Autistic-like traits and cybercrime

Mark Brosnan, Katy-Louise Payne, Katie Maras, Ailsa Russell, Richard Mills, Dheeraj Rai
Cybercrimes...

Cybercrime and fraud scale revealed in annual figures

Each company averaged 633 attempts each day

Nearly half of UK manufacturers hit by cyber attacks

There were an estimated 3.6 million cases of fraud and two million computer misuse offences in a year, according to an official survey.
January 2018: 115 Cyberattacks
Winner: Health South-East RHF, a large healthcare management organization in southeast Norway — 2.9 million patients

February 2018: 133 Cyberattacks
Winner: GitHub’s successful defense of a massive DDoS attack

March 2018: 98 Cyberattacks
Winner: MyFitnessPal, Under Armour’s food and nutrition app and website — 150 million users affected

April 2018: 99 Cyberattacks
Winner: Saks Fifth Avenue and Lord & Taylor stores — 5 million+ credit card users

May 2018: 117 Cyberattacks
Winner: 50 small Japanese websites — 200+ million Japanese internet users

June 2018: 96 Cyberattacks
Winner: MyHeritage — 92 million users compromised
Autism and cybercrime headlines...
Autism and (cyber) employment

How SAP is hiring autistic adults for tech jobs

SAP’s Autism at Work program is helping adults on the autism spectrum flourish in IT roles, bringing an untapped talent pool into the workplace and fueling further innovation.

By Sharon Florentine
Senior writer, CIO | DEC 9, 2015 4:27 AM PT

Autistic employees can give companies an edge in innovative thinking

Despite the benefits they can bring to employers, those on the autism spectrum are often thwarted in their job search because of the interview process.

—PayPal Founder Peter Thiel has long been a proponent of hiring staff with autism and Asperger’s to avoid what he describes as “social thinking.” Photograph: Nelson Bellard/Boot Images for New York Times

Global technology group Hewlett-Packard’s newest cybersecurity employee spent the past two years grilling burgers at McDonald’s. Like many on the autism spectrum, the young man in his 20s possessed an impressive range of IT skills to match or even outshine most university graduates.
Moving from university to work

BESSA
A free event for University of Bath students on the autism spectrum
31 January - 1 February 2018

The Bath Employment Spring School for Autism (BESSA) is a free two day event for students on the autism spectrum to support their transition from university to employment.

Day 1: University of Bath: Sessions include preparing for getting a job and understanding the strengths and weaknesses of students on the autism spectrum.

Day 2: J.P. Morgan's Stearnsmouth Corporate Centre
2018 provides experimental experience of a range of business roles and practical sessions on employment.

Find out more and sign up at gp.bath.ac.uk/BESSA

If you have any questions, email BESSA@bath.ac.uk

JPMorgan
What are autistic-like traits?

- The Autism Spectrum Quotient (AQ)
- 50 items
- 5 Subscales:
  - social skills
  - attention switching
  - attention to detail
  - communication
  - imagination
How do autistic-like traits relate to autism?

Comparing ASD and non-ASD with identical levels of autistic traits (Lundqvist & Lindner, 2017):

Same in 45 items

Endorsed more by the ASD group:
“"I would rather go to a library than a party”
“"I am fascinated by numbers”
“"I find it hard to make new friends”

Endorsed more by the non-ASD group:
“"I find making up stories easy”
“"I enjoy social occasions”

Overlapping genetic and biological etiology underlying autism and autistic population traits (Bralten et al., 2017)
Autistic-Like Traits
• High

Autism Spectrum Disorder
• Spectrum

Highest scoring occupation
Scientific & Technical

Lowest scoring occupation
Sales
Autism and Cybercrime is challenging as...

- Autistic employees generally are trustworthy loyal and reliable (Larner et al., 2018)

- Autistic people are generally law abiding with low rates of criminality (Ghaziuddin et al., 1991; Wing, 1981; Murrie et al., 2002, Woodbury-Smith et al., 2006; Howlin, 2007; Blackmore et al., 2018).
What is cybercrime – cyber DEPENDENT crime?

• Cybercrime: The illegal use of computers and the internet or crime committed by means of computers and the internet

• Cyber-dependent crimes are offences that can only be committed by using a computer, computer networks or other form of ICT. These acts include the spread of viruses and other malicious software, hacking and distributed denial of service (DDoS) attacks – ie, the flooding of Internet servers to take down network infrastructure or websites.

• Cyber-enabled crimes are traditional crimes that are increased in their scale or reach by the use of computers, computer networks or other ICT (e.g. fraud).
Ledingham and Mills (2015)

• Interviewed 7 national law enforcement agencies concerning their perceptions of autism and cybercrime:

• Globally, law-enforcement agencies report a growing number of investigations concerning autistic individuals.

• Whilst a presence of ASD was identified there is no empirical link between the prevalence rates of autism and cybercrime and therefore such an association remains speculative.
Autistic-like traits and cybercrime?
Higher AQ traits a risk factor for cybercrime

• 1) Direct link?
  • Opposite to literature for autism

• 2) Indirect link?
  • Higher AQ traits – STEM interest = more relevant experience?
  • Lower Social Support?
  • Compromised explicit social cognition (Theory of Mind)?

• I overslept this morning. When I woke up, there was just enough time to dress and get to the train, so I skipped breakfast.

• By noon, I was on the train and starving, but I had no money with me. Across the aisle, a young child was complaining about her food, saying ‘I can’t eat it’. Apparently, the father didn’t want the food either, because he told the child to just leave it. I leaned across the aisle and said, ‘If your child doesn’t want her food, can you pass it over for me?’

• A: Fairly normal behaviour in that situation
• B: Rather strange behaviour in that situation
• C: Very eccentric behaviour in that situation
• D: Shocking behaviour in that situation
Present study

• 175 participants recruited from school, university, general populations.
• Undertook an online assessment
• Assessing 3 core areas:
  • Demographics
  • Psychological variables
  • Computer-related experience
1) Demographics

• Sex: Male = 115; Female = 60

• Age: 14-74: Mean 24 years (sd=10 years)

• Non Verbal IQ (NVIQ): 0 -12 (full range): Mean = 10 (sd=2)
2) Psychological variables

• Autistic Traits (AQ 6-44): Mean = 22 (sd=7)
  • (e.g. I enjoy social chit-chat)

• Explicit Social Cognition (Dewey 1-42): Mean = 9 (sd=5)
  • (e.g. train food example)

• Perceived Social Support (ISEL 7-36): Mean = 24 (sd = 8)
  • (e.g., I don’t often get invited to do things with others)
3) Computer-related experience

• Basic Computer-Dependent Skills (33-50): Mean = 49 (sd=3)
  • (e.g., I know how to open downloaded files)

• Advanced Computer-Dependent Skills (10-50): Mean = 35 (sd=13)
  • (e.g., I know how to use one of the scripting languages including the BASH shell (e.g., Perl, Python, Ruby)).

• Illegal Computer-Dependent Activities: (0-8): Mean = 1 (sd=2)
  • (e.g. Hacking, DDoSing)
Correlations (controlling for demographics)

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<thead>
<tr>
<th>Basic skills</th>
<th>AQ</th>
<th>Explicit Social Cognition</th>
<th>Perceived Social Support</th>
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## Descriptive statistics of the sample by the absence or presence of any illegal digital activity (n=174, one removed as no age data)

<table>
<thead>
<tr>
<th></th>
<th>No illegal Digital activity (n=102)</th>
<th>One or more illegal digital activity (n=72)</th>
<th>p</th>
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</thead>
<tbody>
<tr>
<td>Age mean (SD)</td>
<td>22.9 (11.1)</td>
<td>26.6 (8.5)</td>
<td>0.020</td>
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<tr>
<td>Male sex (n, %)</td>
<td>72 (70.6%)</td>
<td>42 (58.3%)</td>
<td>0.094</td>
</tr>
<tr>
<td>Total Ravens (mean, SD)</td>
<td>9.9 (2.8)</td>
<td>10.4 (1.8)</td>
<td>0.168</td>
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<tr>
<td>Total AQ Score (mean, SD)</td>
<td>20.6 (8.3)</td>
<td>24.4 (8.9)</td>
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<tr>
<td>Social Know How (mean, SD)</td>
<td>8.4 (4.5)</td>
<td>9.4 (4.8)</td>
<td>0.140</td>
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<tr>
<td>ISEL 12 (mean, SD)</td>
<td>23.5 (7.1)</td>
<td>23.6 (8.3)</td>
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<td>Basic Digital Skills (mean, SD)</td>
<td>48.9 (2.7)</td>
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<td>29.4 (12.6)</td>
<td>43.8 (8.4)</td>
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<tr>
<td>ASD diagnosis (n, %)</td>
<td>9 (8.8%)</td>
<td>1 (1.4%)</td>
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Notes: p values derived from t-tests, except for the two binary variables (sex and ASD diagnosis) where chi square tests were used.
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Potential mediation by Advanced Digital Skills

**INDIRECT EFFECT**
0.135 (0.043 to 0.230)

**DIRECT EFFECT** 0.122 (-0.037 to 0.272)

Potential confounders
Age, Sex, IQ

**TOTAL EFFECT** 0.258 (0.056 to 0.423)

Proportion of total effect mediated by advanced digital skills: 52.5%
In summary

• Higher autistic traits directly relate to cyber-dependent crime and indirectly relate to cyber-dependent crime though enhanced digital skills

• Numbers are small, but autism may represent the exception. Autistic people may be high in autistic traits and LESS likely to commit cyber-dependent crime

• Ideal for cyber security?
29 (17%) participants had been approached to commit a cyber-dependant offence and declined

<table>
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<th>Reason</th>
<th>n</th>
<th>AQ</th>
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<tr>
<td>Morals</td>
<td>9</td>
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<tr>
<td>Too risky (e.g., being caught)</td>
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<td>Aware/afraid of consequences</td>
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<tr>
<td>Just didn’t want to</td>
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<tr>
<td>It’s illegal</td>
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<tr>
<td>Too complicated</td>
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<tr>
<td>Price too low</td>
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<td>44</td>
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AQ cut off scores above 26 are considered high. Reasons from high AQ people...

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7 cyber criminals also interviewed

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<th>Original Sample (n=175)</th>
<th>Cyber criminals (n=7)</th>
<th>Effect Size (D)</th>
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<td>Advanced skills</td>
<td>35.4 (13.08)</td>
<td>46.14 (4.38)</td>
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<td>AQ</td>
<td>22.21 (8.69)</td>
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<td>Explicit Social Cognition</td>
<td>8.98 (5.30)</td>
<td>11.57 (3.36)</td>
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<td>Sex</td>
<td>66% male</td>
<td>100% male</td>
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<td>Age</td>
<td>24.44 (10.26)</td>
<td>18.29 (3.30)</td>
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<td>IQ</td>
<td>10.10 (2.43)</td>
<td>8.71 (1.50)</td>
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7 interviews with cyber criminals
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<td>Consequences</td>
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<td>X</td>
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<td>X</td>
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<td>X</td>
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<td>X</td>
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Lack of understanding

Consequences

“I didn’t expect it to be a massive hassle for everybody. I caused a lot of problems ... A lot of hold ups ... wasting people’s time in general.”

Impact of behaviour

“... or about how bad the punishment could be ...”

Seriousness of actions

“Yes [knew it was illegal] but not to the extent that it was. I thought it was a bit shady but I didn’t think it was that serious, but it was.”

Lack of specific cyber & the law education

“Really there’s no education on the sort of the legislation [the law] you know.... That you’re at risk when you’re on a computer”
“it’s sort of a mind-set you know... if it’s there it can be broken ... it’s sort of ... a challenge ... it’s like ... it’s just something fun you know, being able to break into something like that.

“I remember testing it ... like on my own computers and stuff and like telling my mates in the school playground about how cool it was ... but I think it was just purely curiosity honestly.”
Social

Negative influence peers

“the website I owned ... it was a small community but we shared ideas ... you know ... different methods ... attacks ... types ... techniques ... and we shared with each other..."

Lack of social group

“I also lost contact with some of my social circles. Coz I used to be ... I used to go out with friends you know ... on an everyday occurrence ... but slowly you know ... after college and university ... I stopped for some reason ... and I kinda distanced myself from ... social interaction”

Grandiose

“Yeah, well we all [the group of friends from school] do computing and we’re all sort of...tech savvy... and like.... I was the only one who knew how to boot someone offline”
Experience & career

Long-standing cyber interest

“I mean ... I’ve sort of always been interested in computers and ... sort of ... it’s sort of a mind-set you know ...”

Desire to improve skills & pursue cyber career

“Really I just wanted to sort of better my skills and get good so that I could pursue a professional errr ... You know legal career in it because it was definitely of interest to me.”

Lack of appropriate teaching methods or resources

“its [illegal activity] just sort of a way I test my skills because you know like virtual machines and like deliberately vulnerable servers they’re not as fun as actually deploying it in the real world”

Desire for applied experience

“the experience [hacking; having own website] ... It did really help me ... it was real world experience rather than learning something from university or college ... it’s not something you can learn like that”
“so I knew it was wrong and I knew ... Like I knew there was some law against it but I didn’t know ... errr ... how easy it was for you to get caught I guess ... so I sort of took the risk and did it ...”

“... you know you’re behind a computer screen ... it doesn’t seem real ... it doesn’t seem like someone is going to come in and raid you and take your stuff ... You’re behind a keyboard ... It’s very different to a real crime”

“but they won’t be able to catch everyone because only stupid people (aka me) bought it with paypal whereas if I had bought the program with bitcoin it wouldn’t be traceable with me which a lot of people have done, probably.
Youth & immaturity

“telling my mates in the school playground about how cool it [illegal tool & associated behaviours] was ...”

Adverse life experiences

“I was raised in a pretty erm ... rough neighbourhood [...] high crime rate [...] it was safer for me to stay indoors and do the things that I was doing rather than go outside and get robbed or something.”

Cyber as a coping mechanism

“... whereas [during depressive episodes] I’d go online find playing games and experimenting with hacking was the reason that I’d get up”
“The company kind of annoyed me in the fact that they wouldn’t take responsibility for the vulnerability [offender rang them to tell them about the vulnerability he had found in their system]”

“We sensitised the document [entire customer database] so that no sensitive information was leaked”
Implications for autism

• Autistic people typically have high autistic-like traits (high AQ)
• Autistic people are typically male and typically have issues with social cognition
• These factors are associated with advanced computer skills
• Advanced computer skills are associated with cybercrime
Potential further implications

**Why not?**

1. Morals
2. Too risky e.g., being caught)
3. Aware/afraid of the consequences
4. Just didn’t want to
5. It’s illegal
6. Too complicated
7. Price too low

**Why?**

1. Lack of understanding
2. Entertainment
3. Social
4. Experience & career
5. Anonymity & risk
6. Life events
7. Morals
Autistic-like traits and cybercrime

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