

UNIVERSITY OF HUDDERSFIELD

M.ENG GROUP PROJECT

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# Cryptic Crossword Solver

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*Authors:*

Mohammad RAHMAN

Leanne BUTCHER

Stuart LEADER

Luke HACKETT

*Supervisor:*

Dr. Gary ALLEN

*Examiner:*

Dr. Sotirios BATSAKIS

Friday, 26<sup>th</sup> April 2014

# Abstract

Cryptic crosswords are a unique style of crosswords in which the answer to each given clue is a word puzzle. An answer can only be obtained if the cryptic clue is read in the correct way. Often when the clue is surface read, the clue makes no sense at all. The challenge is to find a way in which the reading of the clue leads to a solution.

Cryptic crosswords are a popular type of puzzle found in many parts of the world. Most of the national UK newspapers will print cryptic crosswords of varying difficulty on a daily basis. Many users can often become frustrated when a clue appears to be unsolvable.

Clues that appear to be unsolvable are often all part of the fun of cryptic crosswords. However each clue can take some time to solve due to the fact that there are many forms of wordplay.

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# Chapter 1

## Problem Analysis

An initial problem analysis has been conducted to ensure that the overall project remains focused upon the original problem.

This chapter will discuss key topics and will recommend that these topics are researched further to help support the project. The problem analysis will also define the problem in more detail, to help with understanding the project and its purpose.

### 1.1 Defining the Environment

Cryptic crosswords are a popular type of puzzles found in many parts of the world. Most commonwealth national newspapers will print cryptic crosswords of varying difficulty on a daily basis.

Cryptic crosswords are a unique style of crosswords, in which the answer to each given clue is a word puzzle. An answer can only be obtained if the cryptic clue is read in the correct way. Often when the clue is surface read, the clue makes no sense at all. The challenge is to find a way in which the reading of the clue leads to a solution.

### 1.2 Defining the Problem

Many users can often become frustrated when a clue appears to be unsolvable. It is the vast range of possible clues that often makes solving not only challenging but interesting as well.

Fundamentally, the overall aim of this project is to develop a piece of software that is able to solve any given type of cryptic crossword clue.

By using some form of natural language processing and one or more cryptic algorithms, it should be possible to generate an answer to a given clue.

Once a clue has been correctly “guessed” it can simply be returned to be user. It is the “guessing” of the answer that this project will primarily focus upon.

## 1.3 Research Areas

### 1.3.1 Initial Survey

Before undertaking the project an initial review was conducted. The review’s objective was to determine the feasibility of the project as a whole. The review also covered whether or not the project has been completed before.

From the outlined background and problem information it is clear that cryptic crosswords are a popular form of entertainment. It is also clear that some clues are particularly difficult to solve, and users may often ask other people for help in solving a given clue.

### 1.3.2 Cryptic Crosswords

A review of the national UK newspapers was conducted to determine whether or not there is a pattern in cryptic crosswords. Of all the newspaper’s websites that were reviewed (The Guardian, The Times, The Independent and The Mirror) it was clear that the cryptic crosswords are the same style.

Each clue is categorised as being either ‘across’ or ‘down’ with its corresponding grid number. Each clue will also contain the number of letters the answer should be. An example is show below:

12. The seamstress’s sensation? (4, 3, 7) =>PINS AND NEEDLES

The Guardian’s website utilises web standard technologies such as HTML and CSS, and also provides an option to solve a clue. The Mirror’s website follows a similar approach to the Guardians website; however solutions can only be obtained by dialing a premium telephone number.

The Times and the Independent both utilise a different approach and that is to serve a Java applet. Both Java applets allow the user to solve a clue should they get stuck. The Times provides puzzles as part of their paid subscription service.

All of the above newspapers publish cryptic crosswords upon a daily basis, with the solutions to the crosswords appearing in the next day’s newspaper.

Following from the crossword review, a second review into cryptic crossword solvers was undertaken. The objective of this review was to determine whether or not computerised cryptic crossword solvers exist. The three cryptic crossword solvers that were looked at were One Across, Crossword Tools and Cryptic Solver.

Each of the solvers manages to solve some clues with the same answers, with other clues providing a range of possible answers.

Crossword Tools (Crossword Tools, 2013) is a paid subscription based service, which allows users to enter a clue and a pattern. A pattern can contain part of the answer or the number of letters the answer has. If multiple answers are available, they are displayed. An example is shown below:

Kind of dog (10) =>the answer is 10 letters long.

Kind of dog (?????????r) =>the answer is 10 letters long, final letter is 'r'.

Cryptic Solver (Cryptic Solver, 2013) is a free service that offers the same functionality as Crossword Tools. Although Cryptic Solver does provide the correct answer, it does not necessarily provide the correct answer at the top of the list.

Finally One Across (One Across, 2013) provides all the same functionality as the previous two solvers, along with a score. The score is linked to the number of people who have used the given answer (effectively it's a ratings system). One Across uniquely highlights how it has managed to come to the answer, showing the break downs of each sentence. As with Cryptic Solver, One Across is a free service that doesn't require a subscription.

### 1.3.3 Natural Language Processing

In order to correctly solve a clue, some form of natural language processing will be required. It is the natural language processing that will try to deduce the meaning of a clue. It is the meaning that can then be aligned with possible answers.

An example of natural language processing can be found within the One Across application. Given a clue (and a pattern) it will try to provide an accurate solution:

Spin broken shingle (7) =>ENGLISH

In order for the answer to be obtained, One Across will follow a natural language processing path and will provide its trace path. The trace path shows how the clue has been broken down to get to the answer. The trace path for the above clue can be found below:

'spin' is the definition.

'broken' means to anagram 'shingle' to get ENGLISH.

ENGLISH matches ‘spin’ with confidence score 100%.

### **1.3.4 Application Platform**

The existing products that have been discussed within this problem analysis have all been accessible via a browser. Although this is an acceptable platform, there could be a better platform that allows users to utilise the technology easier.

As previously mentioned, most crosswords are designed for users who have a few minutes to spare on the move. As many people own a smartphone and/or a tablet, there may be a gap in the market for a high quality mobile cryptic crossword solver.

An in-depth review will need to be conducted in order to deduce the viability of this proposal.



# Chapter 2

## Research

In the previous chapter a detailed approach to what the project will cover was discussed. In order to correctly implement a working piece of a software a number of areas will need to be researched thoroughly.

Based upon the problem analysis, the the main topics that have been identified are:

- Cryptic Crosswords
- Natural Language Processing
- Application Platform
- Web Services

## 2.1 Web Services

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