# Summary of Cryptic Crosswords

## Cryptic Crosswords In general

## Cryptic Crosswords in the Literature

While not a topic well covered in scientific literature in general, what few analytical studies around cryptic crosswords there are tend to be classifiable into three main groups:

The largest body of work that exists is centred around the generation of cryptic clues, focused largely around analysis of how string literals from a pre-determined answer can be transformed by set clueing patterns, as well as some work around measures of the quality of generated clues.

The next set are the select few who have done prior, similar investigations into solving cryptic clues, with some work put into formalising definitions and notation for the sorts of clue types that appear in the majority of cryptic crosswords, and some attempts at solving. There has also been some work done towards solving non-cryptic crosswords probabilistically, working on whole-grid solutions rather than individual clues.

There are also some more left-of-field studies done: statistical studies into errors made during manual solving, and psychological studies into solving.

## Formalisation

# The Cryptic Crossword

## Metasyntactic Conventions

Here we apply a similar convention to Hart, in using a modified Backus Naur Form (BNF). We will later see that a context-free grammar may not be sufficient to model a cryptic crossword, and may have further deficiencies as a basis for finding a solution. Nevertheless, we will adopt a similar notation:

→ = is composed of

, = followed by

| = or

(x) = x is optional

x\* = 1 or more occurrences of x

(x)\* = 0 or more occurrences of x

We also take the BNF conventions

word = non-terminal symbol

“word” = string literal

[x, y, z] = list containing x y and z

(x, y) = pair x and y

For clarity, we additionally define:

{words} = English word including semantic meaning

For this last one, we really mean that we can still use the word in a synonym equivalence relationship.

## Structure of a cryptic clue

A cryptic crossword differs from a normal crossword in that the clue for each answer consists of two parts.

The first is the definition, which performs the same function as a clue in a 'regular' crossword. The answer to the clue is usually a synonym for the definition ('circular' and 'round') or may be an example of the definition ('farm animal' and 'pig'). Other forms that the definition may take will be discussed later on.

The second part of the clue is the wordplay. This is an encoded and often ambiguous second method of deriving the answer, using techniques such as anagram, substitution and concatenation.

The clue as a whole is presented as a concatenation of the two parts, sometimes with a subsidiary word indicating that one can be derived from the other (for example, 'from' or 'is').

We can present this breakdown as:

Clue → Definition, (Indicator)\*, Wordplay   
 | Wordplay, (Indicator)\*, Definition

The final clue will often resemble a valid English utterance, although this 'surface reading' (i.e. {clue} ) very rarely has any relation to the answer.

Later on we will consider other information and context within the definition of a clue.

## Definition

The definition of the clue consists of one or more English words. The answer to the clue will be a word or phrase that fits an appropriate equivalence function. Usually, the words are synonyms:

{allies} = “Friends”

although sometimes the relation is an ‘example of’ relation.

{country} = “France”

The definition carries a variety of linguistic features with it that the overall answer, and so the answer as derived by the wordplay, must match. These include aspect (noun, verb, adjective), plurality (tree, trees), tense (go, going, gone). These features may also be considered as context to the clue itself.

## Formally

We can define the definition as

Definition → {Word}

## Wordplay

The wordplay section of a clue is a set of deliberately ambiguous instructions that allows the solver to arrive at the eventual answer. As the instructions are ambiguous, multiple possible parsings of the instructions are possible. Some of these parsing will not lead to a valid English word:

Imbecile, bonkers, in a cult (7)

⇒ Wordplay ‘Imbecile, bonkers = definition ‘in a cult’

⇒ Anagram ‘imbecile’ [indicator = bonkers] = definition ‘in a cult’

⇒ ??? (no anagrams of imbecile)

(correct reading was anagram

Others will lead to a valid English word, but one that is not equivalent to the definition:

Minder shredded corset (6)

⇒ Wordplay ‘minder shredded’ = Definition ‘corset’

⇒ Anagram ‘minder’ [indicator = shredded] = Definition ‘corset’

⇒ ‘remind’ = Definition ‘corset’ X

(correct reading was anagram ‘corset’ = escort = minder)

The solver must find the correct parsing of the wordplay that yields the correct definition: even though they may not know which part is wordplay and which is definition.

## Wordplay Types

Some sort of leadup

Wordplay → Anagram | Concatenation […]

## Unitary Operators

**Anagram**

A very commonly used operator in crossword clues is an anagram. These take the form of an indicator word that denotes that the anagram function is being used (called an ‘anagrind’ within cruciverbalist circles), along with the candidate letters to be anagrammed. The simplest form of this gets the candidate letters verbatim from the clue:

Anagram → Anagrind, “candidate words” | “candidate words”, Anagrind

Sometimes, however sometimes there is some sort of operation applied to the letters before the anagram is applied. For example:

Comic bare for short comedy play (7,5)

⇒ Wordplay ‘Comic bare for short comedy’ = Definition ‘play’  
⇒ Anagram ‘bare for short comedy’ [anagrind = ‘comic’]   
⇒ Anagram (“bare for” + Shorten ‘comedy’)  
⇒ Anagram (“bare fore” + “comed”)   
⇒ Anagram (“bare fore” + “comed”)   
⇒ Anagram (“bareforecomed”)   
⇒ “Bedroom Farce”

In which case we find the more general case:

Anagram → Anagrind, Wordplay | Wordplay, Anagrind

Wherein we know that the repeated evaluation of the Wordplay will eventually result in a string literal that can be anagrammed. Ximenes argued against this form of indirect anagram:

Secondly – and here, for once, I differ from Afrit – I hate what I call an indirect anagram. By that I mean "Tough form of monster" for HARDY (anagram of HYDRA). There may not be many monsters in five letters; but all the same I think the clue-writer is being mean and withholding information which the solver can reasonably demand. Why should he have to solve something before he can begin to use part of a clue? He has first to find "hydra" – and why shouldn't it be "giant"? – and then use the anagrammatic information to help him think of "hardy". ... My real point is that the secondary part of the clue – other than the definition – is meant to help the solver. The indirect anagram, unless there are virtually no alternatives, hardly ever does. He only sees it after he has got his answer by other means.

Even so, most setters that claim to be Ximenean more details pls will allow small abbreviations and contractions (as above) to be included in their clues.

Anagrind → “free” | “novel” | “comic” [...]

**Reversion**

Clues can also be reversed. While this is functionally a subset of anagrams, there are some crucial differences. Firstly the ‘directionality’ of the clue (i.e. whether it is a ‘down’ or an ‘across’) comes into effect, in determining the sorts of indicators that can form it: “turned back” may only apply to ‘across’ clues, where “taken up” may only apply to ‘down’ clues.

Further, these clues are usually taken to be ‘fairer’ game for subsequent operations to be applied to the target of the reversion. Therefore, a clue with nested wordplay such as “Fruit, odd-one-out turned back (5)” would be acceptable, where an equivalent clue “Fruit, odd-one-out messed around” would often not be seen as Ximinean.

Anagram → ReversionIndictator, Wordplay | Wordplay, ReversionIndictator

## Binary Operators

**Subtraction**

In a subtraction clue, a number of letters are removed from the target. Usually, the target is some wordplay itself, although sometimes just a string literal. The letters to be subtracted are also often the product of some sort of cluing, although this is usually fairly limited in scope (abbreviations, contractions, first letters of string literals). There are two constraints on this: all the letters from the subtraction set must be in the target, and the length of the subtraction set must be less than the length of the target.

Anagram → SubtractionPreIndictator RemovalSet (SubsidiaryIndicator) Target | RemovalSet SubtractionMidIndictator Target | RemovalSet (SubsidiaryIndicator) Target SubtractionPostIndictator

The letters in the set are thought to be removed in the order in which they’re found in order to be a properly clued wordplay. Thus “standing” with “tan” removed, gives “sanding”, whereas “ant” cannot be appropriately removed. Note though that the order in which nested clues are applied can change what the set is applied too. If we also had an anagram indicator, as in “Boy muddled standing missing trap” we can apply the muddled to standing to get “dansting” before removing “sting” to get the answer “Dan”.

**Insertion**

Insertion clues work similarly to subtraction, except in inserting the sequence of letters into