



# Autistic-like traits and [cybercrime](#)

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# Cybercrimes...

## Cybercrime and fraud scale revealed in annual figures

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THINKSTOCK

Cybercrime and fraud were included in the annual statistics for the first time

There were an estimated 3.6 million cases of fraud and two million computer misuse offences in a year, according to an official survey.



## Nearly half of UK manufacturers hit by cyber attacks

Nearly half of UK manufacturers have been hit by a cyber security incident, according to a report by an industry organisation, which calls for greater government focus on the specific security needs of the sector



Warwick Ashford  
Security Editor  
27 Nov 2014 10:45

Some 48% of UK manufacturers admit they have at some time been subject to a cyber security incident, with half of them suffering financial loss or disruption to business as a result, a survey shows.

Each company averaged 633 attempts each day

## UK law introduces life sentence for cybercriminals

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By OLIVIA SOLON

Friday 6 June 2014



Credit: Shutterstock



## 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

FEATURE

## 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 'herd-like thinking'. Photograph: Nelson Barnard/Getty Images for New York Times

**G**lobal 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 the transition from university to employment.

Day 1: University of Bath. Sessions include preparing for getting a job and understanding the strengths and weaknesses associated with autism in the workplace.

Day 2: JP Morgan's Bournemouth Corporate Centre. Will provide real-world experience of a work environment and practical sessions on employment.

Find out more and sign up at [go.bath.ac.uk/BESSA](http://go.bath.ac.uk/BESSA)

If you have any questions, email [BESSA@bath.ac.uk](mailto:BESSA@bath.ac.uk)



J.P.Morgan

# What are autistic-like traits?

- The Autism Spectrum Quotient (AQ)
- 50 items
- 5 Subscales:
  - social skills
  - attention switching
  - attention to detail
  - communication
  - imagination

**NHS**  
National Institute for  
Health Research

## **AQ-10** Autism Spectrum Quotient (AQ)

*A quick referral guide for adults with suspected autism who do not have a learning disability.*

*Please tick one option per question only:*

		Definitely Agree	Slightly Agree	Slightly Disagree	Definitely Disagree
1	I often notice small sounds when others do not				
2	I usually concentrate more on the whole picture, rather than the small details				
3	I find it easy to do more than one thing at once				
4	If there is an interruption, I can switch back to what I was doing very quickly				
5	I find it easy to 'read between the lines' when someone is talking to me				
6	I know how to tell if someone listening to me is getting bored				
7	When I'm reading a story I find it difficult to work out the characters' intentions				
8	I like to collect information about categories of things (e.g. types of car, types of bird, types of train, types of plant etc)				
9	I find it easy to work out what someone is thinking or feeling just by looking at their face				
10	I find it difficult to work out people's intentions				

# How do autistic-like traits relate to autism?

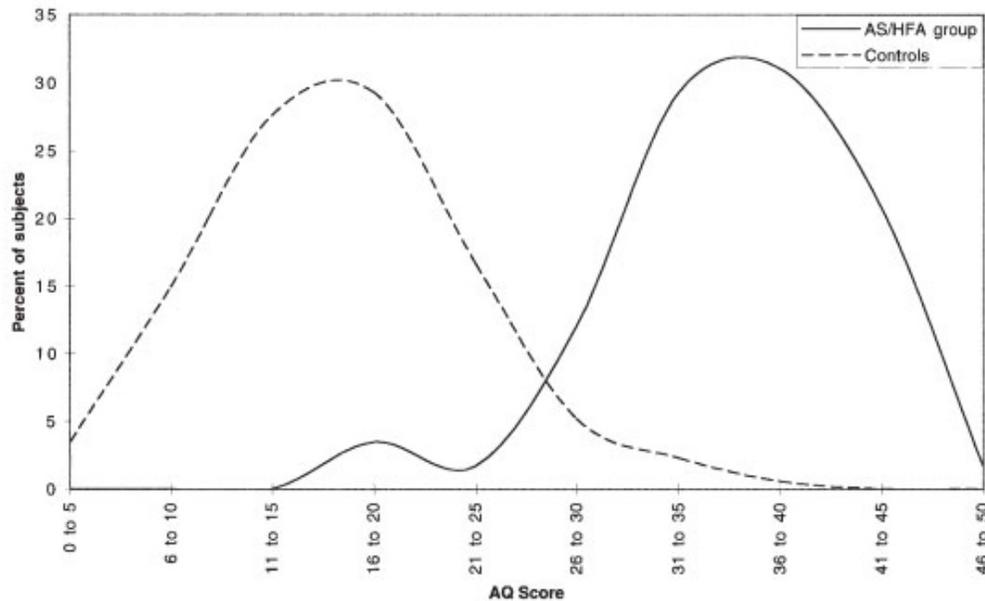


Fig. 1. AQ scores in AS/HFA group and controls (Groups 1 and 2).

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”

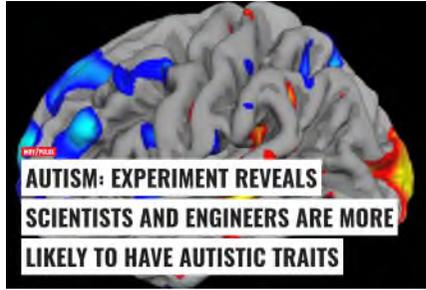
“I find it hard to make new friends”

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)

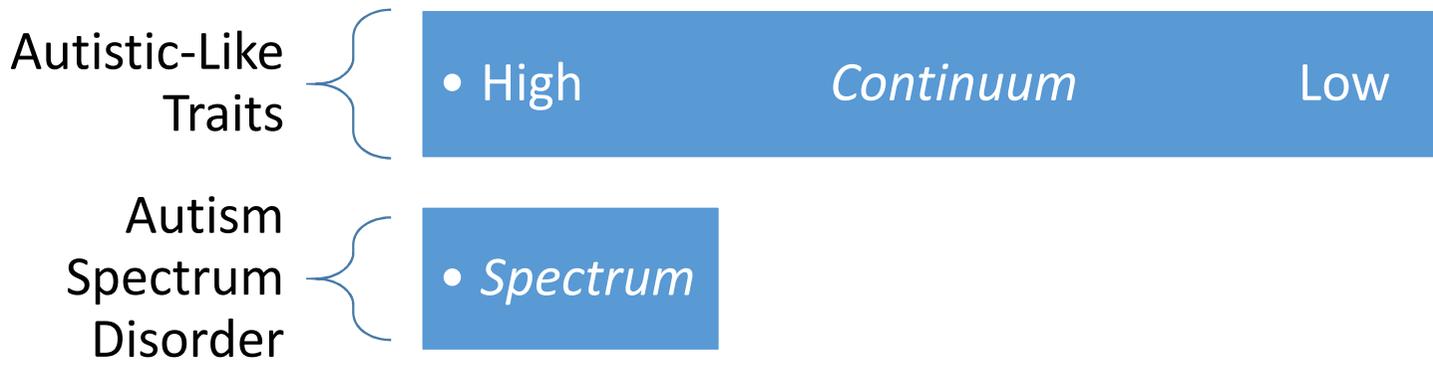
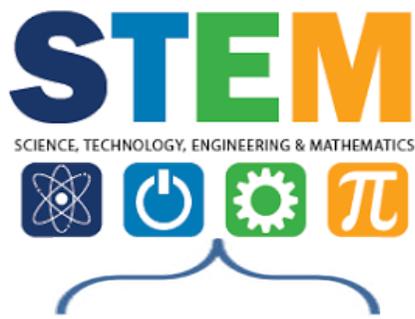


Highest scoring occupation

**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)?

# Vulnerability: Explicit Social Cognition: Understanding the thoughts and feelings of self/ others (Dewey, 1998)

- 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)

	AQ	Explicit Social Cognition	Perceived Social Support
Basic skills	.19 *	.10	.02
Advanced Skills	.23 **	.27***	.01
Illegal activities	.16 *	.07	-.01

**Descriptive statistics of the sample by the absence or presence of any illegal digital activity (n=174, one removed as no age data)**

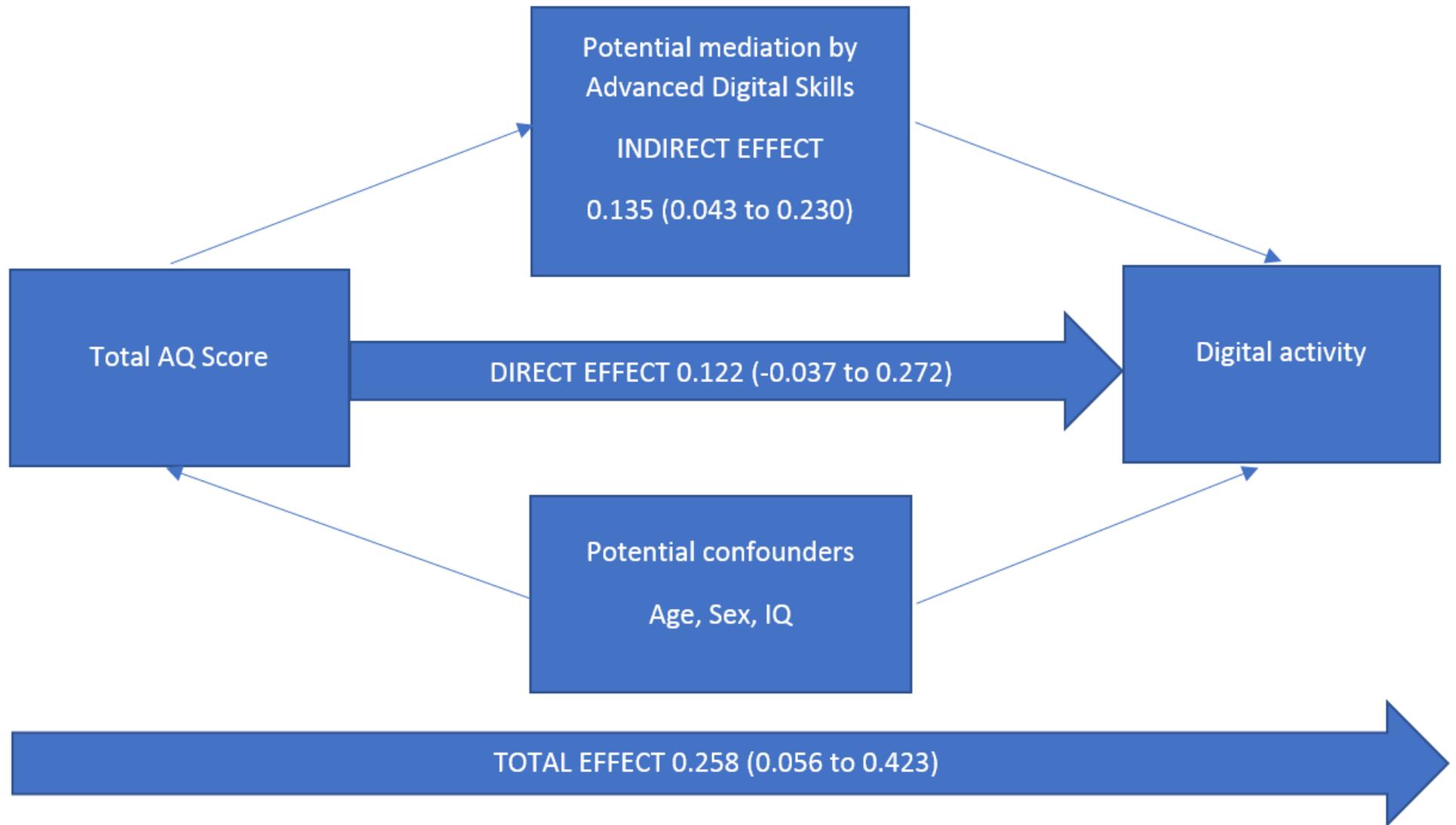
	No illegal Digital activity (n=102)	One or more illegal digital activity (n=72)	p
Age mean (SD)	22.9 (11.1)	26.6 (8.5)	0.020
Male sex (n, %)	72 (70.6%)	42 (58.3%)	0.094
Total Ravens (mean, SD)	9.9 (2.8)	10.4 (1.8)	0.168
Total AQ Score (mean, SD)	20.6 (8.3)	24.4 (8.9)	0.004
Social Know How (mean, SD)	8.4 (4.5)	9.4 (4.8)	0.140
ISEL 12 (mean, SD)	23.5 (7.1)	23.6 (8.3)	0.892
Basic Digital Skills (mean, SD)	48.9 (2.7)	49.6 (2.2)	0.074
Advanced Digital Skills (mean, SD)	29.4 (12.6)	43.8 (8.4)	0.000
ASD diagnosis (n, %)	9 (8.8%)	1 (1.4%)	0.038

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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**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 through 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?

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29 (17%) participants had been approached to commit a cyber-dependant offence and declined

Reason	n	AQ
Morals	9	21
Too risky (e.g., being caught)	9	29
Aware/afraid of consequences	7	20
Just didn't want to	3	23
It's illegal	3	25
Too complicated	2	38
Price too low	1	44

AQ cut off scores above 26 are considered high. Reasons from high AQ people...

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# 7 cyber criminals also interviewed

	Original Sample (n=175)	Cyber criminals (n=7)	Effect Size (D)
Advanced skills	35.4 (13.08)	46.14 (4.38)	0.8
AQ	22.21 (8.69)	18.29 (6.78)	0.3
Explicit Social Cognition	8.98 (5.30)	11.57 (3.36)	0.4
Sex	66% male	100% male	
Age	24.44 (10.26)	18.29 (3.30)	1.0
IQ	10.10 (2.43)	8.71 (1.50)	0.6

# 7 interviews with cyber criminals



Theme	Sub-theme	P1	P2	P3	P4	P5	P6	P7	Sub-theme total
<b>Lack of understanding (n = 7)</b>	Consequences	X	X	X	X	X	X	X	7
	Impact of behaviour	X	X	X		X		X	5
	Seriousness of actions	X		X	X	X		X	4
	Lack of specific cyber & the law education		X	X	X	X			4
<b>Entertainment (n = 7)</b>	Challenge		X	X		X	X	X	5
	Curiosity	X		X	X		X	X	5
<b>Social (n = 6)</b>	Negative influence peers	X	X			X	X		4
	Lack of social group						X	X	2
	Grandiose				X	X	X	X	4
<b>Experience &amp; career (n = 4)</b>	Long-standing cyber interest		X		X			X	3
	Desire to improve skills & pursue cyber career		X				X	X	3
	Lack of appropriate teaching methods or resources		X				X		2
	Desire for applied experience		X				X		2
<b>Anonymity &amp; risk (n = 4)</b>	Minimal perceived risk					X	X	X	3
	Anonymity perception		X			X		X	3
	Importance of detachment		X				X		2
<b>Life events (n = 4)</b>	Youth or immaturity		X		X		X	X	4
	Adverse life experiences						X	X	2
	Cyber as a coping mechanism						X	X	2
<b>Moral (n = 1)</b>	Reasoning			X					1
	Damage limitation			X					1

# Lack of understanding

## Consequences

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

## Impact of behaviour

“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.”

## 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”

# Entertainment

## Challenge

“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.

## Curiosity

“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”

# Anonymity & risk

## Minimal perceived risk

“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 ...”

## Anonymity perception

“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.

## Importance of detachment

“... 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”

# Life events

## 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”

# Moral

## Reasoning

“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]”

## Damage limitation

“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



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