradually returning to baseline 3-4 days after use. Sleep was also disrupted in ecstasy users for 48 h after ecstasy use" (p288). This study suggested that the sub-acute effects were less than previous work, and were "relatively modest and transient" (Huxster et al 2006 p281).

8.4.2. Aggression

It has been "repeatedly demonstrated that MDMA causes the release of serotonin (5-HT), dopamine and norepinephrine. Its main action, however, is the release of 5-HT and the prevention of its reuptake... This efflux of stored 5-HT, combined with the inhibition of tryptophan hydroxylase (TPH) means that levels of brain 5-HT could be depleted for a period of time following acute MDMA administration" (Hoshi et al 2006 p291).

Tryptophan depletion has been linked to increased aggression, and in self-reported club-based studies (Hoshi et al 2006). "However, demand characteristics associated with using self-rating scales may influence the pattern of results. Ecstasy users' preconceptions about the 'mid-week blues', or 'moody Tuesday' phenomena (that are well known among ecstasy users) may affect their responses when presented with scales that make no attempt to disguise what they are tapping" (Hoshi et al 2006 p292).

Hoshi et al (2006) used a more objective measure of aggression - namely, the interpretative bias task. Short ambiguous sentences are presented with the last word missing, and the reaction time to choose from a pair of possible completing words is measured. Only one of the words can meaningfully complete the sentence (eg: "The man pulled out a ..."; knife/running). A quicker reaction time to complete sentences with "aggressive" words than neutral ones is taken as the measure of aggression. Forty-six ecstasy users completed this task four days after drug consumption.

The participants showed a bias towards aggressive content (compared to neutral content and to controls). This bias was stronger with more frequent ecstasy use.

Participants were also asked to self-rate their aggression. In line with previous research, ecstasy users

rated themselves lower than controls soon after taking
the drug, but more aggressive on day 4 (Hoshi et al
2006).

8.4.3. Problematic and Non-Problematic Use

Many ecstasy users will report psychological
problems that they attribute to the drug, but the actual
distinction between "problematic" (PR) and "non-
problematic" (NPR) ecstasy use is subjective. For
example, Fox et al (2001) found little difference in drug
consumption profiles, duration of use, and lifetime
consumption of ecstasy between PR and NPR users. It is
possible that perception of the self as a PR user or not
may be unrelated to ecstasy use.
Soar et al (2006) explored this distinction further
with London volunteers. The categorisation of PR or NPR
was based on the question, "Have you experienced any
problems, which you attribute to your ecstasy use?". Of
the 288 volunteers, sixty-two were classed as NPR ecstasy
users (and other drugs) and fifty-three as PR users (and
other drugs), along with 62 polydrug, but not ecstasy,
users, and the rest were drug-naive controls. Psychiatric
problems were self-reported using the 53-item Brief
Symptom Inventory (Derogatis and Melisaratos 1983).
PR ecstasy users reported significantly higher
depression and anxiety symptoms than the other groups.
"However, despite similar patterns of other polydrug use
between these two ecstasy using groups, problematic
ecstasy users did report higher levels of ecstasy use (a
significantly higher average dose, maximum dose and
lifetime consumption) compared to non-problematic ecstasy
users. What is interesting is that there were no
differences in the duration of ecstasy use between the
two ecstasy user groups, which suggest that problematic
ecstasy use may be a function of intensity of ecstasy use
rather than the duration of use" (Soar et al 2006 p419).
Generally the data supported "the idea that
problematic ecstasy use may be due to pre-morbid
vulnerabilities in individuals (ie: in those individuals
that report problems associated with their ecstasy use).
The data indicated that a greater number of problematic
ecstasy users reported previous psychiatric histories,
and were more likely to have a family history of
psychiatric illness, compared to non-problematic ecstasy
users" (Soar et al 2006 p421). It may be that these
individuals have psychiatric vulnerabilities that are
triggered by the ecstasy use, or that the psychological
problems existed before the ecstasy use but were only
noticed after use began (Soar et al 2006).

The data were self-reported, and the classification
of PR and NPR was "somewhat crude" (Soar et al 2006)

(ie: a single question). This may have, as Soar et al (2006) observed, "missed some important information, as the word 'problem' is of course open to wide interpretation. As highlighted by one of our reviewers, it would be interesting and important in future to obtain more detailed data on the nature of problems: including those related to relationships, career/work, crime/convictions etc. Furthermore, the use of the word 'problem', and of asking users to self-identify themselves as having problems, could be argued to be an approach that may produce some response biases" (p423).

Interestingly, only around one-third of PR users had sought medical or psychiatric help.

8.5. ANIMAL STUDIES AND METHODOLOGY

"There is much evidence from animal studies that the recreational drug MDMA is a selective toxin which damages serotonin nerve terminals and axons. These in vivo studies show that an interaction between MDMA and the serotonin transporter protein (SERT) is the first step in toxicity" (Hayat et al 2006 p257) [52]. MDMA can produce long-term alterations in certain areas of the brain (eg: nucleus accumbens in rats) (Bull et al 2006).

Animal studies have demonstrated MDMA-induced neurotoxicity (ie: damage) "using a variety of experimental techniques at doses that approach or overlap equivalent doses used recreationally by humans" (Reneman et al 2006 p165). For example, a single dose of MDMA at 10 mg/kg produces depletions in serotonin and dopamine lasting around a week (Reneman et al 2006) (appendix 8B) [53] [54].

"Recreational users [55] of ecstasy often claim the adverse effects of MDMA obtained in experimental animals are not relevant to human use. This assumption has mainly been based on the use of much higher doses and different routes of administration in animal studies than recreational human use leading to the suggestion that the animal data may relate more to a 'heavy' user of MDMA" (Easton and Marsden 2006 p194).

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[52] In vivo studies involve live animals, while in vitro studies use tissue culture, say (eg: Hayat et al 2006).

[53] Memory impairments found in rats included in both the acquisition and retention of spatial memory at toxic doses (5-20 mg/kg) and non-toxic ones (eg: 2 mg/kg) (Taghizadeh et al 2020).

[54] In animal studies, "it is not possible to distinguish between MDMA-mediated processes that occur as a direct result of entry of MDMA into serotonin nerve terminals or those effects which are indirect and dependent on activation of other systems" (Hayat et al 2006 p257).

[55] "Recreational user" has been defined as "a person who ingests a standard dose (80-150 mg) of MDMA... occasionally (usually on a weekend, once or twice per week)" (Easton and Marsden 2006 p200).

Saadat et al (2006) made use of a behaviour by mice called "defensive burying". When a harmless object like a marble is placed in their cage, the mice bury it in the bedding. This behaviour can be used as a measure of anxiety-like behaviour. Repeated testing does not habituate the response (Saadat et al 2006).

Mice were placed individually in a cage which contained fourteen glass marbles for thirty minutes, and the number of marbles buried in 10 cm deep wood-chip bedding was recorded.

The number buried was reduced after an injection of MDMA compared to controls, and there was a pattern of less burying with the greater dose of the drug. The difference in burying behaviour was evident after 28 days after the injection. A similar pattern was seen with an anti-depressant paroxetine (that alters serotonin).

There is the suggestion that MDMA reduces anxiety-like behaviour through the altering of serotonin.

In animal studies, the serotonin and dopamine effects of MDMA can be altered by other substances. For example, Goni-Allo et al (2016) gave rats doses of MDMA combined with malonate (mitochondrial inhibitor) (which exacerbated the depletion) or with the anti-depressant fluoxetine (which blocked the MDMA).

A number of aspects of animal studies need to be considered (Easton and Marsden 2006) including:

a) Dosing regimen - eg: rate of administration (eg: daily administration for 24 days in one study with rats).
Rats are sensitive to the mode of administration, "with subcutaneous administration producing a larger effect than oral (the route largely used by recreational users)" (Easton and Marsden 2006 p197).

b) Species - Commonly rats and mice as well as primates, but less guinea pigs.

c) Strain - Different rats strains have different sensitivities to MDMA. For example, the Dark Agouti rat needs less MDMA to produce serotonin damage than Sprague Dawley, hooded Lister and Wistar strains (Easton and Marsden 2006).

d) Sex.

e) Age - In rats, immature ones have little long-term serotonin loss after MDMA compared to mature individuals, and "foetal and neonatal rat brains are not vulnerable to MDMA-induced serotonergic neurotoxicity" (Easton and Marsden 2006 p202).

f) Experimental conditions (eg: light, noise,

temperature) (appendix 8C).

Specific to humans with be factors like previous drug use, family history of drug use, and polydrug use (Easton and Marsden 2006).

Easton and Marsden (2006) raised a number of questions: "Would someone categorised as a heavy user therefore be a person who takes more than a recreational user or a person who takes MDMA over a specific amount in a given time (eg: a person who ingests five standard MDMA doses in a week)? Alternatively, should we examine the effects of a single dose of MDMA in humans, considering that a single dose in the rat and non-human primate can cause long-term impairments or is the damage produced by a high single dose in the rat more representative of heavy users of the drugs?" (p200).

Because of the disagreements between studies, headlines like "Ecstasy not dangerous, say scientist" ("The Guardian" September 2002) have appeared. Then there has been the retraction of studies, like Ricaurte et al (2002), who reported Parkinson's disease-like symptoms in monkeys given MDMA (retracted: Ricaurte et al 2003) (Reneman et al 2006).

Easton and Marsden (2006) ended their article: "Examination of the effects of MDMA in animals enables researchers to overcome the limitations inherent in human studies. However, animal studies present their own limitations making the translation of data from animals to humans difficult particularly when the process being studied involves several complex processes. To an extent, animal studies translate into humans. The acute cardiovascular responses and temperature effects are similar in rats, mice and humans, however relating a rodent's thermoregulation to that in a human is difficult because of physiological variation between species. Acute neurochemical changes and long term serotonergic impairment are well reported but analysing corresponding data in humans is very problematic due to invasive and ethical complications. Neuroimaging suggests that long-term serotonergic impairment occurs in both non-human primates and humans" (pp202-203).

8.6. MDMA-ASSISTED PSYCHOTHERAPY

One major development since 2006 has been the interest in using MDMA in a therapeutic context, specifically with post-traumatic stress disorder (PTSD). MDMA-assisted psychotherapy allows the individual to revisit traumatic events and re-experience them with the appropriate level of emotional engagement (what Feduccia

and Mithoefer (2018) called the "optimal arousal zone") (Bahji et al 2020) [56]. "Although a growing body of clinical research suggests the efficacy of MDMA-assisted psychotherapy in individuals with treatment-refractory PTSD, MDMA has not yet been approved by regulatory agencies..." (Bahji et al 2020 p2).

Bahji et al (2020) reviewed the randomised controlled trials already performed for MDMA-assisted psychotherapy and PTSD. Five relevant studies were found (published between 2004 and 2017), and involving 106 participants in total.
The data were combined in a meta-analysis which showed a response rate of 72% in the MDMA group compared to 19% in the control group.
The researchers noted methodological limitations with the studies including:

- Small sample sizes.

- Variations in MDMA doses, duration of treatment, follow-up, and prior treatment.

- Not double-blinded.

- How treatment-resistance (or refractory) PTSD was defined (eg: after psychotherapy or a single medication).

- Control group (eg: placebo or supportive care).

- In-patient or out-patient samples.

- Definition of "response" (eg: no longer meeting PTSD diagnostic criteria).

Bahji et al (2020) concluded that "our synthesis suggests that MDMA-assisted psychotherapy is a potentially safe, effective, and durable treatment for individuals with treatment-refractory PTSD" (p8).

8.7. APPENDIX 8A - DRUG PURITY

The adulterants in street ecstasy is an issue, and drug-purity checking services are available in some situations. However, such services are not widely utilised (eg: less than one-quarter of ecstasy users

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[56] "MDMA may increase monoaminergic neurotransmission to facilitate an increased emotional tolerance when facing traumatic experiences and memories and promote fear extinction processes" (Bahji et al 2020 p7).

where available) (Dolan and Johnson 2020).

Dolan and Johnson (2020) explored the decisions behind using such services with participants recruited via Amazon Mechanical Turk in 2018-19 (n = 278 US residents). They all completed the Probability Discounting Questionnaire (PDQ) (Madden et al 2009), which measures the perceptions of gains and losses with ten items. For example, participants are offered a sure win (or loss) of $200 or a chance of winning (or losing) $800 at different probabilities (from 10% to 83%). This assessed the risk-taking behaviour of participants. The Ecstasy Severity of Dependence Scale (ESDS) (Bruno et al 2009) was also completed.

Then the experimental task to decide about taking an ecstasy tablet where the likelihood of its impurity was varied (by six levels - 0% to 99%). There were four experimental conditions based on the information given (framing) before the experimental task:

- No Frame (control) condition - No information.

- Drug Effects condition - General information about MDMA.

- Inert Impurities condition - Details of the impurities, like baking soda, found in ecstasy tablets that have no effects.

- Active Impurities condition - Details of the impurities, like bath salts, emphasising their harmful effects.

Controlling for PDQ and ESDS scores, where the chance of impurity of the ecstasy tablet was presented as 0%, there was no difference between the conditions in likelihood of taking it. As the risk of impurity increased, all groups reduced their likelihood of taking the tablet, but the Inert Impurities condition reduced least. Dolan and Johnson (2020) explained: "When impurities were discussed generally (No Frame/Drug Effects) or when harms were explicated (Active Impurities), participants reported reduced use likelihood than when described as inert and harmless [Inert Impurities condition]. Strategies to advocate drug-checking services could most-effectively promote drug-checking by emphasising dangerous effects of pharmacologically-active adulterants in Ecstasy, or simply stressing the high incidence of adulteration, given the reduction in use likelihood without explicitly defining impurities. Conversely, focusing on pharmacologically-inert adulterants may be counter-productive for effective utilisation of drug-checking services" (p5).

8.8. APPENDIX 8B - DOPAMINE

Dopamine has been linked to motivation. Wise et al (1978), for example, established that dopamine-depleted rats no longer found certain rewards rewarding.

Robinson and Berridge (1993) introduced the "incentive sensitisation" theory of dopamine action which emphasised dopamine's role in motivation more than in the obtaining of it. "What dopamine is 'really doing', Berridge says, 'is taking things you encounter, little cues, things you smell and hear, and if they have a motivational significance, [it] can magnify that significance', raising the incentive to pursue them. Placing dopamine directly into the nucleus accumbens of rats, he notes, will make them work two to three times harder to get what they crave, but it will not amplify the pleasurable experience of rewards once they are obtained" (Szalavitz 2017 p51).

Schultz et al's (1997) "reward prediction error" theory of dopamine described how dopamine neurons fire in response to a pleasant reward initially, but then respond to cues associated with that reward more than to the reward itself, unless the reward is greater than expected (Szalavitz 2017).
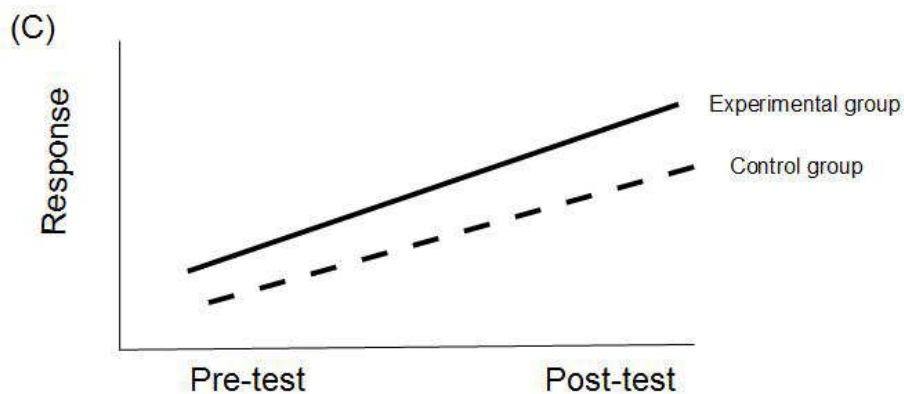
8.9. APPENDIX 8C - EXPERIMENTAL SCENARIOS

(A) = what would be expected if the independent variable (IV) has an affect on the dependent variable (DV).
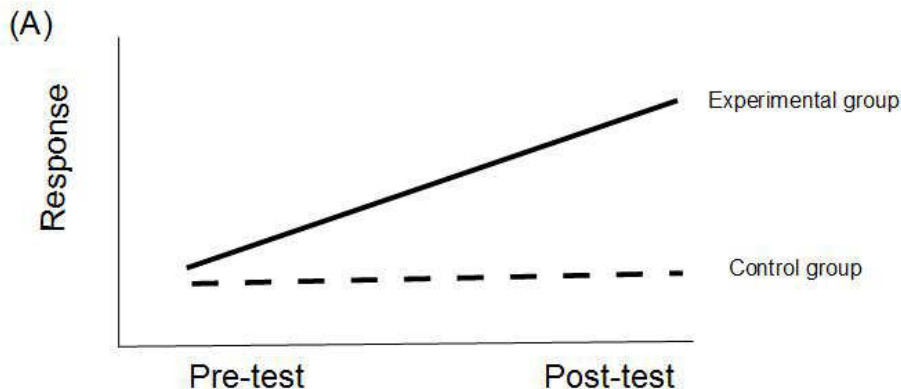
(B) = the control and experimental groups were not similar at baseline.

(B)
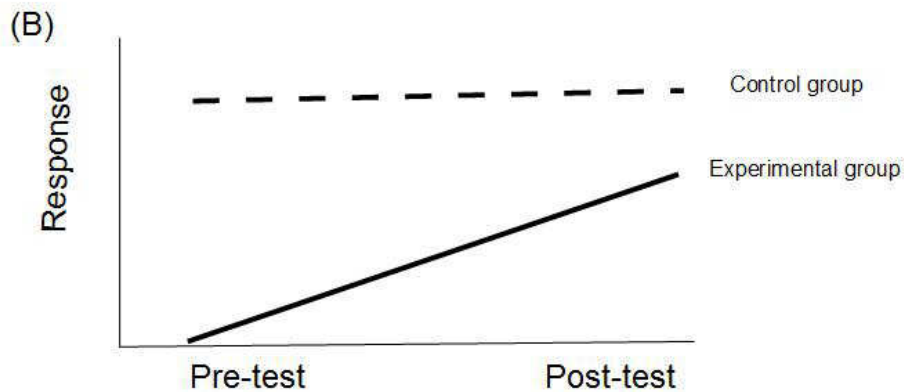
(C) = both groups have improved which suggests that a confounding variable is causing the change rather than the IV.

(C)

(After Gray 2014)

Figure 8.1 - Three experimental scenarios.

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9. INTOLERANCE OF UNCERTAINTY

Carleton et al (2007) made this distinction: "Fear is a protective response to a current, identifiable threat (eg: being attacked by a harmful animal) and is typically accompanied by a fight or flight response having a strong physiological reaction (eg: blood pressure increase, muscle tension, startle response)... In contrast, anxiety is a response to a potential threat that may or may not occur at some point in the future (eg: a harmful animal might attack, somewhere, sometime) and is typically accompanied by an attenuated version of the physiological reaction to fear" (pp105-106). Uncertainty is inherent in anxiety, and individuals vary on their "intolerance of uncertainty" (IU).

IU is defined as "an individual's dispositional incapacity to endure the aversive response triggered by the perceived absence of salient, key, or sufficient information, and sustained by the associated perception of uncertainty" (Carleton 2016 quoted in Carleton et al 2007).

The Intolerance of Uncertainty Scale (IUS) (Freeston et al 1994) was developed with twenty-seven items, and a shortened version with twelve items (IUS-12) (Carleton et al 2007) (table 9.1). The latter has two underlying factors - prospective anxiety and inhibitory anxiety.

Prospective Anxiety (7 items):
* Unforeseen events upset me greatly.
* I should be able to organise everything in advance.
* I can't stand being taken by surprise.

Inhibitory Anxiety (5 items):
* The smallest doubt can stop me from acting.
* Uncertainty keeps me from living a full life.

(Source: table 4 p113 Carleton et al 2007)

Table 9.1 - Items from IUS-12.

Individuals higher in IU try to reduce their anxiety by reassurance seeking behaviours, like checking. Mobile and smartphones allow checking about people (eg: that a late individual to a meeting is caught in traffic rather than in a disaster) and information (eg: about health worries on the Internet). Carleton et al (2019) argued that the "increasingly pervasive and continuous access to mobile phones and the Internet may be having a deleterious effect...; specifically, mobile phones may be facilitating reassurance seeking, acting as safety cues, increasing IU, and therein facilitating increased anxiety on an unprecedented level" (p123).

These researchers sought to establish if IU was

increasing in the 21st century with a review of fifty-two
North American studies using the IUS with university
samples.

The mean scores of the IUS had increased between
1994 and 2014 by 0.51 standard deviation [57]. "In other
words, the average college student in 2014 would have
scored at the 69.5 percentile on a normal distribution
calibrated based on the mean 1994 score as the median"
(Carleton et al 2019 p127). Only North American studies
were included as part of the control of confounding
variables (ie: cultural differences), along with gender.

There were significant positive correlations between
IUS score, and (a) mobile phone penetration, and (b)
Internet usage (based on data from a website that
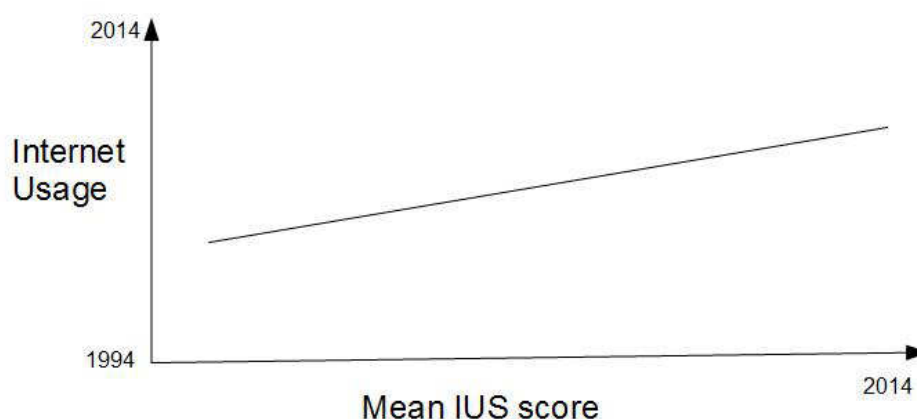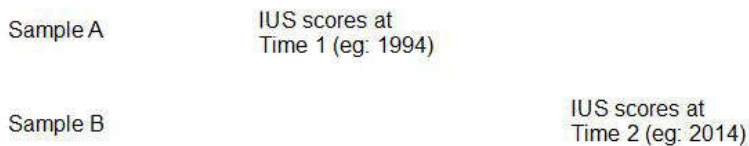collects such information) (figure 9.1).

Figure 9.1 - Representation of the relationship between
mean IUS score and Internet usage (r = +0.54).

Carleton et al (2019) noted the limitation that "the
analyses are based on convenience data that, while
assessed over time, represents a compilation of cross-
sectional samples rather than a true longitudinal sample.
Future researchers should consider using true
longitudinal data sampling for such assessments. Second,
on the basis of these cross-sectional data, there is no
way to actually determine causality and the correlations
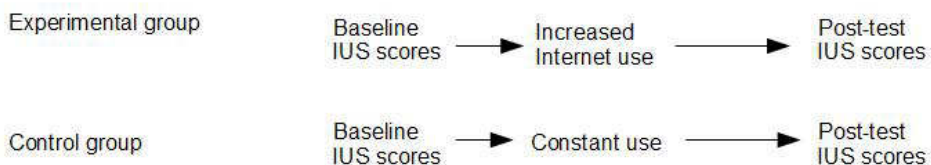identified could be spurious. There may also be any

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[57] "The average standard deviation — an estimate of the average variability of the IUS scoresin a
sample of individuals — was obtained by averaging the within-study standard deviations. The average
standard deviation was used to compute the magnitude of the difference (ie: d)between cohorts of IUS
mean scores, rather than using the standard deviation of the means. Using the average standard
deviation circumvents the ecological fallacy — an erroneous interpretation of data where inferences
about individuals are deduced from inferences for the group in which the individuals are members"
(Carleton et al 2019 p125).

number of confounding factors that would contribute to the rise in IU; for example, the increased connectivity provides personalised access to a 24 h news cycle that can potentiate perceptions of uncertainty and threat... The increasing IU may also be specific to college students and based on increasing tuition costs and economic volatility... Future researchers could use experimental manipulations to test the influence of common place exposures exposure to uncertainty (ie: during course of everyday activities, such as having to wait to check in with a loved one) by randomly assigning participants to increasing or decreasing access to technology" (p129) (figure 8.2). Furthermore, the samples were students from North America, self-reporting using the English version of one particular psychometric questionnaire.

(a) Quasi-longitudinal study

Sample A   IUS scores at
            Time 1 (eg: 1994)

Sample B   IUS scores at
                                  Time 2 (eg: 2014)

(b) Experimental design

Experimental group   Baseline → Increased → Post-test
                      IUS scores   Internet use   IUS scores

Control group   Baseline → Constant use → Post-test
                      IUS scores   IUS scores

(c) Quasi-experimental design

One group   Baseline → Time or → Post-test
             IUS scores   Intervention   IUS scores

(After De Vaus 2014)

Figure 8.2 - Representation of three study designs - (a) used by Carleton et al (2019); (b) recommended experimental design by Carleton et al (2019); (c) a quasi-experimental alternative using the same sample.

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10. GLOBAL DRUGS TRADE AND POORER COUNTRIES

Appendix 10A - Anti-Biotic Pollution
References

The increase in global trade since the 1980s has been accompanied by the global growth of the illicit flow of commodities (eg: drugs, diamonds, currency, humans) (Carrier and Klantschnig 2016).

Focusing on the global drugs trade, it is large scale, and to what degree the estimates vary (eg: 0.1% vs 8% of all international trade) (Carrier and Klantschnig 2016). The size of the trade is important because of the influence on poorer countries in the world and the risk of them becoming "narco-states".

"While highlighting the very real threat these substances and the, often criminal, networks that supply them can have in Africa and elsewhere", Carrier and Klantschnig (2016) argued that "a received wisdom that glibly ascribes a negative effect to all such substances and their trade should be critiqued. There are shades of grey in this regard: the category of 'illicit drugs' contains substances of very different harm potential, often only linked through their classification as 'illegal' in international and national legislation. Indeed, some substances — khat (the stems and leaves of the shrub Catha edulis chewed as a stimulant) and cannabis — in certain contexts — rural Africa, for example — are highly ambiguous in their relation to development, playing a key role in livelihoods and poverty alleviation, a key focus of development projects" (p401).

How to classify the impact of the global drugs trade on poorer countries? Singer (2008a) proposed the following categories: productivity, threat to youth, health problems, corruption, and violence. Carrier and Klantschnig (2016) added environmental degradation.

i) Productivity - A country's productivity can be reduced because of the impact of the drugs trade on workers, whether it be injuries and health problems in processing the substances, arrests, or through the use of the drugs. There is also the use of land to grow drug crops instead of food in places where hunger is already a recurrent concern (Carrier and Klantschnig 2016).

ii) Threat to youth - eg: use of child labour in the production and trade of drugs; drug use by street children. "The cultural cachet and 'cool' that sometimes surround drugs and their trade can also prove enticing for youth, a globalised phenomenon found in developed and

developing countries" (Carrier and Klantschnig 2016 p403).

iii) Health problems - The exacerbation of health problems, like injecting drug use and HIV/AIDS, particularly where healthcare services are lacking.

This is also true for legal drugs (eg: alcohol and tobacco), argued Merrill Singer. For example, "the loss of markets in wealthier countries has meant that tobacco companies have long been focussing on markets in poorer countries, with all the attendant risks of pulmonary disorders, stroke and so forth" (Carrier and Klantschnig 2016 p403).

iv) Corruption - Singer (2008b) stated: "Drug-related corruption... not only involves the bribing of government officials to turn a blind eye to drug-related activities or to actively aid them, it also involves ensnaring law enforcement representatives to provide cover for the movement and street sales of illicit substances" (quoted in Carrier and Klantschnig 2016).

v) Violence - eg: drug-related deaths as rival gangs/organisations/cartels fight over control; the funding of terrorist and rebel groups via the drugs trade and their subsequent violence (Carrier and Klantschnig 2016).

vi) Environmental degradation (appendix 10A) - eg: deforestation to plant the drug crops; use of hazardous chemicals to speed growth or stop it (ie: pesticides) (Carrier and Klantschnig 2016).

After this list of the negative impacts of the drug trade, Carrier and Klantschnig (2016) felt it important to report that "the situation in many developing countries is more ambiguous than this: global demand for drugs has provided livelihoods and economic growth to some regions, often acting to insulate communities — especially rural ones — during economic hard times" (p406). For poor families in rural areas, growing a crop that can be sold is crucial, and drug crops provide this in many places, like Myanmar and opium poppies. One farmer there said: "Opium is our food, our cloths, our medicine, the education of our children" (quoted in Carrier and Klantschnig 2016).

Many drug crops are hardy, like cannabis. "As a crop capable of growing on more marginal land, it has proven especially attractive for land-poor farmers as food and other crops can be focussed on the better quality arable land. It is important to note how the unambiguous legal status of cannabis in African countries — it is technically illegal throughout the continent — is not matched by unambiguous action against its cultivation.

Indeed, its production is tolerated by many state officials because of its economic importance, and in many ways this illegal crop is de facto legal. The state has lacked the capacity to enforce the illegality of the drug, as farmers and traders have easily avoided the state altogether" (Carrier and Klantschnig 2016 p408).

Carrier and Klantschnig (2016) highlighted another aspect: "Crops such as coca, cannabis and khat — and even opium — are also culturally significant in various respects, being valued not just economically but also for their role in ceremonies, healing, sociality and so forth. This cultural insulation makes it yet harder to persuade farmers to desist from growing them" (p409).

Carrier and Klantschnig (2016) ended by placing the impact of the global drugs trade on poorer countries in the context of international trade and development, and problems like poverty, unemployment, violence and war. "In all this, however, there is a sense that little will be achieved until lives and livelihoods in general are improved. While causality is difficult to prove — and drugs trade and consumption continue among the wealthy in society too — poverty exacerbates problems associated with drugs (including legal ones such as alcohol), encouraging people to get involved in their profitable trade, and sometimes become problematic consumers" (Carrier and Klantschnig 2016 p411).

APPENDIX 10A - ANTI-BIOTIC POLLUTION

The legal drugs trade is far from perfect in having a negative impact on poorer countries. For example, in parts of India, environmentally harmful factories are producing cheap pharmaceuticals for the global market [58]. Chemical waste escapes into local water supplies, particularly high concentrations of anti-biotics (ABs) (producing "anti-biotic pollution") (Bomboy and Barneoud 2019).

AB-resistant bacteria are usually attributed to excessive use of ABs, but environmental contamination plays a part. Individuals excrete between 30-90% of the active compound of ABs during use, farm animal use of ABs also involves leakage, and factories produce waste (Bomboy and Barneoud 2019). Larsson et al (2007), for example, found concentrations of a common AB (cipofloxacin) a thousand times higher than needed to kill bacteria in waste-water from drug manufacturing factories in Hyderabad (figure 10.1).

[58] Eg: 90 bulk drug companies in Patancheru. Hyderabad (Kristiansson et al 2011).
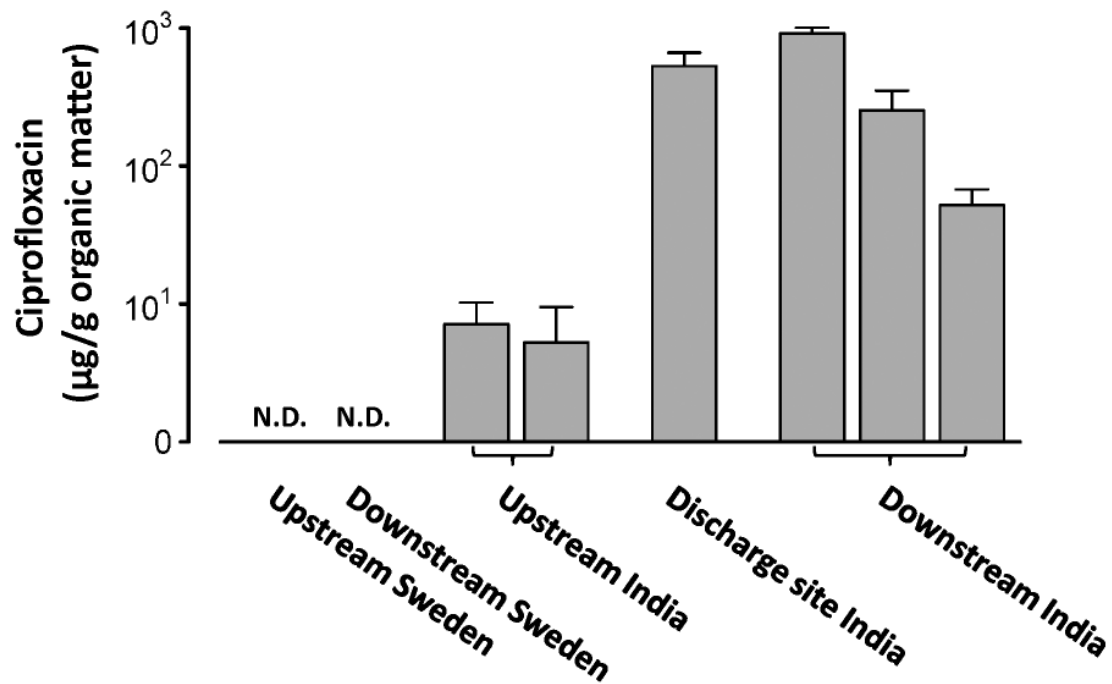
(N.D = not detectable)

(Source: Kristiansson et al 2011 figure 1)

Figure 10.1 - Levels of cipofloxacin in river sediments receiving waste-water in India and Sweden.

Doctors in that vicinity estimated that around one-third of their patients are carrying drug-resistant microbes (Bomboy and Barneoud 2019). "Unfortunately, it isn't easy to demonstrate a direct connection between pollution and individual infections" (Bomboy and Barneoud 2019 p44). Kristiansson et al (2011) confirmed genetic material in waste-water near pharmaceutical factories in India that suggested drug-resistance.
    Flach et al (2015) reported much higher levels of resistant bacteria in lakes in the industrial areas of India as compared to unpolluted lakes in that country and in Sweden (Bomboy and Barneoud 2019).

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