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WORD PUZZLES

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41.1 INTRODUCTION

Word puzzles generally use letters as their basic elements rather than sound units. This raises the question (section 2) of what counts as a word for the purpose of word puzzles. While linguists generally use a combination of phonological, syntactic, and semantic criteria for identifying words, word puzzles rely on orthographic conventions. Section 3 discusses three elements determining what counts as a word puzzle: retrieval of lexical and encyclopedic knowledge, ingenuity in dealing with word forms, and the sense of beauty as part of the search of perfection. In section 4, three forms of puzzling are discussed in some detail: flats, forms, and crosswords. The ground will then have been prepared for a detailed comparison of cryptic crosswords in English and Dutch (section 5). This comparison reveals that the English convention of writing compound words with an internal space has consequences for the way in which English speakers deal with the notion of word, while the Dutch convention of writing compounds as one word also determines the way they look at words. This contrast has led to enormous differences in the way Dutch and English speakers do their word puzzling.[1][2]

[1]I would like to thank my former colleague Piet Verhoeff for letting me profit from his uncommon expertise in solving both English and Dutch cryptic crosswords; also Ray Nickerson for his stimulating remarks on an earlier version.

[2]The *OED* defines *English* as 'the language of England, now widely used in many varieties throughout the world'. The term will be used in this wide sense, but there are also many instances in which it is to be understood more narrowly. Most of the crossword examples discussed in this chapter, including those taken from Greeff (2003), are by setters who work for British newspapers.

41.2 WHAT COUNTS AS A WORD (IN PUZZLING)?

41.2.1 Word and morpheme

A third of the way into the last century, Bloomfield (1933:178) gave his famous definition of a word as a 'minimal free form': a word is the smallest linguistic unit able to be used 'on its own'. The definition can lead to tricky questions, such as whether or not the determiners *an* and *the* in *an apple* and *the apple* are words. To circumvent problems such as these, linguists tended to work with the notion of morpheme, understood as the smallest unit able to carry meaning.

A morpheme consists of phonemes, defined as the smallest segmental sound units capable of making a meaning distinction. The focus on morphemes and phonemes had the effect of detaching linguistic units from their written appearance: how a word was spelled was of no significance. English could have been written in Georgian rather than Roman letters; it would have been the same language and would have sounded just the same. In 1929, Turkish changed from using Arabic script to Roman script, and still remained Turkish.

Nowadays linguists are more willing to take wordhood as a theoretical concept. Even so, when morphologists (not 'wordists') do so, they see a word as a layered complex of phonological, syntactic, and semantic characteristics (see, among many others, Allwood et al (2001); Booij 2007; Jackendoff 2002; Spencer 1991). Taking a word as a three-layered theoretical construct, however, ignores the fact that speakers of English are likely to think of the word *black* as having five letters rather than the four phonemes /b/, /l/, /æ/, and /k/. In their judgement about what counts as the basic units for carrying meaning, they take into account this fourth layer of their knowledge about words, namely the orthographic system. This conforms with the popular definition of a word as an uninterrupted sequence of letters surrounded by spaces (or punctuation marks). Puzzle-makers do not ask for phonemes but for letters. The notion of a word puzzle is therefore firmly based in the orthographic conventions of a particular language. In the mental lexicon, the orthography of a word is an important factor in the knowledge speakers have of a word, and (as just mentioned) the orthographic information may even be more salient than phonological information.

41.2.2 Compounding

At this point it is necessary to also take compounding into account. The English word *rivermouth* is composed of the two words *river* and *mouth*. Dutch has the same procedure: *rivier* and *mond* make *riviermond*. However, there is a clear difference between the two languages. in English the preferred option is to write the components of the compound as separate words: *river mouth*, the orthographic form *rivermouth* being somewhat unusual. In Dutch, the convention is to write the compound without an internal space. French is even more outspoken than English as one can see in Table 41.1.

Table 41.1: **Compounding in English, Dutch and French**

English	Dutch	French
river basin	stroomgebied	bassin fluvial
riverbank	rivieroever	rive
river mouth	riviermond	embouchure
blood group	bloedgroep	groupe sanguin
bloodstain	bloedvlek	tache de sang
city hall	stadhuis	hôtel de ville
cityscape	stadsgezicht	vue de la ville
concert hall	concertgebouw	salle de concert
sign language	gebarentaal	langage gestuel
crossword puzzle	kruiswoordraadsel	mots croisés
fine-tooth comb	stofkam	peigne fin
road hog	wegpiraat	fou du volant

There has been an intensive discussion about the word status of the examples in this Table 41.1. With respect to the English column, it is generally agreed that a compound word—spaced or not—is a word and not a phrase, not least because the qualifying word lacks a determiner. In French, however, the situation is more complex: some of the examples do contain an article in the modifying part: *fou du volant*, *vue de la ville*. In Dutch and German, compounding results in just one word, written without internal spaces. If there is an exhibition (in Dutch: *tentoonstelling*) of tents (in Dutch: plural *tenten*), then the Dutch have a *tentententoonstelling*; if this exhibition concerns oxygen tents (in Dutch: plural *zuurstoftenten*), then they are able to stage a *zuurstoftententen-toonstelling*. And so on. Nowadays, however, most Dutch speakers use English as their second reading language; because of this there is an increasing tendency to follow the English orthographic convention and to insert a word space.

This trend no doubt explains the indignation and strong disapproval expressed in 2012 by the Dutch Foundation for Spotting Incorrect Spacing (no joke!) when a designer made a new logo for the Rijksmuseum (National Gallery) in Amsterdam in which she separated RIJKS and MUSEUM by a space. Here the old genitive *s* clearly occupies the space that would occur between the compounding elements *rijk* and *museum* in *rijk museum* with the *s* as a linking element. Words with *rijks-* as their first element therefore need to be written as one word. In letters to the editors of daily newspapers one often finds indignation expressed about the decline of the Dutch language, manifest whenever dailies write *bloed groep* 'blood group' and *kruiswoord raadsel* 'crossword puzzle'. Mostly, these reactions are in the context of resistance to the penetration of English into Dutch. In the Rijksmuseum case, though, it was seen as an incorrect use of the language. It did not help very much when the designer was supported by a commissioner who pointed out that in 1865 the architect Cuypers had RIJKS MUSEUM engraved on one of the pillars in the way shown on the upper picture. It is interesting to see that at that time people were uncertain about how to spell new compounds. On the tympanum of the Concertgebouw in Amsterdam, built in the same period, one can still read CONCERT-GEBOUW. In the Dutch spelling system, the hyphen has the function of connecting two words until such time as their status as a compound has become sufficiently familiar so that it can be spelled as one word.[3] Nowadays, both *Rijksmuseum* and *Concertgebouw* have reached the status of being spelled without any space, and this practice will no doubt be maintained until the influence of English spelling conventions becomes too great to resist.

In spite of the uncertainty about whether or not compounds count as one word, the English puzzle setters generally identify the basic unit of the crossword puzzle as one orthographic word. That is, for obtaining the answer:

■	M	A	I	D	E	N	S	P	E	E	C	H	■

they give a Clue *C* = *Each MP needs one composed* (6,6) rather than taking the answer as a word consisting of twelve letters. The signal (6,6) is used to indicate that the comma stands for a space separating two words of six letters which happen to form a compound. (We may note in passing that this clue contains an anagram spread over the three underlined words, the missing I being provided by *needs one*.) In the case of *fine-tooth comb* the proper signal would be (4-5,4). American setters have fewer scruples; in the above example, Shortz (2006) would not give the (6,6) information at all.

This section has focused on the first part of the compound *word puzzle*, in the following section we will discuss what goes into the notion of a puzzle.

[3] A similar trend is of course operative in English. As new compounds become more frequent, they sometimes come to be written either with a hyphen or as one word without a space. Even so, the option of writing compounds without a space generally remains available.

41.3 WHAT COUNTS AS PUZZLING (IN WORD PUZZLING)?

41.3.1 Knowledge

There are crossword puzzles which mainly focus on knowledge. The clue *Capital of Iran* leads to the answer TEHRAN. The problem here is to get to this piece of encyclopedic knowledge by consulting one's memory and, if one does not succeed, by consulting puzzle dictionaries or internet sites. Puzzles of this kind do not require ingenuity, yet they fall under the heading of word puzzles, in this case because the clue asks for a proper name with six letters. A game often played during long car journeys is geographical chaining. With TEHRAN as the starting point, the first link could be NAIROBI, the second ISLAMABAD, the third DENVER, etc. Here the players are led by the implicit clue *Capital of* . . .. In this way, parents may extend the knowledge of their children (or their own) in all sorts of encyclopedic domains such as names of towns, rivers, proper names, musical instruments, or historical personages.

Knowledge is also the only guide in getting from the clue *a low long sound expressing discomfort* (4) to the right answer MOAN. In this case, puzzlers have to access the right-hand side of their mental dictionary entry for *moan* something in the nature of 'noise expressing discomfort due to physical mental suffering or sexual pleasure often in the form of a low long sound' in order to get to the headword *moan* itself. The basic idea of a puzzle of this kind is that the clue gives sufficient information from the definition in order for the puzzler to arrive at the appropriate headword.

In a regular dictionary the headword (H) *hypothermal* is explained in terms of a definition (D) in which descriptions such as 'not very hot', 'tepid' and 'lukewarm' are likely to appear. Looking up the headword *tepid*, however, one does not find 'hypothermal' as an explaining term in the definition but rather something like 'only slightly warm, almost cold' but also 'lukewarm'. Similarly, *lukewarm* might be defined as 'barely or moderately warm', 'tepid'. If $\geq$ stands for 'more difficult or at the same level of difficulty', H $\geq$ D represents the way in which a regular dictionary relates H to D. H is explained in terms which are easier than H, or in terms which are equal in difficulty. Puzzle dictionaries are quite different in that they have a D $\leq$ H-relation, where D is (part of) the clue and H is the answer. In a puzzle dictionary—in fact, a reverse semantic dictionary—the entry

- **lukewarm** tepid (5), hypothermal (11)

has this structure, where, in terms of difficulty, *lukewarm* = *tepid* and *lukewarm* < *hypothermal*. 'Difficulty' may be taken here as pertaining to specialized vocabulary that can be seen as technical, professional, learned, elitist, and so on. One may also understand 'difficult' as equivalent to 'less common.' Sometimes, the clue simply counts as a synonym of the answer, as in the case of the clue *wealthy* requiring the answer PROS-

PEROUS. In most cases, however, the clue is a hyponym or has an even weaker semantic relation with the answer, as in the pair *hang around* - WAIT.

This form of puzzling is often considered a mere pastime (read: waste of time). In order to counter this reproach, puzzlers may point out that they see it as a way for people to keep their vocabulary up to date or even to extend it. They have support from cognitive scientists who maintain that mental activities fostered by this kind of puzzle do indeed appear to contribute to keeping the brain in good working order under the rubric: 'If you don't use it you lose it' (Hall et al. 2009; Keijzer 2011; Nickerson 1977).

41.3.2 Ingenuity

Ingenuity comes in as soon as structure is involved. Word forms are structured entities, so there may be a relation between the structure of the clue and the structure of the answer. For example, a puzzle maker may invent the clue *Large bay with a distorted sort of long low sound* (4). Here the solution depends on the D-to-H strategy discussed above. First, a large bay, or a large area of sea enclosed by land, can be called a gulf. Second, the description 'long low sound' should be sufficient to evoke the headword *moan*. The next step is suggested by the word *distorted* and involves mapping the collection of letters *moan* onto another collection of letters, in *Oman*. This connection is partly dependent on encyclopedic knowledge because one has to know that there exists a Gulf of Oman. The phrase *large bay* in the clue justifies the transformation of *moan* into its anagram OMAN.

There is more to ingenuity than moving letters around. Consider the clue *This country joins two countries diametrically opposed* (7). Here the idea is to piece together two proper names in a way suggested by the clue in order to get a new proper name consisting of seven letters. One has to find two countries diametrically opposed, which is quite difficult given that there are nearly 200 countries in the world. In order to prevent loss of interest, the setter may therefore decide to give some more information by rephrasing the clue as *This European country joins two Asian countries diametrically opposed* (7). That should enable the puzzler to find the answer ROMANIA, which contains both *Iran* and *Oman* and joins them together in an acceptable way. Here ingenuity goes hand in hand with geographical knowledge.

The qualification 'in an acceptable way' raises a crucial issue: both *Iran* and *Oman* have an *n* and one does not find two *n*'s in *Romania*. The join has an overlap, whereas Oman and Iran are discrete. It is precisely on this point that we see that the *OED* definition of *puzzle*—'a game, toy, or problem designed to test ingenuity or knowledge'—lacks an important element, namely that the solution should invoke the sense of beauty. Beauty is for many puzzlers the decisive factor. It raises questions like: Is it pleasing to join two words of four letters into a complex of seven letters by suppressing an *n*? Is the join of OMAN and IRAN comparable to the telescoping of two parts of a drainpipe (allowing the suppression of an *n*) or does it require strict adjacency (with no suppression)? A choice between these options is guided by a sense of beauty: drainpipe aesthetics, which

allows the smuggling away of a redundant *n*, may be considered a weakness, whereas strictness may be regarded as being closer to the Platonic ideal.

41.3.3 The sense of beauty

There can be no doubt about the sort of beauty under consideration: it is Platonic in the pure philosophical sense, predominantly so because in puzzling there is not only a tendency for a perfect match between clue and answer but also a need to match an answer with an ideal immaterial Form.

To illustrate how closely the search for beauty is connected with puzzling, consider the following true story. In the basement of our former house, the cupboard built below the flight of stairs going up to the main floor had a moisture problem due to lack of ventilation. As the door of the cupboard already had some holes in it, the logical step was to bore some more holes in the stairway. Freehand. Over-confidence is not always a

(a) Ugly (b) Beautiful

good guide, so the result in (a) was ugly. It should, of course, have been what is shown in (b). This figure fails to be the ideal form itself because a representation has all the limitations of concreteness. This would become obvious if, for example, the picture was enlarged up to the level of pixels. Underlying the representations (a) and (b), however, there is an abstract complex of measures and proportions determining the beauty of a structure in which three dots are located in a box: (b) is clearly much closer to the Ideal Form than (a).

Although pictures do not have anything to do with clues and answers in word puzzles, they demonstrate the close connection between the sense of beauty and the sense of perfectness. At a certain level of ingenuity, clue and answer need to form a perfect pair. This puts heavy constraints on puzzle-makers, as we shall see. We now have three guides to puzzling: knowledge, ingenuity, and beauty. These three together will lead us through the domain of word puzzles.

41.4 FLATS, FORMS AND CROSSWORDS

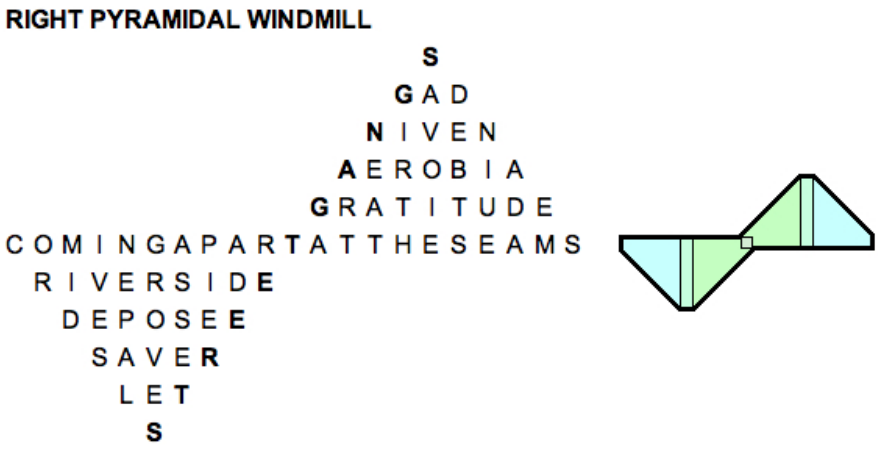
For linguists the domain of word puzzling is fascinating because of the important role of elementary mathematical operations underlying the activities of the puzzlers, such as permutation, deletion, addition, substitution, reversal, joining, splitting, and many other formal operations. One has to take that literally: these are operations on word forms, rather than on word meanings. Certainly, meaning does play a role but very much in the way in which it is taken in the Chomskyan generative theory: as a secondary touchstone

for syntax. This can be demonstrated briefly with the help of some examples taken from the website of a prominent American puzzle organization, the National Puzzle League (NPL), founded on 4 July 1883. In the 130 years of its existence the NPL has collected more than seventy different types of word puzzles. Their principal distinction is quite useful in its simplicity:

1. Flat. A flat has one dimension: the answer is a single sequence of letters forming a word in some specific way relating to the clue.

2. Form. A form is two-dimensional and presumes a crossing of words.

Flats will play an important role in the present chapter, forms to a lesser degree, because the crossword, being a form in virtue of its two dimensions, has more or less freed itself from this category and so is being treated as a category of its own.



Forms in the NLP sense are essentially all sorts of geometric figures made up of words. The Right Pyramidal Windmill is just one of the many sorts of crossings in a certain prescribed mathematical figure. In the triangles the horizontal words cross with the vertical words, whereas the edges of the wings are formed by the expression *coming apart at the seams*.

Flats presume the mathematical operations mentioned above. As they also play an important role in crossword puzzles, it is necessary to pay attention to some of their properties. Flats presume an almost insane inclination to play with word forms, taking them apart or making them belong to a structured set.[4] The restrictions on these op-

[4]Another manifestation of this sort of formal insanity is writing a meaningful story with the restriction that only one vowel may be used (the so-called *A*-story, *E*-story, etc.), or writing a postcard with a meaningful text consisting of only the first 13 letters of the alphabet. Or collecting palindromes in an attempt to pay tribute to symmetry in language forms. And so on. Battus (1981) is an impressive collection of different sorts of formal obsession. It was certainly inspired by Oulipo, the French Workshop for potential literature founded in 1960 by Raymond Queneau and others. Oulipo products include poems in which all the words have the same number of letters, or a novel (*La disparition* by Georges Perec) in which the vowel *e* does not appear, or a text in which each word (*n*) is one letter longer than *n*-1, etc.

erations are, however, essential: they provide the sense of beauty discussed earlier. A famous example of a structured deletion set is the following sequence:

- ⟨ startling – starling – staring – string – sting – sing – sin – in – n⟩.

Nothing in the word *startling* itself reveals the relationship with the other seven words in the sequence. The one-letter-deletion relation is present as part of our knowledge of English words stored in our mental lexicon. The sequence is amusing, and taken by itself it shows, to a certain degree, a glimmer of beauty. On seeing the eight words thus connected, real puzzlers will ask whether the sequence would be more perfect if it contained only nouns, or only verbs, or if just one and the same vowel were to be allowed. And, of course, they will collect the deleted letters by construing the set {l, t, a, r, t, g, s, i, n} in order to see whether words can be formed from this set which have to do with the sequence. Then, suddenly, they will experience beauty, because as soon as the letters form the word *startling*, it gives sense to an otherwise accidental sequence. No drainpipe aesthetics. But real puzzlers, however satisfied by this result, will also continue by raising the question: is this indeed the most pleasing sequence that can be made? Questions like these all boil down to an attempt to find aesthetically satisfying restrictions on the rules of the game. This is a purely Platonic way of thinking about perfectness, and as such is an organizing principle in word puzzling. (Linguists also share this affection for the beauty of restrictions in the rules they construct.)

An anagram is a flat involving the rearrangement of letters. *Beneath Chopin* (3,5,5) becomes THE PIANO BENCH. This example shows how important semantics as a complementary asset of the clue may be. The venom shown by the word play on Wasilla, the small Alaskan town which is home to the American Tea Party leader Sarah Palin—ALL I SAW—has also a semantic base. In this case we have to do with a special subcategory of the anagram: the reversal. An even stronger form of reversal is the palindrome, as in the NLP-example: DRAW PUPIL'S LIP UPWARD.

The above examples clarify the notion of flat, but they also serve as an introduction to what has become an essential part of the English cryptic crossword. The clue-answer pairs of these cryptic crosswords are generally flats. As a consequence, the English crossword is to be seen as a game playing with word forms rather than with word meanings.

41.5 COMPARING THE ENGLISH AND THE DUTCH CROSSWORD

This section is not an introduction to the English or Dutch crossword. There are many good introductions on how to solve cryptic crosswords.[5] Yet it is necessary here to say

[5]For the ingredients and history of the English crossword, see Amende (2001), Arnott (1981), Danesi (2002), Greeff (2003), Greer (2001), Macnutt (2001), Shortz (2006), and Skinner (1993). For the Dutch crossword, see Verschuyl (2004, 2005).

something about the history of word puzzling in the two countries, although many of the books mentioned in the footnote to this paragraph give historical information.

What justifies the comparison of the English and Dutch styling of the crossword is that it sheds light on how deep the effects of certain orthographic conventions are on the notion of the word in the mental lexicon. This can be shown by reviewing in detail the semantic relations between a clue *C* and its answer *A* and the way these are handled in English and in Dutch.

41.5.1 Some history

Crossword puzzling has been popular in Britain and the Netherlands since the 1920s, but the two countries share a warming-up period before the advent of the crossword proper. Newspapers played an important role in popularizing all sorts of word puzzling, there being no puzzle magazines at the time. The majority of puzzles were flats: anagrams, charades, reversals, containers, and the like, mostly aimed at children. At the beginning of the last century, the liberal Dutch newspaper *Algemeen Handelsblad* started a special children's section on its back page called *Below the Line*, edited by Dr. Linkerhoek ('Dr Left Corner'). Children (and their parents) were entertained with language games of the sort just discussed, but also with curious slips of the tongue, amusing examples of misunderstanding, little stories and poems. The puzzle section did not appear out of the blue; at the end of the 19th century several newspapers already had sections with puzzles having a high pedagogical content. The letter puzzle in Table 2, for convenience transposed here into English, is quite typical of the period. The answers to the six clues are HORSE, DEAR, SHORE, SHED, HISS, RAID, giving the solution HORSERADISH. Here, the need to spell correctly is combined with general knowledge and the basic principle of cryptography—the representation of letters by ciphers.

The Filler can be seen as a prelude to the development of forms, i.e. the two-dimensional puzzle (see Table 3). Only one vertical column intersects meaningfully with the horizontal lines.

Table 41.2: **Letterpuzzle**

The whole has 11 letters and is a plant of the cabbage family	
1 2 6 10 5	animal
8 5 7 6	utterance of surprise
4 1 2 3 5	going on it from the boat may cause wet feet
10 1 5 8	small building for storage
11 9 4 10	make the sound of the 19th letter
6 7 9 8	sudden attack

Table 41.3: **Filler**

The middle column forms the name of an English politician					
Broad silk necktie	A	S	**C**	O	T
Operetta composer	L	E	**H**	A	R
Lean and haggard because of sufffering	G	A	**U**	N	T
Opera by Bellini	N	O	**R**	M	A
Person who competes in a race	R	A	**C**	E	R
Very pale with shock, fear or illness	A	S	**H**	E	N
Animate object as distinct from a living being	T	H	**I**	N	G
Exclamation used as a greeting	H	E	**L**	L	O
Extended exchange of strokes	R	A	**L**	L	Y

On 19 december 1913, two days before Arthur Wynne published the first crossword puzzle ever in *The New York World* newspaper, the daily *Algemeen Handelsblad* published the puzzle in Fig. 41.1. This is very close to what was introduced by Wynne because here words are indeed crossing. The clues were given in the form of instructions going from one outside letter to the other: *Put letters in the little squares, so that you can read from*: A–B: is lighted on festive occasions [LAMPION]; C–D: a magnificent building [KASTEEL = castle]; D–A: used by a wagoner to guide his horse [LEIDSEL = rein]; C–B: every girl loves to have in her hair [KRULLEN = curls]; E–F: the word that misses in: *The little thing walked ... into the school alone* [PARMANTIG = jauntily]; G–H: is found at the bottom of a doorway [DREMPEL = threshold]. It is remarkable that the answers C–D, D–A and C–B are reversed. The Dutch word corresponding to the English *castle* is *kasteel*, not **leetsak*. This sort of reversal does not normally occur in crosswords. This

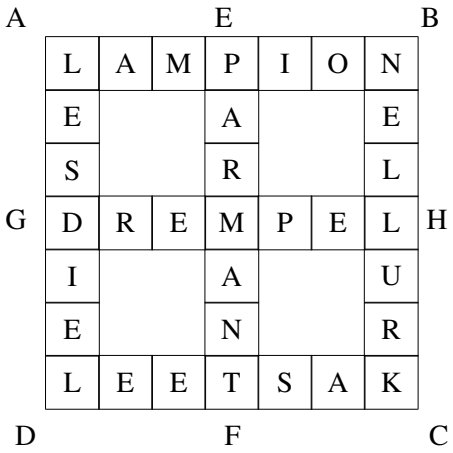


Figure 41.1: **Proto-crossword puzzling**

turns out after all not to be the first crossword, because essential for the crossword is, of course, that given a vertical-horizontal crossing of words, adjacent rows and columns also cross. The four gaps hide a check failure.

Summarizing, one can observe that in the tradition of word puzzling at the end of the 19th and the first quarter of the 20th century, there is an increasing tendency to move from flats to forms. One may see this as a development preparing the ground for adult puzzles. Given the increased complexity of the task, crosswords appeared to be more suitable for adults than for children; in general, word puzzles for children should not take too long to solve because there are so many other games to play.

41.5.2 Diverging developments

The English cryptic crossword has a high degree of flatness, in the sense that all the tricks characterizing this form of word puzzling are an essential part of what gives the English crossword its unique character. The development of the crossword in the Netherlands has focused less on flatness. This does not mean that there has been no interest in it.[6] But the Dutch lack of interest in flatness as an essential ingredient for crosswords certainly has to do with the crucial linguistic difference between the English and the Dutch crossword described in section 5.3.

The crossword as a form of word-puzzling made its entry in Britain in 1922. The first Dutch crossword appeared on 12 January 1925, introduced by Dr. Linkerhoek (Dr Left Corner) in the *Algemeen Handelsblad*. It began as a children's game but within a week it had invaded the adult world. It instantly became a hit, and practically all the dailies and weeklies started to offer crosswords (with enormous prizes) for adults. The Dutch crossword became a knowledge game at the same time that English crossword-setters were popularizing the cryptic crossword. In the late 1920s and the 1930s the English crossword developed into a game with heavy emphasis on ingenuity and beauty. The setters E. P. Powers (Torquemada), A. F. Ritchie (Afrit), and D. S. Macnutt (Ximenes) are generally considered to be the ones who established the rules determining the level of ingenuity and the criteria for beauty. In view of the discussion in section 3.3 about Platonic beauty, these rules constrain the game aesthetically by determining what constitutes a pleasing clue-answer pair. Meanwhile, the Dutch crossword developed into a pedagogical game centred around lexical and encyclopedic knowledge. At first sight, this difference can be explained in terms of cultural differences between the two peoples, but the story turns out to be more complex than that.

On 12 February 1949, a left-wing highbrow Dutch weekly *De Groene* ('The Green') suddenly introduced a new type of crossword called the cryptogram under the label:

[6] In 1981, the mathematician and linguist Hugo Brandt Corstius produced his brilliant book *Opperlandse taal- en letterkunde* (lit. 'Upperlandic linguistics and literature') which is unrivalled in its study of all aspects of flatness. It is still very popular (witness its extended reprint in 2002), and it certainly contributed to the decision to award to Brandt Corstius the highest literary prize in the Netherlands in 1987. So there is a good appreciation in Holland for the sense of beauty in flats.

'Finally the crossword puzzle has become adult.' This clearly was an attempt to transplant the English cryptic crossword as a new, more sophisticated variant of the existing knowledge-based crossword which was (and still is) popular in Holland. The enthusiastic explanation of the new puzzle form in *De Groene* reads like an introduction to the English cryptic crossword. Newspapers followed suit, and so for a couple of years the Dutch and English cryptic crosswords resembled each other quite closely.

However, the Dutch cryptogram gradually began to distinguish itself from its English counterpart by becoming more and more semantics-based. The difference turns out to be determined not only culturally but also linguistically, and is possibly due to the leading setter of the 1950s and the following decades, H. A. Scheltes (1921–1987). He started with anagrams and other tricks familiar from the basic stock of English cryptic techniques, but quite soon moved on to open up the domain of compounds for the cryptic crossword. As a by-product the answers started to increase in length, because a compound may occur as part of a larger compound written as one orthographic word. This increase in complexity and length continued in later decades, and at present is one of the hallmarks of the Dutch cryptogram. This process made it possible for the cryptic crossword to become more and more semantic. The explanation is quite straightforward: one-word compounds allow for more independent relations between parts of the clue and parts of the answer than is the case with simple words.

41.5.3 Cryptogrammar

Whatever the differences between the English and Dutch cryptic crosswords, there is one thing they have in common: a semantic relation between the clue C and the answer A. Without it, the game would be impossible. We have already noted that there is a certain directionality in this relation, from D(efinition) to H(eadword), as discussed in section 3.1. This relation implies that the more general D-term in *C* should lead to a more specific or a synonymous H-term in *A*. The pair *C = Alternative number first by a singer* (5) – *A* = TENOR fulfills this requirement because the set of alternatives contains options expressed by words like *or*, *dilemma*, *possibility*, *choice*, etc., and because TEN is included in the set of numbers, not the reverse.

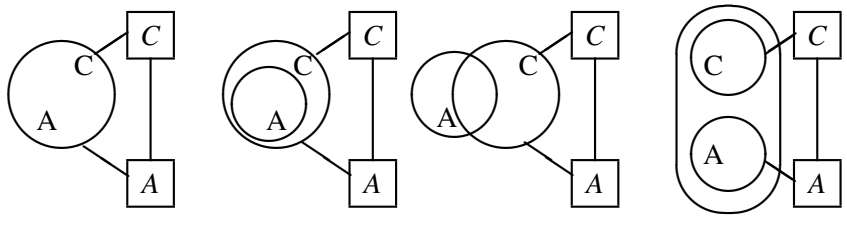
In logical semantics, it is quite usual to treat meanings as sets (pictured by circles). For example, the set of tenors is properly included in the set of singers, so this inclusion relation can be used to relate the meaning of the noun *tenor* to the meaning of the noun *singer*. *Tenor* is a hyponym of *singer*—as long as the inclusion relation between the set of tenors and the set of singers is taken to hold. Not all meaning relations are based on inclusion, but the use of circles makes it possible to deal with that fact too, as we shall see shortly. They also make it possible to chart the four possible logical semantic relations which can exist between words.

41.5.4 Semantic relations between clue and answer

Verschuyl (2004) proposed representing the semantic relation between clue and answers as an I (represented pictorially as a vertical straight line), with the clue *C* on top of the I and the answer *A* at the bottom. This I connects the clue and answer on the basis of four logically possible relations between the circles A and C, which are shown in Fig. 41.2. The circles represent what falls under the meaning of *A* and *C* and their intersection contains information about what is shared by them. In this way, Fig. 41.2a represents a situation in which *C* is synonymous with *A*, as in the pair *C* = *shut* and *A* = CLOSE. The synonymy relation holds if and only if all things that shut also close, and conversely if all things that are closed are also shut. It is generally assumed that it is practically impossible to find two perfect synonyms (see Fellbaum, this volume). This is presumably why the *OED* hedges the definition of a synonym as a word having exactly the same or nearly the same meaning as another word.

The relation in Fig. 41.2b is that of inclusion. *Accountant* is a hyponym of *human* (as long as there are no robots doing the job; in that case, there would be members of A outside C, which would make Fig. 41.2c the proper semantic relation between the two words). In a dictionary, proper inclusion constitutes the stable semantic relation between a Headword H and the general term in the definition D: a chair is a seat which ..., a puzzle is a game which ..., an accountant is a person who ..., etc. They all fit the scheme: an A is a C, where the word *A* is the hyponym of the word *C*, and *C* is a hyperonym of *A*. Hyponymy is an important means for providing structure in the mental lexicon by making it possible to get from more specific to more general information. The full meaning of the word *A* can be understood as a set of circles C_1, C_2, ..., C_n containing A.

The best term to label the overlap in Fig. 41.2c seems to be *contingency*, in the philosophical sense of something being a fact without having to be so. Many accountants are certified, that is, they are officially recognized as meeting some expertness criterion. But there are also accountants who are not certified. This excludes *certified* from being a hyperonym of *accountant*, which makes the semantic relation weaker than the one in Fig. 41.2b. If certification is mandatory in a country, the pair *certified* and *accountant* would fall under Fig. 41.2b as in the case of *university graduate* and *holder of a doctorate*. In many contingency relations, the position of circle A is not fixed with respect to C



(a) identity (b) inclusion (c) overlap (d) no overlap

Figure 41.2: Four logical possibilities of relating lexical meaning

and so one can see the intersection as varying between containing nearly all and nearly no members of A. If one were to move the circle A in Fig. 41.2c more to the left up to the point where only, say, 95% of A is outside C, the semantic relation would become very weak. This could apply, for example, to the pair *freckled–black-haired*, as opposed to *freckled–red-haired*, where the intersection would be larger. On the other hand, if there are situations in which *shut* and *close* are not really synonyms and the pair *C* = *shut* and *A* = CLOSE would have, say, a 95%, overlap, then Fig.41.2c also applies, but with a tendency to ignore the 5% so as to land either in Fig. 41.2a or in Fig. 41.2b. We will see that Fig. 41.2c is an interesting category in word puzzling.

Moving circle A out of C in Fig. 41.2c could continue up to the point where the intersection between A and C is the empty set. This yields the situation pictured in Fig. 41.2d. It covers pairs like *girl-boy*, *dog-cat*, but also *chair-dog*, *easily-hardly*, *centaur - amazone*, *yes-no*, *pedal-bike*, etc. Given this enumeration of pairs, Fig.41.2d would become a heterogeneous garbage can. The first step to remedy this deficiency is to put an oval O in Fig.41.2d providing a superset standing for a property that connects A and C in some way: *girl* and *boy* are in opposition given a proper domain in which this opposition counts. This could be a binary opposition such as in the case of *male* vs. *female* (within O = Sex), or *girl* vs *boy* (within O = young human beings. In this way, Fig.41.2d can cover various kinds of complementarity relation such as negation, contrast or contradiction.

We still face the question of how to deal with non-complementary pairs like *pedal–bike*, *weather–cheerful*, *Friday–fish*. At this point it should be observed that the circles in Fig.41.2 pertain to sets and sets contain elements that can be counted. The relation between *loaf* and *bread* cannot be captured as a hyponymy relation because the word *bread* is a mass noun. (The relation, instead, is one of meronymy; see Fellbaum, this volume.) Furthermore, sets contain elements of the same ontological kind. This makes it impossible to have Fridays and fishes as members of the same set.

There are two possible ways of solving this problem. One is to appeal to the part-of relation (*pedal–bike*, *loaf–bread*, *nose–body*) and to construct a set of relations parallel to those in Fig.41.2.[7] The other is to keep Fig.41.2 and ask how it can deal with associations which play such an important role in retrieving knowledge stored in the mental lexicon. We will see that this second option renders the first unnecessary, and also that it contributes to our understanding of one of the essential ingredients of the English cryptic crossword, namely, associations.

41.5.5 Associations

Consider the connections between the words *Friday* and *fish*, *school* and *cane*, *bible* and *church*, etc. To account for them we have to appeal to associations rather than to stable

[7]The part-of relation has received a lot of attention in psycholinguistics following Miller and Johnson-Laird (1976) (see e.g. Margolis and Laurence 1999), as well as in logical semantics (e.g. the study of mereological structure in Link 1998).

semantic relations of the type displayed in Fig. 41.2a,b. All should fit in Fig. 41.2d, because their intersection is the empty set. But there is a reason to improve on that because *Friday* denotes a set of abstract temporal units and the set of fishes contains concrete objects. If we look for an appropriate oval set O containing them, we need to find a common factor putting them fully or partly in O. A plausible one is a set C of situations in which Fridays occur and situations in which fish occurs, so that a comparison between A and C can be made at the same level of abstraction. In this particular case, this could be situations in which it is Friday and situations in which fish occurs on the menu. In this way, we immediately find ourselves in the situation of Fig. 41.2c. If it turns out to be the case that fish is only eaten on Friday, Fig. 41.2b would count, but as soon as fish is eaten on other days than Friday, there is just the overlap of Fig. 41.2c. When the Catholic church used to be a more dominant force in ruling the daily life of families than is the case nowadays, the association between *Friday* and *fish* was much stronger than it is now. In terms of the intersection between A and C: the intersection was much larger than it is nowadays. The same holds for the period that schoolmasters were allowed to use the cane. Dutch speakers have a quite strong association between the football club Ajax and the colours red and white. The sets containing football clubs and the sets containing red and white colours differ too much for them to have a possible overlap. So the next step is to think of situations in which one gets information about Ajax (by seeing matches, reading about them, etc.) and situations in which the combination of red and white is being experienced. In this way, we land again in Fig. 41.2c. The relative strength of the association in Holland is determined by the dominant position of the club in the football competition.[8]

This analysis rests on the same foundation as what has been obtained in structural semantics of the past decades by the theory of generalized quantification which analyzes the contribution of determiners and adverbials to the formation of structural meaning of sentences. Thus the meaning of *all* can be seen in terms of connecting a set A with another set C, so that all members of A are fully contained by C (*all Advocates are Clever*) whereas the meaning of *some* can be described as warranting that the intersection of A and C in Fig. 41.2c contains at least some members (*some Advocates are Clever*). Parallel to that, the meaning of *always* and *sometimes* can be understood in terms of sets of situations being intersected. *Practically none* is a determiner which tells us that the intersection between A and C is nearly empty but for negligibly few elements. And so on. For the study of what associations are linguistically, the theory of generalized quantification turns out to be quite relevant in view of Fig. 41.2c.[9]

[8]The construal of sets of situations brings the analysis of lexical meaning into the domain of what is known as event semantics, with its study of quantification over eventualities. There is an abundant philosophical, logical, and linguistic literature on this topic. See e.g. Bach (1981), Barwise and Perry (1983), Davidson (1980), Landman (2000), Lasersohn (1995.

[9]There is a huge literature on generalized quantification. See e.g. Barwise and Cooper (1981), van Benthem and ter Meulen (1984), van Benthem and Westerståhl (1995), Peters and Westerståhl (2006

The notion of association is lenient enough to capture also the relation between the count noun *loaf* and the mass noun *bread*. Indeed, the situations in which we use the word *loaf* overlaps with the situations in which the word *bread* is relevant. However, there are situations in which loaves that are not bread and there are situations in which there is bread without there being loaves. The intersection of the two sets of situations fits in Fig. 41.2c. The configuration in Fig. 41.2d turns out to be just the first step in capturing a part-of relation. Birds have limbs so a limb is part of a bird. This provides a strong associative oval, as it also does in *pedal* and *bike*, and in *treadler* and *organ*. It is clear that the set of limbs is disjoint from the set of birds, but in some sort of way the oval part-of relation has much in common with the homynymy relation in (b) or with the overlap relation in (c): it provides strong ties between two words given the construal of situations. The fact that always when one sees a tiger one sees stripes, makes it possible to consider striped as a semantic property of the noun tiger: due to the intersection of sets of situations in which one sees tigers and in which one sees stripes, this relation has the same sort of strength as the homonymy relation between two sets of countable entities.

Summarizing, it seems that for connecting the meanings of two words in a language one can appeal to the set of situations in which the referent of one word occurs and the set of situations in which the second word can apply. This also determines the logical consequences of the relation. One may not conclude from a situation in which someone is whistling that this is tuneful. This will be the case only in some situations. Associations evoked by puzzle makers are legitimized by what puzzlers have experienced in real-life situations as connections obeying one of the configurations in Fig. 41.2. In this respect, the present logical-semantic analysis ties in with psycholinguistic research into word association, semantic priming, and lexical retrieval (De Deyne and Storms, this volume; Neely 1977; Nickerson 2011).

41.5.6 Cryptotypes

In the preceding section, the relation between a clue *C* and its answer *A* was pictorially taken as an I. As soon as there are two I's in a clue-answer pair, there are four logical possibilities for connecting them, as shown in Fig. 41.3. The first is the H-type (where the dashed line stands for the connection between two compounding elements). An example is the pair *C* = *principal route* (7); *A* = HEADWAY. Here there is an I-connection between *principal* and *head* and a second I-connection between *route* and *way*. For another example, we could split the *A* = PECCABLE semantically into PEC and CABLE and construct a complex clue *C* in which the chest muscle-element denoted by *pec(toral)* is associated with the strength expressed by *cable*. Another one is: *C* = *Circle an island* (4); *A* = OMAN. It is also easy to recognize the pair *C* = *Alternative number*; *A* = TENOR as an instance of the H-type. In Dutch, this is a very popular type. One of Scheltes' nicest pairs was *C* = *Er is een Brit teveel* (lit. 'There is one Briton too many'); *A* = OVERSCHOT 'surplus'. Dutch *over* means '(There is) too many' while *Schot* is the Dutch for word for *Scot*.

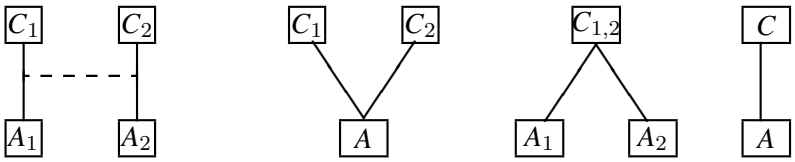


Figure 41.3: Four logical possibilities of connecting two I's.

If there is a Briton too many, there is automatically a surplus. This makes it a better clue than *Circle an island* because Oman has to do neither with an island nor with a circle.

The second type in Fig. 41.3 is the V-type. For English we have: *C* = *Tuneful American painter* (8); *A* = WHISTLER or *Summing up to 18* (5); *A* = SIGMA. In the latter case, *sigma* is to be identified both as the 18th letter of the Greek alphabet and as the mathematical summation sign. For Dutch we have C: *vogelmest* (lit: bird's manure) (4); *A* = GIER 'vulture' or 'slurries'. The V-type is based on the ambiguity of *A*. Dutch *gier* means 'vulture' which by Fig. 41.3b leads to C_1 *vogel* 'bird'; *gier* also means 'manure', which in Dutch leads to the hyperonym *mest* in C_2.

The third type in Fig. 41.3 is the A-type. It is the reverse of the V-type. However, recall that in word puzzling there is the Definition-to-Head-order, which means that the answer is in most cases a hyponym of the clue or at best a synonym. The direction from C to A is from general to specific. So the A-type is an unnatural one and it hardly occurs. This is also the reason why Fig. 41.2 does not consider the situation in which C is a subset of A. A possible instantiation in English would be *C* = *key* (6,4); *A* = *master plot* on the basis of (near-)synonymy. In Dutch the clue could be *gier* and the answer *vogelmest*. As has been pointed out, this doesn't work well because of the wrong direction from Head to Definition. The fourth type in Fig. 41.3 is a simple I.

With I as a basic building block, a simple H and a simple V may combine into a 2:1-type, as shown (in simplified form) in Fig. 41.4: *C* = *doubly evil sailor*; A = SINBAD. In *C* it is easy to recognize the H: evil has an I-relation to *sin* and (doubly!) *evil* has an I-relation to *bad*. From *sailor* there is one I connecting *C* to SINBAD, the well-known sailor in the Arabian fairy tale. The complex type consisting of three I-relations between Clue and Answer can be seen as an H with its right arm functioning as the left arm of a V with a 2:1 structure.[10]

A more linguistic example is *C* = *Listen to a number makes more confident*; *A* = HEARTEN. *Hear ten* forms an H and *Makes more confident* is connected to the answer as an I constituting the right arm of V. The clue *C* = *XI ay 100* occurring in Balfour (2004), a fascinating book about how important it is for immigrants to master crossword puzzling as a part of their assimilation, is a 1:2-type. The clue part *XI* leads to the number 11 which is the number of players in a football team (in this particular case the well-known English major league club *Everton*), the part *ay* occurs in the expression

[10] Verschuyl (2004) provides a type-logical grammar for the recursion involved; it is possible to extend the complex types H and V into more complex types by simply adding a basic type I.

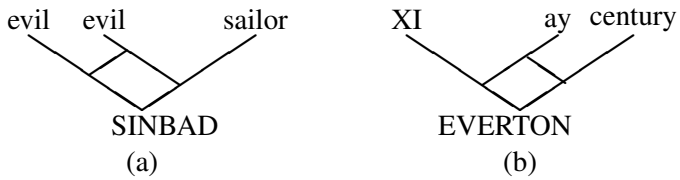


Figure 41.4: Two complex V-types: (a) 2:1 and (b) 1:2

For EVER *and ay*, and in cricket 100 stands for a century. A century scored is often referred to as a TON. In this way, the answer is composed on the basis of the I-pairing XI–EVERTON and the H-pairing *ay* + *century*–EVER+TON.

At this point it should be observed that on the typology given so far English *C–A* relations do not deviate very much from those in Dutch. But if we now introduce as a factor the complexity of an answer, the way is open for more complex relations. The 2:3 type is a typical Dutch one. *C = Daar liggen de spruitjes te slapen* (10) (lit: 'There lie the sprouts to sleep'); *A* = GROENTEBED (lit: VEGETABLE BED or GREEN IN BED). The left arm of V has a binary split: *de spruitjes* + *daar liggen te slapen* = GROENTE + BED, whereas its right arm is parsed as: *Daar* + *de spruitjes* + *liggen te slapen* corresponds to TE + GROEN + BED. Another nice one is: *C = Zij vermaken anderen daar met blunders* (9) ; A = ERFLATERS 'testators'. In Dutch, the unambiguous word *erflater* is composed of *erf-* (from the verb *erven* 'inherit'- and *-later* (from the verb *laten* 'bequeath, let'). In its plural form *erflaters* allows for another parsing into *er* 'there' and *flaters*, which is the plural form of *flater* 'blunder'. Hence the task in *C = They amuse others there with blunders*. But the Dutch verb *vermaken* is ambiguous: it means 'amuse, entertain' but also 'bequaeth'. Here we are in the heart of what makes the Dutch cryptic crossword cryptic in terms of possibilities given by compounding, puns and different parsing being important semantic instruments.

Verschuyl (2005) randomly sampled a large number of crossword diagrams made by different setters for both English and Dutch. For English, the average word length of *A* in Gilbert (1993), Skinner (1993), Greer (2001), and Greeff (2003) is around five letters. The same applies to American crosswords (e.g. Shortz 2006), and to the French cryptic 'mots croisés'. For Dutch, by contrast, diagrams set by the most important weeklies and dailies (most of them presenting cryptic crosswords just once a week as opposed to the simple crosswords which appear daily) have a much higher average length. At present, the average word length of Dutch cryptic crosswords has nearly doubled as compared with the average in 1950/1960, which was then comparable with the current average of the English, American, and French answers: between 5 and 6 letters per word. It is not unusual to have one-word answers in Dutch consisting of more than 15 letters. They often contain a pun, as in *C = Paris & Helena*; *A* = SCHAAKLIEFHEBBERS. The Dutch verb *schaken* is ambiguous between 'play chess' and 'abduct'. If you know that Paris abducted Helena and that they were lovers, then in *schaakliefhebbers* 'chess lovers' the ambiguity of *schaken* appears unexpectedly in the compound. Or in: *C = Het onderscheid tussen goud, zilver en brons* 'the difference between gold, zilver and bronze'; *A* = PRIJSVERSCHIL 'difference in price'. Dutch *prijs* is ambiguous between English

price and *prize*. The compound *A*, however, is normally used without this ambiguity, but given *C* it suddenly appears to the puzzle-solver as a possible but highly unusual use of the compound.

41.5.7 The real difference

Fig. 41.3 contains straight lines because they fit Fig. 41.2a and 41.2b. In that sense, they meet the requirements of the Platonic ideal forms. However, Platonic beauty suffers from the menace of predictability and boredom. The empirical fact is that some people prefer associations to stable semantic relations between words. It is also a fact that there are really nice examples of associative clue-answer pairs, illustrated in Fig. 41.5. The H-type suffers from a weak semantic relation between *aarzeling* 'hesitation' and *twee* 'two', whereas the Dutch word *strijd* 'battle' denotes a sort of fighting (*gevecht*). Indeed, it is certainly permitted in English to connect the word *hesitation* with *double* or *two*, but semantically the relation between clue and answer falls under Fig. 41.2c. The dots between *flat* and *raft* express the weak form of the relation displayed in Fig. 41.2c: the situations in which one experiences flats overlap hardly at all with situations in which rafts occur. The semantic relation between *raft* and *float(er)* is more stable. Other examples of dot-relations are the left arm of the 2:1 V-type consisting of the *C* = *Keep in office* and *A* = RE-ELECT. In both arms of the V there is only a weak association in the pairs *keep*-RE and *office*-ELECT.

The 2:1-type at the right side in Fig. 41.5 is helpful for understanding an essential feature of the English crossword: the mixing of object language and metalanguage. *Hat* and *pipe* are used in the language to talk about hats and pipes. Italics indicate that we are talking about the words *hat* and *pipe*. Setters do not make the distinction, in order to mislead. This brings up the semantic relation in Fig. 41.2d; there is no overlap between the set of hats H and the set HL = {a,h,t} of letters forming the word *hat*. The same applies to the set P of pipes and the set PL = {e, i, p} of letters from which the word *pipe* is constructed. One has to ignore the difference between a set S and its name *S* and construe a set HL + PL which is identical to the set of letters making up a hyponym for 'things that can be found in a cemetery'.

For non-linguists, this formulation is a horror, but it reflects precisely what is happening. The identity relation involves the metalinguistic level. In *Rat must emerge from the rock layer* the clue presents *Rat must* (misleadingly) in the object language, but in fact

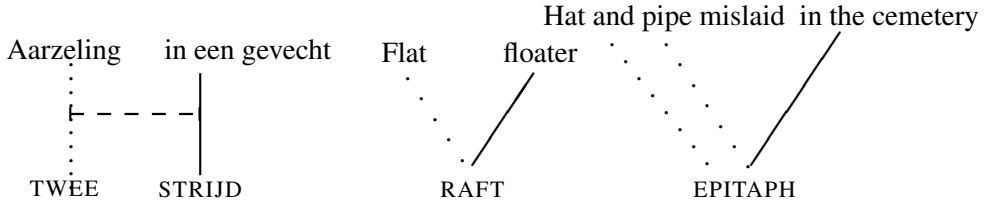


Figure 41.5: Weak semantic relations

it is an anagram of the *A* = STRATUM at the metalevel. Identity is found in the (meagre) semantics of the metalinguistic level in which two word forms in *C* are identical to one word form in *A*, their meaning relation being reduced to having exactly the same number of letters. At the metalevel, the proper noun *New York* can be seen as identical to *NY*. The same holds for the relation between *C* = . . . *one*. . . and the letter I in the pair *C* = *One fled the country*; A = IRAN. This metalinguistic relation between word forms falls under Fig. 41.2a under the label of (form-)identity.

In summary, we can see what English-speaking crossword puzzlers do. Constrained by the ideal of one spaceless word per answer, they have a preference for (dotted) associations. The Dutch are more interested in complex semantic I-relations matching Fig. 41.2a and 41.2b, puns and unexpected reparsing included.

41.6 CONCLUSION

From a linguistic point of view, it seems possible to explain some of the differences between cryptic crossword puzzling in two languages with different orthographic conventions. One can see that the notion of word in English-speaking countries is heavily influenced by the written appearance of words as surrounded by spaces. English speakers know that a compound counts as a word, but they react differently. One telling example is that when Nickerson (2011) made a list of English palindromes he reached the number of 66. But they are all simplex words in the sense that they do not have internal spacing or hyphens. A list of palindromes in Dutch would include considerably more items because compounds like *parterretrap* 'ground floor staircase' and *parterreserretrap* 'ground floor veranda staircase' are taken as one unspaced word.

In terms of the four options in Fig. 41.2, one could say that the English crossword puzzle operates in the two right-hand configurations Fig. 41.2c and 41.2d, whereas the Dutch counterpart is more open to inclusion and identity as the determining relations. This is why the H-type and the V-type have manifested themselves in the Dutch way of crossword puzzling, because the way compounds are taken in Dutch facilitates not only the simple H- and V-types but also the more complex types in Fig. 41.4.

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