BJPsych The British Journal of Psychiatry (2016)
208, 305–306. doi: 10.1192/bjp.208.3.305

Kaleidoscope

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Friedman's statement[1] that 'most people who are violent are not mentally ill, and most people who are mentally ill are not violent' remains apposite, but recent US gun killings inevitably reawaken the debate. In a moving editorial in the *New England Journal of Medicine*,[2] Malina and colleagues compellingly compare gun lobbyists to a cancer growing in the mutated cells of the psychological and sociological make-up of the United States. What is the contribution of mental health to this problem? Estimates suggest it might have impacted the trajectory of 3–5% of the approximately 33 000 US gun deaths in 2013. Sadly, one imagines that psychiatry had a far bigger role in terms of the subsequent psychological impact on their relatives, witnesses of the violence, and the further 84 000 who survived such assaults that year. Against the backdrop of halting convulsions towards legislative change, the authors reason that mental healthcare cannot be held responsible for what they label the impossible task of identifying anyone who might conceivably start shooting others.

Happiness may be the greatest gift that we possess,[3] but does it make us healthier? The ambitious UK Million Women Study[4] prospectively tested this hypothesis. The biological argument goes that happiness might have a positive impact on neuroendocrine and immune functioning; however, this is heavily confounded by the associations between mental state and lifestyle factors such as diet, exercise, smoking and alcohol consumption. Over 700 000 British women (median age 59) completed 3-year post-recruitment well-being questionnaires, and had their mortality tracked for a decade. What was the answer? Happiness did *not* have any direct effect on mortality – even when adjusted for sociodemographic, lifestyle, mental and physical health factors – which makes us feel sad; although it was pleasing that 39% reported being happy 'most of the time' and a further 44% were 'usually happy'. Reverse causality, however, was found: poor health was strongly associated with *un*happiness. It would appear that one's health drives one's happiness level, not the other way around. The data are a serious test to the erstwhile message that a positive mental state reduces cardiac events and cancer mortality; it also curiously exposes our biases – this wasn't the answer any of us wanted.

The link between neuroendocrine dysfunction – particularly the glucocorticoid cortisol – and depression remains robust; but can this be manipulated for therapeutic benefit? In a randomised placebo-controlled trial, McAllister-Williams *et al*[5] tested whether the antiglucocorticoid agent metyrapone augmented serotonergic antidepressants in a naturalistic cohort with treatment-resistant depression. During the 21-day trial period, they failed to show any benefit over placebo for the novel compound in this representative out-patient population, though the drug was relatively well tolerated. Hypothalamic–pituitary–adrenal (HPA) axis dysfunction is not uncommon in depression, and can be prognostic of future illness relapses and poor response to standard treatment. However, the general utility of HPA monitoring remains uncertain, including whether this could help target more specific treatment subpopulations.

Electroconvulsive therapy (ECT) is one of our best-evidenced backstops in treatment-resistant depression, but is hindered by enduring issues around patient acceptability, and concerns about memory difficulties and cortical thinning. Sartorius *et al*[6] challenge our preconceptions, neuroimaging whole-brain grey matter in 18 individuals before and after ECT. They found prominent longitudinal *increases* in grey matter across temporal lobe regions, highly significant in the hippocampus and amygdala, and there were no grey matter decreases anywhere. Of note, no white matter decreases were found: such changes have previously been argued to be the indirect cause of any grey matter increase. This prospective work seriously undermines what the authors label 'falsifying older ideas' of ECT being 'brain damaging'; hippocampal volume alterations have long been noted in depression, and these findings suggest that ECT could facilitate therapeutic neuroplastic change.

Humans are remarkable for their ability to discriminate between, and generalise from, limited exemplars. For example, after seeing only a couple of horses and dogs, we can find features that discriminate between them (e.g. size), but also find properties that make them members of a superordinate class (e.g. animals having four legs). Further, with limited data, we can create novel examples: a zebra is like a horse with stripes – one could generate an example without ever seeing one. Artificial intelligence researchers spent decades trying to develop symbolic linguistic models based on the discrete mathematical principles of predicate and propositional logic. For example: 'For all instances of X such that X has 4 legs, is 2.5 metres long, X is a HORSE'. This had a seeming resemblance to how internal beliefs might be represented, but didn't tolerate real-world variability and didn't really perform well on either the discrimination or generative task. Contemporary machine learning avoids symbolic linguistic models, utilising algorithms that learn classifications given examples of variable data similar to those to which our perceptual system is well adapted; however, unlike humans, they typically require vast amounts of example data from which to learn and they lack compositional flexibility in generation.

Lake *et al*[7] combine the compositional flexibility of the symbolic approach with a noise-tolerant, probabilistic approach, using Bayesian program learning (BPL). Utilising handwritten symbols from novel alphabets, they show how BPL can learn reliable classifications of symbols from just a few examples, and produce a generative model of the composition of pen strokes of these symbols. Humans (and the BPL algorithm) were shown a single example handwritten character from one of 10 alphabets. They were then shown a further 20 samples selected from the 10 alphabets and asked to decide which alphabet the example was from. The BPL algorithm showed highly skilled one-shot learning, outperforming humans and computational deep-learning approaches. Further, when BPL-*generated* novel exemplars were paired alongside human examples, only 3 of 48 human judges performed above chance level in discriminating which ones were created by the computer: the algorithm passed the visual Turing test.

Could machine learning be applied to help clinical decision-making in mental health? Two recent papers argue that the answer is 'yes' for depressive disorders. Kessler *et al*[8] report on the validation of a WHO World Mental Health machine-learning tool, which was prospectively applied to a national household sample of 1056 respondents with lifetime major depressive disorders. The machine-learning models were applied to the baseline data and generated predictions that were subsequently compared with both observed outcomes a decade or so later, and also conventional logistic regression models applied at that latter time-point. The machine-learning model was consistently more accurate in terms of predicting chronicity and severity, despite having fewer data points than the logistic

models, and demonstrated an inexpensive clear utility (and superiority over conventional methods) in individual first-stage predictive risk stratification.

Cavalcante Passos and colleagues[9] specifically tackle self-harm, looking for a 'signature of suicidality' that machine learning can pick up. A sample of 144 patients with affective disorders had demographic and clinical data – including past self-harm – fed into a machine-learning program to 'train' it; three algorithms were devised and prospectively tested to try to identify new individuals as either suicide attempters or non-attempters. All algorithms were successful, with one demonstrating approximately 72% accuracy in terms of both sensitivity and specificity in identifying previously unseen suicide attempters. Depression, like most mental health conditions, is highly heterogeneous; our ability to disentangle sociodemographic and clinical factors to determine prognosis is less robust than we would like. Other branches of medicine utilise such technology routinely; perhaps it's time for some digital assistance in psychiatry.

Are you WEIRD? In this context, Westernised, Educated, Industrialised, Rich and Democratic; if so, how does it affect the development of your sense of fairness? There are two components of fairness that support societal cooperation: aversion to *being treated* unfairly (disadvantageous inequity aversion), where one rejects receiving less than a peer, communicating that one is not a 'fool' and cannot be exploited; and the aversion to *seeing others* treated unfairly (adverse inequity aversion), avoiding receiving more than a peer, communicating that one is a good cooperator and will not exploit others. Behavioural economic studies have shown that adults prefer the cost of disadvantageous inequity over adverse inequity and neuroscientific studies implicate different neural networks in each behaviour.

Blake *et al*[10] explored how this might vary in children (aged 4–15) across different societies. They were paired (matched for age and gender) and randomly assigned to either disadvantageous inequity or adverse inequity food conditions. In each experiment, one child decided whether to accept or reject an allocation of small treats to themselves and the other child; rejection would mean neither received any food. The authors predicted that disadvantageous inequity rejection behaviours – self-interested rejection of food for both rather than have the peer receive more – occurred almost universally in young children across societies, but adverse inequity rejections – an egalitarian child refusing to receive more than their peer – would emerge later in development, if at all. Across seven societies, rejection of disadvantageous inequity conditions emerged in all, but at different times; earliest in the US and Canada (4–6 years) and latest in Mexico (10 years). The effect increased with age across all societies, except Mexico. Rejection of adverse inequity conditions was uncommon, found in only three societies (US, Canada and Uganda) and developing later in adolescence. They note that children from Uganda had regular contact with WEIRD institutional norms (via frequent contact with WEIRD teachers and researchers). The authors interpret this as suggesting that disadvantageous inequity aversion is a universal behaviour, but rejecting personal advantage is more common in WEIRD environments owing to parental and societal norms where one's future standing is determined by demonstrating autonomy and altruistic behaviour, and enforcing constructs of equality. Rejection of immediate gain might serve longer-term self-interests in such societies.

Finally, the process of submitting research and receiving critical peer review can appear unjust and engender conspiratorial whisperings. As psychiatrists, we are interested in unusual beliefs. From the JFK assassination through alien abductions to 9/11 denial, conspiracy theories are a phenomenon on the rise, no doubt abetted by the internet; four nationally representative surveys have shown that 50% of the American public believe at least one such theory. Professional debate has questioned whether this is an erroneous but honest attempt to – rather simplistically – comprehend a complex and poorly explained world, or due in part to pathological, self-maintaining cognitive–perceptual traits. Using a web-based sample, Swami and colleagues[11] obtained the beliefs in such theories and scores on the Personality Inventory for DSM-5 (PID-5) of 259 individuals. Interestingly, there were no differences by gender, ethnicity or education; however, regression analyses showed that 'unusual beliefs and experiences' and 'suspiciousness' significantly predicted belief in conspiracy theories. This fits with previous work showing facets of schizotypy associated with odd beliefs and magical thinking, and extends this to a broader picture of influencing maladaptive personality traits.

Moving to a real publishing conspiracy, Haug[12] discusses the worrying and increasing trend of hacking the scientific publication process. In 2015 the publisher Springer had to retract 64 articles, and BioMed Central 43, after discovering authors who had created fake email addresses – and on occasion whole identities – for non-existent reviewers, and thereafter glowingly reviewed their own work. It is argued that in a dynamic, global scientific community it is increasingly difficult for journals to know individual reviewers and the veracity of provided information. Many journals are no longer allowing reviewer suggestions, though this passes an onerous task to the editorial staff; perhaps even more shockingly, Haug noted how the publisher Hindawi was recently stung by three *editors*, individuals with significant authority, but often little direct supervision, in choosing reviewers and managing their feedback. In this instance, fraudulent editorial manuscript handling led to 32 papers ultimately being retracted. We're happy to assure that quality control is well-managed in the *BJPsych* family of journals.

1 Friedman RA. Violence and mental illness — how strong is the link? *N Engl J Med* 2006; **355**: 2064–6.

2 Malina D, Morrissey S, Campion EW, Hamel MB, Drazen JM. Rooting out gun violence. *N Engl J Med* 2016; **374**: 175–6.

3 Dodd K. *Happiness*. EMI Music Publishing, 1964.

4 Liu B, Floud S, Pirie K, Green J, Peto R, Beral V. Does happiness itself directly affect mortality? The prospective UK Million Women Study. *Lancet* 10 Dec 2015 (doi: 10.1016/S0140-6736(15)01087-9).

5 McAllister-Williams RH, Anderson IM, Finkelmeyer A, Gallagher P, Grunze HCR, Haddad PM, et al. Antidepressant augmentation with metyrapone for treatment-resistant depression (the ADD study): a double-blind, randomised, placebo-controlled trial. *Lancet Psychiatry* 23 Dec 2015 (doi: 10.1016/S2215-0366(15)00436-8).

6 Sartorius A, Demirakca T, Böhringer A, von Hohenberg CC, Aksay SS, Bumb JM, et al. Electroconvulsive therapy increases temporal gray matter volume and cortical thickness. *Eur Neuropsychopharmacol* 29 Dec 2015 (doi: 10.1016/j.euroneuro.2015.12.036).

7 Lake BM, Salakhutdinov R, Tenenbaum JB. Human-level concept learning through probabilistic program induction. *Science* 2015; **350**: 1332–8.

8 Kessler RC, van Loo HM, Wardenaar KJ, Bossarte RM, Brenner LA, Cai T, et al. Testing a machine-learning algorithm to predict the persistence and severity of major depressive disorder from baseline self-reports. *Mol Psychiatry* 5 Jan 2016 (doi:10.1038/mp.2015.198).

9 Cavalcante Passos I, Mwange B, Cao B, Hamilton JE, Wu M-J, Zhang XY, et al. Identifying a clinical signature of suicidality among patients with mood disorders: a pilot study using a machine learning approach. *J Affect Dis* 2015, **193**: 109–16.

10 Blake PR, McAuliffe K, Corbit J, Callaghan TC, Barry O, Bowie A, et al. The ontogeny of fairness in seven societies. *Nature* 2015; **528**: 258–61.

11 Swami V, Weis L, Lay A, Barron D, Furnahm A. Associations between belief in conspiracy theories and the maladaptive personality traits of the personality inventory for DSM-5. *Psychiatry Res* 21 Dec 2015 (doi: 10.1016/j.psychres.2015.12.027).

12 Haug C. Peer-review fraud – hacking the scientific publication process. *N Engl J Med* 2015; **373**: 2393–5.

https://doi.org/10.1192/bjp.208.3.305 Published online by Cambridge University Press