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Forty years of movie hacking: considering the potential implications of the popular media representation of computer hackers from 1968 to 2008

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Abstract: Increasingly movies are being produced which feature plots that incorporate elements of computer security and hacking, and cumulatively these movies are creating a public perception as to the nature of computer security. This research examines movies that feature hackers (and hacking) to identify if any common themes emerge from these movies in their representation of these issues. To achieve this, first a corpus of hacking movies is created, and then using a qualitative data analysis technique, guidelines are developed which distinguish those movies that actually have the potential to create a perception with the general public. The resultant dataset is analysed and the salient details are compared to the reality of hacking. This research has implications in a range of fields, including in the education of computer students, organisation computer security and in the behaviour of the general public when using computers.

Keywords: computer security breaches; crackers and hackers; Jungian archetypes; filmic representations.

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Biographical notes: Damian Gordon is a Lecturer in Computer Science at the Dublin Institute of Technology and is completing his PhD on Differentiated Instruction. He received his BA (Mod) in Computer Science in 1995, and his MA in Computer Vision in 2001, both from Trinity College, Dublin. He has worked as an IT Researcher and as a Visiting Lecturer in both Trinity College and NUI Maynooth. During his years working in the IT industry, he was employed variously in the roles of Software Developer, Technical Team Leader, Systems Analyst and Implementation Consultant. In that period he was also responsible for authoring a wide range of technical documentation, including manuals and training courses. As an academic, he has contributed to several books and has had research papers published on a diverse range of topics, including website design, security risk analysis, virtual learning environments, learning styles, ICT and special needs, curriculum design and thinking techniques. He coined the term '3D alignment which refers to a curriculum with vertical, horizontal and constructive alignment. He designed and presented an In-Career Development Course for Primary School Teachers of Special Needs students for the Department of Education, and regularly

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lectures in Trinity College, Dublin on the topic of special needs and ICTs. He is also a certified Six Thinking Hats Edward de Bono Trainer.

1 Introduction

1.1 The term 'hacker'

The term 'hacker' can mean one of two things, within the computing community it means a very skilful programmer who delights in understanding the inner workings of a system (Levy, 2001), whereas outside of the computing community it refers to people engaged in the circumvention of computer security (Legg, 2005). Since this paper is going to focus on the media representation of hackers, in it the second definition of the term 'hacker' is the one that will be considered. Skoudis and Liston (2006, pp.7–9) suggest that there is a common cultural view of hackers as being teenagers sitting in their bedrooms hacking into top security systems, and that this view can be a dangerous one to subscribe to, since it may blind policy-makers to more relevant threats to their computer security. Where such a view of hackers has come from is difficult to say, certainly some computer security books suggest this image, e.g. Pfleeger and Pfleeger (2006, p.22) mention that hackers are "often high school or university students", in spite of the fact that research on hackers (Schell et al., 2002) has identified their average age as being 27 years old. This research seeks to investigate whether or not movies are culpable in this portrayal of hackers as being teenagers hacking from their bedrooms. To achieve this aim, first an attempt to determine what exactly constitutes a hacker movie will be researched; secondly, movies over a range of decades will be classified and analysed to determine if they are presenting a consistent view of what a hacker is.

2 Literature review

As movies exist as part of the arts domain, and hacking and computer security are part of the science domain, it is worth exploring the relationship between the arts and the sciences. Their relationship has always been a difficult one, so much so that Lord Snow in his famous 1959 Rede Lecture (Snow, 1959) claimed that there was an irrevocable breakdown between the 'two cultures' of arts and science, and that breakdown was the fundamental cause of most of the world's problems. Although other critics (Leavis, 1962; Huxley, 1963; Brockman, 1995; Gould, 2003) suggest that the gap between the cultures is not unbridgeable, they do emphasise that when science is being represented in the arts, it is not always a faithful representation, just as a portrait isn't always an exact replica of the study. This is especially true of movies, when science is represented in the movies the objective is often to display spectacle and illusion, and not necessarily verisimilitude.

At their inception movies were considered to be a valuable scientific instrument, famously in 1877, Eadweard Muybridge used movies to investigate whether or not horses have all four legs off the ground simultaneously when trotting (Solnit, 2003), and was able to demonstrate that they do when he photographed them using a prototypical motion picture camera that he developed. Kammerer (2004) adds that movies are still being used for such purposes, and discusses that fact that when explosive experts are demolishing buildings they will study footage of previous demolitions, slowing down the process on

film, and often reversing the recording to better understand how different structures will collapse. Thus movies can be used to help understand scientific principles.

In contrast to this, the depiction of science in the movies is generally not realistic since the purpose of movies is usually to entertain rather than to inform. In his book *Hollywood Science: Movies, Science and the End of the World Sidney*, Perkowitz (2008) identifies that movies generally portray science in simple dualistic terms; scientists are either evil maniacs or heroic techno-wizards, computer will take over the world or faithfully aid us as our servants, cloning will lead to the end of the world, or will allow people to easily replace missing limbs. He further goes on to suggest that, with very few exceptions, the only movies that portray science and scientists accurately are biographic films, such as, *Madame Curie* (1943), *Gorillas in the Mist* (1988), *Infinity* (1996), *The Insider* (1999), *A Beautiful Mind* (2001) and *Kinsey* (2004). The exceptions Perkowitz mentions are Jodie Foster's portrayal of fictional astronomer Eleanor Arroway in *Contact* (1997), and Laura Dern as fictional paleobotanist Ellie Sattler in *Jurassic Park* (1993). What Perkowitz fails to recognise is that both movies are based on books written by scientists. The movie *Contact* (1997) is based on the novel by renowned astronomer Carl Sagan, and *Jurassic Park* (1993) is based on a novel by Michael Crichton who was a medical doctor and anthropologist.

Considering hacker movies from an educational perspective, Efthimiou and Llewellyn (2003, 2004, 2006) argue that in general movies not only misrepresent the basic scientific facts, but they help contribute to science illiteracy. In their research, they analyse scenes from popular movies, e.g., *Speed* (1994), *The Core* (2003) and *Aeon Flux* (2005), and strongly dispute the outcomes of these scenes by invoking basic physics equations. Nonetheless they identify the fact that clips from these movies can be used in the classroom to explore topics in science and generate enthusiasm and excitement in students. In their research, student performance in examinations improved significantly when teaching involved movie clips, and the majority of students surveyed in their work expressed the opinion that this approach to teaching has developed their interest in science. In fact, Pendle (2006) suggested that early science fiction movies in USA resulted in the first generation of scientists and engineers in the field of rocket science. Similarly, Stephenson (2005) suggests that movies may be a potent force that can be utilised by educators to engage students' imaginations and foster a more vibrant, appealing and creative environment. In this research, two groups of students were used, a control group and an experimental group. The control group were taught scientific principles in the traditional way, whereas the experimental group had those same principles augmented by the use of movie clips. The study found a significantly greater margin of success by the experimental group.

Although little research has been done the influence of movies on the public perception of hacking, researchers have investigated other topics in computer science, e.g., Bartneck (2004) looks at how movies represent robots and robotics and in particular how these movies help contribute to the general public's behaviours to real-life robots. Similarly, Schmitz et al. (2008) look at models of computer interfaces presented in movies, and consider the viability of such interfaces in real-life. Also, Fisher (2001) looks at how artificial intelligence has been represented in the movies and how this may impact on the public perception of artificial intelligences. In general, the public perception of computer science is strongly influenced by movie representations.

Based on existing research it is clear that there are range of issues associated with the relationship between how computers are represented by the popular media, and how this effects the popular perception of them. On the positive side, it is possible that hacker movies could be used as a teaching tool, but on the negative side, it is possible that hacker movies are misrepresenting what hackers do and the types of threats they pose to organisations. To help answer these questions, it is important to develop a formally compiled dataset of hacker movies.

3 Research methods

Defining exactly what constitutes a hacker movie is a non-trivial task; hacking and hackers are featured in a range of movies, in a range of ways. Deciding how to compile a list of hacker movies can pose some interesting questions: *Does a hacker need to appear in the movie or is a hacking act sufficient?* (e.g., a movie that features salami slicing, but does not include the person responsible), *Should only live action movies be considered or should animated movies also be included*?, and *Should science fiction movies be included*? The answers to these questions should flow naturally from the central premise of the research, that managers may be somewhat influenced by the portrayal of hackers in movies in deciding security policies.

So the first step in this process was to identify some potential candidates that may be considered as being hacker movies. A range of books and websites were used to create a substantial list of movies (Butler, 2007; Perkowitz, 2008; Gill, 2008; Wikipedia, 2008). Each movie on this list was examined to determine whether or not it was truly a hacker movie, and using phenomenology (Moustakas, 1994) a series of guidelines were developed to explain why some moves were accepted and others rejected.

Table 1 Hacker guidelines

1	A hacker movie must feature a hacker in it, it is insufficient to have an act of hacking in the movie, the hacker must appear in the movie as being either the main protagonist or antagonist, or at least be a well-developed character with their hacking being integral to the plot.
2	Although they are related genres, not all cyberpunk movies can automatically be considered as hacker movies.
3	Only science fiction movies that feature recognisable hacker scenarios should be included on the list.
4	No animated movies will be included on the list.
5	No movies will be considered whose sole focus is cryptography.
6	No hacker documentaries will be considered, only movies.

3.1 Guideline 1: Requirement for a hacker to be visible

The logic of this rule is simple, if the premise of this research is that the public may form a stereotypical view of what a hacker is and what they do from movies, a character should substantially appear in movies under consideration that represents these qualities.

Heist movies usually feature a little bit of hacking but that doesn't mean they should be automatically included on the list. For example, *Ocean's Eleven* (2001) features a

character named Livingston Dell (Eddie Jemison), who is identified as a surveillance specialist, his character is not very developed other than the fact that he is anxious, plus his expertise is more in AV than computer hacking, and thus, he does not make it onto the list, whereas by contrast in *The Italian Job* (2003), the character of Lyle alias 'The Real Napster' (Seth Green) is much more fully developed as a character and is shown undertaking computer hacking, and thus does make it onto the list.

3.2 Guideline 2: A cyberpunk movie is not the same as a hacker movie

Cyberpunk movies are generally described as focussing on 'high tech and low life' so they usually feature outsiders, armed with their own individuality, fending off the tendencies of traditional institutions to use technology to control society (Butler, 2007). It is clear that this scenario closely converges with the notion of a lone hacker trying to fight the system, therefore a lot of cyberpunk fiction features hackers, but that does not necessarily imply that all cyberpunk movies are hacker movies.

For example, *Blade Runner* (1982) which is considered the seminal cyberpunk movie does not really feature any hacking, similarly for *Brazil* (1985) and *Robocop* (1987), whereas *The Matrix* (1999) is generally rated to be second only to *Blade Runner* in terms of importance as a cyberpunk movie clearly is also a hacker movie, since it features Thomas Anderson (Keanu Reeves) as a computer programmer who leads a secret life as a hacker under the alias 'Neo'.

3.3 Guideline 3: SciFi movies need hacker scenarios

As a rule science fiction movies show computers as being futuristic and fantastic, with plots that feature aliens and spaceships, and thus would generally not contribute to a stereotypical view of the hacker persona.

However, a few science fiction movies were included on the list, based on their presentation of hacking scenarios, for example, the robot R2D2 in *Star Wars* (1977) is clearly shown hacking into the Death Star computer systems in several scenes of that movie, and thus should be included on the list.

3.4 Guideline 4: All animated movies are banned

The rationale behind this rule is that animated movies are less 'real' than their live-action counterparts and thus would also generally not contribute to a stereotypical view of the hacker persona.

Hackers are a core feature of many Japanese anime movies, e.g., *Ghost in the Shell* (1995), which is considered to be one of the most important anime movies created which crossed over to non-anime viewers around the world, and features a character called 'The Puppet Master' who is both a computer hacker and a mind hacker, but as this movie is animated it will not be included on the list.

3.5 Guideline 5: Cryptography is not hacking

It is important to clearly establish a definition of what hacking is and to distinguish it from other scenarios involving encryption and decryption.

For example, the World War II movies, *Enigma* (2001) and *U-571* (2000) feature the allied attempts to decode the Wehrmacht Enigma machine, but do not feature modern electronic computers and the focus on encryption, and thus are not included on the list.

3.6 Guideline 6: Documentaries are not the same as movies

Since documentaries generally do not reach as wide an audience as movies do, they are excluded from the list, but movies that are based on real-life stories are included.

So *Revolution OS* (2001) is not included on the list but *Takedown* (2000) and *Pirates of Silicon Valley* (1999) are included on the list.

4 The hacker movie list

The complete list of movies judged to be hacker movies based on the rules outlined above contains 50 movies featuring a total of 60 hackers in those films remembering that some movies feature more than one hacker. These key movies will be discussed below on a decade-by-decade basis.

4.1 Hacker movies of the 1960s

Although real-life large-scale hacker attacks were not widely reported until the 1970s (Chirillo, 2001) surprisingly the first decade that features legitimate hacker movies is the 1960s. There are two movies from the 1960s that conform to the above guidelines and are regularly reported on hacker movie lists. The two movies are *Hot Millions* (1968) and *The Italian Job* (1969).

Hot Millons (1968)

Featuring Peter Ustinov as Marcus Pendleton, a con-man just out of prison, who impersonates a computer programmer named Caesar Smith and gets a job in a large organisation where he begins to send claim checks to himself in various guises at addresses all over Europe.

During the movie Marcus is seen to use a range of social engineering techniques, is seen to disable security systems and to create fraudulent identities, thus this movie is the first real hacker movie to be added to the list.

The Italian Job (1969)

This is a heist movie concerning a group of English thieves who attempt to steal $4 million worth of gold arriving in Turin, Italy. They recruit Professor Simon Peach, portrayed by comedian Benny Hill, who is a computer expert who they wish to take control of the Turin traffic control system to create a massive traffic jam that will provide the diversion the thieves need to successfully execute their plan.

This movie features an outsider attack on a large computer system, and thus qualifies for the hacker list.

4.2 Hacker movies of the 1970s

Interestingly during the decade when many of the initial real-life hacking events were occurring, only one movie from the 1970s successfully made it into the list based on the criteria outlined above, that movie is *Star Wars* (1977). A factor in the lack of relevant hacker movies in the 1970s may be the fact that censors around the world relaxed their rules on the depiction of violence and nudity in the 1970s (Lyons, 1997) which resulted in fast-moving, ultra-violent, ultra-explicit movies. In such an environment, showing a hacker sitting in a stagnant fashion typing at a keyboard attempting to break into a computer system, may have been too inactive for the 1970s movie audiences.

Star Wars: A New Hope (1977)

As mentioned previously, Star Wars features several scenes where robot R2D2 interfaces with the Death Star computer systems and hacks in to locate Princess Leia in the Detention Block, and controls the garbage compactor to prevent the heroes of the movies from being crushed.

Although R2D2 is clearly not a human being, the impact of the Star Wars movies were so phenomenal that it is possible this movie may have had an influence on the cultural view of hackers.

4.3 Hacker movies of the 1980s

The 1980s included many seminal hacker movies, including *WarGames* (1983) which features Matthew Broderick as a young hacker who accidentally hacks into a military computer which could result in a nuclear Armageddon. Another 11 movies are included on the list from the 1980s including another appearance by Matthew Broderick as the eponymous hero of Ferris Bueller's Day Off (1986) where he remotely deletes records of his absences from the school computer. Highlights of hacker attacks from this decade include a salami slicing attack featured in Superman III (1983), and hacking into ATMs in Prime Risk (1985).

Star Trek 2: The Wrath of Khan (1982)

Based on the classic 1960s television series, the second movie in the *Star Trek* movie series features scenes where the spaceship U.S.S. Enterprise (captained by James T. Kirk) is being attacked by another ship, the U.S.S. Defiant (captained by Khan Noonien Singh). As both ships are run by computer, Captain Kirk successfully manages to wirelessly hack into the computer systems of the Defiant, and instructs its computer to lower their shields.

Although a science fiction movie, the manner in which this hacking is presented is sufficiently congruent with the stereotypical image of hacking to be included in the list.

Tron (1982)

Starring Jeff Bridges as Kevin Flynn, a former employee of fictional computer company *ENCOM*, within whose computer systems are files which provide evidence that Flynn was wrongly fired from his job. Flynn, with the help of two fellow employees of *ENCOM* manages to hack into the systems and access these files.

This movie includes the first time in movie history that the term 'hacking' is used when Flynn says: "*I've been doing a little hacking*" to his comrades. Incidentally, this movie is also very well known for having been one of the first movies to feature the use of computer generated imagery.

Superman III (1983)

Based on the comic book series, the third *Superman* movie concentrates on a new character, an unemployed man Gus Gorman (Richard Pryor) who discovers that he has an extraordinary talent for computer programming. He gets a job in a fictional corporation named *Webscoe Industries*, where he proceeds to embezzle a large sum of money from the company payroll.

This movie includes a real-life hacker technique, *a salami slicing attack*, and therefore is included on the list.

WarGames (1983)

This movie focuses on David Lightman (Matthew Broderick) a high school student who is highly unmotivated at school but is an enthusiastic computer hacker at home. His main hacking method is *war dialling*, which is an automated search for computer systems connected to the public phone system. When he hears about a new computer games company, he attempts to hack into the games company's systems, but inadvertently links to a NORAD military supercomputer system, and deduces a *backdoor password* to log in and as a result almost causes World War III.

This movie is an extremely well-known movie and is recognised as having had an extremely significant impact on the way in which hackers are viewed (Halbert, 1997), therefore, it is definitely included on this list.

Prime Risk (1985)

Julie Collins (Toni Hudson), a computer expert who decides to take her revenge on a bank that declined to give her a job by creating *fake ATM cards* and stealing money from the bank. She stumbles on a plot by big-time international hackers to ruin the Federal Reserve and destroy the US monetary system. These thieves waste no time in discovering that Julie knows about their plot, and chase her all the way to Washington, DC, where Julie tries to convince the FBI that the impending electronic attack on the Federal Reserve Bank is real.

This movie is one of the first to show ATM machines being hacked and is therefore, included on the list.

Real Genius (1985)

This movie is set on the campus of 'Pacific Tech', a fictitious technical university based on Caltech. The main plot concerns a young genius, Chris Knight (Val Kilmer), who is working on a chemical laser system. Chris meets a brilliant hacker, Lazlo Hollyfeld (Jon Gries) who lives in the tunnels beneath the student dormitory. Lazlo uses his computer skills to discover that the laser work being undertaken by Chris is going to be turned into a weapon by an unscrupulous professor.

The character of Hollyfield is based on a number of real Caltech students, in 1971 a real computer hacker lived in the tunnels underneath the student dormitory for six months. Also in the movie, Hollyfield sends in a large number of entries to a contest, this matches the actions of Caltech students Steve Klein, Dave Novikoff and Barry Megdal, who, in 1974, used a similar strategy to win a McDonald's sweepstakes (Dodge et al., 1983, p.71). This movie is included on the list in particular for the *password hacking* used.

Weird Science (1985)

Two teenage computer hackers, Gary Wallace (Anthony Michael Hall) and Wyatt Donnelly (Ilan Mitchell-Smith) use their home computer to design the perfect woman. They feed various data into the computer, but lacking sufficient processing power, they use a fictional software hacking programme called *Crypto-smasher* to hack into a US Government mainframe and use its power to create a computer simulation of 'the perfect woman'. A bizarre electrical storm follows, and a real woman is created.

This is an infantile movie, but is be included on the list since it contains scenes of hacking, and is widely known.

Jumpin' Jack Flash (1986)

Terry Doolittle (Whoopi Goldberg) is an outspoken and irreverent employee of an international bank, is working overtime one evening when her terminal receives an encrypted message pleading for help from *Jumpin' Jack Flash*, code name for Marty Phillips (Jonathan Pryce), a British spy and master hacker trapped in Eastern Europe. At first Terry does not believe him, but eventually she becomes an essential element of his escape plan which involves her outmanoeuvring both the KGB and the CIA.

This movie was one of the first to feature online communications as a central plot device in the story, as it also shows a range of password hacking it is included on the list.

Ferris Bueller's Day Off (1986)

Ferris Bueller (Matthew Broderick) a high school student decides to skip school for a day to go on the town by pretending to be sick, something which he has done many times in the past. Unfortunately for Ferris, the Dean of Students, Edward Rooney (Jeffrey Jones) has been tracking Ferris's many absences from school on his computer, and will force Ferris to repeat the school year on the basis of these absences. Ferris hacks into Mr. Rooney's computer and remotely deletes these absences from the computer while Rooney watches helplessly.

This movie is widely known and although the scene showing Ferris hacking Mr. Rooney's computer is short, it is a key plot element; therefore this movie is included on the list.

Terminal Entry (1986)

Bob (Patrick Labyorteaux), a high school student who enjoys playing online games on Bulletin board systems chooses a game called 'Terminal Entry' that is password protected. At first Bob attempts a *brute force* password hacking approach, however that

does not work, fortunately Bob drops a chocolate bar on his keyboard which enters the numbers '5.9.125.35 1/5.25.35' which coincidently turn out to be the password. Unfortunately the game is really a communication forum where cells of a terrorist network communicate with each other and receive instructions.

The premise of this movie is a chilling one that a decentralised system of computer networks makes it easy for terrorist cells to communicate, while making it very difficult for authorities to track them down. This movie includes scenes of attempting to crack remote passwords and is therefore included on the list.

Bellman and True (1987)

Hiller (Bernard Hill), a computer expert, gets drunk and loses his job as a result of it; before he cleans out his desk, he sells what he thinks is one of his 'worthless' computer tapes to a group of bank robbers. The gang locate and kidnap Hiller's son and force him to decode the information on the tape which turns out to be a map of the National General Bank security system. With his son still in the gang's clutches Hiller is forced to take part in the robbery.

This movie exposes the dangers of insider threats, and the problem with having confidential data being available of computer storage, thus it is included on the list.

Die Hard (1988)

A group of thieves led by German terrorist Hans Gruber (Alan Rickman) invade a high-rise building, the Nakatomi Plaza, attempting to steal $640 million in bearer bonds from the building's vault. Theo (Clarence Gilyard), the group's technical mastermind, hacks into the buildings computer systems to open the vault locks, but he warns Gruber that the final electromagnetic lock is uncrackable. Gruber attempts to get the code to open the final lock from a corporate executive, Joseph Takagi, but is unsuccessful and the robbery fails.

This movie highlights the fact that if a password cannot be discovered using computer-based attacks, it is sometimes possible to get the possessor of the password to reveal it (either by force or by trickery), thus this movie is included on the list.

4.4 Hacker movies of the 1990s

Interestingly the 1990s feature the most hacker movies so far, twenty in total. Significant entries include; *The Matrix* (1999) with Keanu Reeves as Thomas Anderson alias 'Neo' who discovers the true nature of reality, *Sneakers* (1992) with Robert Redford as Martin Brice a hacker who has been on the run from the government since 1969, and *Jurassic Park* (1993) which features lead computer programmer Dennis Nedry (Wayne Knight) undertaking an insider attack on the InGen security system. A co-star in Jurrasic Park, Jeff Goldblum went on to star in *Independence Day* (1996), where he hacks into an alien computer system using an Apple Macintosh Powerbook. The dangers of computers being used to steal someone's identity are examined in several movies in this decade including *The Net* (1995), *Twilight Man* (1996) and *Enemy of the State* (1998). Finally, a movie that seems to have strong resonances in the hacker community is *Hackers* (1995) featuring Jonny Lee Miller and Angelina Jolie as Dade Murphy and Kate Libby, two teen hackers who must defeat a computer virus written by an evil genius.

Sneakers (1992)

The movie opens in 1969, where two college students Martin Brice (Gary Hershberger) and his friend Cosmo (Jo Marr) are using their college computer to hack into banking systems and illegally transfer funds from organisations they see as corrupt into organisations they see as worthy. They transfer money from the Republican Party to the Black Panthers, from Richard Nixon's personal checking account to National Association to Legalise Marijuana, and as they are about to transfer money from AT&T Cosmo is caught and arrested by the police, and Martin goes on the run. Twenty years later Martin (Robert Redford) is working as the leader of a *Tiger Team* and Cosmo (Ben Kingsley) is working for organised crime.

This movie features a range of hacking and security penetration scenarios including the use of *social engineering* to obtain a spoken passphrase, and Martin efforts to sneak past a motion and infrared heat detector, with such scenes; this definitely qualifies for the list.

The Lawnmower Man (1992)

Jobe Smith (Jeff Fahey), a simple gardener has his intelligence gradually increased by Dr. Lawrence Angelo (Pierce Brosnan) through a combination of special drugs and virtual reality. Eventually Jobe develops megalomaniacal tendencies and decides that he will transform himself into 'pure energy' and reach into all the computer systems of the world. To do this Jobe hacks into the computer mainframe of the organisation that had been sponsoring his transformation.

This movie features computer games, virtual reality, computer games and some hacking, and as such is included on the list.

Jurassic Park (1993)

Dennis Nedry (Wayne Knight) is employed by fictional genetics company *InGen* as the chief programmer of their Jurassic Park systems. Feeling that he has been underpaid for his two million lines of code that controls the entire park, he accepts an offer of $1.5 million from a rival fictional genetics company *BioSyn* to steal twelve dinosaur embryos from the park's labs. In order to achieve this (and make a quick getaway), he shuts down the park's entire security systems, including the electrical fences, covering it up by a series of deliberately engineered computer shutdowns.

This movie is an excellent example of the dangers of an *insider threat*; Nerdy feels underpaid and underappreciated and thus is easily bribed by a rival corporation. His behaviour and skills make him a perfect candidate for the hacker list.

Goldeneye (1995)

Boris Grishenko (Alan Cumming) is a computer programmer employed by the Russian government to undertake various top secret computer projects. He has used his computer skills to carry out a series of cyber-thefts from major British institutions, as well as hacking into the US Department of Justice. When his hacking is almost traced he sends a 'Spike' programme that seizes the phone line of whoever is tracing him and jams their modem so they cannot hang up. Boris frequently spins pens with his hands while

working, and is often seen typing with one hand. After a serious explosion occurs in the facility where he is working, Boris uses the opportunity to sell his talents on the open market and joins the fictional *Janus* crime syndicate and attempts to take control of the *Goldeneye* satellite.

Alan Cumming's portrayal of Boris Grishenko is a stereotypical representation of a hacker; thin, bespectacled, juvenile and nerdish, it also definitely qualifies him for the hacker movie list.

Johnny Mnemonic (1995)

The year is 2021, and the whole world is connected by the internet, and almost a half of the population is suffering from the fictional condition called Nerve Attenuation Syndrome (NAS). Johnny Mnemonic (Keanu Reeves) has an implanted memory chip in his brain that allows him to transport sensitive data. When Johnny is hired by fictional organisation *Pharmakom Industries* to carry a package that exceeds the implant's safety limits he must download in 24 hours or he will die. He joins up with an anti-technology group (called *LoTek*) whose leader J-Bone (Ice-T) help hack into Johnny's chip and into the *Pharmakom Industries* headquarters.

The character of J-Bone is the hacker whose behaviour and actions are sufficiently similar to a modern-day hacker to allow this movie to be included on the list.

The Net (1995)

Angela Bennett (Sandra Bullock) is a computer software analyst for fictional company *Cathedral Software*, she receives a disk from a friend of hers who asks her to fix a bug in a software programme called *The GateKeeper System*. From the moment she receives the disk her life takes a turn for the worse. Her records are changed and she is now a wanted felon on the run. Using her hacking skills she figures out who is responsible for her troubles and foils the villains.

Although from a technical perspective many of the scenes do not make sense, e.g., hacking remotely into a computer that has no network connection, this movie's main theme is hacking and has many hacking scenes in it, it was also a box office success and thus should be included on the list.

Hackers (1995)

Dade Murphy alias 'Crash Override' (Jonny Lee Miller) and Kate Libby alias 'Acid Burn' (Angelina Jolie) with their friends hack into computer systems for fun. When one of their group, Joey, who is considered a *script kiddie*, successful hacks into a fictional petroleum company, *Ellingson Mineral Corporation*, and manages to download part of a garbage file, he is arrested. The file contains evidence that the company's head of company security Eugene Belford alias 'The Plague' (Fisher Stevens) is using *a salami slicing attack* to embezzle money from his organisation. Dade and Kate must defend 'The Plague' before he capsizes a large portion of Ellingson's automated tanker fleet, causing a global ecological catastrophe.

This movie's main theme is hacking, and uses a range of hacker terminology and scenarios, and as such is included on the list.

Mission: Impossible (1996)

Luther Stickell (Ving Rhames) is an unfairly 'disavowed' Impossible Mission Forces (IMF) agent is a well-known hacker/phreaker and is the only man alive who hacked NATO Ghostcom. He is recruited by IMF agent Ethan Hunt (Tom Cruise) to break into the CIA headquarters and steal the CIA's Non-Official Cover (NOC) list. Reluctant at first, Luther is baited into the hack when Ethan played to Stickell's ego, selling the job proposal as '*The Mount Everest of hacks*'. Hunt performs the physical act of obtaining the information himself but has Luther, in his ear via headset, instructing him on performing the hack.

This movie features several hacking scenes, including when Luther interrupts the online theft of the NOC list via a makeshift jamming device disguised as a mobile phone, and as such should be included on the list.

Twilight Man (1996)

College professor Jordan Cooper (Tim Matheson) authors a book which causes vindictive hacker Hollis Deitz (Dean Stockwell) to begin to ruin his life. Hollis alters Jordan's medical records to indicate that he has serious brain problems, which causes Jordan to be shipped off to a psychiatric hospital. Before the hospital can perform brain surgery on him, Jordan escapes, but is quickly framed for murder. He searches through old newspapers to locate similar cases and from that sets up a meeting with his stalker.

Very much in the style of *The Net*, with the themes of stolen identities and evil hackers, the movie should be included on the list.

Independence Day [also known as 'ID4'] (1996)

Giant alien spaceships enter the earth's orbit, and David Levinson (Jeff Goldblum), an underachieving MIT-graduate working for a cable company discovers hidden satellite transmissions which he believes to be a timer counting down to a coordinated attack by the aliens. David heads to the White House to meet up with his ex-wife and informs the President of his discovery. When an invasion plan is confirmed, Levinson devises a plan to introduce a computer virus into the alien mothership, using a captured alien fighter. With the successful implantation of the virus, Levinson fires a nuclear missile at the mothership that successfully destroys it.

The fact that a computer virus written on an Apple Powerbook can be transmitted and successfully executed on an alien computer system without any compatibility issues makes this movie technically suspect, but is nonetheless an excellent example of hacking and thus this movie is included on the list.

Speed 2: Cruise Control (1997)

Annie Porter (Sandra Bullock) takes a cruise to the Bahamas on a Norwegian luxury liner. The cruise ship's passengers include members of a diamond dealers' association, who have filled the ship's vault with very valuable diamonds. Another passenger John Geiger (Willem Dafoe), the designer of the ship's computer system, who was fired from his job plans to steal the diamonds and sets the ship on a collision course with an oil tanker.

This movie features hacking, and the dangers of *insider threats* as it was Geiger who originally designed the ship computer systems, and as such is included on the list.

Masterminds [also known as 'Smart Alec'] (1997)

Young hacker Oswald Paxton (Vincent Kartheiser) is forced to take his sister to school by his parents as punishment for his hacking behaviour. Oswald finds that former school employee Rafe Bentley (Patrick Stewart) has taken several students as hostages for ransom. Oswald uses his computer hacking skills and love of pranks to rescue the hostages and capture Rafe.

Several hacking scenes in the movie show Oswald outwitting Bentley ensure that it is included on the list.

Enemy of the State (1998)

Labour lawyer Robert Clayton Dean (Will Smith) meets an old friend who surreptitiously slips a videotape into his shopping bags. The next day NSA agents break into Dean's house looking for the tape and smear him with false accusations. He is fired from his law firm and thrown out of the house by his wife. When he attempts to check into a hotel for the night, he learns his credit cards have been cancelled and somebody has stolen his attaché case. Dean makes contact with a retired NSA agent Edward 'Brill' Lyle (Gene Hackman), who shows him the bugs that have been planted in his belongings, and tells him that the NSA are after him. Dean and Brill work together to try to expose details of the illegal NSA operation captured on the videotape to the NSA's top brass.

Brill is portrayed as an extremely paranoid hacker whose computer is surrounded by 'The Jar', a copper-mesh Faraday cage that blocks unwanted transmissions; as such this movie qualifies to be included on the list.

eXistenZ (1999)

Allegra Geller (Jennifer Jason Leigh) is a brilliant computer game designer and is currently developing her latest virtual reality game, *eXistenZ*, a fully immersive virtual reality type game. To play the game the players must plug a 'pod', a bio-organic gaming device, into the bottom of their spines. Geller is attacked by an assassin so she flees her office with public relations trainee Ted Pikul (Jude Law), who is suddenly assigned as her bodyguard. Unfortunately her pod, containing the only copy of the *eXistenZ* game, is damaged so she and Ted must immerse themselves in the game to check if it is damaged.

As with many movies directed by David Cronenberg, in this movie much of the technology featured has a biological component to it, nonetheless there are sufficiently normal hacking scenes to qualify this movie for the list.

The Thirteenth Floor (1999)

Virtual reality designer Douglas Hall (Craig Bierko) is accused of the murder of his mentor and friend, Hannon Fuller (Armin Mueller-Stahl). Before he was killed Fuller hides a message for Douglas in a Virtual Reality simulation of the 1930s. Fuller's previously unknown daughter (Gretchen Mol) comes to claim the corporation in order to shut it down, so Douglas must enter the 'game' by taking over the consciousness of one of the game simulations to prove his innocence.

This movie features scenes of both hacking and of virtual reality; therefore it is included on the list.

Office Space (1999)

Two programmers, Samir Nainanajad (Ajay Naidu), and Michael Bolton (David Herman) have been working in fictional company *Initech* for several years until they are fired in a cost cutting measure. In order to get revenge on the company, they decide to infect the accounting system with a computer virus, which will undertake a *salami slicing attack* that rounds down fractions of a cent from accrual of interest and transfer the fractions into their own account over a period of years, leaving them with a steady income.

At one point in the movie the character of Michael acknowledges that his knowledge of hacking in part comes from movies when he says that the virus was inspired by the salami slicing attack in *Superman III*, thus this movie is definitely included on the list.

Netforce [also known as 'Tom Clancy's Netforce'] (1999)

Set in the year 2005, Alex Michaels (Scott Bakula) is head of a new fictional division of the FBI called 'Netforce' which investigates internet crime. When his mentor is killed, the evidence points to Web pioneer Will Stiles (Judge Reinhold). Stiles is about to release a new web browser that may allow his to hack into any computer in the world and to gain control of the internet.

This movie features a range of hacker scenarios, including the use of internet worms and e-mail viruses, additionally the character of Will Stiles is clearly based on Bill Gates, and as such is included on the list.

23 (1999)

Based on a true story and set in the 1980s the movie follows hacker Karl Koch (August Diehl) as he slowly starts to believe that there is a massive conspiracy to control the world by a secret society. At a meeting of fellow hackers, Karl meets David (Fabian Busch) who joins him to hack into the internet to help uncover this conspiracy. They eventually begin to work for the KGB, and are faced with increasing pressure by their controllers to successfully hack foreign computer systems. Karl becomes addicted to drugs and increasingly delusional.

Although some of the facts were altered, this movie is based on real events in the life of Karl Koch who was famous under his hacker handle '*hagbard*' and was involved in selling hacked information from US military computers to the KGB. This movie definitely is included on the list.

The Matrix (1999)

Computer programmer Thomas Anderson (Keanu Reeves) leads a secret double life as a hacker named 'Neo'. He is plagued by a question that appears on his computer frequently: 'What is the Matrix?' He comes into contact with Trinity (Carrie-Anne Moss) and Morpheus (Laurence Fishburne) who offer him the opportunity to learn the secret of the Matrix. What he discovers is that he exists in a simulation of the 20th century and the year is really 2199 where computers control humanity and force them to live their entire

lives in this simulation. Morpheus believes that Neo is 'the One', a man prophesied to end the war through his complete control over the Matrix.

The opening scenes of this movie are very typical of a hacker movie, but it rapidly transforms into a fantastical scenario, but because of the opening scenes this movie is included in the list.

Pirates of Silicon Valley (1999)

This movie tells the story of the rise of the personal computer and the rivalry between *Apple Computers* and *Microsoft*, and their founders, Steve Jobs (Noah Wyle) and Bill Gates (Anthony Michael Hall). The movie begins in the 1970s on the Berkeley campus where Steve Jobs and Steve Wozniak (Joey Slotnick) are caught in a riot stuck between the police and students until they successfully manage to make their escape. Jobs and Wozniak see themselves as revolutionaries of a different kind; they are creating 'Blue Boxes' a phreaking device to allow phone calls to be made for free and prevent big corporations like the phone company from taking everyone's money. Jobs and Wozniak meet up with famous phreaker John Draper alias *Cap'n Crunch*, and together they make a call to the Pope.

This movie concerns stolen software, and also as phreaking is closely associated with hacking; this movie is included on the list.

4.5 Hacker movies of the 2000s

Fifteen movies on the list appear so far from the 2000s, including one portraying the life story of Kevin Mitnick (Skeet Ulrich) entitled *Takedown* (2000). A number of movies featured the theme of the protagonist being forced into stealing money, including Hugh Jackman in *Swordfish* (2001), Ryan Reynolds in *Foolproof* (2003) and Harrison Ford in *Firewall* (2006). Insider threats are featured in *Antitrust* (2001), *Cypher* (2002) and *Storm Watch* (2002). Finally several movies in this part of the list are sequels to movies already on the list; *The Net 2.0* (2006), *Die Hard 4.0* (2007) and *WarGames 2: The Dead Code* (2008).

Takedown [also known as 'Trackdown' and informally as 'Hackers 2'] (2000)

Based on the real life events of hacker Kevin Mitnick (Skeet Ulrich), this movie depicts Mitnick as a self-deluding idealist who is fighting against 'Big Brother' to maintain 'freedom of information' while at the same time hacking into highly classified computers. Two federal agents, McCoy Rollins (Tom Berenger) and Mitch Gibson (Christopher McDonald) are tracking down Mitnick with the help of security expert Tsutomu Shimomura (Russell Wong). When Mitnick gains access to an encrypted programme that turns out to be a computer virus that Shimomura created as part of advanced security research, the hunt becomes escalated.

This movie centres on a real life hacker who mostly used *social engineering* to achieve his hacking feats, he is very well known for authoring two extremely popular books on hacking; '*The Art of Deception*' and '*The Art of Intrusion*', as such this movie is included in the list.

Bait (2000)

In this action comedy movie, Bristol (Doug Hutchison) is a computer hacker who manages to shut down the computer security of the Federal Gold Reserve in New York; while his assistant, Jaster (Robert Pastorelli) steals $40 million worth of gold bullion. Having second thoughts about the robbery Jaster flees with the gold and hides it, before being arrested and put in jail. While in jail Jaster tells a con artist, Alvin Sanders (Jamie Foxx) to pass a coded message onto his wife regarding the location of the gold. When Jaster is accidentally killed in Jail, Alvin becomes a target for Bristol.

This movie features a hacker as a main character and several hacking scenarios centred on a bank raid, and as such is included on the list.

Swordfish (2001)

Stanley Jobson (Hugh Jackman) is a hacker who infected the FBI computer systems with a virus, damaging them significantly. He is caught and convicted for his crimes and spends two years in jail. A condition of his parole is that he is forbidden from touching a computer. Using a combination of threats and bribery Gabriel Shear (John Travolta) convinces Stanley to write a computer worm to steal money from a secret government bank account. Stanley discovers that Gabriel works for a black ops organisation called 'The Black Cell' that was started by J. Edgar Hoover in the 1950s, which is responsible for retaliatory attacks against terrorists, and realises that nothing is as it seems.

This movie features a hacker forced into committing cyber crimes and several hacking scenarios including the use of a virus and a worm, and as such is included on the list.

Antitrust [also known as 'Conspiracy.com' and 'Startup'] (2001)

Software developer Milo Hoffman (Ryan Phillippe) is hired by CEO Gary Winston (Tim Robbins) of fictional computer company *NURV (Never Underestimate Radical Vision)* for a lucrative programming position. At first working at *NURV* is wonderful, a friendly organisation that values creativity, and provides direct access to the CEO at all times, but over time Hoffman becomes distrustful. He begins to suspect that *NURV* is stealing software from other developers and killing them.

Milo uses his hacking skills to alter *NURV*'s latest software release so that it will reveal the truth behind the organisation, also the character of Gary Winston is clearly based on Bill Gates and NURV represents Microsoft, thus this movie is included on the list.

Cypher (2002)

Morgan Sullivan (Jeremy Northam) loses his job as an accountant and is hired to undertake corporate espionage for fictional company *Digicorp*. Under the false identity of Jack Thursby, he secretly records presentations being given by rival organisations. When he meets with fellow agent Rita (Lucy Liu), her revelations cause him to question the nature of his new job. Rita tells Morgan is a disposal spy, once he has achieved his goals, he will be eliminated. Together Morgan and Rita attempt to uncover all of *Digicorp*'s secrets and escape elimination.

This movie features several hacking scenarios where Morgan and Rita attempt to uncover *Digicorp*'s motivations, and as such is included on the list.

Storm Watch [also known as 'Code Hunter' and 'Virtual Storm'] (2002)

Computer hacker Nick 'Jester' Chase (Nick Cornish) is banned from ever touching a computer after being convicted of several computer crimes, but illicitly plays a fictional virtual reality game called *Aftershock*. An unknown group blackmails him into stealing a computer programme from a government supercomputer built to control the weather. It turns out that the group's intentions for the weather programme are far from benign.

This movie features a hacker as a main character and several hacking scenes where Jester must uncover who is blackmailing him, and as such is included on the list.

Foolproof (2003)

For several years, friends Kevin (Ryan Reynolds), Samantha (Kristin Booth), and Rob (Joris Jarsky) have played a game whereby they simulate breaking into organisations for entertainment. When ruthless gangster Leo Gillette (David Suchet) plans a diamond heist he becomes suspicious that the three friends may be rival criminals. Leo manages to obtain the three friends plans and uses them to successfully undertake the robbery. Based on the success Leo blackmails the trio into planning another heist for him which leads them to be on the run from both the police and the criminals.

This movie features several hacking scenarios with the three friends planning and executing break-ins and hacks, and as such is included on the list.

The Italian Job (2003)

A remake of the 1969 movie, but with changes to characters and elements of the plot. Conman John Bridger (Donald Sutherland) meets up with planner Charlie (Mark Wahlberg) to discuss John's last job, a gold heist. They decide on a plan and a team is assembled, included Lyle 'The Real Napster' (Seth Green) who is their hacking expert. Lyle claims the he is the real creator of Napster, and that his roommate Shawn Fanning stole it from him. Lyle cracks into the Los Angeles traffic system and brings traffic to a halt. By turning on and off the traffic lights, he creates a snarl across the city.

This movie features a hacker as a main character, as well as the real creator of Napster, Shawn Fanning, and several hacking scenarios, and as such is included on the list.

The Core (2003)

Geophysicist Dr. Josh Keyes (Aaron Eckhart) determines that earth's magnetic field has been comprised because the earth's inner core has stopped rotating. He contacts the government who funds the building of a vehicle the can travel deep into the earth's crust. A team of experts are hastily assembled to pilot the craft, and detonate a nuclear advice that they hope will restart the core. Theodore 'Rat' Finch (D.J. Qualls) is a brilliant young hacker with criminal convictions who is hacking the Internet in order to prevent widespread panic. He is also secretly sending messages to Keyes about something that he suspects could change the nature of the mission.

This movie features a hacker as a main character who is controlling the flow of information on the internet, and as such is included on the list.

Serenity (2005)

Set in the future, this movie centres on the adventures of the crew of the spaceship 'Serenity' who are trying to make a living on the edge of space. When one of the crew, River Tam (Summer Glau) goes berserk and mutters the phrase 'Miranda' this leads Captain Malcolm Reynolds (Nathan Fillion) to discover an undocumented planet named 'Miranda' which is full of corpses. It is revealed that the galactic government undertook an experiment to suppress aggression in the population of that planet. Malcolm contacts an old friend Mr. Universe (David Krumholtz) a brilliant hacker who has tapped into all the major networks, and asks him to transmit the secret of Miranda.

This movie features a hacker as a main character who monitors all the information on all of the various networks, and as such is included on the list.

Firewall (2006)

Jack Stanfield (Harrison Ford) is a computer security expert who works for a bank. When his wife and children are kidnapped, he receives a ransom demand of $100 million, which the kidnappers expect him to obtain using his computer skills, incriminating himself in the process and eradicating any electronic evidence that the kidnappers ever existed. Under constant surveillance, he has only hours to accomplish the heist while desperately hunting for a loophole in the thief's own impenetrable wall of lies to save his family and beat the criminals at their own game.

This movie features a hacker as a main character who is forced into robbing his own organisation, and as such is included on the list.

The Net 2.0 (2006)

Computer systems analyst Hope Cassidy (Nikki Deloach) goes to Istanbul to begin a new job. Upon her arrival she finds that her credit cards are cancelled and her bank account has been emptied. Additionally she discovers that her identity has been stolen and she has been given one with a criminal record, and accused of stealing $14 million and murdering a police officer. Nikki uses all her hacking skills to try to reclaim her life.

This movie is less a sequel to 'The Net' than it is a remake of it; nonetheless, it features a hacker as a main character and several hacking scenarios, and as such is on the list.

Breach (2007)

Based on a true story, FBI Agent Robert Hanssen (Chris Cooper) is a computer specialist who, after 25 years of service, is put under surveillance as a suspected sex offender. Eric O'Neill (Ryan Phillippe) is assigned the surveillance task, and poses as Hanseen's clerk. Eric at first resents the nature of his job, but soon becomes fond of Hanseen and his family. He doubts the claims against Hanseen until he uncovers evidence that he may be investigating the biggest security breach in American history.

Although some of the facts were altered, this movie is based on real events in the life of Robert Hanssen who spied for the KGB. This movie definitely is included on the list.

Die Hard 4.0 [also known as 'Live Free or Die Hard'] (2007)

Police detective John McClane (Bruce Willis) is asked by the US Department of Homeland Security to bring in a hacker named Matt Farrell (Justin Long), because he is a suspect in a breach of the FBI computer systems. After John gets to Matt's apartment, a group of men show up and try to kill both John and Matt, who barely escape with their lives. The duo discovers that a group of terrorists are trying to shut down the US computer infrastructure. They successfully shut down the stock market systems, which could result in disaster for the US economy unless John and Matt can defeat the terrorists.

This movie features a hacker as a main character and several hacking scenarios, including the threat of destroying the US financial systems, and as such is on the list.

WarGames 2: The Dead Code (2008)

Will Farmer (Matt Lanter) is a computer hacker who has accessed a government super-computer named RIPLEY. He thinks he is playing an online game, but what he doesn't realise is that the online game is actually part of a sophisticated piece of US Government spyware designed to identify and locate potential terrorists. Believing that Farmer is a terrorist Homeland Security sets out to apprehend him and chases him across the country.

Like 'The Net 2.0' this movie is less a sequel to 'WarGames' than it is a remake of it, nonetheless, it features a hacker as a main character and several hacking scenarios, and as such is on the list.

5 Types of attacks featured in movies

In this section a brief review of some of the types of hacker attacks portrayed in the hacker list are discussed to demonstrate the wide range of attacks that the general public will have an awareness of. It is also important to consider the range of attacks if clips from movies were being used to demonstrate hacking in a computer security class. As discussed previously, the work of Efthimiou and Llewellyn (2003, 2004, 2006) and Stephenson (2005) identified that using movie clips can aid in developing student interest in science, in a similar way computer security courses that incorporate appropriate clips for hacker movies to explore topics and demonstrate principles could enthuse students.

5.1 Salami slicing attack

This real-world hacker attack involves stealing money repeatedly in extremely small quantities, by taking advantage of rounding to the nearest cent in financial transactions in the hope that the sum is small enough on any single transaction that it will go undetected (Glaessner et al., 2002). This hacker attack is featured in *Superman III* (1983), *Hackers* (1995), and *Office Space* (1999). In *Superman III*, Gus Gorman (Richard Pryor) uses a salami slicing attack to embezzle money from his company *Webscoe Industries*. In *Hackers*, company security expert Eugene Belford alias 'The Plague' (Fisher Stevens) is using the same attack to embezzle money from his organisation, the *Ellingson Mineral*

Corporation. Finally, in *Office Space* Samir Nainanajad (Ajay Naidu), and Michael Bolton (David Herman) create a virus that runs the attack on their company *Initech*, and two characters elude to the fact that they were inspired by a similar attack featured in *Superman III*.

5.2 Social engineering

Social engineering is the art of manipulating people into divulging confidential information, and is featured regularly in movies. In *Hot Millions* (1968), con-man Marcus Pendleton (Peter Ustinov) uses social engineering to uncover information that will allow him embezzle, he pretends to be an expert on the computer system and gives other computer users 'quizzes' to check whether or not they understand how the system works. In *Sneakers* (1992), the hackers need to obtain a verbal recording of a user saying the phrase '*My voice is my passport. Verify me*' to gain access to a building secured by a voiceprint ID system. They get a female friend to take this user out on a date and make a recording of his conversation until all the necessary words have been said. In *Hackers* (1995), Dade Murphy alias 'Crash Override' (Jonny Lee Miller) calls a local television station, and dupes the security guard into giving him the modem's phone number using social engineering. From that, he successfully hacks into the station's computer network, changing the current television programme. The movie *Takedown* (2000) is based on the real-life events of hacker Kevin Mitnick (Skeet Ulrich), who frequently used social engineering to obtain passwords and other confidential information.

5.3 Hacking software

Movies often feature software that has the power to break into any system, in *Weird Science* (1985) two hackers need more power, so they use a fiction software hacking programme called *Crypto-smasher* to hack into the grid. In *The Net* (1995), illegitimate 'protection' system called *The GateKeeper System* gives the user entry point access to government and military computer systems. In *Sneakers* (1992), an algorithm is developed that will decrypt any code, and this algorithm is built into a 'black box' decoder that is the central quest in the film.

5.4 Insider attacks

As discussed previously, an *insider attack* is an attack that is launched by an authorised computer user from inside the system. In *Jurassic Park* (1993), Dennis Nedry (Wayne Knight) is employed by *InGen* as the chief programmer of their Jurassic Park systems but accepts an offer of $1.5 million from a rival genetics company *BioSyn* to steal twelve dinosaur embryos. In order to achieve this (and make a quick getaway), he shuts down the park's security systems. In *Speed 2: Cruise Control* (1997), John Geiger (Willem Dafoe), the designer of a cruise ship's computer system, plans to take over the ship, and steal diamonds off it until thwarted by Annie Porter (Sandra Bullock).

5.5 Password discovery

Cracking other users' passwords is a fairly common theme in hacker movies. A range of techniques are featured in movies. In *WarGames* (1983), the concept of *backdoor passwords* are explored, whereby systems often have a hidden password that allows users to login and have administrative access to the computer system. In this movie, hacker David Lightman (Matthew Broderick) researches the software developer who created the system to discover the most likely backdoor password that he would have used. In *Terminal Entry* (1986), hacker Bob (Patrick Labyorteaux) uses *Brute Force Hacking* to attempt to hack an online computer game. Brute Force hacking involves trying every possible combination of numbers and letter to solve the password. In *Hot Millions* (1968), con-man Marcus Pendleton (Peter Ustinov) uses a number of hacking techniques including *shoulder surfing* to determine a password of the system he is trying to hack. Shoulder surfing refers to using a direct observation technique to determine password information, such as looking over someone's shoulder.

5.5.1 'Swordfish' password

Many movies feature 'Swordfish' as the password, including *Hackers* (1995), *The Net* (1995) and *Swordfish* (2001), this password refers to the Marx Brothers movie *Horse Feathers* (1932) which includes a scene where Professor Wagstaff (Groucho Marx) attempts to gain access to a speakeasy that is being guarded by Baravelli (Chico Marx);

Table 2 Extract for *Horse Feathers* (1932)

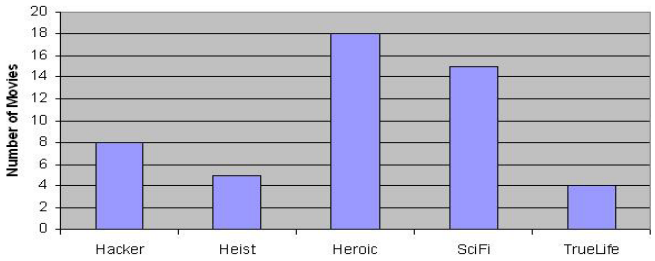
BARAVELLI: You can't come in unless you give the password.
PROFESSOR WAGSTAFF: Well, what is the password?
BARAVELLI: Aw, no. You gotta tell me. Hey, I tell what I do. I give you three guesses. It's the name of a fish.
PROFESSOR WAGSTAFF: Is it 'Mary'?
BARAVELLI: [laughing] 'At's-a no fish!
PROFESSOR WAGSTAFF: She isn't? Well, she drinks like one! ...Let me see... Is it 'Sturgeon'?
BARAVELLI: Aw, you-a craze. A 'sturgeon', he's a doctor cuts you open when-a you sick. Now I give you one more chance.
PROFESSOR WAGSTAFF: I got it! "Haddock".
BARAVELLI: 'At's a-funny, I got a "haddock" too.
PROFESSOR WAGSTAFF: What do you take for a "haddock"?
BARAVELLI: Sometimes I take an aspirin, sometimes I take a calomel.
PROFESSOR WAGSTAFF: I'd walk a mile for a calomel.
BARAVELLI: You mean chocolate calomel? I like-a that too, but you no guess it. [Slams door. Wagstaff knocks again. Baravelli opens peephole again.] Hey, what's-a matter, you no understand English? You can't come in here unless you say, "Swordfish." Now I'll give you one more guess.
PROFESSOR WAGSTAFF: ...swordfish, swordfish... I think I got it. Is it "swordfish"?
BARAVELLI: Hah. That's-a it. You guess it.

Comment [e2]: Author: Please note that this has been renumbered as Table 2.

6 Results

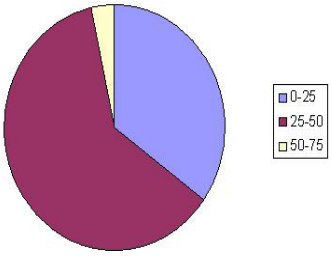
The fifty movies featured on the list were classified on the basis of their genre, to determine which genre of movie features the most hacker characters. The five categories that were identified were: *Hacker* (movies exclusively about hackers and hacking), *Heist* (movies where a robbery is the central plot), *Heroic* (a movie where a regular person is forced by circumstances to do extraordinary things), *SciFi* (Science Fiction movies that feature some type of futuristic technology) and *TrueLife* (movies which depict the adventures and exploits of true life hackers). The results of which are displayed below, and they show that the *Heroic* category is the most often represented one on the list.

Figure 1 Hacker movies by genre (see online version for colours)



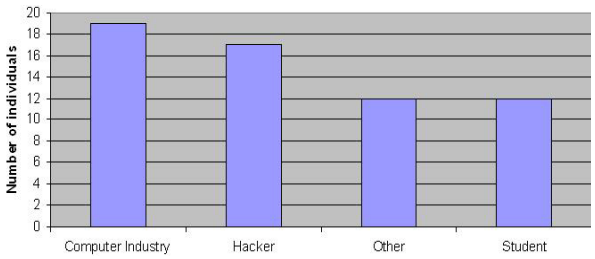
An investigation of the ages of the hackers as portrayed in the movies was carried out to determine if any particular age group was more significantly represented than others, particularly since, as mentioned previously, there is a popular cultural image of hackers as being teenagers sitting in their bedrooms hacking into top security systems. The hackers' ages were determined as follows; if their age is stated in the movie then that age is taken, otherwise if their date of birth is given (e.g., on a police record) and the year that the movie is set in is given, then a simple difference is calculated, otherwise if the year that the movie is set in is not given then the year is assumed to be the year of production of the movie (NB: not the year of release of the movie, but the year of production, sometimes these can differ significantly), otherwise the age of the actor portraying the hacker at time of production of the movie is used. In the movies identified here, 21 (35%) hackers were portrayed as 0–25 years old, 37 (62%) hackers were portrayed as 25–50 years old, and 2 (3%) hackers were portrayed as 50–75 years old.

Figure 2 Hacker age ranges (see online version for colours)



Next the profession of the hackers were investigated, to determine if any particular profession is generally portrayed as being responsible for hacking. In this list, 19 (32%) hackers were portrayed as working in the computer industry, 17 (28%) hackers were portrayed as being full-time hackers, 12 (20%) hackers were portrayed as being students, and 12 (20%) hackers were portrayed in other professions.

Figure 3 Hacker occupations (see online version for colours)



Next the morals of the hackers were investigated, are hackers generally portrayed as being good guys, bad guys, or somewhere in between? In the movies of the list, 44 (73%) hackers were portrayed as being good guys, 6 (10%) hackers were portrayed as being in between, and 10 (17%) hackers were portrayed as being bad guys.

Figure 4 Hacker morals (see online version for colours)

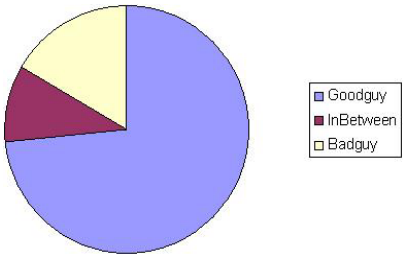
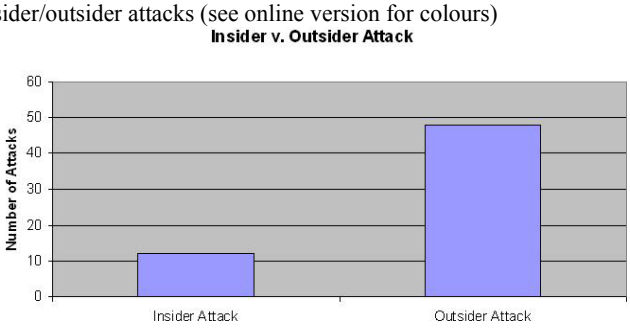


Figure 5 Insider/outsider attacks (see online version for colours)



Finally the types of attacks portrayed in the movies were investigates, are they mostly insider attacks of outsider attacks? In thee movies of the list, 12 (20%) attacks were portrayed as being insider attacks, and 48 (80%) attacks were portrayed as being outsider attacks.

7 Discussion and conclusions

It is clear from the analysis above that the popular cultural image of a hacker as being a teenager hacking from their bedroom is not being generated from the majority of hackers being featured in movies, in fact, the majority of hackers in movies are good guys between 25 to 50 years old who work in either the computer industry or is a full-time hacker which matches well with the reality of hackers (the majority of who see themselves as good guys) whose average age is said to be 27 years old and who work in either the computer industry or is a full-time hacker (Schell et al., 2002). The one aspect of hacking that is portrayed in movies very inaccurately is the ratio of insider to outsider attacks, in the movies the ratio is 20/80 whereas the reality is very different, there is a lack of hard statistics for computer crime, thus it is difficult to accurately assess the exact division of attacks between insider and outsider attacks; some suggest it may as high as 50/50 (Vontu, 2005).

Although the majority of movies portray a relatively accurate depiction of hackers, some of the movies discussed in the list are most memorable for facets other than their hacking. So, for example, *The Matrix* (1999) which accurately features a 25–50 year old hacker working in the computer industry is less memorable for its correct profile of a hacker than it is for people in black coats dodging bullets in slow motion. Similarly in *Superman III* (1983), the hacker is again a 25–50 year old hacker working in the computer industry, but this movie is best remembered as the 'comedy Superman' movie. In contrast, perhaps the most influential movie which depicts hackers as 'teenagers in their bedrooms' is *WarGames* (1983) which has created a specific and powerful mythology regarding the nature of hackers (Halbert, 1997) showing hackers to be young men who can hack into any computer system from the privacy of their own bedroom. This was one of the first movies to portray a 'digital divide' between those with computer skills who can do anything with computers and those who are not computer skilled and are outsiders in the computerised and networked world which often does not match reality (Kessler and Shepard, 1997), but echoes the simple dualist representation of all sciences discussed in Perkowitz (2008). It is worth noting that this movie conforms to what mythologist Campbell (1949) identified as 'the Hero's Journey' (or 'monomyth') in his book *The Hero with a Thousand Faces*, this means that it has an archetypical nature which resonates with a very wide audience. These Jungian archetypes feed unconsciously into views of hackers via 'script theory' (Schank and Abelson, 1977). Script theory suggests that people create a series of simple archetypical stories (or 'scripts') to help in their day-to-day interactions, and these scripts are based on their previous experiences. If a manager's script for security threats is 'the risk to my organisation's computer security comes from teenage hackers in their bedrooms' because of their experience of the *WarGames* movie, then their focus may be on ensuring outsider attacks are repealed, for example, making sure that their firewall is resilient and up-to-date.

From an educational perspective, it is clear from previous research (Efthimiou and Llewellyn, 2003, 2004, 2006; Stephenson, 2005) that using movie clips from relevant movies can improve student achievement and improve there retention of information. The hacker list provides lecturers and teachers with a wide range of materials to select from, and with the aid of Section 5 which outlines which movies feature which attacks it will be possible to locate and select an appropriate movie clip for illustrating different kinds of hacker attacks, which may be very useful for a range of modules; a 'Computer Security' module might benefit greatly from such clips, also training courses for the police force, particularly those focussing on cyber crimes, also more general 'Computers in Society' modules would be greatly enhanced by the use of clips. This would add a great dynamism and enthusiasm to the classes and might even help students learn more accurate information. In fact, considering that the majority of movies are relatively truthful in their portrayal of hackers, they may, in fact, be offering more accurate information than computer security books who, as mentioned previously, suggest that hackers are 'often high school or university students' (Pfleeger and Pfleeger, 2006).

This research sought to investigate if the movie portrayal of hacking contributes to the stereotypical view of outsider attacks by teenagers, and concludes that the majority of movies do not show that stereotypical view, but some specific movies may have a significant resonance. For whatever reasons such stereotypes exist, it is vital that all interested parties be aware of such stereotypes and that draw their conclusions on the basis of evidence rather than speculation and stereotypes, and that these movies can be used as tools to teach and learn about hacking and hackers.

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Appendix Full hacker movie list

Title	*Year*	*Genre*	*Name*	*Occupation*
Hot Millions	1968	Heist	Marcus Pendleton	Con-man
The Italian Job	1969	Heist	Prof Simon Peach	Hacker
Star Wars	1977	SciFi	R2D2	Robot
Star Trek II: The Wrath of Khan	1982	SciFi	James T. Kirk	Starship Captain
Tron	1982	SciFi	Kevin Flynn	IT Industry
Superman III	1983	SciFi	Gus Gorman	IT Industry
WarGames	1983	Hacker	David Lightman	Student
Prime Risk	1985	Hacker	Julie Collins	IT Industry
Real Genius	1985	Heroic	Lazlo Hollyfeld	Student
Weird Science	1985	SciFi	Gary Wallace	Student
			Wyatt Donnelly	Student
Jumpin' Jack Flash	1986	Heroic	Marty Phillips	Spy
Ferris Bueller's Day Off	1986	Heroic	Ferris Bueller	Student
Terminal Entry	1986	Hacker	Bob	Student
Bellman and True	1987	Heist	Hiller	IT Industry
Die Hard	1988	Heroic	Theo	Hacker
Sneakers	1992	Heist	Martin Brice	IT Industry
			Cosmo	Criminal
The Lawnmower Man	1992	SciFi	Jobe Smith	Gardner
Jurassic Park	1993	SciFi	Dennis Nedry	IT Industry
Goldeneye	1995	SciFi	Boris Grishenko	IT Industry
Johnny Mnemonic	1995	SciFi	J-Bone	Hacker
The Net	1995	Heroic	Angela Bennett	IT Industry
Title	Year	Genre	Name	Occupation
Hackers	1995	Hacker	Dade Murphy	Student
			Kate Libby	Student
Mission: Impossible	1996	Heist	Luther Stickell	Spy
Twilight Man	1996	Heroic	Hollis Deitz	IT Industry
Independence Day	1996	SciFi	David Levinson	TV repair man
Speed 2	1997	Heoric	John Geiger	IT Industry
Masterminds	1997	Heroic	Oswald Paxton	Student
Enemy of the State	1998	Heroic	Edward Lyle	ex-NSA
eXistenZ	1999	Hacker	Allegra Geller	IT Industry
The Thirteenth Floor	1999	Heroic	Douglas Hall	IT Industry
Office Space	1999	Heroic	Michael Bolton	IT Industry
			Samir Nagheenanajar	IT Industry
Netforce	1999	SciFi	Will Stiles	IT Industry

Appendix Full hacker movie list (continued)

Title	*Year*	*Genre*	*Name*	*Occupation*
23	1999	TrueLife	Karl Koch	Hacker
			David	Hacker
The Matrix	1999	SciFi	Thomas Anderson	IT Industry
			Trinity	Hacker
			Morpheus	Hacker
Pirates of Silicon Valley	1999	TrueLife	Steve Jobs	Student
			Steve Wozniak	Student
			John Draper	Student
Takedown	2000	TrueLife	Kevin Mitnick	Hacker
Bait	2000	Heroic	Bristol	Hacker
Swordfish	2001	Heroic	Stanley Jobson	Hacker
Antitrust	2001	Heroic	Milo Hoffman	IT Industry
Cypher	2002	Heroic	Morgan Sullivan	Corporate Espionage
Storm Watch	2002	Hacker	Nick Chase	Hacker
Foolproof	2003	Hacker	Kevin	Hacker
			Sam	Hacker
The Italian Job	2003	Heist	Lyle	Hacker
The Core	2003	SciFi	Theodore Finch	Hacker
Serenity	2005	SciFi	Mr. Universe	Hacker
Firewall	2006	Heroic	Jack Stanfield	IT Industry
The Net 2.0	2006	Heroic	Hope Cassidy	IT Industry
Breach	2007	TrueLife	Robert Hanssen	FBI agent
Die Hard 4.0	2007	Heroic	Matthew Farrell	Hacker
WarGames: The Dead Code	2008	Hacker	Will Farmer	Hacker
23	1999	TrueLife	Karl Koch	Hacker
			David	Hacker
The Matrix	1999	SciFi	Thomas Anderson	IT Industry
			Trinity	Hacker
			Morpheus	Hacker
Pirates of Silicon Valley	1999	TrueLife	Steve Jobs	Student
			Steve Wozniak	Student
			John Draper	Student
Takedown	2000	TrueLife	Kevin Mitnick	Hacker
Bait	2000	Heroic	Bristol	Hacker
Swordfish	2001	Heroic	Stanley Jobson	Hacker
Antitrust	2001	Heroic	Milo Hoffman	IT Industry

Appendix Full hacker movie list (continued)

Title	*Year*	*Genre*	*Name*	*Occupation*
Cypher	2002	Heroic	Morgan Sullivan	Corporate Espionage
Storm Watch	2002	Hacker	Nick Chase	Hacker
Foolproof	2003	Hacker	Kevin	Hacker
			Sam	Hacker
The Italian Job	2003	Heist	Lyle	Hacker
The Core	2003	SciFi	Theodore Finch	Hacker
Serenity	2005	SciFi	Mr. Universe	Hacker
Firewall	2006	Heroic	Jack Stanfield	IT Industry
The Net 2.0	2006	Heroic	Hope Cassidy	IT Industry
Breach	2007	TrueLife	Robert Hanssen	FBI agent
Die Hard 4.0	2007	Heroic	Matthew Farrell	Hacker
WarGames: The Dead Code	2008	Hacker	Will Farmer	Hacker