ATH 2011-12 solution

Treasure location and themes

The treasure was hidden in **Shenley Wood** [LOC1][1], on the outskirts of Milton Keynes. This is not far from Bletchley Park [LOC2], which during World War 2 was a secret establishment dedicated to the decryption of intercepted enemy communications. Its most famous achievement – which did not become public knowledge until the late 1970s and early 1980s - was the breaking of the method of encryption of Germany's Enigma cipher machine, which is reckoned to have shortened the war by a year or two and to have saved thousands of lives. One of the key figures in this work was the mathematical genius and computer pioneer Alan Turing.

During his time at Bletchley Park, Turing stayed at the Crown Inn [LOC3] in Shenley Brook End. It is known that at some time during the war, he bought a couple of silver bars as a hedge against the possible collapse of the banks, and hid them in a wood near his digs. He returned to the wood a number of times during and after the war with the aim of retrieving the silver bars, but was unable to remember where he had hidden them. They essentially became **lost treasure**. There is no record of which wood he hid the bars in, so I chose Shenley Wood since it is close to where Turing stayed.

The ATH thus had multiple themes, in tribute to Turing:
- "**lost treasure**" [LOC4], as represented by the centre puzzle on each page, and by **Turing's silver bars** [LOC5]
- **code-breaking** [LOC6] or decryption or decipherment – I wasn't pedantic about the difference, but did expect you to realise that the theme was code*breaking*, not just codes or ciphers in general.

Hidden or lost treasure and codebreaking are both fundamental components of the ATH.

The centenary of Turing's birth is the 23rd of June this year, so welcome to what has been designated as "Alan Turing Year" - see http://www.turingcentenary.eu/.

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[1] text in square brackets indicates an item for which points will be awarded

The Poster

The poster was similar in style to the pages of the ATH. In addition to the announcement about the ATH, it contained some items which hinted at the themes of the ATH. There are no points for solving any of the puzzles on the poster.

The island in the map in the centre of the page is **Oak Island**, in Nova Scotia, with all names removed except for Smith's Cove, which I left in simply because of my surname (Smith, not Cove ☺). The cross marks the location of the Oak Island Money Pit – a deep vertical shaft which is reputed to contain a fortune in treasure at the bottom. Much money and a few lives have been lost in trying to find the treasure. I originally had this as one of my "lost treasures" in the ATH itself, but realised that I couldn't use it because no one knows if there is actually a treasure there, and also because it is impossible to associate a specific date with it – you'll see later why that is important.

Clues to Oak Island are the picture of an **oak tree** on the left, and the logo of **Island Records** on the right.

The picture below is the well-known "**And when did you last see your father?**", by William Frederick Yeames. Purely by coincidence – a phrase which will recur several times in this document - when writing this solution I found that this is the best known example of a genre of art popular in the late Victorian era, the "problem picture", in which a deliberately ambiguous scene can be interpreted in a number of ways. It seems appropriate to feature a "problem picture" on the ATH poster.

However, it's not really the picture which is important, but the symbols below it. The symbols are from a slab of stone recovered from about 90 feet down in the Money Pit. It is a simple substitution cipher. The message on the stone has been deciphered as a message that the pit contains a fortune. The symbols beneath the picture read "**And when did you last see the treasure?**". (The Oak Island Cipher doesn't contain symbols for 'H' or '?'.)

This was intended to hint at the theme of lost treasure. It was also intended to be easy for anyone, not necessarily an ATH regular, to solve. Knowing the title of the original picture, one can easily determine what letter each symbol represents. I hoped that someone doing this might be intrigued when they came across the deviation from the picture title at the end of the question. I hoped that this might encourage a few "ATH virgins" to tackle the main puzzle.

The picture at bottom left is the cover of an album by ex Deep Purple keyboards player Jon Lord, called "**Pictured Within**". The reason for using this might have become clear when you saw the ATH itself. Jon Lord is very fond of Elgar's music, and the album title is taken from Elgar's dedication to his "**Enigma Variations**", which is "To my friends pictured within". This picture thus belongs to a series of clues in the ATH itself. (BTW, I highly recommend this album. It's not at all like Deep Purple, and is a beautiful and moving piece of music. I've been listening to Jon Lord for over 40 years, and this is his masterpiece. It is long out of print, but if you come across a copy, snap it up.)

The three birds at bottom right are **nightingales**, and the flag is of course that of **France**. The French for "nightingale" is "**rossignol**". As with Jon Lord above, you'll find out later the significance of that.

The six-digit numbers in red on the right are Ordnance Survey grid references – an easting and a northing - and if you type them into www.streetmap.co.uk they take you to **Herrings Lane** in Chertsey. The combination of the red font and the name of the Lane were not coincidental! Similar to other things on the poster, this was related to a series in the main ATH, the significance of which you will shortly discover.

The **logo** at the top of the page is that of an interbank network in Puerto Rico and the Caribbean. There is no significance to this other than that it carries the initials "ATH", although as a veteran of many late-night ATH sessions I rather liked the "at all hours" slogan. You'll have seen that most of the pages of the ATH itself carried a logo at the top.

The **Santas** are a simple geometric code - each Santa is a letter of the alphabet, where the letter is denoted by the distance of the Santa from the top or bottom of the page.

A4 paper is an interesting size – 297mm x 210 mm. 297 divided by 27 is 11, so I could place 26 Santas at 11mm vertical intervals on the page, with the top one 11mm from the top of the page, and the lowest one 286mm from the top of the page. Distances were measured to the centre of Santa's nose.

There is the potential problem that the page may well be distorted or scaled when viewed or printed. I wasn't too worried about the poster – if you couldn't solve it, it didn't matter. But you'll see later what I included in the actual ATH to counter this problem.

On the poster, A is the lowest position on the page (286mm from the top) and Z is the highest position. The Santas on the poster simply spell **Logica**.

At the bottom of the page, the word "deciphering" tells you what one of the themes of the ATH is, and is in the same style as the 11-letter words at the foot of the ATH pages, the significance of which will be revealed later.

All setters say that competitors find things in the ATH – patterns, links, codes, whatever - which were unintentional, and I am no exception. It started with the poster. One observation was that the initial letters of **M**OST SECRET   **A**TH EYES ONLY   **P**RIORITY HIGHEST spelled out MAP. Pure coincidence. As was the link between Jon Lord and the Japanese cipher known as "Purple" – I knew about Purple, but hadn't thought about it when putting Lordie on the poster.

The protective marking MOST SECRET was the highest marking used by the UK prior to WW2. At some time during the war, they changed to TOP SECRET, to use the same markings as the USA. The marking MOST SECRET is no longer used on current documents, which is why I'm safe to use it here.

The page border on the poster and on the ATH pages was originally for decoration only, although I did later use the border in the ATH. (Described later.) It was created from an illustration in one of the many books which I had read about lost treasure. I have no idea what the coins are, and they are of no significance to the ATH. I hope you didn't spend too much time on them.

The small image version of the poster on the ATH website was created purely because the contents of the full poster would not have been legible when reduced to the size of the small image.

Page ordering and lost treasures

Pages 1 and 13 of the ATH carry page numbers, but no others do – which I thought was an obvious hint that the other pages were not necessarily in the "correct" order.

The centre puzzle on each of these other pages provided clues to a "**lost treasure**" [ORD1], with both "lost" and "treasure" being interpreted liberally! This was meant to be mainly a bit of fun – it would have taken you no more than seconds to determine what some of the treasures were. Intended to lure you in and hook you…

The correct page ordering is found by arranging the lost treasures into **chronological order of when they were "lost"** [ORD2], where "lost" includes "destroyed" and "stolen" as well as "mislaid". Clues to the re-ordering of the pages were provided by:
- the poster: "And when did you last see the treasure?"
- the introductory text on the website: "Knowledge of history ancient and modern – when, where and what, will be useful…"
- the text on page 1: "All the information you need is scattered through these pages – it's up to you to impose order…"
- the fact that one page has 8 questions, whilst all the others had 7, might have given you a clue that it should be the last page
- the phrase given by the images at top centre of each page would have helped, if you solved that first
- some of the other sequences would have helped too, if you had worked them out.

I expected you to realise fairly quickly the need to re-organise the pages – it was intended as an early "aha!" moment to give you a quick win and encourage you.

The correct ordering of the pages [ORD3] is as follows. With no page numbers, I have always referred to the pages by using abbreviations for the 11-letter words at the foot of them – more about these words later.
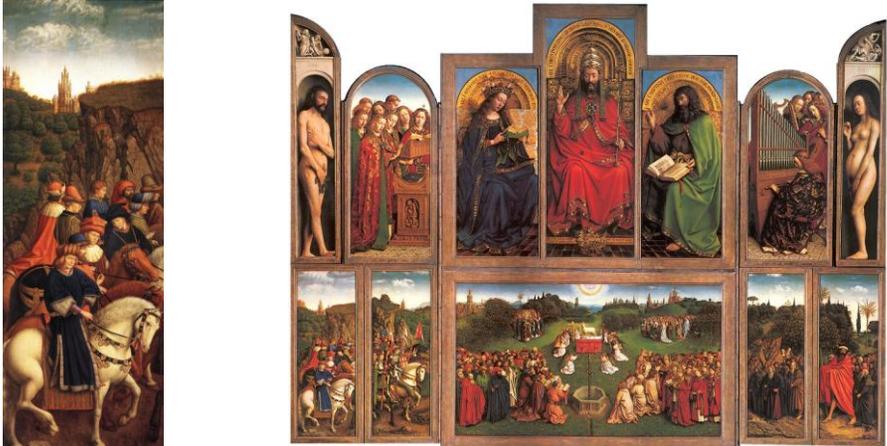
page	treasure	last seen
rationality (RAT)	The Colossus of Rhodes [RAT1]	Destroyed by earthquake in **226 BC**. [RAT2] (Although after that it lay in ruins for hundreds of years, and so, strictly speaking, wasn't "last seen" in 226 BC.)

the clues

Map of the island of **Rhodes**. [RAT3]

Picture of film maker **Sergio Leone**, whose directorial debut in 1961 was *Il Colosso di Rodi* (The Colossus of Rhodes). [RAT4]

Picture of **Caroline Lawrence**, author best known for *The Roman Mysteries* series of historical novels for children, including 2005's *The Colossus of Rhodes*. [RAT5]

Cartoon from *Punch* magazine, showing **Cecil Rhodes** as a Colossus [RAT6] bestriding Africa, following announcement of his plan for a telegraph link from Cape Town to Cairo.

Picture of a **Colossus** machine [RAT7], as used at Bletchley Park and elsewhere during WW2, in the decryption of messages enciphered by the Lorenz cipher machines used for communication by the German High Command.

page	treasure	last seen
agnosticism (AGN)	The **menorah** [AGN1], the 7-branched lamp that is one of the oldest symbols of Judaism.	The menorah was brought to Rome following the sacking of the Temple in Jerusalem in **70 AD**. It is not clear what happened to it after that, but it may well have been taken to Carthage by the Vandals in **455 AD**, and other accounts suggest that it may have survived until around **700 AD** [AGN2 – any of the dates above]. A current theory is that it is now held in the vaults of the Vatican, but I'll leave Dan Brown to explore that one! Here is the menorah on the triumphal Arch of Titus in Rome, constructed around 82 AD:

the clues

The text in the centre of the page refers to **Exodus, chapter 25, verses 31-40**, where the instructions for construction of the menorah are given.

"*Find the way out Greek*" – the Greek for "way out" or "departure" is *exodos*.[AGN3]

"*Nesta Robert sang about*" – one of Nesta Robert (Bob) Marley's most well-known songs is *Exodus*. [AGN4]

"*In the traditional port for sending mail*" – port 25 is the original port for sending SMTP email traffic [AGN5]. It is often blocked nowadays to prevent spam, with other ports being used.

"*From the days in this month*" – it doesn't matter whether you were reading this in December or January – both have 31 days. [AGN6]

"*until life begins*" – at 40. [AGN7]

page	treasure	last seen
orderliness (ORD)	**The Crown Jewels** [ORD1]	Lost on **12 October 1216** [ORD2] when King John's party was taking a short cut across the Wash. Historians will know that although it is commonly said that the Crown Jewels were lost in the Wash, there is no hard evidence for this. One theory is that, having squandered his fortune on himself and on supporting his elder brother Richard (the Lionheart) in the Crusades, King John simply sold his treasure, and staged their "loss" in the Wash. What *is* known is that when his son, Henry III, was crowned just over two weeks later on 28 October, a simple gold band was used, since the crown was no longer available. Whilst travelling through the east of England, King John had contracted dysentery at King's Lynn. After crossing the Wash, his illness became worse. He was first taken to Swineshead Abbey, and then to Newark Castle, where he died on 18 October. A popular theory, to which Shakespeare alludes, is that he was poisoned at the Abbey, possibly by a "surfeit of peaches", or perhaps plums, or new ale, or all of them.

the clues

No one is sure where this treasure was lost. The map illustrates four candidate locations. [ORD3]

Traditional lore says that the treasure was lost whilst crossing the Wellstream (now the river Nene) near **Sutton Bridge** [ORD4], whose bridge is pictured. Another possible location was **Wisbech** [ORD5], signified by the labels of the winter seasonal ales produced by **Elgood's Brewery** in that town. A third possibility was further north, between Walpole and Foul Anchor, which is near the modern-day **Tydd Gote** [ORD6], represented by a… tied goat!

The most recent theory, based on knowledge of the times of high tide back then, suggests that the calamity may have taken place much further north-west, when crossing the Welland river, near modern-day **Fosdyke** [ORD7], represented by the cartoon characters from the cover of one **of Bill Tidy's** *Fosdyke Saga* **books**.

page	treasure	last seen
premonition (PRE)	**Lasseter's Reef** [PRE1]	**1897** and also possibly **1930** [PRE2 – for either date] In 1929 & 1930, Harold Bell Lasseter claimed that in 1897 he had discovered a fabulous gold reef somewhere out in the inhospitable area around the border of the Northern Territory and Western Australia, but that he was unable to fix its location. He claimed to have spent three decades trying to raise money for an expedition into the desert to try to find it, but it was 1930 before the expedition happened. Eventually most of Lasseter's party deserted him, leaving him with just one companion. One day Lasseter returned from a trip alone into the desert, claiming to have re-located the reef, but refusing to share its location. A fight between the two men ensued, after which Lasseter's companion left, leaving Lasseter alone, eventually to perish in the desert. Attempts are still being made to locate Lasseter's Reef, but its existence remains a matter of debate.

the clues

A bottle of **Lasseter's Reef Verdelho** [PRE3], and some tasting notes for it [PRE4] and for Lasseter's Reef Verdelho Chardonnay.

Pictures of lumps of **gold-bearing ore**. [PRE5]

Lasseter's gravestone in Alice Springs. [PRE6] Like many of the images in the ATH, this one has been processed by a photo-editing program in an attempt to fool Tineye and Google Images.

page	treasure	last seen
foreknowing (FOR)	**The Just Judges** [FOR1]	**April 1934** [FOR2]. This is a panel from the **Ghent Altarpiece**, by Hubert and Jan van Eyck, which is in St Baaf's (or St Bavo) Cathedral in Ghent, and which was unveiled in 1432. It was stolen in April 1934, and is one of the most valuable missing artworks in the world. On 30 September 2011 the *Daily Telegraph* included an article on artworks which had been lost forever, and **The Just Judges** was the first piece covered by the article. Other ATH setters will know that sinking feeling when something that you have included in your ATH appears in a blaze of publicity just before the ATH is published!

the clues

Heavily processed picture of **panel on the outside of the door, depicting St John the Baptist** [FOR3], which is back-to-back with the Just Judges, which is on the inside of the door (bottom left in the picture above). The John the Baptist panel was also stolen along with the Just Judges, but was returned in May 1934.

Picture of **Mark E Smith**, founder and leader of long-lasting band **The Fall** [FOR4], named after Camus's novel. Included to guide you to the right work by Camus.

Football shirt which could have been worn by **Albert Camus**, who played in goal. In his most well-known novel *The Fall*, the main character claims to have found the Just Judges [FOR5] in a bar in Amsterdam called "Mexico City", and his secret withholding of the painting empowers him, he feels, in his newfound role of "judge-penitent".

Processed picture of the **cathedral**. [FOR6]

Signature of "Hubie and Jan". (Sorry!) There used to be an inscription on the frame saying that it was started by **Hubert van Eyck**, and completed (after Hubert's death) by his younger – and now more celebrated – brother **Jan**. [FOR7]

page	treasure	last seen
abecedarian (ABE)	**The Crystal Palace** [ABE1]	Destroyed by fire on **30 November 1936**. [ABE2]

the clues

In the centre, the **masterplan for the redevelopment** [ABE3] and restoration of the Crystal Palace park, unveiled in 2007.

Left, the first **strip worn by Crystal Palace FC** [ABE4], in 1905/06.

Top, **Crystal Palace football ground** [ABE5] in 1911, with one of the towers from the Crystal Palace building visible in the background.

Right, picture of the **fire at the Crystal Palace**. [ABE6]

Bottom, the **Infomart**, a modern office and data centre building in Dallas, Texas, **modelled on the Crystal Palace**. [ABE7]

page	treasure	last seen
paradoxical (PAR)	**The Amber Room** [PAR1]	A room in the Catherine Palace near St Petersburg. Last known sighting was in **October 1941** [PAR2], when the invading Nazis dismantled it for transport to Konigsberg Castle. There are various theories about what happened subsequently – with perhaps the most credible being the one that it was, inadvertently, destroyed by Soviet forces when they overran Konigsberg Castle in April 1945.

the clues

Left, **Charlottenburg Palace** [PAR3] in Berlin, where the Amber Room was originally created and located, until 1716 when it was given by Prussian king Friedrich Wilhelm I to his then ally, Tsar Peter the Great.

Right, the **Catherine Palace** [PAR4] of Tsarskoye Selo near Saint Petersburg, where the Amber Room was installed. A reconstructed room can be seen there today.

Middle, a set of **traffic lights**, from the online version of the Highway Code, showing **amber** [PAR5], which means "floor the throttle and get through before they go to red".

page	treasure	last seen
objectivism (OBJ)	**The Skylon** [OBJ1]	Built on the South Bank of the Thames in London for the Festival of Britain in 1951, and demolished in **1952.** [OBJ2]

the clues

The letter 'O' taken from the **logo of the current-day Skylon restaurant** in the Royal Festival Hall. [OBJ3]

The Skylon was often jokingly compared to the British economy – both had "**no visible means of support**". [OBJ4] The text is angled to resemble a couple of the Skylon's supports.

Pictures of the **sky** [OBJ5], and of **Lon Chaney Snr** [OBJ6].   (It was because of my use of his first name, and that of Uri Geller and the initials of B A Baracus, that just before publication I realised that I should add the qualifier "mostly" into the ATH introductory text on the website. I hadn't strictly followed the rule of using surnames unless necessary to distinguish from another of the same surname.)

page	treasure	last seen
sempiternal (SEM)	**Shergar** [SEM1]	Famous racehorse, stolen from Ballymany Stud in County Kildare by masked gunmen on **08 February 1983** [SEM2], and never seen again. The most popular theory is that he was stolen by the Provisional IRA, that he panicked and injured himself in the horse-box shortly after being taken, and was then shot by the gang who did not know how to look after a highly-strung horse which was now damaged goods.

the clues
They represent the six races won by Shergar in his 8-race career [SEM3].

In 1980, as a 2 year old, the **Kris Plate**. [SEM4]

In 1981, as a 3 year old:
- the **Guardian Classic** [SEM5] (the Sandown Classic, which was sponsored at the time by the Guardian)
- the **Chester Vase** [SEM6] – Deva was the Roman name for Chester, and "Memento Devam" is (I hope!) Latin for "Remember Chester", i.e. the vase is a souvenir of Chester. (The font used is Wide Latin Regular.)
- the **Derby** [SEM7] – pictured is the 12th Earl of Derby, who was instrumental in setting up the race, and after whom it was named following a toss of the coin with Sir Charles Bunbury
- the **Irish Derby** [SEM8]
- the **King George VI and Queen Elizabeth Stakes** [SEM9].

In case you're wondering, the two races which he didn't win were both at Doncaster:
- the 1980 Futurity Stakes, in which he was second
- the 1981 St Leger, in which he was a poor fourth.

page	treasure	last seen
unbelieving (UNB)	"**Everyone I Have Ever Slept With 1963-1995**" [UNB1] Popularly known as "Tracey Emin's Tent".	Destroyed in the fire at the Momart warehouse in London on **24 May 2004** [UNB2], along with about 100 other artworks from Charles Saatchi's collection, and other works as well. According to Wikipedia, and providing one of those unintentional connections which ATHs throw up: "In collaboration with **Uri Geller**, artist Stuart Semple collected remains from the Momart fire site and packaged them in 8 plastic boxes under the title *Burn Baby Burn*; the boxes had slogans in pink lettering, including "RIP YBA" which referred to the Young British Artists amongst whom Emin is classified." **Uri Geller** appears at the top of ATH page FOR.

the clues

Contrary to the sneers at the time of the Daily Mail and other pillars of the Establishment, the title of the work is to be taken literally, and, as well as those with whom Emin had a sexual relationship, the names inside the tent [UNB3] include, for example, her grandmother. The text on the floor reads "WITH MYSELF   ALWAYS MYSELF   NEVER FORGETTING".

The names include Roberto Navikas, Lucey Baxter, Carl Freedman, Frank Berbee, Tracy Horn, Maria Tanton, and Billy Childish. If you put any selection of those surnames into Google, you'd have found the answer straight away.

Ironically, I don't know the forename of my namesake, Smith, and if you'd included that name in your search you'd probably have drawn a blank.

page	treasure	last seen
obscurantic (OBS)	**The Codex Calixtinus** [OBS1] A 12th century illuminated manuscript, providing background detail and advice for pilgrims following the Way of St James to the shrine of the apostle St James the Great, in the cathedral of Santiago de Compostela in Galicia.	Stolen from the cathedral at Santiago de Compostela in northern Spain, probably on **03 July 2011** [OBS2]**.** Although I already had more than enough "lost treasures", I was delighted to be able to include a very recent one, especially one which was a "Code X" ☺ I was tempted to find those who had taken it, and ask them to be sure to keep it until the ATH had closed. The picture below from the Codex shows Charlemagne and his knights on their way to Santiago de Compostela.

the clues

The copy of the Codex which belonged to Santiago de Compostela consisted of 5 volumes, represented by the pictures [OBS3]:

- **Vol 1: Book of the Liturgies** [OBS4] – yes, I <u>have</u> read umpteen descriptions of why "liturgy" and "order of service" is not the same thing, but it's the best I could come up with!
- **Vol 2: Book of the Miracles** OBS5] – represented by a photograph of the group who had that name for most of their career. Only for a relatively short period were they officially "Smokey Robinson and the Miracles".
- **Vol 3: Transfer of the body to Santiago** [OBS6] The story is that the body of St James floated on a raft "with neither sail nor rudder" from the eastern end of the Mediterranean out into the Atlantic and northwards before coming ashore in north-west Spain. The picture here is taken from a website about Santiago de Compostela – I haven't established whether that carving is actually in the cathedral or is elsewhere.
- **Vol 4: The History of Charlemagne and Roland** [OBS7] – Describes the coming of Charlemagne to Spain, and his defeat and the death of the knight Roland at the Battle of Roncevaux Pass. The picture in the ATH is an illustration of the death of Roland, from a 14th century manuscript. The book then describes how St James appeared in a dream to Charlemagne, urging him to liberate his tomb from the Moors, and giving him the instruction to find the tomb by following the route of the Milky Way. In Spain, an alternative name for the Milky Way is *Camino de Santiago*, the Way of St James.
- **Vol 5: A Guide for the Traveller** [OBS8] – often said to be the first tourist guide, this provides information for pilgrims following the Way of St James, on where to stop, where there were relics and sanctuaries which they should visit, and on commercial scams and bad food ("don't eat the local fish") to watch out for. Also describes the city of Santiago of Compostela and its cathedral. The cover of my fake Baedeker for the Way of St James (the Milky Way) [OBS9] features a picture of a pilgrim, taken from the same website as the picture of St James's raft, and a picture of the cathedral itself [OBS10].

Finally, the **Shell** logo [OBS11] is a scallop shell, although they refer to it as "the pecten". Due to the pilgrims' habit of picking up shells from the Galician coast, the shell became the symbol of St James [OBS12] (and, as I only realised when researching this, gave its name to *coquille St Jacques*). Shell's website reveals that there may be a link between their logo and St James:

"The word "Shell" first appeared in 1891, as the trade mark for kerosene being shipped to the Far East by Marcus Samuel and Company. … The word was elevated to corporate status in 1897, when Samuel formed The "Shell" Transport and Trading Company. The first logo (1901) was a mussel shell, but by 1904 a scallop shell or 'Pecten" emblem had been introduced to give a visual manifestation to the corporate and brand name.
…
Both the word "Shell" and the Pecten symbol may have been suggested to Samuel and Co. by another interested party. A Mr Graham, who imported Samuel's kerosene into India and sold it as 'Graham's Oil', subscribed capital to, and became a director of, The "Shell" Transport and Trading Company.

There is some evidence that the Shell emblem was taken from his family coat of arms. The 'St James's Shell' had been adopted by the Graham family after their ancestors made the pilgrimage to Santiago de Compostella in Spain. Whatever its origins, the original design was a reasonably faithful reproduction of the Pecten or scallop shell."

With the unnumbered pages in chronological order, a number of sequences fall into the correct order [SEQ1]:

-	the Ordnance Survey grid references
-	the ADFGX ciphertext
-	the Smithy code
-	the logos at the top of each page
-	the "Polo mint" diagrams
-	the 11-letter words at the bottom of each page
-	the treasure-chest code
-	the "3 men" verse
-	the clue to Dirk Rijmenants' website
-	the "fair and bright clearing" message
-	the "codebreakers" chronological sequence of date of birth (with the exception of those on the last page)
-	the message derived from the answers to the questions.

All of these are explained below.

Clues to Shenley Wood

There were a number of clues of varying vagueness and precision.

Enigma clues

The Enigma clues (see later) might have suggested that the treasure was somewhere near Bletchley Park.

National Grid references

The co-ordinates all dumped you in the middle of streets in and around London, which had been found in the A-Z, with the co-ordinates verified online using both Streetmap and Google Earth.

They followed on from the reference to **Herrings Lane** in Chertsey which was on the poster. When you worked out the other streets, you may well have continued to think that there was something **fishy** about them [NGR1] – that was the sole (!) criterion for me choosing these particular places.

However you might have noticed that these co-ordinates were in green font, signifying that they were different in some respect from those on the poster.

If you have the pages in the correct order (RAT, AGN, ORD, etc.) then the locations are:
- Napoleon Road [NGR2] (Napoleon fish or Napoleonfish is another name for the humphead wrasse)
- Eel Pie Island [NGR3]
- Albacore Crescent [NGR4]
- Roach Road [NGR5]
- Whiting Avenue [NGR6]
- Angel Road [NGR7]
- Troughton Road [NGR8]
- Ling Road [NGR9]
- Indus Road and Barhill Road – There are not many fish whose names start with 'i' – and even fewer whose names are also London streets. Inkfish aren't fish and could have misled you. Most fish with names beginning with 'i' have complex names - Indian something or Inca something or imperial something. Here I am referring to the Indus baril. [NGR10]
- Nursery Close [NGR11]
- Garibaldi Street [NGR12] (Yes, there is a fish called the garibaldi – not to be confused with the biscuit)
- Salmon Street [NGR13]
- Tench Street [NGR14].

The first letters give you "**NEAR WATLING ST**" [NGR15], which was both a clue and a red herring (I told you there was something fishy). The old Roman road which was later called Watling Street was even later designated as the A5. And even later than that, part of it was re-designated as the A5183. As you'll see later, I hoped to misdirect you to a place called Shenley near where I live in St Albans. Watling Street runs near to that Shenley, goes through Roman Verulamium in St Albans – a few hundred yards away from me as I type this – and runs north-west through Milton Keynes, where it is grid road V4, not far from Shenley Wood.

Chappe semaphore indexing into the treasure names

The symbols printed across the treasures on each page are Chappe semaphore positions [CHA1] – Chappe being the answer to question 4 on page AGN. The reason that they were printed across the treasures was that they referred to the treasures [CHA2] – although not necessarily the treasure on the same page.

List the treasure names in chronological order – you need the first 10 characters of each name.

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page      1| 2| 3| 4| 5| 6| 7| 8| 9|10
---------|--|--|--|--|--|--|--|--|--
RAT       C| O| L| O| S| S| U| S| O| F
AGN       M| E| N| O| R| A| H|  |  |
ORD       C| R| O| W| N| J| E| W| E| L
PRE       L| A| S| S| E| T| E| R| S| R
FOR       J| U| S| T| J| U| D| G| E| S
ABE       C| R| Y| S| T| A| L| P| A| L
PAR       A| M| B| E| R| R| O| O| M|
OBJ       S| K| Y| L| O| N|  |  |  |
SEM       S| H| E| R| G| A| R|  |  |
UNB       E| V| E| R| Y| O| N| E| I| H
OBS       C| O| D| E| X| C| A| L| I| X
```

On page RAT, the Chappe semaphore characters are RAT10. The 10th character of the treasure on page RAT is F. (By the way, 10 was deliberately chosen to make it clear that this didn't refer to the questions, which only go up to 8.)

On page AGN, the semaphore gives you OBS7&9. The 7th letter of the page OBS treasure is A, and the 9th is I – so the letters are AI.

On page ORD, the semaphore gives you PAR6&7&5&3 – i.e. the 6th, 7th, 5th and 3rd letters of Amber Room – RORB.

When you completely decode the message, you have the phrase "**FAIR OR BRIGHT CLEARING OR WOOD**" [CHA3]. Google would have told you that "The name Shenley [CHA4] is based on the Anglo-Saxon Scenlai, Scenlei or Senlai, which means 'fair or bright clearing or wood'", and most of the references in front of you would have been to the Shenley near me in Herts, not to the Shenleys on the edge of Milton Keynes. Another deliberately ambiguous clue.

The treasure chests on pages 2 to 12

A more complex version of the Santas geometric code on the poster. Each chest represents a letter of the alphabet, where the letter is denoted by the distance of the chest from the top of the page. With the treasure chests, distances were measured to the lock on the chest.

The DTP tool that I was using to create the ATH – Scribus - supports very precise placement of items on the page. However, I did realise that displaying the image on the screen, or printing it, could mess up the measurements. In particular, most printers leave a margin at top, bottom and sides, so that the actual printed area would be less than A4 size. I thought about recommending that you use borderless (photo) printing if you had it, but even that could have messed up the measurements.

Anyway, I hoped that however you viewed or printed the pages, you would be able to determine that the Santas and treasure chests were in particular vertical and horizontal positions. To give you a clue, I included a faint set of lines down the right border of page 13. No matter how your printer distorted things vertically, you should have been able to use the lines to work out the positions. [CHE2]

On the poster, A is the lowest position on the page (286mm from the top) and Z is the highest position. The Santas on the poster simply spell "Logica".

Assuming that you would have solved this before the actual Hunt started, on the ATH pages the order is reversed - A is the highest position, 11mm from the top of the page, B is 22mm from the top, and Z is the lowest position. [CHE1]

However, to complicate things further, I encrypted the message using the names of the "lost treasure" on each page, by requiring you to "add" the first six letters of the treasure name on that page to the six letters given by the treasure chests on that page. [CHE3]

Think of A, B .. Z as being numbered 1, 2 .. 26. The treasure on page RAT is the Colossus of Rhodes. Following the usual rule of ignoring "the", the first six letters of the treasure name are thus COLOSS. The six letters given by the treasure chests are TSWWLF.

So if you add them together and roll round from the end of the alphabet to the beginning (i.e. mod 26 arithmetic) you will get:

```
C O L O S S
T S W W L F
-----------
W H I L E Y
```

The names of the treasures are as given earlier. I replaced the Santas from the posters with treasure chests as a clue that the treasures were somehow involved in the code, and also to signify that the code was not exactly the same as that on the poster. And the pirate on page RAT tells you to add the treasure to the chest.

It is no coincidence that the message has 66 letters, which meant that I could put 6 letters on each of the 11 pages.

The decoded message, with punctuation added, is "**While you are near, have a quick look at Green View and then visit PO Box one one one**." [CHE4]

If you knew what Green View and PO Box 111 were, this would give you an indication of the area in which the treasure was.

Green View is a rather nice Grade 2 listed mid-19th century house in Shenley Brook End. With a little bit of investigation, you could have discovered that for most of its existence it was an inn. During WW2 it was the Crown Inn [CHE5], and it was there that Alan Turing was billeted whilst he was working at Bletchley Park. I had originally thought of leading you initially to the Crown Inn, and then to the treasure, but it's quite a distance, and there was also the privacy of those who live in Green View to respect.

The picture of Green View below was taken on our first reconnaissance trip to the area in February 2008. The side of the outbuilding on the left still carries the remains of an advert for Flowers Ale.

"PO Box 111, Bletchley" was the war-time address for Bletchley Park. [CHE6]

So in the message I was suggesting that – since you may well have travelled some distance to unearth the treasure – you make a day of it and have a look at Green View and then pay a visit to Bletchley Park itself. Please note that this was a suggestion, not an instruction, and that there were no points for actually visiting Green View and Bletchley Park.

The black grid on the first page and the planes on other pages

At the top level of the road hierarchy in Milton Keynes is the grid road system, a number of national speed limit roads with plenty of roundabouts but no traffic lights or "STOP" junctions, which enable rapid movement around the area. There are 11 roads running (very) approximately north-south – these are designated V1, V2, etc. There are 10 which are roughly east-west, designated H1, H2, etc. Each road also has a conventional name – the V roads are all "streets" and the H roads are all "ways". I couldn't use the names as they were just too obvious, but I thought I could use the H and V designations. If you know Milton Keynes, you should know about the road system – if not, Google would have been your friend.
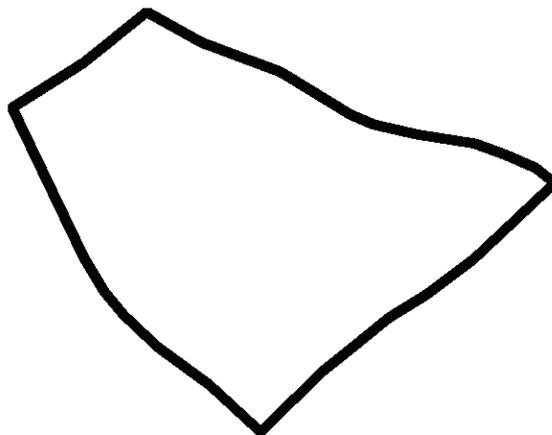
The grid on the first page is an abstract representation of the four V and H roads within which Shenley Wood lies [GRI1]. The text inside the grid is all about treasure. The horizontal road across the top is **H5 (Portway)**, then, going clockwise, **V3 (Fulmer Street)**, **H6 (Child's Way)** and then **V2 (Tattenhoe Street)**.

The airplanes on the other pages belong to pretty obscure airlines:
- on page PRE, you have **I-Fly** (whose **IATA code is H5**) [GRI2]
- on FOR, **Carpatair (IATA code V3**) [GRI3]
- on SEM, **Hageland Aviation Services (IATA code H6)** [GRI4]
- on OBS, **Vision Airlines (IATA code V2)** [GRI5].

So the **IATA codes of the airlines give you the designations of the roads around Shenley Wood** [GRI6]. I originally had the planes on the grid on the first page, but I was worried that this was too easy, so I moved them to other pages, using the page border to represent the four roads, and placing each plane on the appropriate road. [GRI7]

In fact, the actual road grid in Milton Keynes is **very** approximate – the city planners had the sense to let the grid follow the contours of the land, rather than imposing a regular grid on an irregular landscape. The result is that the four roads around Shenley Wood are all about 45 degrees off the N-S and E-W axes, with Fulmer Street in particular being more "horizontal" than "vertical". I originally had an accurate map of the roads (see below) instead of an abstract grid, but I decided that that was too easy – especially when someone thought of Bletchley Park after seeing just the poster!

The Polo mint diagrams

These were simply **maps taking you to the car park at Shenley Wood**. [POL1]

One of my discarded ideas was to include my satnav's directions to Shenley Wood - possibly from where the previous year's treasure had been located – but I gave up on this as it monotonously directed me straight through 12 roundabouts in a row in Milton Keynes.

One thing that Milton Keynes is famous for is its roundabouts so, still thinking of last year's ATH, I thought of using a Polo mint to represent a roundabout, and used a certain amount of artistic freedom in compressing them together. The maps are not to scale, and the different sizes of Polo mint and width of road – which may have caused some confusion – were not significant.

With the pages in chronological order, those on the left hand side of the pages take you east from the M40 to the car park at Shenley Wood [POL2], and those on the right take you west from the M1 [POL3]. I reckoned that most of you would travel on either the M40 or M1 to reach the site.

The sequence on the left starts at junction 10 of the M40. I have shown only roundabouts, ignoring other junctions and roads apart from those on the final stretch of road near Shenley Wood. On the section of the road on the left of page PRE, you pass under the "David Shakespeare" and "Kenneth Ross" bridges. Messrs S and R are past or present Conservative councillors in Bucks. Apparently the Conservatives in Bucks have been immortalising themselves by attaching their names to bridges, buildings and probably even bus-stops, much to the annoyance of the other parties, who have their own worthies whom they would like to commemorate. I originally included these bridges and abbreviated versions of the names, but then I realised that I had better delete them, otherwise some of you would take 40-mile detours just to check the names.

The diagrams on the right hand side of the pages take you from junction 14 of the M1. In fact, if you were travelling north up the M1, then you could consider the roadworks sign to be the start of this sequence [POL4], since there are 15 miles of roadworks between junctions 10 and 13.

The car park at Shenley Wood is itself doughnut-shaped, so I felt that I could represent it, too, as a Polo mint.

Applying the "diagonal argument" to the 11-letter words

List the 11-letter words in the correct order:

```
R A T I O N A L I T Y
A G N O S T I C I S M
O R D E R L I N E S S
P R E M O N I T I O N
F O R E K N O W I N G
A B E C E D A R I A N
P A R A D O X I C A L
O B J E C T I V I S M
S E M P I T E R N A L
U N B E L I E V I N G
O B S C U R A N T I C
```

Draw a diagonal line from the 'R' which is the 1st letter of "rationality" to the 'C' which is the 11th letter of "obscurantic", through the 2nd letter of "agnosticism", the 3rd of "orderliness", and so on.

Take the letters which are on that diagonal – R G D M K D X V N N C.

Shift each letter one place down the alphabet (i.e. add "one" to it) – **S H E N L E Y W O O D** [DIA1]. This is the only place in the puzzle where the actual name "Shenley Wood" can be found.

There is no significance in the 11-letter words. If they have a quality of mysticism, or spirituality, or "science vs non-science", then that's just coincidence! Well, not really - but there's no hidden meaning.

That's also why there are 13 pages in the body of the ATH – 11 letters for Shenley Wood, plus the first and last pages. I think this was the very first puzzle that I created for the ATH, and it survived all the drafting and rewrites over the period of development – so it will be interesting to see if anyone actually solved it.

OK, next question – what is a "diagonal argument" and what is its relevance here?

The "diagonal argument" is a technique which has been used by mathematicians to demonstrate some very profound findings. The three most well-known mathematicians [DIA2] to use it were:

- **Georg Cantor**, who used it to show that the infinite set of **real** numbers (all numbers, including fractions and irrational numbers, on the traditional number line that runs from negative infinity to positive infinity) cannot be put into one-to-one correspondence with the infinite set of **natural** numbers ({1, 2, 3, …} or {0, 1, 2, 3….}, depending on which definition you use). Amongst other things, this showed that there are different "sizes" of infinity!

- **Kurt Gödel**, who used it to show that arithmetic is *incomplete*, which here means that there are assertions in arithmetic which can neither be proved or disproved. The equivalent of trying to decide whether the statement "I am lying" is true or false.

- **Alan Turing**, who used it in showing that in the theory of computation – algorithmic processing of symbols, which is what the computers that we use every day are doing – there are problems which are *unsolvable*. In very informal terms, there are "problems" where you can't say whether your program will find a solution.

I won't say more about these uses of the diagonal argument here. If you want to know more, there is a little more detail at the end of this solution, including an example of how Cantor used it, and there is information available online.

By the way, with all the clues to the use of diagonals, I thought you might have done this and found "Shenley Wood" without knowing what the "diagonal argument" actually is.

Clues to the importance of diagonals and the use of the diagonal argument

The bishop chess-piece
The red chess piece on page 13 is a bishop. In fact, this is the logo of the **Bishop's Move** removal company, with the company name removed. Bishops move diagonally. [DIA3]

The roadworks sign
If you write the 25 letters of the text as a 5x5 square

```
f e d r s
g o r w k
o i r o o
a l s t a
I p o e h
```

and then read along the diagonals from upper left to lower right, starting in the bottom-left corner, you will read the text "I apologise for the roadworks!" [DIA4]. This is a heartfelt apology from me. I was horrified when the long-term 15-mile roadworks on the M1 between junctions 10 and 13 appeared, after I had selected my treasure site, because I knew that many of you would have to drive through them. If it's any consolation, I have been working in Logica's Birmingham office since early 2011, so I have driven through them many more times than you!

This could have given you a vague clue to the treasure location – i.e. somewhere near 15 miles of roadworks - but it was also intended to make you think about moving diagonally through a square of letters. I hoped you'd realise that there were 25 letters, write them in a 5x5 square, realise that the capital I was the first letter, that the exclamation mark came after the last letter, and that the word "roadworks" could well be in there.

The diagonal acrostic in the answers
Sticking to the diagonal theme, the acrostic in the answers is diagonal [DIA5] on each page – 1st letter of answer 1, 2nd letter of answer 2, etc.

Grok diagonal turn? Got argent lucre!!
"grok" is from Robert A Heinlein's *Stranger in a Strange Land*, and basically means "understand" – albeit a very deep and profound understanding which affects or even in some ways intermingles the observer (in this case, you) and the observed (me, as embodied in the ATH). It seems like a good description of what we're trying to do in an ATH. (I have a feeling that it has been used before in an ATH, but I can't remember when.)

Anyway, the message is telling you that if you use or do a diagonal "turn" [DIA6], you'll find the silver wealth [DIA7]. That is, the diagonal argument reveals the name of Shenley Wood, which is where the "silver" treasure – Turing's silver bars – are hidden.

It's also an anagram of **Georg Cantor**, **Kurt Gödel**, and **Alan Turing**. [DIA8]

3 men known for oblique discussion
2 of them died not eating enough
1 of them died from eating a bad 'un
That should help you find the stuff.

I'm not a poet, am I? The lines appear in the right order when you have the pages in the correct order. The 3, 2, 1 would also have helped you – but you should have been able to work out the correct order without these hints. This is another clue that use of a "diagonal argument" would help you find the treasure ("the stuff").

"oblique discussion" is diagonal argument [DIA9], and the three men are **Cantor**, **Gödel** and **Turing**. [DIA10].

A mathematician's life is not a wealthy one. In his later years **Cantor** suffered from extreme poverty, and **died from malnutrition** in a sanatorium, in 1918. (Some sources say that he died from a heart attack. However, the fact was that he did suffer from malnutrition during the years of WW1, so even if a heart attack finished him off, it's still correct – if a bit flippant - to say that he died "not eating enough".)

Gödel worked at the Institute for Advanced Study in Princeton, so he wasn't poor. However, he became mentally instable, and developed a fear of his food being poisoned. He refused to eat anything unless his wife had tasted it first. In late 1977 she was hospitalised for some months, and with no-one around whom Gödel trusted to taste his food, he effectively **starved to death**, weighing only 65 pounds when he died in January 1978.

Turing is widely believed to have **committed suicide** in 1954, by biting into an apple which had been dipped in cyanide.

So Cantor and Gödel died from not eating enough, and Turing from eating a "bad" apple.

The **word square** on the front page, and the words "**thinking along the same lines as me**" [DIA11] in the introductory text on the ATH website might also have helped you think of diagonals.

Detailed instructions for locating the treasure

These were enciphered in the text in the middle of page 13, the last page - the traditional place for the detailed instructions to be.

If you didn't already know it, one of the things you will have looked up very early on was **Kerckhoffs' Principle**. Auguste Kerckhoffs was a 19th-century Dutch linguist and cryptographer - look up his full name if you want to see something that I would have liked to use in the ATH, but didn't. In 1883, he published six principles of cipher design, of which one has become rather better known than the others, becoming known as "Kerckhoffs' Principle". It can be stated as "The design of a system should not require secrecy and compromise of the system should not inconvenience the correspondents". In short, the only thing that a crypto system should rely on is the secrecy of its key, and it should not rely on the secrecy of any other part of the system.

Following Kerckhoffs' Principle, I made no attempt to conceal the detailed instructions, and didn't attempt much to disguise the method by which they were encrypted. They were encrypted using an online simulator of an **Enigma** machine.

You can find many descriptions of how the Enigma worked online and in books, so I won't describe it here. The Enigma didn't quite follow Kerckhoff's Principle, in that one of the vital pieces of information needed to decrypt Enigma messages was knowledge of how the connections inside the machine were hardwired – hence the efforts of the Allies to capture Enigma machines, as well as Nazi codebooks, during the war. But apart from that, the secrecy of Enigma machines depended essentially on the secrecy of the key – although in the ATH you had a slightly more difficult problem in that you also had to work out which version of the Enigma had been used.

The items of information needed to decode the detailed treasure instructions were:
- the type of Enigma machine
- the reflector
- the rotors and their order
- the ring settings
- the plugboard configuration
- the structure of the message.

You also needed clues to lead you to an Enigma simulator – this was one cipher I wasn't expecting you to break with pencil and paper!

The instructions took you from the car park at Shenley Wood to the treasure location.

Clues to the use of Enigma

Each page of the ATH carried a pictorial clue to the use of Enigma:

- **page 1**: bottom right – **Arthur Scherbius**, the German engineer who invented and patented the cipher machine which was to be marketed as the Enigma [ENI1]
- **page 13**: middle left – **Marian Rejewski**, a Polish mathematician and cryptographer, who with his colleagues Jerzy Różycki and Henryk Zygalski in 1932 broke the encryption of the German Enigma machine that was then in use [ENI2]. There is a substantial article about him on Wikipedia - http://en.wikipedia.org/wiki/Marian_Rejewski - where you can read about how the Poles kick-started the Bletchley Park effort by handing over everything they knew about Enigma just before the war started, how his talents were under-used by British during the war, and how he was only just beginning to receive the recognition due to him when he died in 1980.
- **page 13**: middle right – **Alan Turing** [ENI3]. He had a very distinctive face, and most photographs of him were far too obvious to use. This is a processed picture of the slate statue of him at Bletchley Park.

The other pages carried pictorial clues [ENI4] where "**Enigma" was the answer, or at least part of it**.

The cover of the *Pictured Within* CD on the ATH poster was part of this series, although there it was a "double-step" to reach Elgar's *Enigma Variations*. There is no ordering to the Enigma series – my apologies to any of you who wasted time trying to find one.

- **ABE**: the musical notes at top right are the **enigmatic scale** [ENI5], in this case on C. It was supposedly invented by Verdi, who composed his *Ave Maria (sulla scala enigmatica)* in response to a challenge in Milan's *Gazzetta musicale* to employ a musical conundrum. Fans of guitarist Joe Satriani may have encountered this scale on the track *The Enigmatic* from his album *Not Of This Earth*.

- **AGN**: the picture of a blaze of lights at top left is a picture of **Pink Floyd's** concert at East Rutherford, New Jersey on Monday 18th July 1994. The brick effect was added close to publication date when I spent some time trying to outfox Tineye and Google Images, and is a nod to the Floyd's album *The Wall*, recently revived by Roger Waters.

    The lights in front of the stage are spelling out the words "ENIGMA PUBLIUS". The **Publius Enigma** [ENI6] was a mysterious episode during which it appeared that there was some sort of riddle associated with the lyrics, artwork and music of the 1994 album T*he Division Bell*. This was caused by a series of anonymous cryptic messages posted to the Usenet newsgroup alt.music.pink-floyd, by someone referring to themselves as "Publius Enigma".

    Many people like a puzzle – you wouldn't be reading this if you didn't – and certain types of Pink Floyd fans were very open to ideas of some sort of mysterious riddle associated with the band. The newsgroup was divided into those who thought that this was the greatest mystery in the history of the Universe, and those who thought it was the greatest load of rubbish in the history of the Universe. On 16th July 1994, Publius sent to the newsgroup a message which was intended to confront the doubters and reassure the believers, by showing that there was a real connection to the band. The message said that at approximately 10.30pm during the show on the 18th, there would be "flashing white lights". It duly transpired that at about the predicted time, the patterns of light at the front of the stage momentarily coalesced into the words "ENIGMA PUBLIUS".

    The whole affair eventually fizzled out, without anyone ever discovering the identity of Publius, or what the riddle was about or what the prize was for solving it (if there was a

prize).

If you are interested, there is plenty to read online – start at
http://en.wikipedia.org/wiki/Publius_Enigma .

- **FOR**: The horned gentleman with the guitar at the upper left is **"The Enigma"**, a sideshow performer, actor and musician known to his Mum as Paul Lawrence [ENI7]. Here is the original photograph.

As can be seen, he has undergone considerable body modification, including the implanting of those horns, reshaping of his ears, body piercing, and a full-body jigsaw puzzle tattoo. He originally came to notice as Slug in the (in)famous Jim Rose Circus, eating anything (worms, grasshoppers) and swallowing swords, and also doubling as the show's organist. Changing his name and appearance to The Enigma, he left the show and has performed as a solo artist since 1998. TV appearances include *The X-Files* and *Penn & Teller*.

- **OBJ**: The painting at upper right is "**The Endless Enigma**" by Salvador Dali, 1938. [ENI8]

- **OBS**: The picture at top right is Martin Sheen in the 1983 film "**Enigma**" [ENI9], a spy film directed by Jeannot Szwarc, who is apparently best known for *Jaws II* and *Somewhere in Time*. The reviews which I have seen are not encouraging. The picture is actually taken from the cover of the VHS video (remember them?) release of the film.

- **ORD**: The picture at top left is from publicity for the 2001 movie "**Enigma**" [ENI10], starring Dougray Scott and Kate Winslet, and based on Robert Harris's novel about wartime Bletchley Park. This particular image was taken from the cover of a "special edition" release of the DVD.

- **PAR**: The ice-cream at upper centre is a Walls Cornetto **Enigma** [ENI11] – a vanilla and raspberry one, to be precise. The Cornetto Enigma was introduced in Spring 2010, but since I'm not a lover of pre-packaged mass-produced ice-cream I wasn't aware of it until I saw adverts for it when on holiday in Portugal in September 2011.

- **PRE**: The picture at bottom left is the cover of the 2008 album "**Seven Lives Many Faces**" by the German group **Enigma** [ENI12]. They are best known for their first and most successful album, *MCMXC a.D.*, which sold over 20 million copies worldwide. Those of you who are old enough to remember it can probably even now hear its then-groundbreaking mixture of Gregorian chant and dance beats. Sorry – *mea culpa* ☺

- **RAT**: The picture at the top right is a variant of that old warhorse, the Soviet T-55 battle tank. This particular variant is the T-55 "**Enigma**" [ENI13] which was the main battle tank of the Iraqi forces at the time of the first Gulf War in 1991. The Iraqis modified the T-55 to carry additional armour on the turret and hull, comprising several layers of "spaced armour" (plates of armour with space in between each) contained in steel boxes, giving the Enigma variation (!) a very distinctive appearance. You can see the additional armour clearly in the photograph, which I took from a website selling scale model kits of these tanks.

- **SEM**: The picture at upper left is of Edward Elgar, composer of the **"Enigma Variations"** [ENI14].

- **UNB**: The clue on this page is the emblem on the shirt of the gentleman in the picture in the upper right of the page. The emblem is actually a Photoshopped version of the logo used for the Enigma machines, with most of the lettering removed, leaving only the 'G'. [ENI15] Who the gentleman is, what he's doing, and why the logo is reversed will be revealed later. Here is the actual logo:

OK, that's the clues which told you about the use of Enigma. The next things you needed were clues to lead you to the correct Enigma simulator.

The Enigma simulator

There are lots of Enigma simulators out there on the Web, of varying quality and, more worryingly, of varying behaviour. So I had to make sure you used the right one. If you googled for "Enigma simulator" you'd have come across Dirk Rijmenants' website - http://users.telenet.be/d.rijmenants/ - near the top of the list. But to be sure, I included a couple of clues to take you to it.

(Incidentally, I did find a few Enigma sims, including the one on the Bletchley Park website, which produced the same results as Dirk's. However, it was sometimes not easy to work out which Enigma variant to use, and how to set the machine up. Dirk's was the best looking, easiest to use, and had the best "help" information.)

Magic square code

Wikipedia tells us that a magic square of order n is an arrangement of n^2 numbers, usually distinct integers, in a square, such that the n numbers in all rows, all columns, and both diagonals sum to the same constant – the magic constant or magic sum, represented by M. A normal magic square contains the integers from 1 to n^2.

Steve Hames included Albrecht Dürer's famous magic square in the ATH a few years ago.

The green lines and blobs inside a square on pages 2-12 of the ATH each comprise a *sigil* based on a 5x5 magic square. The Wikipedia article on magic squares - http://en.wikipedia.org/wiki/Magic_square - notes that magic squares were used in the Middle Ages to construct sigils for spirits, angels and demons, by making a correspondence between the numbers in the square and the letters of the alphabet, and then simply drawing lines through the square to represent words. It includes the example below.

Hagiel = הגיאל = 5; 3; 10; 1(10); 30(3)

The convention of considering i and j to be the same letter reduces the English alphabet to 25 letters, which can be mapped onto a 5x5 square.

There is a method of constructing magic squares known as the **Siamese method**. If you follow that method for a 5x5 square, the resulting magic square is shown below, first with numbers, and then with the numbers replaced by letters using the standard 1=A, 2=B... mapping:

17	24	1	8	15
23	5	7	14	16
4	6	13	20	22
10	12	19	21	3
11	18	25	2	9

R	Y	A	H	P
X	E	G	O	Q
D	F	N	U	W
K	M	T	V	C
L	S	Z	B	I/J

The sigil for each word was produced by putting a blob in the middle of the square for the first letter, then drawing a line to the middle of the square for the next letter, putting a blob there, and so on. [MSQ4] Sometimes the blobs were not quite in the middle of the square – if there were two occurrences of the same letter in a word, or if it would not be clear which line a blob was on.

As always, I wondered how many clues to give you. I removed the grid from each square, but left the actual square there, as a clue and to show where in the square the sigil was located. If you overlaid a 5x5 grid you would see which small square each blob was in.

The square on the final page contains some clues.
- The mathematical formula is the relationship between the order of the square, *n*, and the magic constant *M* for a normal square which contains the numbers 1 to n^2. [MSQ1] (So the magic constant for the normal 5x5 square is 65.)
- The Siamese cat is a clue to the Siamese method of constructing magic squares. [MSQ2]
- A006003 is the integer sequence at OEIS - the On-Line Encyclopaedia of Integer Sequences – that contains the sequence of magic constants for squares of order *n* = 3, 4, 5…. [MSQ3]

With the pages in chronological order, the magic squares gave you the precise URL for Dirk Rijmenants' Enigma simulator. Of course, there's nothing to say which way round the letters are in each magic square, and there's also I and J occurring next to each other (with both being denoted by the same grid square), but ultimately you ended up with **USERS DOT TELENET DOT BE SLASH D DOT RIJMENANTS SLASH EN SLASH ENIGMASIM DOT HTM**. [MSQ5] To my astonishment, ignoring the spaces, that string contains 66 letters, enabling me to put 6 letters in the square on each of the 11 pages.

In case you couldn't decode that, I provided another, more direct clue. Hidden in the border of page PRE, in small black text on a dark part of the border, was the text **DIRK R'S RIDDLE SIM** [MSQ6]. ("Riddle" because I couldn't bring myself to put the word "enigma" into the ATH.) You could have found it by running your cursor over the border and noting it changing when it found the text field. There are probably all sorts of ways of extracting the text. For example, since the text was written in a font embedded in the PDF, you would have been able to select it, copy it, and read it by dropping it into another program such as Notepad.

From Dirk's website, you'll have found that the information needed to set up the Enigma simulator and decode the detailed treasure instructions was:
- the type of Enigma machine
- the reflector
- the rotors and their order
- the ring settings
- the plugboard configuration
- the structure of the message.

Type of Enigma machine

Dirk's sim gives you the choice of three models of Enigma – the 3-rotor Wehrmacht and Luftwaffe Enigma, the 3-rotor Kriegsmarine M3, and the 4-rotor Kriegsmarine M4 Enigma cipher machine. Having read his write-up on the procedures used to operate the machine, I decided that the more complex procedures of the Navy (the Kriegsmarine) were just too complex for the ATH. This was a pity, since it was naval Enigma traffic that Turing worked on at Bletchley Park. So I hope you forgave the historical inaccuracy.

The type of Enigma machine was given, very simply, by the badge at the upper right of page 13. It is the badge of a **Luftwaffe radio-operator** – so the Enigma used in the ATH is the 3-rotor **Luftwaffe-Wehrmacht** version. [LUF1]

Reflector

The reflector sat to the left of the rotors as you looked at an open Enigma machine. Its purpose was to connect the outputs of the last rotor in pairs, redirecting current back through the rotors by a different route. A consequence of this was that no letter ever encrypted to itself – a weakness which was exploited by the codebreakers.

The Luftwaffe/Wehrmacht machine in the sim has the choice of two reflectors, B and C. (In the version of the sim which existed for several years, these were called "Wehrmacht/Luftwaffe". But in the new version which Dirk released a week before the Hunt went live - much to your setter's consternation - these are called simply "Wehrmacht". However, his manual/helpfile made it clear that the Luftwaffe used the Wehrmacht machine, so I didn't change anything in the ATH.)

The reflector used in the ATH is **C**, and this is given by the picture on page UNB of the gentleman holding up a disc (it's actually a DVD). [REF1] Since this picture is the clue to the *reflector*, I have

reversed the picture so that it appears as a mirror image, a reflection. That's why the G of the Enigma logo on his shirt is reversed. I intended the reversed C and G, plus the fact that the C was on the shiny *reflective* underside of a disk, to tell you that this was the reflector clue. (However, I inadvertently reduced the impact of this reversed picture by later flipping some of the other pictures when attempting to outwit the image search programs.) The C is red because "red" was the codename given by Bletchley Park to the Luftwaffe's general-purpose operational Enigma key. Who the gentleman is, and why he's holding up a DVD, will be revealed later.

Rotors and their order

The Luftwaffe Enigma used 3 rotors, chosen from 5, so you had to find out which three were used, and in which order they were placed inside the machine. In fact, I quite simply told you this information, but you had to do some work first!

The first thing that you had to do was solve the **codeword** [ROT1] puzzle on page 13. This was probably the hardest part of the puzzle to create, given that I was trying to keep to a particular theme – and it was probably the first thing that you solved. I deviated from the usual rules for these puzzles by using proper names, and one or two abbreviations, but I didn't think that would cause you any problems. At least I stuck to English, and didn't use many of the German terms associated with the Enigma.

To solve this type of puzzle, you almost certainly used the cryptanalysis technique of **frequency analysis**, using your knowledge of the most commonly-used letters in English (E T A I O N S H R D L U) to guess at what some of the letters were. The letter-frequencies in the puzzle are fairly close to the standard order – maybe I should have used some German!

			C				G		S	P	I	D	E	R	
	D	E	C	R	Y	P	T	I	O	N		O			
			O		A		D			R	O	T	O	R	
		T	W	I	D	D	L	E			G				S
			N		D		L		T	Y	P	E	X		T
M		J		I		I		S		S		R			A
A		U		N		N		A		H		I	H	U	T
N		L		N		G	A	R	D	E	N	I	N	G	I
C	R	I	B			T		A		R		C			O
H		U		B	O	X		B	L	U	E		K		N
E		S	O	W		N		O		T		I			X
S					S	H	A	R	K		O		N		
T	U	N	N	Y				N		E	N	I	G	M	A
E		P		S	Q	U	A	R	E				S		C
R	E	P	L	Y			P								E
		R					P	O	R	P	O	I	S	E	
	Z	O	D	I	A	C	L			B			B		
		F					H	E	R	I	V	E	L	T	I	P

1	2	3	4	5	6	7	8	9	10	11	12	13
W	L	I	F	Q	P	B	V	Z	U	R	K	H

14	15	16	17	18	19	20	21	22	23	24	25	26
D	X	S	O	A	C	N	E	Y	T	G	M	J

T	U	R	I	N	G	'	S		S	I	L	V	E	R

The words *across* in the puzzle are all **terms associated with Enigma or with the code-breaking operation at Bletchley Park** [ROT2]:

- **spider** - a type of *bombe*. A bombe was an electromechanical device designed by Turing, to discover the daily settings (rotors, ring settings and plugboard) of the Enigma. Named after the pre-war Polish *bomba kryptologiczna* (cryptologic bomb).
- **decryption** – self-explanatory
- **rotor** – a component of the Enigma
- **twiddle** – a term used at Bletchley Park, meaning to turn round the rotors of an Enigma machine by hand, for example when testing why a message has failed to decrypt when the settings were already known
- **TypeX** – A family of British cipher machines, originally derived from a pre-war commercial Enigma. Once an Enigma's settings were known, messages could be decrypted by running them through a TypeX set up identically to the Enigma.
- **hut** – much of the work at Bletchley Park was done in huts in the grounds of the house.. Some of the huts at Bletchley Park are still there, in various states of repair. Go and see them.
- **gardening** – a technique used to produce "cribs" (see below). The RAF would "sow" (drop) mines in the North Sea or Atlantic, and the Germans would react by broadcasting enciphered messages warning their ships and U-boats of the mines. These messages would contain the German "minen" (mines) and also details of the location – and Bletchley Park would be using these as cribs to try to break the encryption and discover the Enigma settings.
- **crib** – a piece of known plaintext which was used in breaking a cipher. If you've ever broken a cipher in the ATH by looking for patterns which could be "left", "right", "treasure", etc, then you've performed a "known plaintext attack" using a crib.
- **box** - a rectilinear figure (crudely, a grid) drawn around the text of a transposition cipher to aid decryption
- **blue** – Different parts of the German forces used different Enigma settings – different "keys". Bletchley Park sometimes named them after colours. For example, "yellow" was the key used for the invasion of Norway, "red" was the Luftwaffe's general-purpose operational key, and "blue" was the less useful Luftwaffe training key.
- **sow** – see "gardening" above
- **Shark** – Bletchley Park's name for the code used for German U-boat communications. As well as colours, animals were used to name different codes, e.g. Dolphin, Chaffinch, and Kestrel.
- **Tunny** – Bletchley Park's name for an encryption machine built by the Lorenz company, and used for communications with the German High Command. More complex than the Enigma, the importance of the messages encrypted by Tunny meant that it was a prime target for Bletchley Park. The Colossus machines at BP were designed and built to break the "Fish" traffic from Tunny machines.
- **Enigma** – no explanation needed!
- **square** – various meanings, including one square in a "box", and also the 5x5 grid used in solving transposition ciphers like ADFGX or Playfair

- **reply** – actually, I cheated here! As far as I know, "reply" did not have any particular meaning, other than its usual meaning, at Bletchley Park. But I'm sure they must have watched out for replies to messages that they had already decrypted ☺
- **porpoise** - Bletchley Park's name for the German naval Enigma key
- **zodiac** – a particular code used by the German Navy for broadcasting weather messages
- **Herivel tip** – An idea put forward by the cryptographer John Herivel (who died on 18 January 2011) which was instrumental in breaking the Luftwaffe "Red" code. Basically, understanding both the workings of the Enigma and the pressures on German operators of the machine, Herivel came up with a suggestion that the operators would minimise their workload in such a way that the number of options to be searched to find the ring settings for the day would be greatly reduced. I needed Herivel in the puzzle, because, as you'll see, I needed the 'v'.

The words *down* are all **people, places or things associated with Turing** [ROT3]:
- **Manchester** – Turing took up a post at Manchester University in 1948, and spent the last years of his life there
- **Julius** – his father's name
- **Prof** – the nickname given to him at Bletchley Park
- **NPL** – the National Physical Laboratory at Teddington, where Turing worked between 1945 and 1948
- **Crown Inn** – in Shenley Bourne End, where Turing stayed during the time that he worked at Bletchley Park.
- **Paddington** – in London, where Turing was born on 23 June 1912, at the Warrington Lodge Nursing Home on Warrington Crescent, now the Colonnade Hotel
- **Sara** – the name by which Turing's mother was known – it was actually her middle name, but better than being called by her first name, Ethel (apologies to all Ethels reading this)
- **apple** – it was strongly suspected, but never proved, that Turing committed suicide by biting into an apple which had been dipped in cyanide. There is an urban myth that the logo of the Apple computer company is a tribute to Turing.
- **Godel** – the mathematician Kurt Gödel, whose work on the incompleteness of mathematics and undecidability was a vital foundation for Turing's work on computability
- **Sherborne** – Turing's school.
- **Porgy** – his teddy bear
- **OBE –** After WW2, Turing was awarded the OBE (Officer of the British Empire) for his war service. This was the standard gong for civil servants of his grade. The story is that he was not pleased at having the initials added to his name on his office door. Perhaps because he knew he had contributed so much more to the war effort, or perhaps because he dreaded people asking him what he had done to earn it – a question which he was not permitted to answer.
- **Princeton** – Turing obtained his PhD at Princeton between 1936 and 1938
- **Kings** – Turing was first an undergraduate and then a Fellow at Kings College, Cambridge, from 1931 until 1939 (apart from his time at Princeton)
- **BP** – not the oil company, this was the common wartime abbreviation for Bletchley Park
- **Station X** – the cover name given to Bletchley Park when acquired by the Government in 1938, the 'X' signifying that it was the 10th such site acquired by MI6
- **ACE** – An early computer built at NPL from a design by Turing, although he had left NPL by the time of its completion.

Solving this puzzle [ROT4] gave you the phrase **TURING'S SILVER** [ROT5], a hint about the theme of the ATH.

No other use was made of the solution of the codeword puzzle. It was pure coincidence that J was letter 26. (Dropping either I or J gives you a 25-letter alphabet as used in other ciphers.) I hadn't noticed this until it was mentioned by one of the teams that I was monitoring.

Turing Machine simulator

To discover the rotor order you had to enter the phrase **TURING'S SILVER** into an online simulator of a Turing Machine, which would then check if the phrase was correct – if so, it would tell you the rotor order.

A Turing Machine is a conceptual machine conceived by Alan Turing during his work on mathematical computability. It consists of a tape, divided into squares (or regular positions), a read-write head, and a mechanism for moving the tape. The Turing Machine is a state machine – that is, its innards, if you like, at any time will be in one of a number of possible configurations or "states", which you can number 1, 2, 3, etc. The Turing Machine (which I will abbreviate to TM) can obey simple instructions of the form "if you are in state *a*, and the character under the read head is *x*, then replace the *x* with *y*, change your internal state to *b*, and (optionally) move the tape one position <right or left>".

a and *b* must be valid state numbers: *x* and *y* will be valid characters in the alphabet that you have defined for the TM. *a* and *b* could be the same state, *x* and *y* could be the same character, and if you had such an instruction which didn't include a tape move, then basically your TM would be in an infinite loop, stuck on the same position, in the same state, endlessly replacing the character on the tape with itself. For convenience, a TM can also have a special state, called the "halt" state – when this is reached (*if* it is reached) then the TM stops and no further processing is done.

The remarkable thing about a TM is that it can be shown to be logically equivalent to a number of other methods of computational notation – neural networks, Markov algorithms, lambda calculus, etc – and indeed (ignoring limitations of storage space and processing speed) it is logically equivalent to the modern computer. So anything that Turing showed about the TM – e.g. that you can't always say if it will reach its halt state - applies to today's technology as well.

The online TM sim is at http://morphett.info/turing/turing.html . There are a couple of clues in the ATH to guide you to that site.

The principal one was the piece of music "To Albert R" on page UNB. Music codes have featured over the years in the ATH, and I created one here which I thought was very clever, and played reasonably well. But then I found that it was nearly identical to one used many years ago, in an ATH created by people whom I know are still competing. So it had to be scrapped.

Then I came across an online version of a book called "Olivier Messiaen's System of Signs - Notes Towards Understanding His Music". A chapter of that book considers musical cryptograms or cryptography, and includes the **cipher invented by Swiss composer Arthur Honegger in his piece *Hommage à Albert Roussel*** [TMC1]**:**

In fact, Honegger didn't strictly adhere to his own cipher in the piece, but I did in mine. The lengths of the notes on page UNB are unimportant. It is only the actual notes which are played which are important, and using Honegger's cipher they give us the URL of the Turing Machine

simulator: **MORPHETT DOT INFO SLASH TURING SLASH TURING DOT HTML** [TMC2]. By the way, "cifrati" is Italian for "enciphered".

The music puzzle was produced using the demo version of the *Sibelius* program. Rather than give the music a particular key – which I thought could have been confusing – I selected the "open/atonal" option in *Sibelius*, and let it decide when to include the accidentals – the sharp, flat and natural symbols.

If you google for "Honegger", "Roussel" and "cipher", you should find the book online at Google books. There is also an interesting article on Wikipedia at http://en.wikipedia.org/wiki/Musical_cryptogram , which notes, amongst other things, Elgar's use of cryptograms in his *Enigma Variations* and elsewhere. If I had discovered this earlier I might well have pursued it further for the ATH.

(Incidentally, you'll remember I said that the URL for the Enigma sim consisted of 66 letters – exactly divisible by 11. The TM sim URL above consists of 44 letters – also exactly divisible by 11. What are the chances of both of them being exactly divisible by 11? Genuine question – I was never any good at probability…)

In case you couldn't decode it, I provided another clue, just I like did for the Enigma sim. This was hidden in the border on page OBJ, and said **MORPHETT'S TM SIM**. [TMC3]

OK, you found the TM sim, and read the instructions on how to program it. You may have looked at the example programs. Then you'll have realised what that stuff is that appears on each page – the lines of numbers, letters and _ (space) symbols. They are program instructions for the Turing Machine. [TMC4]

What you had to do was run the program on the Turing Machine, with **turing's silver** (the machine only works on lower case letters) on the input tape. This is specified on page OBS, where there is a formula telling you to "add" the URL music clue and the codeword puzzle answer (in lower case). [TMC5] The machine would then tell you what the rotors were.

If you found the online TM without decoding the clue on page OBS, you might have been able to work out what input to supply it with by reverse-engineering the TM program. In fact, you could have worked out the required rotor numbers and order by doing this. In case you did try to reverse-engineer the program, I included some dummy statements at the start and end of it, just to make it harder for you to work out what input the program checked for and what output it produced. I wouldn't have fancied trying to reverse-engineer it, though, because after I created a program that worked, I jumbled it up by renumbering the states in a random fashion, then by jumbling up the lines of the program, and then by assigning the segments of the program to the pages in random order.

The TM machine doesn't care how you number its states, and it doesn't care what order the instructions are listed in. What is does is look for an instruction that applies to the state that it is in, with the specific character under the read/write head. So all you had to do was bring together the segments of the program, in any order, and load them into the TM. On the tape, you should have entered **turing's silver**. The machine would check the string, and if all was well would output the message **ii v iii**. [TMC6]

In fact, it did a little more than this. Whilst checking the input phrase, you'll have noticed that it kept returning to a particular square and writing a character in that square. Depending at what speed you were running the machine, you may have been able to read the message. It was **near crown inn**. This was a clue to the approximate location of the treasure, provided that you knew that Turing was billeted at the Crown Inn in Shenley Bourne End whilst he was at Bletchley Park.

Of course, the two output messages appear on the right-hand side of the TM instructions. And, most of the phrase **near crown inn** [TMC7] appears on the left-hand side as well. So I did worry that if you reassembled the program into order according to the first number of each line (the TM state number) then you might guess the messages. So I did this, and found that you could clearly see "near" and "crown" in there, but nothing else. So I reckoned that would be OK. Even if you worked out the rest, the rotors could have been II V III or I IV II, and of course each of these rotor sets has 6 permutations.

But if you drew the state diagram for the TM, you would clearly see the output sequence of rotor numbers. So I included a number of dummy state transitions – which would never actually be executed – to obfuscate the output sequence.

If you stepped through the program manually, with paper and pencil, then you would find the rotors order. Fair enough – but, as with many of the codes in this ATH, you didn't have to solve it manually.

If you didn't enter the **turing's silver** phrase exactly as required, then the behaviour of the machine was unpredictable. Most likely it stopped because it reached a state/character combination for which there was no instruction in the program. It's not easy to write a error-handler for a Turing machine – in fact the Halting Problem (see the Appendix to this solution) says that it's impossible to write a general-purpose one which is guaranteed to work in every circumstance.

(Those of you who have come across TMs before, or who read the online instructions, may have noted that the program does not contain an instruction which explicitly puts the TM into the *halt* state. This is because the word *halt* would have appeared in the program, which would have been too much of a giveaway. If you entered the string correctly, then the program ends after the output of **ii v iii** by entering a state for which there is no valid instruction.)

The table below shows you the original TM program, and how I transformed it.

original program	program with states renumbered and lines shuffled
0 i - r 12	26 r o r 11
0 - - r 9	28 _ _ l 5
0 t - r 2	9 w̄ _ r 6
0 c i r 17	8 j ī r 21
0 n v r 19	24 - ī r 32
0 _ _ r 0	7 d v r 13
0 v̄ ī r 16	26 w n r 16
0 x _ r 31	3 u v r 33
2 u _ l 16	0 c i r 26
3 _ _ r 3	16 _ _ r 16
3 r̄ _ l 16	27 _ n r 28
4 _ _ r 4	12 _ - r 2
4 ī _ l 16	21 ȳ _ r 3
5 _ _ r 5	33 _ _ r 33
5 n _ l 16	18 _ _ r 17
6 _ _ r 6	24 ī n r 15
6 ḡ _ l 16	0 i - r 16
7 _ _ r 7	13 i _ l 26
7 ' _ l 17	9 v ī r 12
8 _ _ r 8	5 - _ r 30
8 s _ l 17	3 m ī r 31
9 _ _ r 17	14 g _ l 22
10 _ _ r 10	0 x _ r 7
10 s _ l 17	7 x ī r 25
11 _ _ r 11	25 _ _ r 26
11 ī _ l 17	7 t̄ v r 20
12 _ _ r 12	11 _ _ r 11
12 l̄ _ l 17	8 p ī r 29
13 _ _ r 13	22 e a r 34
13 v̄ _ l 18	22 r - r 33
14 _ _ r 14	22 a r r 14
14 e _ l 18	29 s _ l 26
15 _ _ r 15	8 _ ī r 1
15 r _ l 18	15 _ _ r 15
16 _ _ l 16	30 _ - r 12
16 - n r 3	6 _ _ r 6
16 n e r 4	10 ḡ v r 15
16 e a r 5	26 n - r 19
16 a r r 6	0 _ _ r 0
16 r - r 7	17 s v r 23
17 _ _ l 17	0 - - r 25
17 - c r 8	13 _ _ r 13
17 c r r 9	21 l̄ ī r 2
17 r o r 10	10 f _ r 32
17 o w r 11	5 _ _ l 5
17 w n r 12	0 t - r 4
17 n - r 13	32 e _ l 24
18 _ _ l 18	19 v _ l 24
18 - ī r 14	1 x ī r 22
18 i n r 15	4 u _ l 22
18 n _ r 19	34 _ _ r 34

```
19 _ _ l 20      8  e  v r 5
20 _ n r 21      18 c  v r 10
21 _ _ l 22      34 n  _ l 22
22 n - r 22      11 s  _ l 26
22 _ _ l 22      3  k  _ r 4
22 - _ r 23      16 l  _ l 26
23 _ - r 24      21 _  i r 18
24 _ - r 25      32 _  _ r 32
25 _ - r 26      26 _  _ l 26
26 _ _ r 27      24 _  _ l 24
27 f _ r 14      5  n  - r 5
27 g v r 15      21 h  v r 24
27 _ i r 28      31 _  _ l 27
27 o i r 30      26 o  w r 13
28 h v r 18      17 r  _ r 7
28 _ i r 29      19 _  _ r 19
28 y _ r 33      22 n  e r 6
28 l i r 25      17 _  v r 7
29 n _ r 29      26 -  c r 29
29 c v r 27      23 _  _ r 10
29 _ _ r 30      10 _  i r 21
29 b _ r 23      3  _  i r 8
30 r _ r 31      20 _  _ r 20
30 s v r 26      2  _  - r 23
30 _ v r 31      17 q  _ r 34
30 q _ r 5       20 r  _ l 22
31 d v r 11      6  i  _ l 22
31 _ _ r 32      15 r  _ l 24
31 t v r 3       24 n  _ r 31
31 x i r 9       19 b  _ r 30
32 _ i r 33      14 _  _ r 14
32 v i r 24      18 n  _ r 18
32 z i r 32      10 o  i r 17
32 w _ r 4       7  _  _ r 9
33 k _ r 2       1  v  I r 22
33 u v r 7       22 -  n r 20
33 _ i r 34      9  _  i r 3
33 m i r 19      33 '  _ l 26
34 j i r 28      26 c  r r 25
34 _ i r 35      29 _  _ r 29
34 p i r 8       22 _  _ l 22
34 e v r 22      9  z  i r 9
35 x i r 16      1  n  v r 31
```

(The absence of a state numbered 1 in the original program is because I originally intended to use another TM simulator – at http://ironphoenix.org/tril/tm/ . However, because of niggles with that sim I switched to Anthony Morphett's one at a late stage. States in the Morphett TM sim start at 0, so what was state 1 in the original program became state 0 in the new one.

By the way, IRON PHOENIX DOT ORG SLASH TRIL SLASH TM consists of 33 letters, another URL of a multiple of 11 letters. What's going on here? ☺)

So now you knew which rotors to use. What's next?

Ring settings

The ring settings can be specified as three letters, but are more usually specified as three numbers, each in the range 1-26, corresponding to the letters A-Z. Turing's birthdate – 23 06 12 – fitted the requirement, but was far too obvious – the equivalent of using your partner's name or birthday for your password.

So I used the date of the official formation of the Government Code & Cipher School (GC&CS or GCCS), which is the agency which occupied Bletchley Park during WW2, and for whom Turing and the thousands there worked. After the war, GC&CS was renamed to Government Communications Headquarters (GCHQ), and from the GCHQ website, from Wikipedia, and probably from lots of other sources, you can find that GC&CS was officially formed on 1st November 1919 – **01 11 19** [RIN1]. (The night before the Hunt went live, I realised that those of you who are across the Atlantic would normally write that date in a different order. Apologies if this stymied you. I wasn't trying to hinder you, and I thought you'd be smart enough to figure it out. Such are the perils of international treasure hunting.)

I wanted to make you work quite hard for this crucial information, so it was enciphered and the message included on page PRE. It's the message in blue text, starting "SXSLK EIAOU …".

Decrypted, the message reads "**FOR NARYA NENYA AND VILYA USE DATE OF ESTABLISHMENT OF THE AGENCY WHICH OCCUPIED BP DURING WW TWO**" [RIN2]. If you didn't already know, you'd have found very quickly that Narya, Nenya and Vilya are the names of the **three rings** in *Lord of the Rings*. [RIN3]

The message is enciphered using the **Solitaire** crypto-algorithm [RIN4], devised by renowned cryptographer Bruce Schneier, and featured in Neal Stephenson's novel *Cryptonomicon*, where it is called **Pontifex** [RIN6], which means "bridge builder".

Alongside the ciphertext, there is:
- the box from a bridge construction game called "**Pontifex**" [RIN7]
- a picture of a diamond **solitaire** ring [RIN5].

I was using a ring setting – solitaire – to encrypt the Enigma ring settings [RIN8].

The Solitaire algorithm is described in an Appendix to the novel, and the description is also online at http://www.schneier.com/solitaire.html . As Schneier says, it is designed for short messages - and I kept this one fairly short. Schneier also emphasises that he has followed Kerckhoffs' Principle – knowledge of the algorithm won't help you, and secrecy of the key is of vital importance. Solitaire uses a full pack of playing cards, including two jokers, and the "key" is the initial set-up of the cards. We'll come back to the key in a moment.

Encrypting or decrypting using Solitaire is a labour-intensive process – "designed for short messages"! – as you will have realised when you read the description of it. I found that when I was doing it by hand, I inevitably made mistakes every now and then, which was an absolute pain, because I had to get the cards back into their initial order and then start again from scratch. I quickly learned to reduce the effects of an error by "**saving the state**" of the deck regularly – that is, writing down the ordering of the cards in the complete deck after every few letters, so that when I made a mistake I didn't have to go too far back. Being a nice guy, I suggested that you should do likewise. [RIN13]

The ciphertext near the top of page AGN – "DLIPR MTDRG…" - is a very simple substitution code, though I'd like to know how deeply you were into working out the substitution before you discovered the rule! It's simple - replace the first letter of the alphabet with the last, the second letter with the second-last, and so on. That is, A-Z, B-Y, C-X … Z-A. This is a cipher called **atbash** [RIN9], originally developed for the Hebrew language, and there are examples of it in the

Old Testament of the Bible. It's on this particular page because the lost treasure on the page is the menorah. [RIN10]

Decoded, and with the addition of some punctuation, the message is:
"**Working with patience needs great care**,
 So save your state lest you should err." [RIN11]

The card games known as "solitaire" in the US and in Microsoft Windows are known as "patience" in the UK. [RIN12]

Despite what I have said about making errors and saving the state, I found that I quickly became pretty proficient and accurate at working with the cards, and I reckon that generating the keystream for the 80 characters of the message should have taken you a couple of hours by hand. If you did do it manually, you will have found that interesting things occurred early on – the "output card" was a joker a couple of times, and the jokers moved closer and eventually crossed over each other – but if you followed Schneier's instructions precisely, then you'll have had no problem.

But there was no need to do it manually. Schneier's webpage also references a number of implementations of the Solitaire algorithm in a variety of programming languages. I'll give you a clue about my vintage by telling you that the two languages that I used were Ada and Pascal. A little bit of jiggery-pokery with the code, and use of free open-source implementations of these two languages – including the GNU Ada still on my machine from a few ATHs ago - confirmed that my manual encryption was correct. I thought I'd give you a clue and **steer you towards those two implementations of the algorithm** [RIN17]. If you couldn't decode the message manually, then I knew you would get the right result with either of these.

The clue is the paper tape on page PAR, which is 7-bit ASCII with odd parity, and reads "**blue code has been checked by hand, by Augusta and by Blaise**". [RIN14] Augusta is the other forename of **Ada Lovelace**, daughter of poet Byron and friend and colleague of Charles Babbage. I always thought she was Ada Augusta, but on Ada Lovelace Day (October 7th) last year, I saw her referred to as Augusta Ada, and, on checking, that seems to be correct. She is usually referred to as the "first computer programmer", and the Ada language was named after her [RIN15]. Blaise is the first name of **Blaise Pascal**, the mathematician, physicist and philosopher after whom the Pascal language was named [RIN16]. (In another coincidence, it's also the forename of Blaise de Vigenère, of the ubiquitous cipher that bears his surname. I hope you appreciate that there isn't one of these in this ATH, nor a Playfair, nor a Beaufort – I've seen too many of them over the years.)

Solitaire uses the full pack of 54 cards, and the "key" is the initial set-up of the cards. So I had to tell you how to do that, which was inevitably a long message. This was the message in the **ADFGX** cipher, which runs through all 13 pages of the ATH.

The ADFGX cipher

This was a cipher that was used by the German forces during WW1. (Yes, there was a point for realising that I was using real German ciphers from both wars. [ADF1]) The cipher's name was derived from the obvious fact that enciphered messages used only those five letters, chosen because they sounded very different in Morse code. A later variant added the letter 'V', and I shall leave the working out of its name as an exercise for the student.

The ADFGX cipher was introduced by the Germans in March 1918, and was cracked by French cryptanalyst **Georges Painvin** the following month. Some accounts say that Painvin's work enabled the Germans' Spring Offensive to be halted, but this is disputed. I thought it was glaringly

obvious what cipher this was, but anyway the French street scene alongside the ciphertext on page PRE gives you **Painvin's name**.

The operation of the cipher is described in many sources – for example, see http://en.wikipedia.org/wiki/ADFGVX_cipher - so I won't repeat it here.

It requires two secrets:
- a jumbled alphabet written in a 5x5 square
- a transposition key.

To write the alphabet in a 5x5 square, 'i' and 'j' are regarded as being the same letter. A pangram is a sentence which uses all the letters of the alphabet, such as "the quick brown fox jumps over the lazy dog", which everyone knows. A perfect pangram uses each letter only once. "J Q Vandz struck my big fox whelp" is one such perfect pangram, commonly seen on the Internet, and fortuitously having 'J' as its first letter, which could easily be deleted. Giving you the full string "**Q Vandz struck my big fox whelp**" [ADF2] was, I thought, too easy, so I just gave you the start "Q Vandz"…". Oddly enough, at the time that I write this, Google returns only 3 hits for "Q Vandz", but over 540 for "J Q Vandz". But the latter ("J Q Vandz") all contain the former ("Q Vandz")….

So the 5x5 square looked like this:

	A	D	F	G	X
A	Q	V	A	N	D
D	Z	S	T	R	U
F	C	K	M	Y	B
G	I	G	F	O	X
X	W	H	E	L	P

For the key, well, what could be more obvious than a musical key signature? It's on page OBJ, but it is ambiguous, in that it could be the key signature for B major or for G# minor. Hence the inclusion of the B major guitar chord on page ORD. The transposition key was literally "**BMAJOR**" [ADF3]. In fact, any 6-letter transcription key which gave the same re-ordering of columns of text would work – "CRAFTY" was one which was found early on - so the cipher could be solved without actually knowing the key. Now you know why the length of the key can be vitally important in cryptography.

As with the Solitaire cipher, I hand-coded the ADFGX message. However, there are also plenty of online implementations of it, and I did check my work against a couple of these:
- http://ruffnekk.stormloader.com/adfgx_tool.html
- the ADFGX tool at http://www.cryptool-online.org/

Keying the deck

The ADFGX cipher text on each page is decoded separately. The clue to this is that the final ciphertext group on some pages does not consist of 5 letters. If you had the pages in the correct order, and then decoded the message, you would see it in its correct order. Even if you didn't have the pages in the correct order, you should still have been able to re-arrange the lines of the message until it made sense. The message, here with punctuation added for clarity, was [ADF4]:

"**First, find the equine metric used
by the Universal Exports employee
when in place atop a skyscraper.
Second, assemble the villain's
digging implements face up high to low.**

**Third, proceed clockwise, adding each other's
digging implements underneath in the same order.
Fourth, repeat for H, putting them under S, then repeat for D and then C.
You should have Motorhead facing you, three H over one
D in the middle, and Pratts and Boodles on the bottom.
Finally, place the alpha Space Cowboy beneath the
digging implements and the beta Gangster
of Love beneath the name of the cipher**."

My reason for starting three different lines with "digging implements" is so that I would have three separate lines of ciphertext each starting off with the same sequence of characters – they turned out to be GGGXX D. Just a little thing which might have puzzled you before you broke the code.

Let's start explaining, then…

"**equine metric**" – **hand** – the unit of measurement of the height of horses, and also the name given to the set of cards dealt in a game such as bridge [ADF5].

 "**the Universal Exports employee**" – **James Bond**'s cover story when on a mission is often that he is working for a company called "Universal Exports" [ADF6]

"**used by [James Bond] when in place atop a skyscraper**". This refers to the novel *Moonraker*. [ADF7]

A moonraker is a small sail sometimes mounted as the highest sail on a square-rigged mast. The definition of it that I found whilst creating the ATH said that it was mounted above a skyscraper, which is also a sail. One of the teams that I was monitoring completely missed this reference to *Moonraker*, so I did some more research to check that it wasn't an error on my part. That's when I found that there is much confusion over skysails, moonsails, skyscrapers and moonrakers.

Both skyscrapers and moonrakers are triangular sails, whereas skysails and moonsails are four-sided. So although about half the references said that moonrakers were mounted above ("atop") skyscrapers, I began to doubt whether two triangular sails would be used, one above the other. Hence the "clarification" that I published, which documented my uncertainty and suggested that the moonraker might be either above or in place of the skyscraper. I hope this didn't hold anyone back. If you'd worked out what a skyscraper was then you'd have picked up the reference to a moonraker. And if you were trying to use a baccarat or poker hand from *Casino Royale*, then you were lost anyway.

Early in the *Moonraker* novel, Bond is involved in a game of bridge with his boss, M, and with the baddie of the novel, Drax.

On the next page is the hand, scanned from a copy of the book, but you can find it in many places on the Web.

068   *Moonraker*

BOND
◇ Queen, 8, 7, 6, 5, 4, 3, 2
♣ Ace, queen, 10, 8, 4

DRAX
♠ Ace, king, queen, knave
♡ Ace, king, queen, knave
◇ Ace, king
♣ King, knave, 9

MEYER
♠ 6, 5, 4, 3, 2
♡ 10, 9, 8, 7, 2
◇ Knave, 10, 9

M
♠ 10, 9, 8, 7
♡ 6, 5, 4, 3
♣ 7, 6, 5, 3, 2

And suddenly Basildon understood. It was a laydown Grand
Slam for Bond against any defence. Whatever Meyer led, Bond
must get in with a trump in his own hand or on the table.
Then, in between clearing trumps, finessing of course against
Drax, he would play two rounds of diamonds, trumping them
in dummy and catching Drax's ace and king in the process.
After five plays he would be left with the remaining trumps
and six winning diamonds. Drax's aces and kings would be to-
tally valueless.

It was sheer murder.

An earlier version of the rigged hand illustrated above was believed to have been used to con the
Duke of Cumberland (son of George III) into losing £20,000 in a game of whist. That earlier
version is known as the "Duke of Cumberland Hand", and although many references also give
that name to the *Moonraker* hand, my research indicated that the hands are different. You had to
use the hand from the Bond novel.

In *Moonraker*, Bond has been called in by M to investigate Drax, who is suspected of cheating at
bridge in M's club. Bond, pretending to be drunk to boost Drax's confidence, gives M a pre-
arranged signal, substitutes a rigged deck of cards, raises the bets, and then proceeds to utterly
humiliate Drax. And this is just the start of the story!

So this is the hand that I wanted you to start with. Next you have to put all 54 cards into the
correct order.

"**assemble the villain's digging implements face up high to low**". Drax is the villain. Digging
implements are spades. "face up high to low" means facing you, in order, with the highest on top
and the lowest on the bottom. In other words, from the top down, the ace, king, queen and jack of
spades.

"**Proceed clockwise, adding each other's digging implements underneath in the same
order.**" Referring to the diagram above, Bond doesn't have any spades, so you next add Meyer's
spades underneath Drax's, and then M's.

"**Repeat for H, putting them under S, then repeat for D and then C**". Repeat the process for
hearts, putting them under the spades, then diamonds, then clubs.

"**You should have Motorhead facing you, three H over one D in the middle, and Pratts and Boodles on the bottom**." A check that you have assembled the pack correctly. Motorhead's most well-known song is "Ace of Spades" [ADF8], and that card should be facing you on top of the pack. In the middle, the three of hearts should be on top of the ace of diamonds. Pratts and Boodles are two clubs in London [ADF9], and that card should be on the bottom.

"**Finally, place the alpha Space Cowboy beneath the digging implements and the beta Gangster of Love beneath the name of the cipher**." Schneier's instructions for Solitaire tell you to label the two jokers A (alpha) and B (beta). "Space Cowboy" and "Gangster of Love" refer to the first lines of the 1973 song *The Joker* by the Steve Miller Band [ADF10]:
"Some people call me the space cowboy, yeah.
 Some call me the gangster of love.."

A song that is well-known to people of my age, but if you weren't even born in 1973 you'll have found it straight away with your favourite search engine.

Anyway, the instruction is to slip Joker A beneath the spades (between the spades and the hearts), and to place Joker B beneath the ace of diamonds (single diamond = solitaire, the name of the cipher).

And now you had keyed the deck, and were ready to decrypt the ring settings message.

Plugboard configuration

An Enigma machine where you pick 3 rotors from 5 available, place each in the machine in one of 26 possible positions (the ring settings), and then rotate each to one of 26 possible start positions, gives you about 713 million possible starting configurations, i.e. 713 million different encryption keys.

This is nowhere near enough to stand up to intense cryptanalysis.

What gave the Enigma its complexity and its extremely large number of starting configurations was the plugboard, in which up to 10 pairs of letters could be wired together. There are approximately 1.5×10^{14} ways in which the plugboard could be set up. Multiplied by 713 million, the result is that there were about 10^{23} initial states for the 3 rotor Enigma machine. The Germans changed their Enigma settings at midnight every day, so every night the analysts at Bletchley Park were faced with the problem of finding the new settings. Remember also that different parts of the German forces, and also civilian organisations such as the railways, used different settings from each other. And that the Navy introduced a 4 rotor machine in early 1942. So the analysts at BP faced many different instances of this problem every night.

Anyway, to decode my Enigma message, you needed to find the letter pairs that I had used.

In the introductory text in the centre of the first page of the ATH, some of the letters are italicised. They spell out "**smithy code**". The real "Smithy code" is an encrypted message embedded by Mr Justice Peter Smith (no relation) within his 2006 judgement on the copyright/plagiarism case on *The Da Vinci Code* [PLU1]. See http://en.wikipedia.org/wiki/Smithy_code

I was determined NOT to have anything related to Dan Brown in my ATH, but when I came across something called the Smithy code I couldn't resist it. The ATH message uses the same key as the original code, and the remainder of the message, encrypted, is spelled out in italicised letters throughout the questions on the following 11 pages. (This led to the inclusion of the superfluous word "subsequently" in a couple of the questions, where the Smithy code required a 'q'.) You have to have the pages in the correct order for the message to make sense.

Decoded, and with some formatting and punctuation, the message is:

Winning this Armchchair Treasure Hunt
Would prove that you're not mugs.
One thing you'll need to do that is
My batch of x-wired plugs. [PLU2]

This quite literally told you the information that you needed.

If you look at the last line of the verse, you'll see that it contains 20 letters, and that all 20 are unique – none is repeated. The plugboard letter pairs were simply **M-Y B-A T-C H-O F-X W-I R-E D-P L-U G-S** [PLU3]. (Finishing with my initials was a nice touch, I thought ☺)

Strictly speaking, this plugboard setting would not have been allowed by the Luftwaffe, who had a rule that no letter could be connected to its neighbour in the alphabet. The setting above has B connected to A. This rule was another little weakness – similar to the fact that no letter could be encrypted to itself – which assisted BP in their decryption efforts. Later versions of the bombes – the machines built at BP to automate the search for daily Enigma settings - automatically disregarded possible plugboard settings which violated the rule.

For a long time, I intended to include this poem unencrypted in the ATH – hiding something in plain sight, if you like. But in the end I was too squeamish to do this, so it was hidden.

Message structure

Different parts of the German forces used different message structures. Turing worked mostly on decryption of Naval Enigma messages, but I decided that their message format was just too complex for the ATH. So I followed the format of the first example provided by Dirk Rijmenants, which was an Army or Luftwaffe format.

The acrostic derived from the answers to the questions told you this. Following the diagonal theme, you took the 1st letter of the 1st answer on a page, then the 2nd letter of the 2nd answer, and so on. You did this on each page. This gave you the message "**Follow help page to initialise with your settings. Message structure is same as first example**." [STR1] This simply referred to Dirk's help page to assist you in setting up the Enigma sim, and told you the message format. This clue has 78 letters, which is why there are 8 questions on page OBS, the last of the pages in chronological order. (That 78 is the number of letters on an Enigma rotor multiplied by the number of rotors in the type of Enigma used in the ATH is yet another coincidence.)

The answers to the questions are given later.

So now you knew the Enigma settings and the message structure:
- Wehrmacht reflector C
- rotors II V III
- ring settings 01 11 19
- plugboard MY BA TC HO FX WI RE DP LU GS.

The first line of the Enigma message is `AL3 4J N 1512 = 865 = ATH RJA =`.

The first line of the first example in Dirk's helpfile is `U6Z DE C 1510 = 44 = EHZ TBS = `.

I have no detailed knowledge of what `U6Z DE C 1510` is – it probably identifies the sender and maybe the time. Anyway, I replaced it with AL3 4JN, which is simply the post-code of where I live in St Albans – still trying to mislead you, which is why it is in red – and the ATH **start date, 15th Dec**. [STR2]

The next item is the number of characters in the encrypted message, and to keep things simple I broke another of the Germans' good cryptographic practices. They had a rule that no more than 250 characters could be sent under a particular setting, so messages that were longer – like Dirk's second example – were split into several parts, each with a different key setting.

The two trigrams give you the message key – the start position of the rotors. You set up the rotors with ATH (for Armchair Treasure Hunt), then decrypt RJA. This gives you **AMT** (for **Alan Mathison Turing**) [STR3], with which you set the rotors, and you are ready to decrypt the message.

The first five characters of the message is a Buchstabenkenngruppe. This enabled the receiver identify which key had been used for a particular message – for example, if a message was from a previous day – and it plays no part in decrypting the message. So you should simply ignore it. Dirk's manual describes the use of Kenngruppen and the Buchstabenkenngruppe.

The Buchstabenkenngruppe in the message is LABOP, which is an anagram of **Pablo** [STR4], the late founder of the ATH.

Dirk's sim includes an Auto Typing facility which enables you to copy and paste the encrypted message, and have it decrypted in seconds. However, I hope you took time for some manual

interaction with the sim, because it really is a lovely piece of work. It even has sound effects recorded from a real Enigma machine.

When you decrypted the Enigma message, this is what came out: [STR5].

```
AUSGA NGSPU NKTIS TDERP ARKPL ATZXB EHALT ENSIE DIEPL AKATE
ZUIHR ERLIN KENUN DPASS IEREN SIEDR EIGEL BEUND DREIS CHWAR
ZEXAN DERKR EUZUN GBIEG ENSIE RECHT SABXN ACHFD REIEL FSWBI
EGENS IELIN KSABU NDYDU RCHEI NGATT ERYIN DENWA LDXUE BERQU
ERENS IEDEN BACHX ANDER KREUZ UNGBI EGENS IEREC HTSAB YUNDF
OLGEN DEMKU RVIGE PFADX ZWEIG ENSIE GLEIC HNACH DERZW EITEN
BANKN ACHRE CHTSA BXUNG EFAEH RFUEN FUNDA CHTZI GSCHR ITTEN
ACHDE RKREU ZUNGB EFIND ENSIE SICHZ WISCH ENZWE IBAEU MENYW
ELCHE CIRCA ZWOEL FSCHR ITTEV ONEIN ANDER ENTFE RNTST EHENY
NAHED ERREC HTENS EITED ESPFA DESXZ WISCH ENDIE SENST EHTEI
NGROS SERYG RUENG EFAER BTERB AUMYW ELCHE REINS TUECK VOMWE
GENTF ERNTS TEHTY UNDEI NLTRA EGTXG EHENS IEIND ENWAL DUNGE
FAEHR ZWANZ IGSCH RITTE HINTE RDIES EMBAU MXFIN DENSI EDASV
OGELH AUSSI EBENU NDBLE IBENS IEDAR UNTER STEHE NXCIR CAFUE
NFZEH NSCHR ITTEE NTFER NTYIN NORDO ESTLI CHERR ICHTU NGYIS
TEINE KLEIN EANHA EUFUN GVONH OLZSC HEITE NZWIS CHENZ WEIBA
EUMEN WELCH EIHRE RINDE VERLO RENHA BENXD ORTBE FINDE TSICH
DERSC HATZX
```

I followed the convention of using an X to represent a full-stop and a Y to represent a comma – I told you this on page UNB [STR6]. With umlauts and the double-S restored, this reads [STR7]:

Ausgangspunkt ist der Parkplatz. Behalten Sie die Plakate zu Ihrer Linken und passieren Sie drei Gelbe und drei Schwarze. An der Kreuzung biegen Sie rechts ab. Nach F drei elf SW biegen Sie links ab und, durch ein Gatter, in den Wald. Überqueren Sie den Bach. An der Kreuzung biegen Sie rechts ab, und folgen dem kurvige Pfad.

Zweigen Sie gleich nach der zweiten Bank nach rechts ab. Ungefähr fünfundachtzig Schritte nach der Kreuzung befinden Sie sich zwischen zwei Bäumen, welche circa zwölf Schritte voneinander entfernt stehen, nahe der rechten Seite des Pfades. Zwischen diesen steht ein großer, grüngefärbter Baum, welcher ein Stück vom Weg entfernt steht, und ein L trägt. Gehen Sie in den Wald ungefähr zwanzig Schritte hinter diesem Baum. Finden Sie das Vogelhaus sieben und bleiben Sie darunter stehen.

Circa fünfzehn Schritte entfernt, in nordöstlicher Richtung, ist eine kleine Anhäufung von Holzscheiten zwischen zwei Bäumen welche ihre Rinde verloren haben. Dort befindet sich der Schatz.

I make no apologies for the deciphered instructions being in German – this was an Enigma message after all. I don't speak German, so one of my wife's colleagues translated the instructions into German, after which a friend of mine, in a blind test - knowing only that they were instructions for finding treasure in a wood – translated them back to English. Automated tools such as Google translation do a reasonable, but not perfect, job of translation into English – it was up to you whether to take the risk or spend more time ensuring that you had an exact translation.

In English [STR8]:

Start from the car park. Keep the notices on your left and pass three yellows and three blacks. At the crossroads turn right. After F three eleven SW, turn left and enter the wood through the gate. Cross the stream. At the crossroads go right, and follow the curving path.

Just after the second bench, fork right. Approximately eighty-five paces after the fork you will be between two trees which are about twelve paces apart, close to the right of the path. Between them is a large green-coloured tree which is further off the path. There is an L on it. Go into the wood about twenty paces beyond that tree. Find nesting-box seven, and go and stand there.

About fifteen paces away to the north-east is a small pile of logs, between two trees which have lost a lot of bark. That's where the treasure is.

The "three yellows and three blacks" are vertical poles across the path, to keep vehicles out.

The lampposts along the path on the edge of the wood each had a serial number painted on them – F 3 1 SW, F 3 2 SW, F 3 3 SW, and so on. They were fading nicely, but new labels were stuck on in summer 2011, and are rather obvious ☹

Alan Turing's Silver Bars

I had to provide you with some clues about Turing's capers with his silver bars.

The **TURING'S SILVER** solution to the codeword puzzle was one.

Another was the **symbol or person at the top centre of each of pages 2-12**. With the pages in chronological order, the sequence is:

- a picture of **silver bars**
- the logo of the information security firm **RSA**
- logo of the health club chain **LA** Fitness
- former **NT** logo of the National Theatre
- spoonbender **URI** Geller
- the emblem of the National Gardens Scheme, **NGS**
- a brochure about the international system of units, **SI**
- an old sign for Luncheon Vouchers, popularly known as **LV**s
- a Beefeater at the Tower of London, with the significant letters **ER**
- the actor Mr T, best known for his role as **BA** Baracus in *The A-Team*
- two copies of a diagram illustrating the **"rotate left"** instruction which appears in many computer instruction sets.

The text string derived from the symbols is RSALANTURINGSSILVERBA.

Rotate that string left twice, as the instructions after it indicated, and, with the addition of spaces and punctuation, you have **Alan Turing's silver bars** [BAR1].

I hope that most of you realised this, although when I saw the early workings of the teams that I was monitoring I realised that you may well have tried to include **Ag**, for silver, in the string. Sorry – my intention was to top and tail the string by the pictures of the silver bars and the rotate left instructions. I originally had a picture of the shape of Shenley Wood (see below) where the silver bars were, but near publication date I decided that this was too dangerous, and replaced it with the silver bars. In view of the confusion that I inadvertently caused, I am minded to mark this generously.

The **word square** on the first page might have helped, although it didn't mention Turing by name.

The word square was a late addition to the puzzle. In October 2011, I received a new Logica laptop. For those of you who don't work for Logica, the standard Windows wallpaper on Logica laptops is the word square below, on a white background.
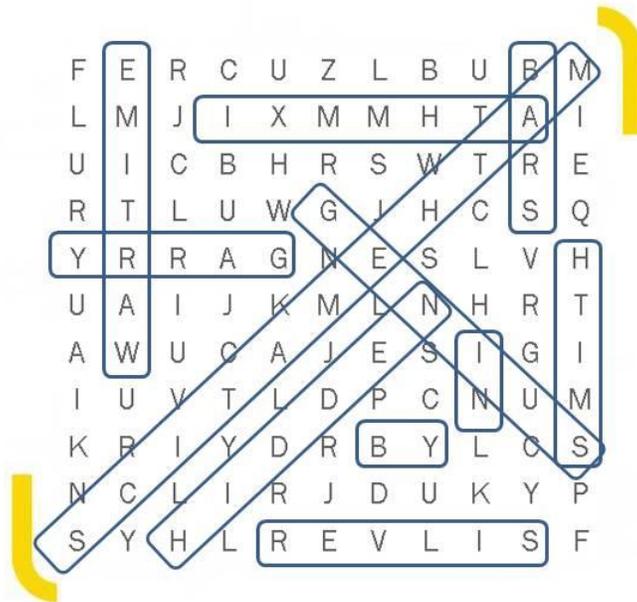
```
E  Z  C  L  R  Y  K  A  T  D  Z
G  D  I  A  M  O  N  D  M  G  C
N  O  P  W  N  H  N  R  D  N  R
E  I  C  A  S  C  E  E  C  E  O
V  T  B  R  R  B  T  T  B  V  T
E  A  H  D  H  T  E  S  H  E  S
R  M  B  S  I  B  R  L  B  R  I
E  R  E  M  T  G  V  N  Z  T  I
E  E  M  G  R  E  L  E  S  L  F
R  O  H  N  T  H  I  P  H  E  E
C  E  V  I  T  A  V  O  N  N  I
```

In this square, you can identify the Logica company values "open", "committed" and "innovative", as well "diamond awards", which is the company scheme for recognising exceptional work.

As was pointed out with glee when the word square was introduced in 2009, you can also find "rot", "never", and, very oddly, "revenge".

Anyway, I had long since replaced this wallpaper on my old laptop, but was reminded of it when I received my new one. Thinking of my 11x11 word square in which the diagonal argument reveals "Shenley Wood", I realised that the company wallpaper was also an 11x11 square. I had to use it!

The word square on the first page contained the words "**silver bars hidden in wartime by mathematics genius**" [BAR2]. I also included **my own name** [BAR3] – NOT as the mathematical genius! - and a record that this was the **2011 ATH** [BAR4].

```
F  E  R  C  U  Z  L  B  U  B  M
L  M  J  I  X  M  M  H  T  A  I
U  I  C  B  H  R  S  W  T  R  E
R  T  L  U  W  G  J  H  C  S  Q
Y  R  R  A  G  N  E  S  L  V  H
U  A  I  J  K  M  L  N  H  R  T
A  W  U  C  A  J  E  S  I  G  I
I  U  V  T  L  D  P  C  N  U  M
K  R  I  Y  D  R  B  Y  L  C  S
N  C  L  I  R  J  D  U  K  Y  P
S  Y  H  L  R  E  V  L  I  S  F
```

I hoped you wouldn't have been able to find any more words in there, apart from some which are, unavoidably, made up from letters of the words in the message. Don't ever try to do this. It took me about two and half hours one Saturday afternoon to eliminate all the unwanted words I could see, and even as I was typing this up I noticed an error above and had to go back and change everything. And of course it turns out that there <u>are</u> other words in there. I have no idea how I didn't see "Agnes", which was part of the name of one of the bombes at BP, and was even in an early draft version of the codeword puzzle.

Maybe the inclusion of this word square nudged you in the direction of putting the 11-letter words from each page into a word square, to see what you could find.

Jon Earl, I know you're reading this – remember those comments you and Kevin Ayton made on logica.talk when the new wallpaper was introduced in November 2009? You wondered if it was early training for the ATH. I hope you're happy now!

Miscellany

"…a man temporarily…"

When I was writing the introductory text for the ATH website, I wrote "a man hid some treasure…". Then I realised that if I introduced a word beginning with 't' after "a man", then I would have Turing's initials AMT, i.e. "**A M**an **T**emporarily hid…" [MIS1]. I didn't expect anyone to pick this up.

odhu ntinggo

At the end of the announcement about the ATH on the website, this is the famous "good hunting" wish from **Big Chief I-Spy** [MIS2], whom I **know** that many of you are old enough to remember – so don't deny it.

Dee codeine

A hideous visual/verbal pun. On the front page, you have a picture of 1960's TV star Simon **Dee**, overlaid by the chemical structure of the painkiller **codeine** – representing one of the themes of the ATH, decoding [MIS3] (decipherment, decryption, etc.).

Too easy

The first letters of the sentences in the introduction in the middle of page 1 spell "**Too easy**" [MIS4]. Just me letting you know that you're going to have to work harder than that to find the treasure.

Linear B

The symbols between the two black-and-white photos of gentlemen on page PAR are in the ancient script Linear B. **Michael Ventris** (above the symbols) and **John Chadwick** (below) are generally given credit for the decipherment of Linear B, although, as with so many "discoveries", they were building on the work of others. (Between 1942 and 1944, John Chadwick worked in intelligence in Alexandria, Egypt, breaking lower-level Italian naval codes. In 1944 he was again transferred to Bletchley Park, learned Japanese, and worked on reading the encoded messages sent by the Japanese naval representatives in Stockholm and Berlin.)

Linear B is a syllabic script – that is, each symbol represents a syllable, and not a single letter as in our alphabet. Uncertainties in deciphering the script – or uncertainties in pronunciation, if you like – mean that we cannot be sure precisely how to speak Linear B. Because of this, I decided that it could not be used for any important message in the ATH.

Linear B – or, more precisely, its predecessor Linear A – was designed for a non-Greek language. Most of its symbols represent a consonant-vowel (CV) syllable – e.g. "pa" or "to". Greek, on the other hand, allows initial consonant clusters, consonants at the ends of words, and diphthongs. So conventions were developed by the Greeks:
- in a syllable with an initial consonant cluster, individual consonants in the cluster are written with CV symbols whose vowel matches that of the syllable – e.g. for "Christmas" the first two CV symbols would be "ki-ri"
- some consonants occurring at the end of words, including 'r' and 's', were not normally written - whereas others were, following the same rule as initial consonants.

It should also be remembered that the sound of 'j' was actually a 'y' sound.

Given the message I was trying to convey, I decided to follow the first convention, but not the second one about omitting final consonants – that would have made things too difficult.

The symbols in the message are me-ri-ki-ri-si-ma-sa-a-na-da-ha-pi-nu-je-re – i.e. **Merry Christmas and a Happy New Year** [MIS5], the traditional greeting from the ATH setter. Using Linear B for it was an anachronism [MIS6] which appealed to my strange sense of humour.

Codebreakers on each page

Each page also included a clue to a "code-breaker". [COD1] Initially these were all to be cryptographers, but rather belatedly I realised that I could include people who had broken all sorts of codes. I wish I'd thought of that much earlier – the ATH might have been very different.

This was simply a filler, tied in with the theme of code-breaking – there was nothing here to help you solve any puzzles or find the treasure. I put a border – reminiscent of Morse code - round each of the codebreakers, to "partition" them from the rest of the puzzle, and to make it clear that they were all part of the same series.

The three French nightingales (*rossignols*) on the poster were part of this series (although they did not fit into the date order). They refer to the cryptographers **Antoine, Bonaventure and Antoine-Bonaventure Rossignol**, who served the French Crown during the 17th century. They set up the *Cabinet Noir* (Black Chamber), a cipher office for encrypting French communications and, of course, for intercepting and deciphering others' diplomatic, commercial and private communications. The term Black Chamber came to be used for any country's cipher bureau. Bonaventure Rossignol is an important character in *The Confusion*, the second volume of the *Baroque Cycle* series by Neal Stephenson. (If you knew this it may have helped you discover my use of the Solitaire crypto-algorithm.)

In the ATH itself, when you have the pages in chronological order, the code-breakers are in order of date of birth [COD2] (apart from those on page 13):

page 1: **Daniel** [COD3] (born before 600 BC), from the Old Testament of the Bible. The picture is Doré's engraving of Daniel interpreting the writing on the wall at Belshazzar's feast.

RAT: Ya'qūb ibn Isḥāq **al-Kindī** [COD4] (born around 801 AD), the father of Islamic or Arabic philosophy. Scientist, philosopher, mathematician, physician, and musician, he was a pioneer in cryptanalysis. The Arabic text in the picture is the first page of his manuscript "On Deciphering Cryptographic Messages", containing the oldest known description of cryptanalysis by frequency analysis.

AGN: Charles **Babbage** [COD5] (1791), mathematician, philosopher, inventor and mechanical engineer who originated the concept of a programmable computer. Babbage broke Vigenère's allegedly unbreakable autokey cipher, as well as the weaker system which is known as the Vigenère cipher. His technique, which you may well have used in other ATHs to break ciphers, included analysis of the distances between repeated fragments of ciphertext, to try to establish the length of the key. His work was not published until years later, and the technique is nowadays known as Kasiski examination, after the Prussian military officer who independently discovered it.

The clue here includes a picture of the front panel of a GEC 4080 computer from the early 70s. Its high-level assembler language was known as Babbage. Production of GEC 4000 series computers continued until 1995, so it's possible that some of you have actually programmed in Babbage. The phrases around it – "WHY NOT?", "JUST IN CASE", etc – are taken from a humorous article which appeared in the IT magazine *Datamation* in 1981, describing a fictional programming language also called Babbage. You can find it fairly easily on the Web – a combination of that and the GEC 4080 should have taken you to Babbage himself.

ORD: Edgar Allen **Poe** [COD6] (1809). Poe was an enthusiastic cryptographer, and his Gold Bug code has appeared in the ATH. The picture is of the Teletubby called Po, on her *trottinette*. (I

once spent several weeks working at Airbus in Toulouse. Being a Teletubby fan, every morning in my hotel I watched them, in French – a doubly surreal experience. That's when I learned things like the French for scooter…)

PRE: Georges **Painvin** [COD7] (1886), who broke the ADFGX and ADFGVX ciphers in WW1.

FOR: Herbert O **Yardley** [COD8] (1889), the founder and head of the US Cipher Bureau, which was set up during WW1 and which closed down in 1929. After WW1 the Cipher Bureau concentrated on breaking diplomatic ciphers – especially the Japanese – but was closed down when Herbert Hoover's Secretary of State, Henry Stimson, discovered it and what it did, and promptly cut off its funding, saying "Gentlemen do not read each other's mail". Yardley published his memoirs in 1931, under the title of *The American Black Chamber*, and the revelations in it mark it as one of the first of the many exposés of secret operations – Bletchley Park, NSA, GCHQ, etc – which have been published over the years.

The clue is the two racing cars, from which the name of the main sponsor, Yardley, has been removed, although the big Y in front of the cockpits might have helped you. The car on the left is a model of the P160 Yardley BRM car from 1971. The car on the right is a model of the M23 Yardley-McLaren F1 car from 1973. The sharp-eyed amongst you will have noted that it was driven by Jody Scheckter, who went on to win the F1 Drivers' Championship in a Ferrari in 1979, buy and manage the award-winning organic Laverstoke Park Farm in Hampshire, and eventually **achieve the ultimate accolade of being the subject of a question in this ATH** [COD9].

ABE: William F **Friedman** [COD10] (1891), who ran the research division of the US Army's Signals Intelligence Service (SIS) in the 1930s, and parts of its follow-on services into the 1950s. In 1940, his team broke Japan's Purple cipher, thus disclosing Japanese diplomatic secrets before America's entrance into World War 2. The success of the SIS was one reason why Yardley's Cipher Bureau was closed, and the SIS was given all of the Cipher Bureau's files after its closure.

I can't remember where I found the bizarre image of the man in the frying pan. I do actually have a picture of a small figure of a man which has been deep-fried in batter or breadcrumbs, but I thought that that would be too difficult.

Incidentally, Friedman's wife, Elizebeth (that *is* the correct spelling) was a renowned cryptologist in her own right, but I couldn't find an appropriate image.

PAR: John **Chadwick** (1920) and Michael **Ventris** (1922) [COD11], who deciphered Linear B. I had lots of ideas for puzzles for their names, but never had the time to do them – so be grateful!

OBJ: Robert W **Holley** (1922), Har Gobind **Khorana** (1922) and Marshall W **Nirenberg** (1927) [COD12], who in 1968 were awarded the Nobel Prize in Physiology or Medicine 1968 "*for their interpretation of the genetic code and its function in protein synthesis*". In short, they are the people who "cracked the genetic code" [COD13], and showed how the information carried within DNA is used to make protein. (Crick and Watson – who were the people I had in mind when I first thought of this – discovered the double-helix structure of DNA, but this is not "breaking the genetic code".)

The genetic code defines how sequences of three nucleotides, called codons, specify which amino acid will be added next during protein synthesis. Wikipedia explains how it all works at http://en.wikipedia.org/wiki/Genetic_code . Each codon consists of three nucleotides, usually representing a single amino acid. The nucleotides in messenger RNA (mRNA) are abbreviated with the letters A, U, G and C. The table below shows what codons specify each of the 20 standard amino acids involved in translation. Note that each amino acid can be represented by a single letter. (If you want the full names of the amino acids, see the Wikipedia article.)

Ala/A	GCU, GCC, GCA, GCG	Leu/L	UUA, UUG, CUU, CUC, CUA, CUG
Arg/R	CGU, CGC, CGA, CGG, AGA, AGG	Lys/K	AAA, AAG
Asn/N	AAU, AAC	Met/M	AUG
Asp/D	GAU, GAC	Phe/F	UUU, UUC
Cys/C	UGU, UGC	Pro/P	CCU, CCC, CCA, CCG
Gln/Q	CAA, CAG	Ser/S	UCU, UCC, UCA, UCG, AGU, AGC
Glu/E	GAA, GAG	Thr/T	ACU, ACC, ACA, ACG
Gly/G	GGU, GGC, GGA, GGG	Trp/W	UGG
His/H	CAU, CAC	Tyr/Y	UAU, UAC
Ile/I	AUU, AUC, AUA	Val/V	GUU, GUC, GUA, GUG
START	AUG	STOP	UAA, UGA, UAG

So the three lines of text on page OBJ are simply the names Holley, Khorana and Nirenberg "encoded" using an appropriate codon from the table above for each letter. I used the START and STOP codons at the beginning and end of each name, and also when I needed to "jump out" of the code for the letters O and B, which (along with J, U, X and Z) don't appear in the table.

SEM: Liam **Fox** (1961) [COD14], the former UK Secretary of State for Defence, who resigned in October 2011 after the revelations that his close friend Adam Werritty, a lobbyist with no official position, had basically been given too much access to Dr Fox and his business. It was found – and widely reported – that Dr Fox had "**broken the ministerial code**" [COD15].

UNB: The man in the reversed picture with the partial Enigma logo and the clue to the Enigma reflector is Jon Lech **Johansen** [COD16] (1983), also known as "DVD Jon". He specialises in reverse-engineering data formats and releasing software which can circumvent digital rights management (DRM) and copy protection restrictions. He is most well-known for the DeCSS software for decrypting content on commercially-produced DVD video discs. He developed this with two others, who remain anonymous, and landed himself in a whole heap of trouble by releasing it on the Web in 1999.

OBS: This is current Australian Open, Wimbledon and US Open tennis champion Novak **Djokovic** [COD17] (1987) abusing his equipment, which is a "**code violation**" [COD18] in tennis. I say "current Australian Open champion", but that tournament is always in the second half of January, so he may have lost that title by the time that you read this.

Red Herrings

I wanted to include some red herrings in the ATH. However, conscious of the distance that many of you would have to travel to Milton Keynes, I didn't want you to actually go to an incorrect location. So any red herrings would just have to hint at another location, or perhaps lure you away from the proper location – just to waste a little of your time.

I live in St Albans, and not far away from there is a small village called Shenley. I thought I'd try to make you think that I might have hidden it near where I live, possibly at Shenley. Both that Shenley and the Shenleys (Bourne End and Church End) in Milton Keynes are near the Roman road which we know as Watling Street.

Things to steer you towards St Albans and Shenley were:
- the inclusion, at the end of the introductory text on the ATH website, of my actual home phone number in St Albans: I had to tell you somehow that I lived there!
- the London streets derived from the OS co-ordinates, which told you that the treasure was "near Watling Street"
- the clue derived from the treasure names – "fair or bright clearing or wood" – which is the meaning of the old English placenames from which Shenley is derived
- the questions whose answers were St Albans and Rothamsted
- the inclusion of my post code (AL3 4JN) at the start of the Enigma message.

Questions and answers

I had originally thought about awarding more than one "point" for some of the questions – e.g. one mark for the correct answer, and one or more marks for explaining things in the question. Hence the text on the website saying that I will award points for explanation. But when I tried to work out a marking scheme, I realised that in many cases an explanation wasn't necessary - if you had the right answer then you **must** have figured out something else for which I had thought of awarding points.

So in the end I decided to stick to the traditional ATH scheme of one "point" per question – although the actual number of points for each answer will depend on how many entries have it correct. If that leads to a very close result – or even a dead-heat – then so be it!

page no.	question	answer	sig letter
RATIONALITY			
1	**What complete failure contains wine?**	a **fiasco**	F
	A fiasco is one of these round-bottomed bottles, often in a straw basket, that you used to find on the walls of old-fashioned Italian restaurants. A Chianti flask, in other words. One theory of how the word came to mean "complete failure" is that the French in the 18th century used the term "*fare fiasco*" ("to make a bottle") when Italian actors on the French stage made a linguistic error. Another theory is that when Italian glassblowers made a mistake in making some intricate piece, they would then use the glass to make a simple bottle.		
2	**Which team were jinxed for nearly 85 years after their owner sold their star player on Boxing Day?**	The **Boston** Red Sox	O
	On December 26, 1919, the owner of the Boston Red Sox baseball team sold Babe Ruth, who had played the previous six seasons for the Red Sox, to the New York Yankees. This was to help fund the newly-opened Broadway play *My Lady Friends*, which was later developed into the musical *No No Nanette*. Legend has it that the sale caused the "Curse of the Bambino" (Ruth was sometimes called "the Bambino"), which was finally overcome when the Red Sox won the baseball World Series in October 2004 – the first time they had won it since 1918.		

3	**In 1995, who was actually felled by a tiger in SW19?**	Caroline **Hall**	
	Caroline Hall was the ballgirl accidentally hit by a ball swiped in anger by "Tiger" Tim Henman, during a doubles match at Wimbledon, which is in London postal district SW19. The Independent reported that: "The incident happened after Henman missed a net-cord. As the ball-girl moved to retrieve the ball, Henman lashed out with his racket in frustration, hitting a ball he was holding. The girl, only a foot away, received the full force of the ball on her ear. She initially fell to the ground, but then ran to her usual position in tears and a doctor was called." Henman thus became the first player to be disqualified from Wimbledon – in fact, the question when I first found it was "Who was the first player disqualified from Wimbledon?", but that was too easy. Incidentally, the other innocent party whose Wimbledon was upset by this was Jeremy Bates, who was Henman's partner, and who thus found himself out of the doubles through no fault of his own. That could have been another question, but I've ruined it now ☺		**L**
4	**Whose bedtime reverie recently appeared where the writer of *Wuthering Heights* had always intended it to be?**	**Molly** Bloom's	
	For *Director's* Cut, her album of reworked material released in May 2011, Kate Bush (whose self-written first hit, in 1978, was *Wuthering Heights*) renamed her song *The Sensual World* as *Flower of the Mountain*. As lyrics, she incorporated text from Molly Bloom's soliloquy at the end of James Joyce's *Ulysses*. She had always intended to do this, but had been unable to obtain rights to use Joyce's words when the song was first recorded in 1989. This was one of the few answers where the first name was required – the reason being that Bloom would have been ambiguous, since the main character in Ulysses is Molly's husband Leopold.		**L**

5	**Where, last summer, did a crossword puzzle finally live up to its name?**	**News of the World**	
	Although editorial staff at the News of the World were reported to have carefully checked the 10 July 2011 final edition for messages directed at News International management, they obviously didn't check the crosswords on page 47, which contained some… well…. "cross words" about the closure of the newspaper in the light of the phone hacking scandal. Clues included "woman stares wildly at calamity" – you may recall the widely used picture of the-then News International chief exec Rebekah Brooks gazing out of her car as she was driven away from her office. Clues also included "catastrophe", "stink", "criminal enterprise", "string of recordings", "mix in prison" and "will fear new security measure". Answers included "deplored", "stench", "disaster", "menace", "racket", "desist" and "tart". It was pleasing to be able to include in the ATH a question about messages hidden elsewhere. One of my favourite examples of this is the acrostic that ended TV presenter James May's career at *Autocar* magazine. See his Wikipedia entry at http://en.wikipedia.org/wiki/James_May		**O**

6	**Who once fronted three separate groups in one *Top of the Pops* programme?**	Tony **Burrows**	
	In February 1970, session-singer *extraordinaire* Burrows became the first (and still the only) person to front three different acts on one *Top Of The Pops* show. They were Edison Lighthouse (who were number one that week with *Love Grows Where My Rosemary Goes*), White Plains (*My Baby Loves Loving*), and Brotherhood of Man (*United We Stand*). Afterwards, he was told that he would be unofficially blacklisted from the programme as viewers might suspect nefarious goings-on with his appearing so often. In fact, he returned to the show a few weeks later singing *Gimme Dat Ding* as one member of The Pipkins, a duo - the other member being songwriter Roger Greenaway. However, his success did work against him - he subsequently made several singles under his own name which were excluded from radio playlists. There's an interview with him from 1999 at http://www.popentertainment.com/burrows.htm		**W**
7	**Which Tube station is three floors above ground, between West Kensington and Earls Court?**	**West Ashfield**	
	This is a full-size mock-up of a Tube station on the third floor of the London Underground training establishment Ashfield House, which is just to the east of West Kensington station, and so lies between West Ken and Earls Court. As it should be, given its location, it is a District Line station.		**H**

	AGNOSTICISM		
1	**Which thoroughfare provided a goddess of love for E A Blair?**	**Euston** Road	E
	Eric Arthur Blair is better known as George Orwell. His widow, Sonia, married him not long before he died. A literary editor, she had earlier been nicknamed the *Euston Road Venus* by the arty Bloomsbury set amongst whom she moved.		
2	**In which Home Counties market town, where Logica employees were imprisoned, did the red and the white clash twice in a conflict named nearly 400 years later by a Scottish novelist?**	St **Albans**	L
	The conflict was the War of the Roses – 1st Battle of St Albans in 1455, 2nd Battle of St Albans in 1461. Now re-enacted every Saturday night at chucking-out time. Logica's first St Albans office – the one on Victoria Street, beside the station – was in the town's former prison, which appears in the opening sequence of the old Ronnie Barker *Porridge* sitcom. The name "Wars of the Roses" was first coined by Sir Walter Scott in his 1829 novel *Anne of Geierstein*. This is NOT the Logica question!		
3	**On Mr T's 59th, what uplifting emotion did AFC Wimbledon fans experience, slightly ahead of schedule?**	rapture	P
	Mr T is the actor who is best known for his role as B A Baracus in the TV series *The A-Team*, although more recently he has been advertising Snickers bars, and gracing page UNB of this ATH. He was born on 21st May 1952, so 21st May 2011 was his 59th birthday. On that day, AFC Wimbledon – the fan-owned club founded when Wimbledon FC moved to Milton Keynes – achieved promotion to the Football League by beating Luton Town 4-3 on penalties after extra time. The match had kicked off at 3pm, so the result did not come until shortly before 6pm. However, promotion may be uplifting, but it's not an emotion. 21st May 2011 was also the day when Harold Camping, head of an American religious broadcasting network, had predicted that the Rapture – the gathering up of all Christians into the air, to meet Christ – would happen. He had said that this would happen around the world at 6pm local time. So the Wimbledon fans experienced rapture slightly ahead of schedule. This question was conceived and documented between 6.15pm and 6.45pm on 21st May 2011. The London *Evening Standard* newspaper asked "What didn't arrive as anticipated on May 21?" in its 2011 news quiz on Friday 23rd December.		

4	**What was the surname of Claude, a communications pioneer, who was born on Christmas Day and subsequently ended his life in a well?**	Chappe	P
	Claude Chappe (1763-1805) invented and demonstrated in 1792 a practical semaphore (or telegraph) system that eventually covered all of France – and was later used in this ATH. In 1805, depressed by illness and claims that he had plagiarised other telegraph systems, he committed suicide by throwing himself down a well in the yard of the administrative office of the telegraph company. I was hoping that those of you who knew a little about communications pioneers would waste a little time researching Claude Shannon. You might also have come across Claude Berrou, one of the inventors of the error-correcting codes known as *turbo codes.*		
5	**Which opium eaters were accused of running rings in the fields in a natural state a couple of years ago**?	**Wallabies**	A
	In August 2011, it was reported that "stoned wallabies" had been blamed for crop circles in Tasmania ("Australia's natural state") in 2009. Australia produces about 50% of the world's legally-grown opium, for morphine and painkillers. The wallabies were "entering poppy fields, getting as high as a kite and going around in circles", according to Tasmania's Attorney General.		
6	**Which title character of a 21st century opera claims to have been born in a tube station?**	Jerry **Springer**	G
	Title character of *Jerry Springer: The Opera*, Springer says that he was born in a tube station, where his mother was sheltering during an air raid on London in February 1944. Many sources say that he was born at East Finchley station, but that is unlikely since it is an open, on-the-surface station, and would not have offered the shelter that the underground stations would have. It's more likely that Springer was born at the next station down the line, Highgate. But see also question 7 on page OBJ. TfL says that there have been only three births on the Tube, and Springer is not one of them.		
7	**The death of which green-clad playwright and actor belied the nature of his own title character, whom he had been playing only hours earlier?**	**Molière**	E
	The French playwright and actor suffered from pulmonary tuberculosis. The last play he wrote was called *Le Malade imaginaire (The Imaginary Invalid)*, and he played the hypochondriac title character in it. During a performance, he collapsed on stage in a fit of coughing and haemorrhaging, but insisted on completing his performance. Afterwards he collapsed again with another, larger haemorrhage before being taken home, where he died a few hours later. The superstition that green brings bad luck to actors is said to originate from the colour of the clothing he was wearing at the time of his death.		

ORDERLINESS			
1	**Which great writer died in a stationmaster's apartment shortly after leaving home and family, in winter, for a life on the road?**	Leo **Tolstoy**	**T**
	Having renounced his title and wealth, in late 1910 Tolstoy finally decided to live as a wandering ascetic, something he had been thinking about for years. In poor health, he left his wife and family, who had been caring for him, and set out into the Russian winter. A few days later, he was taken ill at the railway station in Astapovo (now called Lev Tolstoy), where the stationmaster gave up his own apartment to him. Tolstoy died of pneumonia on November 20th (November 7th, Old Style), ten days after leaving home.		
2	**Which rock star made his professional recording debut giving season's compliments to an astromech?**	John **Bongiovi** (or **Bon Jovi**)	**O**
	The first professional appearance on record by John Bongiovi (as he then was) was on the 1980 Star Wars Christmas album *Christmas In The Stars*. The album's story takes place in a droid factory where robots labour all year to build toys for Santa Claus. However they don't understand the meaning of Christmas until C-3PO and R2-D2 (an astromech droid) show them how to appreciate the holiday spirit. The album was recorded at the famous Power Station studio in New York, then run by Tony Bongiovi, who suggested that his 18-year-old cousin – who ran odd jobs and swept the floors at the studio – should audition for one of the lead vocal parts. John Bongiovi took the lead on a song called *R2-D2 We Wish You A Merry Christmas*. He later recorded some demos at the studio, signed his first big deal in 1983, changed his name to Jon Bon Jovi, named his band after himself, and you know the rest.		

3	**Which aptly named athlete air-freighted himself home from London after failing to make it to the 1964 Olympics?**	Reg **Spiers**	
	The Australian javelin thrower came across to London to train for the 1964 Tokyo Olympics. Failing to qualify, and very short of money, with the help of another athlete he built a wooden crate in which he shipped himself back home to Perth in Australia. The journey took 63 hours and included a sweltering, dehydrating stopover in Bombay. This is irrelevant to the ATH, but 20 years later Spiers was jailed for drug-smuggling offences, and in February 2011 so was his 44 year old daughter.		**I**
4	**Who crossed the Styx on Route 466?**	James **Dean**	
	On 30 September 1955, James Dean was driving his Porsche 550 Spyder along US Route 466 (now State Route 46) near Cholane, California. At the intersection with State Route 41, a car coming in the opposite direction driven by student Donald Turnupseed attempted to turn left across Dean's path, and the two cars met nearly head on. Turnupseed received only minor injuries (and was not charged with any offence). Dean's mechanic Rolf Wütherich, who was in the Porsche with Dean, received a broken jaw and other injuries. Dean was apparently alive when taken into an ambulance, but was pronounced dead on arrival at hospital. When I came up with the question, I had in mind the classic song *(Get Your Kicks On) Route 66*. In Greek mythology the river Styx separated the Earth from the Underworld, and was crossed by the souls of the newly dead. It may not have been completely accurate that James Dean died on Route 466, but it was too good a question to resist!		**N**
5	**Whose Christmas Day coronation was preceded at the start of that year by a royal funeral and probably another coronation, all in the same new church?**	**William** I of England (the Conqueror)	
	Westminster Abbey, built by Edward the Confessor on the site of a Benedictine monastery, was consecrated on 28th December 1065. Edward died on 5th January 1066, and the very next day saw both his funeral in the Abbey, and also the coronation of Harold Godwinson (Harold II), which probably took place in the Abbey although no definitive records exist. The rest is history and all that, and Christmas Day 1066 saw the coronation of William the Conqueror in Westminster Abbey.		**I**
6	**Which Saxons found fame and mania after one of their arrows hit a city in Michigan?**	The **Bay City Rollers**	
	Legend has it that in the late 60s, Scottish pop group The Saxons were looking for a new name. A dart thrown at random at a map of the USA landed in Arkansas, so they had another go, and this time it landed on Bay City in Michigan. Worldwide fame and "Rollermania" were just around the corner.		**T**

7	**In March, an Oxfordshire 9-year-old with a spicy name became the World Champion in what?**	**Pooh Sticks**	
	In late March 2011, Saffron Sollitt, from Wallingford in Oxfordshire, beat 500 other competitors from around the globe, at Days Lock in Little Wittenham, near Abingdon, to win the individual prize in the World Pooh Sticks Championships. The Championships started in 1983.		**I**

PREMONITION			
1	**Which comprehensive best-seller was first published in 1936 after a 3000-mile walk by its creator?**	The **A-Z** street map of London	A
	In 1935, portrait painter Phyllis Pearsall got lost on her way to a party whilst using the best available map of London (a 1919 Ordnance Survey map). Next day she set out on foot to map London, and the first A-Z was published in 1936 after she had walked around 3000 miles, working mostly 18-hour days.		
2	**Complete the sequence: red, blue, white, black, orange …**	**black and white**	L
	The colours worn by the dogs in traps 1 to 6 in greyhound racing.		
3	**In May, what was it alleged that Roger Bannister had lowered in 1954?**	the **toilet seat**	I
	In May 2011, two contestants, Andrew and Vanessa, on ITV's *Million Pound Drop* were asked whether in 1954 Roger Bannister became the first man to go into space, run a sub-four minute mile, or put the toilet seat down. It was reported that after some hesitation, Andrew suddenly burst out with "I think I've seen 'Bannister' written on a toilet!", and so the couple chose that option. I think it's safe to assume that neither Andrew nor Vanessa is reading this. You can find their performance on YouTube.		
4	**Which religious masterpiece was first publicly performed in a Dublin music-hall, and came to London under a less-specific name a year later?**	Handel's **Messiah**	S
	Messiah was first performed in a music hall on Fishamble Street in Dublin, on 13 April 1742. Although Handel was living and working in London at that time, he appears to have been reluctant to present such a sacred subject matter in London, where many clerics still regarded the theatre, and Handel's music, as profane and subversive. In Dublin, Dean Jonathan Swift, the author of *Gulliver's Travels*, almost prevented the premiere by threatening to forbid singers from St. Patrick's Cathedral to take part. To avoid charges of blasphemy, the London premiere in 1743 was advertised as *A Sacred Oratorio*.		
5	**What was the product in the first commercial aired on Channel 5?**	**Chanel No 5**	E
	Channel 5 went live on 30 March 1997, and this famous perfume just had to be in the first ad. See http://www.meldrum.co.uk/mhp/continuity/channel5.html . Chanel No 5 celebrated its 90th anniversary in 2011.		

6	**Who wore only a sheet outside the Mother of all Parliaments, and was later the first to be evicted from the House?**	Sally **Bercow**	
	On 3 February 2011, the wife of the Speaker of the House of Commons appeared in the *Evening Standard* newspaper, photographed wearing only a bedsheet in a hotel room overlooking the Houses of Parliament. The article had her blathering on about how the view from the Speaker's House was "incredibly sexy", how power was an aphrodisiac, and how she and her husband had both had members of the opposite sex "hitting on" them since he became Speaker. Mr Speaker's former colleagues on the Conservative benches do not like him, or her, and so several took this opportunity to have a pop at him. Other newspapers commented on the row, and in doing so just *had to* reprint the photograph. On 26 August, Mrs B became the first person to be evicted from the house in *Celebrity Big Brother*. The London *Evening Standard* newspaper featured both parts of this question – *and* reprinted the photograph – in its 2011 news quiz on Friday 23rd December.		**W**
7	**Which nineteen-year-old stuck by her pals when the Bobby caused a crisis in the bedroom?**	Queen **Victoria**	
	This is about the Bedchamber Crisis of May 1839, in the last days before Victoria turned 20. Lord Melbourne had resigned as Prime Minister and recommended that the Queen should appoint Sir Robert Peel to succeed him. (As Home Secretary, Peel created the concept of a modern police force, with police officers henceforth being known as "Bobbies".) Peel was a Tory, and requested the Queen to replace some of her Ladies of the Bedchamber, who were married to Whig ministers. Victoria refused, on the grounds that they were friends, not political appointees. Peel refused to form a government, and Melbourne was then asked to head the next administration. Wikipedia notes that the Bedchamber Crisis was depicted in the 2009 film *The Young Victoria*, which I haven't seen, although it was on TV on 22 December 2011. In typing up this solution, I've just realised that this is another case of my not sticking to the rules about using surnames unless absolutely necessary. Sorry!		**I**

FOREKNOWING			
1	**Who, in March, was deliberately late for her own funeral?**	Elizabeth **Taylor**	
	A statement from her publicist said that "Miss Taylor had left instructions that it [her funeral] was to begin at least 15 minutes later than publicly scheduled, with the announcement "She even wanted to be late for her own funeral."".		**T**
2	**Which record-breaking bear survived three high speed crashes, including a tragic one on our 21st day?**	Mr **Whoppit**	
	Mr Whoppit was the teddy bear mascot of land and water speed record holder Donald Campbell. Campbell was highly superstitious, and Mr Whoppit always accompanied him in the cockpit for his attempts on world speed records. Campbell and Mr Whoppit survived a serious crash in the *Bluebird* car at the Bonneville Salt Flats on 16 September 1960. Campbell was killed on Coniston Water on 04 January 1967 when the *Bluebird* boat somersaulted at a speed in excess of 300mph. Mr Whoppit was found floating in the water just after the crash. He then passed to Donald's daughter Gina, and together they survived a crash in October 1984 at Holme Pierrepoint in Nottinghamshire, when she was attempting to break the Women's World Water Speed Record that she had set just minutes before. The phrase "on our 21st day" means "on the 21st day of this ATH" – i.e. the 4th of January. (It doesn't mean 21 days from the start of the ATH – 15th December was day one.) There are a couple of other questions with similar phrases – relics of the time I was thinking of having an "On This Day" series of questions.		**H**

3	**Who was the first living person outside the Royal Family to appear on a UK postage stamp?**	The answer I was looking for was Roger **Taylor**, the drummer with Queen. But answers of Francis **Chichester** were also accepted.	
			Y

The stamp above left was issued in 1999. Yes, Freddie Mercury died eight years before that, but there was much controversy at the time because the tiny shadowy figure behind the drums is of course Roger Taylor, who was and still is very much still alive.

The image above is somewhat larger than the real thing. I can't recognise Roger Taylor, but nevertheless this stamp caused much controversy, debate, discussion, and harrumphing from retired colonels. "Disgusted of Tunbridge Wells" didn't know whether to complain about the stamp prominently featuring a flamboyant bisexual who had died with AIDS or - *quelle horreur!!* - a living person!

It was pure coincidence (that phrase again!) that two questions with the same answer – Taylor – appeared on the same page. Despite having an abundance of questions, when it came to fitting them into the diagonal acrostic I often didn't have many options.

Monitoring one of the teams, I noted their answer **Francis Chichester**, referring to the stamp issued in 1967 to commemorate his solo voyage around the world on *Gipsy Moth IV*. The stamp above right shows an unidentifiable figure on board the yacht, but since it was a solo voyage it must be Francis Chichester. I accepted either answer – only one point, though, if you gave both.

4	**Which Bill was the first non-talking head to appear on TV?**	**Stooky** Bill	
	Stooky Bill was the name of the head of a ventriloquist dummy used by John Logie Baird used in his early television experiments (1925-26) at 22 Frith Street in London. "Stooky" is Scottish slang for a plaster cast. (Wikipedia says it also means someone who is wooden in their movements, but my wife and I – both Scottish - have always understood that to be a different term, "stecky".) One story is that the lights that Baird had to use put out so much heat that he couldn't use a real human for the testing. The first human to appear on Baird's TV may also have been a Bill. He was William Edward Taynton, a 20 year old lad from the office below Baird's rooms in Soho. The Wikipedia entry for Baird suggests that immediately after televising Stooky Bill, he went downstairs and fetched Taynton, but other sources place four weeks between these events.		**O**
5	**Where did the first message commence with audio confirmation of the sight of jumbos in the background?**	**YouTube**	
	The first video posted on YouTube, in April 2005, depicts co-founder Jawed Karim at San Diego Zoo, who starts off by saying "So here we are in front of the elephants." http://www.youtube.com/watch?v=jNQXAC9IVRw		**U**
6	**Which F1 driver - after 1959 - came 6th, yet retired without a point?**	Lella **Lombardi**	
	Lella Lombardi is the only female driver to score in the F1 World Championship - but that would have been too easy a question! In the 1975 Spanish Grand Prix she finished 6th, which would normally have earned her a point. However, the race had been ended at about half-distance after a dreadful crash in heavy rain which had killed a fireman, a photographer and two spectators, and so the points awarded to the drivers were halved. Lombardi thus received only half-a-point. This was the only time she scored in F1, and she is the only driver to end their career with a career total of 0.5 of a point – "without a point". In the early seasons of the F1 championship (1950 to 1959), 2 points were awarded for 5th place, none for 6th, and 1 for the fastest lap during the race. In 1960, the point for the fastest lap was dropped, and the driver finishing 6th was awarded one point. Ever since then, there has been at least 1 point for 6th place. But it is possible that in the years 1950-1959, someone could have come 6th in a Grand Prix and ended up their career with no points – hence the inclusion of "after 1959" in the question.		**R**

7	**Who, on Christmas Day, utilised simple harmony to make a horological breakthrough that lasted almost 300 years?**	Christiaan **Huygens**	
	On Christmas Day 1656, Dutch scientist Huygens first attached a pendulum – a simple harmonic oscillator - to a clock, and the pendulum clock became the most accurate instrument for time-keeping until around the 1930s. The original version of this question said that this happened "on the same day" that the English Parliament met to consider further measures against what one MP called "this foolish day's solemnities". Puritans argued that Christmas was a Catholic relic which simply provided an excuse for drunkenness and gluttony. (Has anything changed?) The English Parliament did indeed discuss this on Christmas Day 1656. But then I realised that England was then still using the Julian calendar, whilst several Dutch provinces, including South Holland where Huygens was (in the Hague) had already adopted the Gregorian calendar. In 1656 the calendars were 10 days apart, so Huygens made his breakthrough 10 days before the debate in the English Parliament. There are some good quiz questions that you can derive from the confusion arising from the use of different calendars, but I'm not going to tell you what they are ☺		**S**

ABECEDARIAN		
1	**In recent public opinion, what came between the upwardly mobile *alauda arvensis* and a Japanese New Year tradition?**	Elgar's **Enigma Variations**
	In 2011, the BBC asked the public to compile their own *Desert Island Discs* by telling them their most popular tracks. Top of the list was Vaughan Williams's *The Lark Ascending*. Third was Beethoven's Ninth Symphony (the "Choral"), the playing of which is a New Year tradition in Japan.	**E**
2	**Which north-facing door has a wall of death on one side and trainloads of tourists on the other?**	The **Stollenloch**
	The Stollenloch is a door in the middle of the North Face ("Nordwand" in German) of the Eiger mountain. On the outside is one of the most hostile environments on Earth. So many climbers have lost their lives on the North Face that it is often known by another, similar, German name - "Mordwand", meaning "murder wall" or "death wall". The Eiger has a railway – the Jungfraubahn - running though it. One end is at the Kleine Scheidegg pass (elevation 2061 metres), and the other is at the Jungfraujoch saddle between the neighbouring peaks of Mönch and the Jungfrau. At 3454 metres, the Jungfraujoch station is the highest in Europe. Apparently it is so popular with Asian tourists that amongst the restaurants there is one called "Bollywood", and also a Japanese noodle bar. There are two train stops, with windows and viewing platforms, within the Eiger. The Stollenloch is not actually at one of the train stops, but, like the other windows, it is used to gain access to the North Face, sometimes to climb it, sometimes for rescue attempts, and sometimes (to the dismay of the authorities) to ski down it. I first became aware of the Stollenloch from a BBC TV programme – *Eiger: Wall of Death* - in summer 2009, and was fascinated by the contrast between the environments on either side of the door. *The Guardian's* TV reviewer caught my amazement perfectly: "There can be few doors – the one on the wardrobe on the way to Narnia perhaps, and possibly the Pearly Gates – that are so different on either side."	**T**

3	**Where, on our 32nd day, did a small band of Christian followers disembark and end an experiment with breadfruit?**	**Pitcairn** Island	
	On 15th January 1790, Fletcher Christian and a small band of followers made landfall on Pitcairn Island. A few days later, they literally burned their boat, *HMS Bounty*, on which they had mutinied nearly nine months earlier. The *Bounty's* original mission had been to take breadfruit from Tahiti to the West Indies, to see if they would grow well there and provide a cheap source of food for slaves. Whilst monitoring the teams, I saw a few answers of Tubuai for this question, so I checked on it. The mutineers tried, unsuccessfully, to settle on the island of that name during 1789 – the mutiny was actually on 28th April 1789 – but this doesn't fit the question. The 32nd day of the ATH was 15th January, so it was Pitcairn Island that I was looking for.		**T**
4	**Which republic has a monarch on its flag?**	**California**	
	The Bear Flag is the official flag of the state of California in the USA. It features a star, a bear and the words "CALIFORNIA REPUBLIC" on a white field, above a broad red strip. The bear was modelled on the last wild Californian grizzly bear in captivity. Named "Monarch", it was captured in 1889 by newspaper reporter Allen Kelley, at the behest of William Randolph Hearst. It was subsequently moved to Woodwards Gardens in San Francisco, and then to the zoo at Golden Gate Park. After its death in 1911, it was mounted and preserved at the Academy of Sciences at Golden Gate Park.		**I**

5	**Which bird links Paradise and the Hi-Hi with an inability to watch an uprising?**	**Heron**	
	Gil Heron was a Jamaican footballer who was the first black player to play for Glasgow Celtic, in 1951. Celtic's ground is often referred to by its fans as Paradise. When released by Celtic, Heron went to Third Lanark ("the Hi-Hi") - and later to Kidderminster Harriers - before returning to America.		**N**
	Gil Heron's son, Gil Scott-Heron, was the American jazz-poet whose best-known work is *The Revolution Will Not Be Televised*.		
	It's amazing how many of my questions "appeared" in the press or on TV after I had thought of them and included them in my list of potentials for the ATH. Sadly, this one might have been made easier for you by Gil Scott-Heron's untimely death, at age 62, in May 2011, two-and-a-half years to the day after his father's death.		
6	**What animal has webbed feet, was used to herd fish and act as a ship-to-ship courier, and has lived in a casa branca since April 2009?**	a **Portuguese water dog**	
	An in-joke for my wife, Nancy, who, one day a few years ago, told me a fantastic tale of a type of dog with webbed feet, which used to help Portuguese fishermen by herding fish, moving nets around, and carrying messages between boats. Frankly, I didn't believe a word of it.		**G**
	Although I eventually bought her one – on a t-shirt – I still found it hard to believe in them. In September 2011, we spent a couple of weeks in their homeland, the Algarve, but we never saw any. There were supposed to be PWD kennels in a nature reserve that we visited, but when we went there, we were told that the dogs had recently moved. I was beginning to suspect a massive international deception about these fake dogs.		
	However, we were told that the next day, Sunday, there was a PWD competition in Lagos, quite a distance from where we were staying. We arrived there around lunchtime, and eventually I found a poster in a window saying where the competition had been, supposedly, at 1000 on the Sunday morning. Come off it – no-one would have a dog competition at that time on a Sunday morning! The conspiracy theory was almost proven.		
	In fact, the deception reaches to the highest levels of society, maintaining that the Obama family acquired one, called Bo, in April 2009, shortly after they moved into the White House (*casa branca* in Portuguese).		
	OK, Nancy – happy? I got it into the ATH!		
	I realised fairly early on when monitoring some teams that the question was a little ambiguous, and that some of you thought that the answer was "Bo". I didn't publish a correction because if you worked out the link between the answers then you'll have realised what answer I was wanting. But if your answer was "Bo" then you'll get the point for this question.		

7	**Where, not far from where I live, would you find classical scientific experiments which have been running continuously for over 150 years?**	Rothamsted	
	The "Classical Experiments" into crop yields, use of fertilisers and land management have been running at Rothamsted Research, near Harpenden, since the 1850s and in a couple of cases since the foundation of the research centre in 1843. http://www.rothamsted.bbsrc.ac.uk/Research/Centres/Content.php?Section=Resources&Page=ClassicalExperiments You should have been able to work out from my phone number that I live in St Albans, just a few miles away from Rothamsted. As explained elsewhere, I was wanting to make you think that I had hidden the treasure near where I live. This might have been reinforced if you noticed that Rothamsted is close to the Roman road of Watling Street.		**S**

PARADOXICAL			
1	**What opinion-polarising French casserole cookware could be unsafe and illegal in Denmark?**	**Marmite**	M
	In French, a "marmite" is a type of casserole dish or pot, and Marmite was first sold in a pot resembling such a dish. One is still depicted on the label today. Love it or hate it, you probably never considered the famous yeasty spread to be unsafe. In May 2011, it was reported that the Danish authorities had asked a shop in Copenhagen to stop selling it. Foodstuffs with additives such as vitamins and minerals – as Marmite is – must be approved by the Danish Food and Veterinary Administration. Without such approval, it cannot be considered to be "safe" in Denmark, and its sale there would be illegal.		
2	**Whose hatred of helicopters led to him hiking across a mountain to a shooting scene, armed only with a sword and shield?**	Sean **Bean**	E
	Bean has a well-known fear of flying. Playing Boromir in the *Lord of the Rings* films involved helicopter rides into the mountains in New Zealand where the films were made. The story is that after one particularly bad ride, the next time he took a ski lift as far as he could and then hiked the last few miles across the mountain to the shooting scene, in costume as Boromir, complete with weaponry. The annual Sean Bean question.		
3	**Which soluble stimulant was first produced for the mass market by George Washington?**	**Instant coffee**	S
	George Constant Louis Washington (1871-1946) was an American inventor and businessman of Anglo-Belgian origin. He is best remembered for his invention of an early instant coffee process and for the company he founded to mass-produce it, the G. Washington Coffee Company. He didn't invent instant coffee – that is generally credited to Satori Kato, a Japanese-American chemist whom I was researching when I came across Mr Washington – but he was the first to mass-produce it.		

4	**In June, whose mesmerising show, where rabbits are unmentionable, was abandoned when the star himself was dazed?**	David **Days**	
	On 03 June 2011 in Portland, Dorset, stage hypnotist David Days had already put three people "under" when he tripped over a participant's leg and knocked himself out. When he could not be roused immediately the show was abandoned. However, he soon came round and released the three from their hypnosis – but if he hadn't, then he always carries around a voice recording to be used in emergencies. There is a superstition about rabbits in Portland – possibly linking their burrowing activities to landslides in the island's quarries. The word "rabbit" is taboo, with terms such as "underground mutton" and "long-eared furry things" being used instead. The Wallace and Gromit film *The Curse of the Were-Rabbit* was advertised on the island as "*Something bunny is going on*".		**S**
5	**What would you be if your blood was T- ?**	**Vulcan**	
	In *Star Trek*, T negative is a rare Vulcan blood type, shared by Mr Spock and his father Sarek. The question says "what would you be", not "who would you be", so answers of Spock or Sarek are not correct.		**A**
6	**Which flow controller, just west of a prime meridian, provided us with a scandalous ending?**	**Watergate**	
	A water gate or sluice gate is used to regulate the flow of water. The Watergate scandal of the 1970s in the US began with the arrest of 5 men for breaking into the headquarters of the Democratic National Committee, which was in the Watergate complex of buildings in the Foggy Bottom area of Washington DC. This is just a few hundred yards west of the line of the Old Naval Observatory meridian which was used by the US as its prime meridian for astronomical purposes between 1850 and 1912. The boundaries of a number of western states – Kansas, Colorado, Nebraska, Wyoming, the Dakotas, and more – were defined in terms of whole numbers of degrees of longitude west of this prime meridian. The Watergate affair provided the English language, and others, with the suffix "-gate", the ending commonly tagged onto a name or a noun to designate some form of scandal, serious or not. See http://en.wikipedia.org/wiki/List_of_scandals_with_%22-gate%22_suffix		**G**

7	**The twins could have killed Macbeth. When they arrived, Dad was watching the Aussies being bowled out in Kennington. Mum was Dad's second, but subsequently achieved a first of her own when she occupied a house redesigned by William Kent. What is the family name?**	Thatcher	
	Twins Carol and Mark Thatcher came into the world by Caesarean section, so they, like MacDuff in Shakespeare's play, were not technically "born of woman", and so would have been able to kill Macbeth. They were born on 15 August 1953, the first day of the final Test of that year's Ashes series, at the Oval, and there are many reports that that is where Dad Denis spent the day. The Australians were bowled out for 275 on that day – England went on to win the match by eight wickets, and the series 1-0. Margaret Thatcher was Denis's second wife. On 4th May 1979, she became the UK's first woman Prime Minister, and moved into 10 Downing Street, which had been created, by William Kent, from three smaller adjoining houses in 1732-1735, after Walpole had accepted George II's gift of property, but for the First Lord of the Treasury and not for himself personally. The Prime Minister is the First Lord of the Treasury, and it is that title that is engraved on the letterbox of No. 10.		E

OBJECTIVISM			
1	**Which Hunt did Betty and Abigail initiate?**	The **Salem** Witch Hunt or Witch Trials	
	Betty Parris and her cousin Abigail Williams were the first girls to exhibit abnormal behaviour and to make accusations of witchcraft in Salem Village in February 1692. The hysteria spread across several towns and villages in Massachusetts, and between February 1692 and May 1693 about 350 people were arrested on witchcraft charges, with at least 19 subsequently being hanged, one being crushed to death by heavy stones in an attempt to make him enter a plea, and several dying in prison whilst awaiting trial. The highly combustible combination of religious fervour, false accusation and weak justice ensured that the term "witch hunt" quickly lost its literal meaning and is still in all-too-common use today.		S
2	**In July, which vehicle, not named after a mythical lost island, brought the curtain down on a 30-year programme?**	**Atlantis**	
	Yes this was about the final Space Shuttle flight. However, I tried to put you off by saying that OV-104 was not named after the legendary lost island civilisation. In fact, it is named after *RV Atlantis*, the first and main research vessel for the Woods Hole Oceanographic Institution from 1931 to 1964. That boat was sold to Argentina in 1966, and still sails in the Argentine Naval Prefecture as the *Dr. Bernardo A. Houssay*. Having sailed over 1,300,000 miles to date, she is the oldest serving oceanographic research vessel in the world.		T
3	**What was the popular name of the great leader whose real name meant "yawner"?**	**Geronimo**	
	The Apache leader's real name was Goyaałé, "one who yawns"; often spelled Goyathlay or Goyahkla. He acquired the name "Geronimo" when fighting the Mexicans. Attacking the Mexicans with a knife, many of them cried to St Jerome for assistance – "Jeronimo!". The name stuck. I found out that the novel *Flashman and the Redskins* includes "the Yawner" as an important character. So I checked the book, and I could only see one place where it was noted that he was indeed Geronimo, so I took the chance and left this question in.		R

4	**Which novel is named after a cellar in which the author survived a controversial bombardment by his own side?**	**Slaughterhouse-Five**	
	In WW2, Kurt Vonnegut Jr was taken prisoner by the Germans during the Battle of the Bulge. He was imprisoned, with others, in Dresden, in a makeshift prison which was actually a disused underground meat storage locker, called *Schlachthof Fünf* (Slaughterhouse Five), and thus he survived the bombing of that city by the Allies. The name of the prison gave him the title and some of the plot for his most famous novel, and the Dresden bombing is also a theme in some of his other novels.		**U**
5	**Whose dynamic career includes a championship-winning Ferrari and an award-winning farm in Hampshire?**	Jody **Scheckter**	
	Scheckter was Formula 1 world champion, driving for Ferrari, in 1979. He is now an expert in organic farming, and founded the organic/bio**dynamic** Laverstoke Park Farm, Overton, Hampshire. Scheckter was featured – and both of the points from the question were mentioned – in Raymond Blanc's Christmas special programme on BBC1 TV on Friday 23rd December.		**C**
6	**Where in London can you shop for arty-crafty stuff amongst two former Senior Service members' members?**	**Liberty**	
	The Tudor-style Liberty store on Great Marlborough Street was constructed in the 1920s using the timbers (members) from two former ships of the Royal Navy (the "Senior Service") - HMS Impregnable and HMS Hindustan. Liberty's founder, Arthur Lasenby Liberty, formed strong links with designers working in the Arts and Crafts and Art Nouveau movements – connections which the company still exploits to this day.		**T**
7	**On our fifth day, we wish Jennifer Kowalska a happy third birthday. Where was she born?**	**Kingsbury** Tube station	
	Transport for London says that there have been only three births on London Underground premises: - Marie Cordery in 1924 at Elephant & Castle, - Jennifer Kowalska, 19 Dec 2008, Kingsbury, - boy Jenkins, 26 May 2009, London Bridge. It is not clear where that leaves Jerry Springer's claims to have been born at East Finchley station during an air raid in WW2 (see question 6 on page AGN). One would have thought that quite a few babies could have been born when people were sheltering in the Tube stations. Maybe TfL doesn't count them, or maybe they were never recorded correctly.		**U**

SEMPITERNAL			
1	**Who, by Jove, voiced an apology to Dave for shutting him out 10 or 11 years ago?**	Douglas **Rain**	
	Douglas Rain provided the voice of the HAL 9000 computer in the film *2001: A Space Odyssey*. 2001 was 10 years before this ATH was published, and 11 years ago if you were still puzzling over the question in January. The question refers to the famous (344,000 hits returned by Google on 1st January 2012) dialogue when astronaut Dave Bowman, who is outside the main spaceship, finds out that HAL, who has gone rogue, does not intend to let him back in: *Bowman: Open the pod bay doors, HAL.* *HAL: I'm sorry, Dave. I'm afraid I can't do that.* This takes place in the vicinity of the planet Jupiter – i.e. "by Jove".		**R**
2	**What, in March, rewards a 64 kilometre bicycle ride against the airflow?**	St **Wendreda's** Church	
	I already had a number of questions which referred to the month of March, so it occurred to me to create one about the town of that name in Cambridgeshire. St W's Church was described by John Betjeman as "worth cycling 40 miles into a headwind" to see.		**E**
3	**Which musical rozzer's father might have been the subject of the only song that David Cameron knows all the words to?**	**Sting**	
	With a real name of Gordon Matthew Thomas Sumner, Sting was the son of Ernest Sumner, a milkman in Wallsend. There are online references to his father as "Ernie". On *Desert Island* Discs in 2006, the then Leader of the Opposition Cameron said that the only song he knew all the words to was the 1971 hit by comedian Benny Hill, *Ernie* – about the "fastest milkman in the West". We were reminded of this in 2011 when, now Prime Minister, he accused a Labour MP of being in "Fairy Dairy Land" – a quote from *Ernie*.		**I**

4	**Inside which division between A and B will you find nothing named after FOR 7?**	The **Cassini** Division	
	The Cassini Division is the space between the A and B rings of the planet Saturn. From Earth it appears as a dark gap. The Voyager spacecraft in the early 80s discovered that it actually contains rings of darker material, as well as some gaps where there is no material. The gap (i.e. "nothing") at the inner edge of the Cassini Division is named after Huygens, the answer to question 7 on page FOREKNOWING (FOR 7). Strictly speaking, the Huygens Gap isn't "nothing", because it contains a small ring known as Huygen's Ringlet.		**S**
5	**In the summer, who sailed away after seven weeks and a day, leaving a lot of people hacked off?**	**LulzSec**	
	The LulzSec hacker group announced in late June 2011 that their "planned 50-day cruise has expired", and that they would be disbanding. Victims of their attacks included Sony, Nintendo, the US Senate, the CIA, and the UK's Serious Organised Crime Agency (SOCA).		**S**
6	**In the 19th century, which professorial King, excused from holy orders, followed George and Charles, and preceded another George?**	**Joshua**	
	The question refers to Lucasian professors of mathematics at Cambridge – the post held by Newton and Hawking, amongst others. In the 19th century, there was the following sequence: - appointed 1826: George Biddell Airy - 1828: Charles Babbage - 1839: Joshua King - 1849: George Gabriel Stokes. One of the stipulations in the will of Henry Lucas, who founded the post, was that the holder of the professorship should not be active in the church. Isaac Newton later appealed to King Charles II that this requirement excused him from taking holy orders, which was compulsory for most fellows of the university at that time. The King supported Newton, and excused all holders of the professorship, in perpetuity, from the requirement to take holy orders.		**A**

7	**Who knelt to pray at a Christmas Day Mass, and arose, apparently to his surprise, as an Emperor?**	Charlemagne	
	He was crowned "Emperor of the Romans" in St Peter's Basilica on Christmas Day 800, by Pope Leo III, who was trying to restore power and control to Rome. Charlemagne claimed he didn't know that this was going to happen, although one would have thought that he'd have been given a clue by the presence of a glittering, jewelled crown on the altar where he knelt to pray. Unless, of course, it was so well wrapped that he couldn't tell what it was.		**M**

UNBELIEVING			
1	**Which is the most northerly Scottish Premier League or Scottish Football League football club?**	**Elgin City**	
	An absolutely straight question – no catch, no clever stuff. I am regularly irritated by reading that Ross County are the most northerly club in Scotland, which is what most people think. I've even written to the *Guardian* about it after they printed it for at least the second time. It's easy to see how the mistake arises. To get to Dingwall, where Ross County are located, if you're coming from the south (as most people will be) then you drive northwards up the A9, continuing past my home-town Inverness in the direction of Wick and Thurso, turning off the A9 approximately 6 miles north of Inverness and continuing north-west for another 7 miles. Or you get a train to Inverness and then change to one heading northwards from there. To get to Elgin from Inverness you think you are heading east – by road or rail, you are on the route that takes you to Aberdeen. But if you look at a map, you'll see that for the first part of that journey, you are in fact heading north-east. Using Google Earth and Streetmap, when I wrote to the *Guardian* I calculated that Elgin City's ground is approximately 2.6 minutes of arc (about 4 miles) further north than Ross County's.		E
2	**Which dogsbody is said to have had one peg made shorter than the other, to enhance their striking ability?**	Douglas **Bader**	
	"Peg" is slang for leg, especially an artificial leg. It is said that double-amputee WW2 fighter pilot Bader had a set of legs made with one shorter than the other, so that when he was playing golf he always in effect was playing uphill, which makes it easier to strike the ball cleanly. As the leader of a fighter wing, Bader was entitled to have his initials DB painted on his plane, and this gave rise to his radio callsign "dogsbody". I was trying to mislead you into thinking of Marilyn Monroe, who is said to have had one of her shoe heels shorter than the other to emphasise her wiggle, which might have been regarded as a "striking ability". However, as far I know, no one has ever applied the term "dogsbody" to her ☺		A

3	**Whose death from pneumonia is thought to have been a consequence of paying early-morning winter visits to a northern queen?**	René **Descartes**	
	From Wikipedia: "René Descartes died on 11 February 1650 in Stockholm, Sweden, where he had been invited as a teacher for Queen Christina of Sweden. The cause of death was said to be pneumonia—accustomed to working in bed until noon, he may have suffered a detrimental effect on his health due to Christina's demands for early morning study (the lack of sleep could have severely compromised his immune system). Others believe that Descartes may have contracted pneumonia as a result of nursing a French ambassador, Dejion A. Nopeleen, ill with the aforementioned disease, back to health."		**S**
4	**What type of plant is on average 7 feet tall, has a long whip-like sting, and uses its roots for locomotion?**	a **triffid**	
	From the novel *The Day of the Triffids* by John Wyndham.		**F**
5	**Who waited without complaint for 26 years before making his tragic stage debut as a jester alongside an admiral, a clown and a cigar?**	André **Tchaikowsky**	
	When concert pianist André Tchaikowsky died in June 1982, it was discovered that in his will he bequeathed his skull to the Royal Shakespeare Company "for use in theatrical performance". The RSC first put his skull on the roof of one of their buildings to weather for a couple of years, then stored it away. It was used as Yorick's skull in rehearsals of *Hamlet*, and casts of it were used in actual performance, but squeamishness seems to have been the reason for it not being used in actual performance until July 2008. Having been a professional musician, this wasn't Tchaikowsky's actual stage debut, hence the use of the term "tragic" in the question, referring to the play's full title, *The Tragedy of Hamlet Prince of Denmark.* Yorick was the King's jester - in Act 5 Scene 1 of the play his skull is unearthed by the First Clown and handed to Hamlet (the cigar), who is accompanied by Horatio (Nelson, the admiral).		**I**

6	**Which renowned Hollywood beauty co-devised a method for helping fish reach their destinations, which has other, widespread uses today?**	Hedy **Lamarr**	
	Working with avant-garde composer George Antheil, Hedy Lamarr – who was often called "The Most Beautiful Woman in Films" - invented and patented an early version of **frequency hopping**, which used a piano roll to change between 88 frequencies and was intended to make radio-guided torpedoes ("fish") harder for enemies to detect or jam. The patent was granted in 1942, but the technology of the time could not implement the idea. Others had also developed methods of frequency hopping spread-spectrum communications, but Lamarr and Antheil's technique forms the basis of methods used in WiFi, cordless phones and mobile phones today. On Christmas Eve I was catching up on the reading that I'd missed during my final preparations for the ATH. I was horrified to discover that the *New Scientist* magazine of 3rd December had devoted a whole page to a review of a book about Lamarr's inventions, concentrating mainly on frequency-hopping. That explains the comment made by a member of one of the teams who had allowed me to monitor their progress – "I was reading about this only a couple of weeks ago". ☹		**R**
7	**Which fair-headed national icon failed to tempt a monarch who, in May, was visiting the neighbours for the first time?**	a pint of **Guinness**	
	On 18 May 2011, during her first-ever trip to Ireland, Queen Elizabeth visited the Guinness brewery in Dublin. TV news showed an amusing sequence of a perfect pint of Guinness being poured and placed in front of her. It was then moved even closer to her, to the traditional Irish encouragement of "Go on, go on". Both the Queen and the Duke of Edinburgh gazed at it with bewilderment for a few moments. Liz then turned away, but for a second it looked as though Phil might go for it. But he too realised the gift he would be handing to the Guinness marketing people, and possibly also thought of all the pictures of him with cream from the head all along his upper lip. So he stiffened said lip and moved on. 5 days later, President Barack Obama was also confronted with a pint of plain, in a pub in the village of Moneygall. He didn't hesitate.		**S**

OBSCURANTIC			
1	**Which team's goalie kept a bony mascot called Fred in his glove bag?**	**Tynefield City**	
	In the *Roy of the Rovers* comic, Tynefield City's Scottish goalkeeper, Gordon Stewart – the "safest hands in soccer" – kept a toy skeleton called Fred in his glove bag. Where was Fred, one wondered, when Gordon died in a plane crash off the coast of Brazil. (The second annual Roy of the Rovers question ☺)		**T**
2	**What was the name of the high-stepping Bristol-born stage acrobat who moved to the USA in 1920 and later became a Hollywood superstar?**	Archibald "Archie" Alexander **Leach**	
	Leach moved to the USA for a two-year tour as a stiltwalker with the Bob Pender stage troupe. When the rest of the troupe returned home, Leach stayed on to seek fame and fortune. After a move to Hollywood, he changed his name to Cary Lockwood. When he was signed by Paramount, the studio bosses were not impressed with his surname. On the basis that the initials C and G had done Clark Gable and Gary Cooper no harm, Cary changed his surname to Grant. Answers of Cary Grant were not accepted, because the question specifically asks for the name of the person who moved to the USA in 1920. Incidentally, it is said that on the journey to the USA, on board *SS Olympic*, Leach met his idol Douglas Fairbanks and new bride Mary Pickford, returning from their honeymoon. And thus I have ruined another good ATH question.		**E**
3	**What conceptual activity was denied to vehicle owners in Great Yarmouth?**	**Sex**	
	In the old UK licence plate scheme after 1932, each local authority which issued licence plates was allocated a double-letter code, e.g. ST for Inverness-shire. This was prefixed by a letter, and followed by a number in the range 1-999. Thus Inverness-shire issued AST 1, AST 2, up to AST 999, then BST 1 to BST 999, then CST 1 to CST 999, etc. The two-letter code for Great Yarmouth was EX, but the prefix letter S was never used, leading to newspaper headlines such as "No sex for Great Yarmouth motorists".		**X**

4	**Whose third Queen was known as Q4?**	**Cunard's**	
	At the time of the launches of the *Queen Mary* and then the *Queen Elizabeth*, the shipping company was known as the Cunard White-Star Ltd, having been given money to complete the ships by the UK Government on condition that it merged with the ailing White Star Line (most famous for its ill-fated flagship *Titanic*.) The company name reverted to Cunard Line in the 1950s. Up to the time of its launch in 1967, the ship called *Queen Elizabeth II* (the QE2) was known as "Q4". There had been plans in the early 1960s to replace the *Queen Mary* with a similar-sized (75,000 tons) liner, which was known as Q3. But trans-Atlantic air travel was literally taking off, so Q3 never became anything more than a concept, and was replaced by the smaller (55,000 tons) more flexible Q4. Until the ship was launched, no one officially knew what it was going to be called. The ship was built on Clydeside and was a proud symbol of the Scottish ship-building industry – on launch day many schoolkids in Scotland were either given the day off school or were allowed to watch it on TV at school. So when HM named it after herself, there was a lot of controversy in Scotland, because she isn't Queen Elizabeth the Second of Scotland.		**A**
5	**What links Cassandra, the Globe, and Jack Nicklaus (five times)?**	**Wanamaker**	
	Actor Zoë Wanamaker voiced the character Cassandra in *Dr Who* episodes in 2005 and 2006 – Cassandra was simply a face on a large piece of skin that had to be continually moisturised, mounted on a frame with her brain in a jar below it. She called herself the last human in the universe. Her father, Sam Wanamaker, is credited as being the individual most responsible for the modern recreation of Shakespeare's Globe Theatre in London. Rodman Wanamaker (no relation) was an American businessman who was instrumental in setting up the Professional Golfers' Association (the PGA) in the USA. The winner of the annual PGA Championship, one of golf's four "major" championships, is presented with the massive Wanamaker Trophy. Jack Nicklaus had this pleasure five times between 1963 and 1980, as did Walter Hagen in the 1920s. Tiger Woods has to win it once more to sit alongside Jack and Walter.		**M**

6	**Where in north London is an address shared by two independent institutions founded nearly 150 years apart by men called Taylor?**	**Kings Place**	
	Kings Place, at 90 York Way, London N1, is the headquarters of the *Guardian* newspaper, founded in Manchester by John Edward Taylor in 1821, in the wake of the 1819 Peterloo massacre, when 11 to 15 people (no one knows for sure) were killed and several hundred injured when cavalry charged into a crowd gathered at a meeting to demand parliamentary reform. The independence of the newspaper and the promotion of liberal values are principles of the Scott Trust, which owns the Guardian Media Group. Kings Place is also the London premises of Logica, which, probably uniquely amongst its peers from the 1960s UK software industry, has remained independent since the company of that name was founded in 1969, by Philip Hughes, Pat Coen and Len Taylor. So this is the traditional "Logica question".		**P**
7	**At the start of the year, which twin had her collar, rather than her derrière, felt?**	**Gabriela** Irimia	
	The forename was the significant name here, because the question asked "which twin…". Miss Irimia and her twin sister Monica are better known as the Cheeky Girls, whose 2002 debut single *Cheeky Song (Touch My Bum)* sold 1.2 million copies worldwide. On 7 January 2011 she was cautioned by police for shoplifting in a Sainsburys in Wilmslow. She *is* the one who used to be engaged to former MP Lembit Opik.		**L**
8	**Where did the undead recently invade an unready city?**	**Leicester**	
	In June 2011, a concerned citizen used a Freedom of Information request to ask how the Leicester city authorities would tackle a zombie attack. The City Council admitted that it had no specific plans in place for such an emergency. About a week later, 150 people in horror make-up took part in a "mass shamble" in the city. In true zombie fashion, the mob "groaned and pressed on the glass" at the Council offices.		**E**

<u>Appendix - More about the diagonal argument</u>

First use of a diagonal argument is generally credited to mathematician **Georg Cantor**, who used it in 1891 to show essentially (mathematicians please look away now) that there are different sizes of infinity! More precisely, what he showed is that the infinite set of **real** numbers (all numbers on the traditional number line that runs from negative infinity to positive infinity) cannot be put into one-to-one correspondence with the infinite set of **natural** numbers ({1, 2, 3, …} or {0, 1, 2, 3….}, depending on which definition you use).

Real numbers include rational numbers, which can be written as fractions, e.g., ⅔, -⅝, 42, etc, and irrational numbers, which can't be expressed as a fraction, i.e. √2, *pi*, *e*, etc.

Suppose you thought you had a list of **all** the real numbers. You could then number the items of the list using the natural numbers. So you could have something like:

```
item    real
no.     number
1       0.285663540…
2       0.483265740…
3       0.964383846…
4       1.758584623…
5       1.843765403…
6       2.575748356…
7       2.734630456…
8       3.384565603…
9       3.502405873…
10      4.696763964…
```

and so on, to infinity (and beyond!).

But you can create a real number which is not in the list. Take the first digit of the first number, the second digit of the second number, and so on. In the example above you would get 0.468740674.

Now add 1 to each digit – in the example above we get 1.579851785. (This was the technique used earlier to derive "Shenley Wood" from the 11-letter words.)

The number you get cannot have been in your original list, because:
- its 1st digit is different from the 1st digit of the first number – so it can't have been the first number
- its 2nd digit is different from the 2nd digit of the second number – so it can't have been the second number
- and so on, all through the list.

And if you now include that new number in the appropriate place in your list, you can do exactly the same thing again to generate another number which is not in your new list.

So you cannot set up a one-to-one correspondence between the set of natural numbers {1, 2, 3…} and the set of real numbers, even though both are infinite sets. There **are** different "sizes" of infinity!

So what? Why is this relevant to the ATH?

It's relevant because Cantor's "diagonal method" or "diagonal argument" has been used by others to demonstrate some profound (and possibly disturbing) insights into mathematics and logic.

In 1931, Kurt Gödel used it to show that arithmetic is *incomplete*, which here means that there are assertions in arithmetic which can neither be proved or disproved. The equivalent of trying to decide whether the statement "I am lying" is true or false.

In 1937, **Alan Turing** used it in showing that in the theory of computation – algorithmic processing of symbols, which is what the computers that we use every day are doing – there are problems which are *unsolvable*. In very informal terms, there are "problems" where you can't say whether your program will find a solution. This is a long way from the issues of tricky things to program that we face every day – this is a much more fundamental limitation of computation.

A classic example of such a problem is called the Halting Problem. Basically, Turing's result says that you can never construct a machine (i.e. write a program) which will look at the description of any another machine (program and input data) and <u>always</u> tell you whether that other machine would halt if started. It can tell you some of the time – maybe most of the time – whether that other machine would halt. But there will be some machines for which it just can't tell.

Now halting is just a particular "state" of a machine that is used as an example because it's easy to understand. You can generalise things to say that you cannot create a machine which will always tell you whether another machine will ever reach a certain state once set into operation.

This has obvious implications for programs which look at other programs - things like debuggers, program-proving tools, process monitors and schedulers, and anti-virus tools. But it also has the same implications for anything which you are trying to model in a computer system, and then study. For example, when I was writing this up, I came across a research paper showing how the Halting Problem affects modelling of cardiac arrhythmias. The model used can be shown to be equivalent to a Turing Machine, and therefore the Halting Problem imposes limitations on what can be shown or deduced using the model.

Just another example of how Turing's extraordinary legacy can still affect us today.