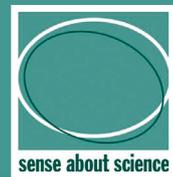


Sense About Lie Detectors



Lie detectors have been around for nearly 100 years. Despite debates over their accuracy and the ethics and legality of their use, the public and professionals remain intrigued by them. Lie detectors are used as entertainment, such as the “*Love Detector*” which claims to uncover how your partner really feels and day time talk shows use them to get to the bottom of domestic dramas. Corporations have used lie detectors to screen potential employees and some insurance firms use them to try to reduce fraudulent claims. Statutory bodies and the state have been interested in lie detector technologies: they are routinely used in the US justice system; in the UK the Department

for Work and Pensions tried to use them to identify benefit cheats over the phone and the Ministry of Justice trialled their use in managing convicted sex offenders.

Lie detectors mainly consist of polygraphs, voice analysis or brain imaging. These technologies are different but three points are relevant to all:

- 1 They are not accurate.
- 2 They do not measure lies but rather something that could be a proxy for lies.
- 3 They all rely on the deterrent effect (that is, fear of being caught lying).

Polygraph

The polygraph is the oldest and best-known lie detector technology. The subject being tested has sensors placed on their body to measure physiological functions including heart rate and blood pressure, breathing rate and depth, and sweating. The idea is that when someone is lying they experience emotional stress and this stress can be detected through changes in bodily functions. By asking the subject attached to the machine a series of questions, the polygraph operator can assess whether some questions or topics create more stress than others.

A polygraph test begins with a preparatory interview, designed to uncover information and also to convince the subject of the accuracy of the polygraph. The most common interview approaches are the **relevant – irrelevant technique** (RIT), the **control question technique** (CQT) and the **guilty knowledge test** (GKT). RIT and CQT rely on the theory that the guilty will be more stressed by questions about the crime or other issue under investigation than by control questions, while innocent people should find the target and control questions equally stressful. In GKT, questions about the crime and multiple choice answers are put to the subject. A guilty subject is expected to have a stress response to the answers which are correct; an innocent person who has no knowledge of the crime would be expected to have the same response to all the alternative answers.

Whether or not a lie detector works depends on whether it can accurately distinguish liars from truth tellers. Reviews of research by the British Psychological Society¹ and the US National Research Council² concluded that the evidence for polygraph’s accuracy is not good. The BPS reported in 2004 for example that polygraphs can correctly identify guilty subjects between 42% and 89% of the time. False alarm rates, that is the rate at which innocent people are incorrectly identified as guilty, also vary. The BPS review of studies found false alarm rates of between 2% and 47% for innocent people.

Voice analysis

Voice analysis for lie detection is based on the theory that emotional stress alters voice and speech patterns. **Voice stress analysis** (VSA) is conducted in a similar way to a polygraph test with an examiner conducting an interview using a particular interview technique and the subject’s voice analysed features including changes in pitch. VSA used to be conducted by trained individuals listening to and watching the subject being interviewed. VSA was sometimes done in conjunction with a polygraph.

Now the subject’s voice is analysed for pitch, frequency and micro-tremors using a computer programme. Voice analysis can be done remotely, over the telephone or the internet and

even without the subject’s knowledge.

Layered voice analysis (LVA) is a branch of VSA that claims to analyse the pitch of the voice in tiny microsecond packages. Linguists have described LVA as not only ineffective but implausible³. No remote voice analysis has been shown to be better than chance at identifying liars and truth tellers².

Brain activity analysis

Two different methods of brain activity analysis have been proposed to detect deceit. **Functional MRI** can show activity in the brain by measuring the use of oxygen in different areas.

Electroencephalography detects neural responses through electrodes placed on the scalp.

These technologies have been used in diagnostics and medical research for years so they are well understood and quite accurate at detecting activity in the brain. Their use as lie detectors is based on the idea that something familiar will cause different brain activity from something that is unfamiliar. In a test a subject is shown images or hears words about the incident under investigation along with irrelevant material. Levels of brain activity are compared.



Stress as a proxy for lying

Although they use different methods, voice analysis and the polygraph are both based on the principle that a subject will exhibit a stress response when they are being deceitful. There are problems with using stress responses as a proxy for lying. The fundamental assumption that an innocent person will react differently from a guilty one may not be true. Someone who is innocent, but who has reason to believe that they might be wrongly convicted - because they had no good alibi, for example - might be just as stressed at questions about the crime as a guilty person. Being in a place of jeopardy such as a police station can evoke a stress response. Conversely, a guilty person might have no emotional reaction if they believed that they had a good alibi, or if they didn't believe they had done anything wrong. And even if a subject is lying, it could be an irrelevant lie. For example the subject might not have committed a crime but might have lied about their alibi for another reason.

Familiarity as a proxy for lying

The problem with using a response to familiarity as a proxy for lies or attempts to conceal information is that there could be a number of reasons why something might be familiar. For example if a picture of a murder scene makes someone's brain "light up" with a response that could mean they are familiar with the scene it does not necessarily mean they murdered the victim, just that they may have been in that area before or seen the image in the media. There is little data to support the use of brain imaging techniques as lie detectors².

Lie detectors cannot accurately identify guilty and innocent people. Using a lie detector to elicit a confession or to induce someone to modify their behaviour depends on duping people into thinking they work when they don't.

1. Lie detectors are not accurate. The quality of available evidence is low^{1,2} and even the accuracy rates given above are probably overstated. Studies have been done in laboratories with paid volunteers where lie detectors were used to uncover imaginary crimes or hidden information.

These studies have also shown a fairly high accuracy rate, but such experiments assume that volunteers, who are not in any real danger whether they pass or fail the test, will react in the same way as real life situations. The volunteers have by their nature agreed to cooperate with an authority so they are not like most people picked up and interrogated about a crime. Studies in real life situations compare polygraph results to confessions of crimes but because these confessions may themselves have been influenced by the uses of the polygraph the two measures are not really independent⁴. So far the evidence shows that lie detectors are not good at accurately distinguishing truth tellers and liars.

2. Lie detectors should be called 'proxy detectors'.

There is no pattern of physiological activity that directly relates to lying⁵. Lie detectors don't directly detect lies, but some surrogate measure that could be associated with lying. It is easy to beat lie detectors using countermeasures to deliberately create stress reactions to control questions, either by thinking about something stressful or causing yourself pain. Functional MRI lie detectors are easy to beat using simple mental countermeasures⁶.

3. Lie detectors, if they work at all, work by the

deterrent effect. Experts have concluded that any effectiveness of lie detectors is probably because people are more likely to tell the truth if they believe that the machine will catch them lying. In psychology this is called the 'bogus pipeline effect'⁷. If this effect is at work, it does not matter how accurate the technology really is; the machine could even be switched off entirely, so long as the suspect believed it was working.

- 1 Bull R et al (2004) **A review of the current scientific status and fields of application of polygraphic deception detection.** *The British Psychological Society.*
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- 3 Eriksson A & Lacerda F (2007) **Charlantry in forensic speech science: A problem to be taken seriously.** *Journal of Speech, Language and the Law.*
- 4 Iacono WG (2008) **Accuracy of polygraph techniques: Problems using confessions to determine ground truth.** *Physiology & Behaviour.*
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- 6 Ganis G et al (2010) **Lying in the scanner: Covert countermeasures disrupt deception detection by functional magnetic resonance imaging.** *Neuroimage.*
- 7 Jones EE et al (1971) **The bogus pipeline: A new paradigm for measuring affect and attitude.** *Psychological Bulletin.*

This Sense About... note was researched and drafted between February and July 2012 by Dr Jamie Horder and edited by Síle Lane, Sense About Science in July 2012 with assistance from Professor Francisco Lacerda, Professor Richard Wiseman and Professor Geraint Rees. Designed by Stephen Chorlton.

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