Linguistic Creativity at Different Levels of Decision in Sentence Production

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Abstract

The shape taken by linguistic creativity at the different levels of decision involved in sentence production (phonetics, rhythm, lexical choice, semantics, syntax and narrative content) is explored in relation to existing computational models of creativity. A general outline of the possibilities is given for each level, and two specific levels - word invention at the lexical level, illustrated by the Jabberwocky poem by Lewis Carroll; and poetic metaphor at the semantic level, illustrated by examples from verses by Garcia Lorca - are studied in further detail. The applicability of the existing computational models is discussed in connection to the kind of creativity apparent in the examples.

1 Introduction

Assuming we all speak a common language, everybody uses very much the same grammar and the same words to build the sentences that make up our daily world. How come some of these sentences are considered creative and some are not?

One way to begin to answer this question is to identify the levels of decision at which the final form of a sentence is shaped. Some of these allow little variation (grammar or syntax), others provide a big field (semantics), others are only immediately available to the trained speaker (rhythm, prosody), others are restricted to use by the poet (alliteration). A complete study of all the possibilities would require an enormous amount of space. As a first approximation, six basic levels of decision can be identified in the production of linguistic elements:

- phonetics, the level at which letters are put together to make sounds
- rhythm, the level at which the stress patterns of words are taken into account to shape the stress pattern of a sentence or a text
- lexical choice, the level at which actual words are chosen for the text
- semantics, the level at which the meanings of the words being used are considered and put together to form the meaning of the text
- syntax, the level at which the linguistic constructions used to join the words (and their meanings) to one another are chosen
- narrative, the level at which the contents of the text are decided

Another possible source of insights is to consider what objectives drive the production of sentences. Sentences are produced in many different contexts, and with many different purposes. Decisions taken at these levels on the final shape of a sentence will necessarily take into account a number of objectives of the speaker/writer. In most instances of language generation, the objectives that drive the utterance process are of a practical nature, related with the communication of a certain message or information. In these cases, the narrative and the semantic levels take priority over all the remaining levels, and transgressions - sometimes dramatically severe - of the accepted elementary rules governing language production are allowed. A speaker in a hurry may, for example, waive the rules of correct syntax as long as he sees his message put across briefly. In going beyond the accepted rules, such a speaker may be deemed to be behaving creatively. This type of linguistic creativity (say, corner-cutting creative communication) is worth exploring in detail, but it would require access to enough samples of specific instances of the phenomenon to provide starting material. Other instances of language generation, have objectives specifically geared towards obtaining a pleasing effect of some sort. These instances tend to get explicitly recorded for this pleasing effect to be available at later times, and they provide an easier starting point for a study of this sort. To make matters even easier, this study will concentrate on literary written texts, even though

there are many other fields and formats in which there can be said to be a conscious linguistic creative effort with an aesthetic aim in mind (film dialogues, TV scripts, radio programs, advertising...).

Finally the point of view from which the question is asked plays a role. When considering whether a sentence is creative or not, it seems important to take into account three basic issues: whether the speaker or writer considers he has been creative in producing that sentence, whether other people consider the sentence creative, and whether the sentence can be considered a valid sentence of the language. These three basic issues already begin to reflect the elementary distinctions outlined by Ritchie (2001) in his sketch of creativity assessment. The matter is considered in more depth in the following sections.

Creativity at the different levels of decision is outlined in this section, formal concepts of creativity are discussed in section 2, two specific cases are developed further in sections 3 and 4, and conclusions are drawn in section 5.

1.1 Phonetics

At the level of phonetics, linguistic creativity may be aimed at searching for a pleasing aesthetic effect by playing with a careful selection of the words in the sentence with an eye on the effect that results over the phonetics of the complete sentence. The results of this type of creativity come up as pleasing uses of rhyme, internal rhyme or alliteration (Espy, 1997). The extreme example is that of sound poetry (Ball, 1974; Hausman, 1971; Schwitters, 1993), an artistic initiative related to the Dada and Surrealist movement. In sound poetry, poems are not built up using words but simple phonetic constructs without meaning. The classic example of this line of creative work is Schwitters' Ursonate, a forty minute long phonetic poem set in a more or less sonata form. This particular approach to composition survives in text-sound composition, an artistic hybrid standing midway between poetry and music. For a review of text-sound composition efforts see Hultberg (1993).

1.2 Rhythm

One can find more creative rhythms that are uncommon in the language, or in the existing poetry. Edgar Alan Poe, in his defence of this poem the Black Raven (Poe, 1997) specifically discusses how the rhythm he has chosen for his verses is innovative - in the sense that it had not been used before to his knowledge, in English literature.

1.3 Lexical

The choice of vocabulary with which to construct a sentence plays an important role in making the result pleasing, but one is usually restricted to words that the reader will understand, leaving little room for creativity. A different alternative lies in using words that the user does not know. This forces the rules to a certain extent, and, if done carefully, it can be done in such a way as to actually convey a certain meaning to the reader in spite of the unknown words. A good example of this is the poem 'Jabberwocky', that appears in Alice's adventures through the Looking Glass (Carroll, 1872). This particular poem is analysed later in the paper.

1.4 Semantics

If we approximate the pictures in our head by means of a logical description of them (a challengeable assumption), a rough and ready formalization of what it takes for a sentence to be semantically creative is to consider as a measure of creativity the ratio between the size of the sentence and the complexity of the picture (a short sentence that manages to create a complex picture may suggest special creativity). However, this may be more related to the author's craftmanship. Another possibility lies in forcing the semantics a little bit. Truly creative sentences seem to put together words that force an interpretation where, in merging the meanings of the words, the reader must necessarily prune one or the other to reach the interpretation intended by the writer. This is particularly the case in the use of metaphor. The amount of pruning required (often triggered by wild clashes between the meanings of words purposefully joined together) gives an idea of the creativity involved. The degree of clashing can be a measure of the creativity involved. A set of examples of metaphors by Spanish poet Garcia Lorca is discussed in relation with this issue.

1.5 Syntax

Much may be said about literary creativity in the sphere of syntax, and most of it would require a precise statement of what non-creative syntax is taken to be, and therefore beyond the scope of this paper. There is much to be said in favour of a close study of the role of creativity in stretching syntax to achieve specific literary effects. This aspect is for the time being left in the hands of more able literary critics.

1.6 Narration

Beyond the boundary of a single sentence, there is a universe of creative possibilities to explore, related to the creativity employed in generating the situations that are being described or narrated. This is the level of creativity involved in general fiction, and the subject of study of thousands of academics world-wide. The implications of attempting to automate creativity at this level in terms of story telling systems have been tackled, among others, for animal stories (Meehan, 1977), Arthurian legend (Turner, 1992), humorous language (Ritchie, 2000) and for tragic stories specifically concerned with treason (Bringsjord and Ferruci, 2000). Interesting as the field may be, the

discussion in this paper focuses on creativity in the production of individual sentences in order to explore its role in language understanding and generation, and therefore this particular level is not explored in detail.

2. Formal accounts of creativity

Various attempts have been made to formalise the concepts involved in creativity in some more rigorous, formal way that allows objective judgements to be drawn.

2.1 Boden's framework

Boden's original framework (Boden, 1990) aims to describe AI approaches to creativity from a philosophical point of view. Two of the distinctions made in that work are particularly relevant to the issue in question. Boden distinguishes between *H-creativity* (creating a concept that has never been created at all) and *P-creativity* (creating a concept that has never been created before by a given creator). This distinction addresses the existence of a important subjective ingredient in our perception of creativity. She also distinguishes between *exploratory* creativity (identifying new concepts within a conceptual space that is already established) and *transformational* creativity (broadening an established conceptual space so that new concepts become accessible outside the bounds of the original conceptual space). Although this distinction opens the way for many interesting insights on creativity, it remains vague as to how an established conceptual space can be identified if not all of its members are known (a necessary requirement for exploratory creativity to be meaningful).

2.3 Extending Boden's framework

Wiggins (2001) outlines explicit definitions of Boden's concepts of exploratory and transformational creativity together with criteria for objectively distinguishing between them. The concepts developed here provide a framework in which the following two examples can be discussed.

Wiggins proposes a mechanism to describe an exploratory creative system in terms of a septuple:

$$<U,L,[[.]],<<.>>,R,T,E>$$

where `U` represents a multidimensional space that includes all possible concepts, `L` is a language for expressing rules on members of `U`, `R` is a set of rules in `L` that defines a given conceptual space `C` included in `U`, `T` is a set of rules in `L` that encode the way in which a particular creative step increments the set of known elements of a given conceptual space, and `E` is a set of rules for evaluating the quality of a concept. The function `[[.]]` is an interpretation function which generates from `L` a function to select members of sets, and provides the mathematical tools to describe a conceptual space `C` in terms of the rules `R` that describe it, so that `C=[[R]](U)`. The function `<<.>>` provides the means for defining the set of known concepts, c_o, after a given creative step in terms of the original set of known concepts, c_i, the sets of rules defining the conceptual space, `R,` and the creative means of traversal of the conceptual space, `T`; so that $c_o = <<R \cup T>>(c_i)$. This characterization allows representation of several concepts that play an important role in an analysis of creativity: the rules that define a particular style (`R`), the rules that represent the *modus operandi* of a particular creator (`T`), or the consensus on what is a good concept for a given community at a given moment in time (`E`).

Wiggins argues that exploratory creativity operates by applying `T` to increment the set of known concepts. It is important to consider that, because creation takes time and effort and the amount of both devoted to exploring a conceptual space is limited in real terms – by the creator's life span at best - the set of concepts that may be reached using `T` within a given conceptual space may always be much bigger than the set of known concepts. This is what makes exploratory creativity interesting in practical terms, allowing timely discovery of specific concepts with high values for `E`.

Transformational creativity is characterised in terms of modifying either `R` − thereby adding new possible concepts - or `T` − providing means for discovering concepts that were possible but not accessible by previous means of creation. The intuition behind this is that the set of techniques available to a set of creators at a given moment in time may not be sufficient to traverse the complete conceptual space in which they are working.

An interesting idea that arises from the formalisation is that there is no formal constraint requiring that `T` be unable to lead to concepts not originally included in `C`- this is the reason why both `R` and `T` are needed to apply `<<.>>` − thereby somewhat blurring the differences between exploratory and transformational creativity. In a way, this corresponds to accepting the fact that the creative technique of a given agent can be transformational in the sense that it leads beyond the initial conceptual space.

Wiggins' proposal includes a conjecture that - the modification of `R` and `T` being itself a creative process - an equivalent formalisation can be used to describe transformational creativity, formulated in terms of creativity at the meta-level. This implies that transformational creativity requires that the creator be aware of the particular methods that he is using in his work, so that he can be creative about them.

3 Inventing Words

The best known example of creativity at the lexical level is Carroll's poem 'Jabberwocky'. Its first few lines provide a fine sample of creativity in the use of invented words:

> `Twas brillig, and the slithy toves
>   Did gyre and gimble in the wabe:
> All mimsy were the borogoves,
>   And the mome raths outgrabe.
>
> "Beware the Jabberwock, my son!
>   The jaws that bite, the claws that catch!
> Beware the Jubjub bird, and shun
>   The frumious Bandersnatch!"
>
> He took his vorpal sword in hand:
>   Long time the manxome foe he sought --
> So rested he by the Tumtum tree,
>   And stood awhile in thought.
>
> And, as in uffish thought he stood,
>   The Jabberwock, with eyes of flame,
> Came whiffling through the tulgey wood,
>   And burbled as it came!
>
> One, two! One, two! And through and through
>   The vorpal blade went snicker-snack!
> He left it dead, and with its head
>   He went galumphing back.
> "And, has thou slain the Jabberwock?
>   Come to my arms, my beamish boy!
> O frabjous day! Callooh! Callay!'
>   He chortled in his joy.
>
> `Twas brillig, and the slithy toves
>   Did gyre and gimble in the wabe;
> All mimsy were the borogoves,
>   And the mome raths outgrabe.

3.1 A Close Look at the Poem

As Alice herself observes in the book, "Somehow it seems to fill my head with ideas -- only I don't exactly know what they are!". A very interesting analysis of complex processes involved in even the most unconscious interpretation of this piece of text is presented in (Dean, 2001).

Exactly how one may arrive at a computational model of the kind of creativity involved in generating this type of language samples is difficult to say. However, many clues are lying around to be gathered by the interested reader.

An important concept for this endeavour is provided in the original text (Carroll, 1872). Alice asks for an explanation of the poem, and Humpty Dumpty (with her help) indulges her whim. This explanation provides some insight into the processes that may be at play in composing the poem. For instance, the idea of a 'portmanteau' word - two meanings packed into one word - is explained. The examples given by Humpty Dumpty in his explanation of the poem are 'slithy', meaning 'lithe and slimmy', or 'mimsy', meaning 'flimsy and miserable'.

Carroll himself goes further towards describing the actual process of creating a new word in a letter to Maud Standen in 1877 (Graham, 1981), discussing the word 'burble' that also occurs in the poem: "If you take the three verbs 'bleat', 'murmur' and 'warble', and select the bits I have underlined, it certainly makes 'burble'...". However, he presents us with an important difficulty in the rest of his sentence "...though I am afraid I can't distinctly remember having made it in that way." It should not be overlooked that, easy as it may seem to reconstruct in hindsight the way in which a poet arrived at a particularly creative word, this need not be the way in which it actually occurred to him.

An important issue is to identify how the poet ensures that a poem with an important amount of invented words can still be - at least partly - understood by the reader. Dean describes several techniques used by Carroll to keep 'Jabberwocky' from becoming complete nonsense:

- manufacture the words in such a way that they look as if they could be real (choose vowel and consonant combination that appear genuine and easily pronounceable),
- use many invented nouns and adjectives but comparatively few invented verbs,
- rely on the sound of the intended words (rather than their non-existent meaning) to convey the meaning of the poem,
- use the placement of the invented words within the sentences to give the reader an idea of how they function within the sentence.

From the point of view of computational accounts of creativity, a more revealing analysis is carried out by Hofstadter (1980) in terms of how the different translators of Jabberwocky chose to render the poem in different languages. Hofstadter considers the matter from the point of view of how the poem activates a symbolic network inside the brain of the reader. In particular, he studies how translators devise versions of 'Jabberwocky' in a new language B, assuming that their aim is to find 'the same node' in the brain of the B reader as the one that activated by the original poem in the English reader. The main problem arises from the assumption that the symbolic network associated with the B language and English will usually be, on some level of analysis, extremely non-isomorphic: in a poem of this type many "words" do not carry ordinary meaning, but act purely as exciters of

nearby symbols, and what is nearby in one language may be remote in another. Hofstadter considers the original poem and a French and a German translation, and shows how each translator adapts the linguistic form and even the contents of the poem in search for equivalent effects. This includes the invention of new words in the corresponding language, where the ingredient words employed by Carroll may not necessarily exist.

3.2 What Creativity is Involved

The composition of a whole poem involves creative decisions at various level of linguistic decision but the present analysis is concentrated on the level of innovation at the lexical level.

Suppose a baseline assignment of definitions to the elements of Wiggins' characterization:

- U the set of all ortographically valid words according to the rules of English
- R the set of rules that describe semantically meaningful words in English at the time the poem was written
- T the algorithm for lexical choice available to Lewis Carroll (memory, dictionary look up...)
- E the criteria used by readers to evaluate a particular word

This would have been the starting point at which Lewis Carroll found himself when he set out to write the poem. Hofstadter's analysis of the translation process may be related to the formalisation applied so far in the following way: each node in such a symbolic network would correspond to a concept, the process of learning a new concept corresponds to adding new nodes to the network and linking them appropriately by activation synapses to existing nodes. In terms of the formalism, our description now becomes:

- U the set of all possible nodes and the connections between them
- R the set of rules that describe nodes and connections associated with words of the language
- T the algorithm for travelling along the symbolic network in order to find a word
- E the criteria used by readers to evaluate the activation patterns resulting from the interpretation of a particular word

It is clear that a user may know a word (have it included in the set determined by R) and yet never use it himself when composing sentences (it is not accessible by means of his T). The introduction of a new word will require on one hand an extension of the existing set of nodes (R) but also an extension of the procedure for composing sentences (T) so that the word is actually used in production. What makes Jabberwocky a striking poem from the creative point of view is that Lewis Carroll has extended the

conceptual space of words available for lexical choice beyond the set of words that have an accepted meaning in English. In terms of Wiggins' model, R has been extended to include newly formed words. however, the correct sequence to be considered is: Carrol extends his T set to include new techniques., the new techniques result in elements that are beyond R, (therefore requiring a new set R'). One option is to consider that transformational creativity has taken place at this stage, yet the sequence is not yet finished. The extended set R' (or the examples of it generated by Carrol's T) meet with approval from the literary taste of the time (score well under their E function). R' becomes the new R for this domain. The other option is to consider that transformational creativity has taken place only if this last effect is achieved. On additional consequence is that Carroll's T has by then become available to other authors, and yet intuitively it seems that any further application of the same technique would no longer be deemed transformationally creative. This could bring in to play the other dimension of Boden's classification: an act of creation could be either H-transformational or P-transformational (depending on whether the evaluators perception of R includes the result or not).

The evidence provided by Carroll himself, both in the words of his characters and in his later explanatory letters, provides an insight into the actual mechanisms that result from – or constitute a sketch of – the new set of rules T. It is apparent from the various attempts at explaining the techniques that the author does not have a clear picture of how exactly the new words have come about, but he is certainly aware of an assortment of possible mechanisms that are somehow involved in the process[1]. Furthermore, Carroll has made his readers aware of these processes in his work. Two interesting questions arise from this last observation. What role does the fact that Carroll explains his technique (in fact his new T) in his book play in the ensuing success (the high score for E)? What role does it play in making any further use of the same T a matter of exploratory rather than transformational creativity? The issue is not discussed further here, yet it has bearing on the interpretation of modern art and modern music, in which new creations seem to be hard to evaluate without an added explanation of how they came about.

The techniques described by Dean illustrate how the author has taken pains to ensure that the final product meets the constraints imposed by E. It is unclear to what extent the particular technique used for word creation assures that the readers will identify the meaning intended by the writer, but the success of the poem over time sug-

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[1] This seems to back up Wiggins' conjecture on the need for self awareness involved in creativity at the meta level.

gests that the author found a way of meeting the necessary requirements, even though the poem was built up by applying rules beyond those traditionally used by readers to evaluate poems. An important role is played by the interaction between the different levels of linguistic decision. Carroll makes sure that, while he is being wildly innovative at the lexical level, he remains conservative at the phonetic and syntactic levels.

Hofstadter argues that the networks corresponding to different languages are non-isomorphic, and that the challenge for the translator involves producing a similar activation pattern, even if it involves nodes that are not necessarily the formally correct equivalents of those activated by the original. This is true of translation in general. In cases as the particular one under discussion, there seems to be an additional ingredient: the invention of new words calls for the creation of new nodes and/or new activation synapses. Two basic issues to be considered in detail arise: how an author produces a new concept (if he ever actually does explicitly), and how a reader reacts on finding a new word (and whether he does produce a 'meaning' for it). Both processes seem to involve creative behaviour: having created a new word requires the creation of a meaning for it. For a case like the one described this can either be provided by the author in the accompanying text, or by the reader when trying to interpret the text. When no meaning is available, it is plausible to assume that the reader produces a tentative - and possibly partial - meaning that fits in with the interpretation of the rest of the text. There are certainly complex creative processes involved in the interpretation of unknown words in general, and this is one of the areas where having a reasonable formalisation of how creativity operates at the various levels may be most useful. One wonders whether there is any guarantee that, given both concept creations, the resulting concepts of author and reader bear resemblance at all, or simply produce a similar general impression. From Hofstadter's description of the translators tricks of the trade, it seems that achieving such a 'similar general impression' is all that is required for a translation to be deemed correct.

4 Metaphor

The study of well documented instances of creativity at the semantic level may provide insights on this issue. One such instance is the use of metaphor in literary texts.

4.1 Theories of metaphor

Various studies (Gentner et al, 1989; Martin, 1990; Indurkhya, 1992; Veale and Keane, 1993; Veale, 1995; Barnden, 1997) have been carried out in search for a computational theory of metaphor. A metaphor involves a conceptual transfer from one object of situation (the source or vehicle domain) and another object or situation (the target or tenor domain). Metaphorical interpretation is considered to be directional: each domain or object has a different role and its interchange will not lead to the same meaning (though it may yield an equally valuable metaphor). Metaphor is constrained by deep rules of coherency. Concepts that are mapped from one domain to another should be coherent among themselves (Indukhya, 1992). Some research on metaphor interpretation consists in finding the largest mapping function (between domains) that avoids inconsistencies.

An elementary structural description of metaphor interpretation is provided in the Sapper system (Veale, 1995). Starting from a representation of semantic memory in terms of a network of concepts linked together by associations, metaphor is described as a two-step process that first identifies implicit relationships between concepts (*dormant bridges*) and then establishes an explicit link between them (an *awakened bridge* that represents the metaphor in memory). In the Sapper system a rule-based symbolic solution deals with the first step and a spreading activation connectionist step deals with the second. Once a bridge is awakened, it effectively warps the memory so that the tenor and vehicle domains move conceptually together. The identification of dormant bridges is carried out not only in terms of identifying structure based on shared associations (Triangulation Rule) but also based on shared metaphor bridges (Squaring Rule).

The consistent transfer of concepts between two different domains is addressed in Leite et al (2000), where Dynamic Logic Programming is used to resolve the possible inconsistencies arising from the transfer, while retaining as much as possible of the added value represented by the metaphor. A metaphorical framework consists of two theories (tenor and vehicle), defined in two different languages, together with a function mapping one part of the language of the vehicle into the language of the tenor. The final theory will consist of the tenor theory together those rules from the transformed vehicle theory that are not contradicted by the rules from the tenor theory.

4.2 Examples

The following lines from a poem provide an example of the type of metaphor employed in literature in general and poetry in particular:

> the streetlamps were switched off
> and the crickets were switched on
>
> (Federico García Lorca, *Gipsy Ballads*)

Crickets are not switched on, but rather start singing at sunrise. The poet forces the use of the verb 'to switch on'

together with the noun 'crickets', which is against the strict rules of language. The metaphor works (can be easily understood by the reader) because crickets are

Crickets	Streetlights
start and stop at periodic intervals	start and stop at periodic intervals
feature in our perception of a scene	feature in our perception of a scene
	switch on and off
animate	inanimate
active	passive
natural	man-made

Table 1. 'Theories' for crickets and streetlights

known to start and stop singing at regular intervals, just as if they were switched on and off by a mysterious hand. The transgression of the rules of language is licensed by the effect achieved: a parallel is drawn in this way between the two verses, in the form of a pattern that is followed by the sentences that make up each one.

One possible interpretation of this example in terms of theory extension (Leite et al, 2000) would be to consider the domain of crickets as tenor and the domain of streetlights as vehicle. The concepts involved for each domain might be represented as shown in table 1.

The fact that both theories share concepts such as starting and stopping at periodic intervals, or being features in our perception of a scene, provides the crossover point, which allows the concept of being switched on and off to be applied to crickets. This would require all other inconsistent concepts (animate/inanimate, active/passive, natural/man-made) associated with switching on and off a streetlight to be pruned from the meaning it has in the full sentence. However, once the rules are broken, it is not clear whether the poet intends the reader to imagine that the crickets are a man-made addition to the landscape, or that the switching off of the streetlamps (or their very existence) is as natural as the song of the crickets. This observation brings into question the directionality of metaphor in a strictly linguistic literary use. In more general terms, because the rules have been broken in this way, each reader may end up with a different reconstruction of the poet's intention. It may be this multiplicity of possible interpretations that makes a metaphor specially successful.

A different example from the same source shows similar behaviour:

> Playing her parchment moon
> Preciosa comes along...

Preciosa is a young gypsy girl. She has no moon, and there is no moon made of parchment, but the moon is round, and she is playing a tambourine (which is round like the moon and made of parchment). The 'theory' for the domain of tambourines (tenor) and the domain of moons (vehicle) might be represented as shown in table 2.

Tambourine	Moon
round	round
parchment	
played on	
active	passive
belongs to Preciosa	
	admired by all

Table 2. 'Theories' for tambourines and moons

It is interesting to note that here the part of the concept that actually establishes the bridge between the domains in both examples is actually not present in the text. Again, the description of what is actually used as a bridge may in fact be different for different readers, or may simply be a 'similar general impression'.

Finally, the actual interplay between concepts that is the hallmark of a poet can be more complex than the sort of simple crossover described in the examples so far. Take the following example by the same author:

> Against the bitter green,
> a card-hard light
> traces raging horses
> and riders' silhouettes.

This occurs in a context where a knife fight takes place in an olive grove between men on horseback for an unknown reason, and ends in the death of several of them. Various interpretation can be put upon the various concepts interacting in these verses by literary critics. Harris (1991) believes that the reference to playing cards in the second line indicates "a reason for the fight", and shows "the quality of hardness from the knives" transferred to the light. Havard (1990) points out that "cards depict motifs in profile, and the equivalent of a jack in Spanish cards is a horse and rider". Whether one accepts this depth of analysis as meaningful or not, it is clear that there are hidden interactions between the concepts represented by the words of the poem well beyond those that could be sketched along the lines followed above. The bitterness of the situation is attributed to the colour, a hypothetical reason for the fight (neither playing cards nor gambling feature anywhere else in the poem) is used to qualify the hardness (supposedly of the knives) attributed to the light, and the scene described evokes the picture that appears in a playing card which has been

brought in to qualify the light and act as suggested reason for the fight. How many of those were intended by the author, how many arose by chance (but were retained by the sensibility of the poet as good contributions), how many did not even surface into the author's consciousness... these are questions for which no answers are available, and yet, from the moment that someone points out the interactions, there is a certain need to model them and provide a computational theory to explain/achieve/evaluate them.

4.4 Which Creativity

One possible baseline assignment of definitions to the elements of Wiggins' characterization would be:

- U the set of all syntactically valid word combinations according to the rules of Spanish
- R the set of rules that describe semantically meaningful combinations of words in Spanish at the time the poem was written
- T the algorithm for sentence composition available to Lorca
- E the criteria used by readers to evaluate the resulting sentence

It is not particularly clear what should be understood as 'semantically meaningful combinations of words in Spanish'. Certainly metaphor had been used often before in literature, so metaphorical uses of particular words and a number of typical word combinations for constructing metaphors should be considered as already included in the set defined by R, and the mechanisms for using metaphor as included in T. In this case, it appears that any particular innovation introduced by Lorca would have to be interpreted solely in terms of exploratory creativity, his creative contribution taking the form of making explicit particular combinations of words that were possibly not available by application of the individual composition techniques of previous authors.

Why is metaphor so striking in general if it in essence it reduces to simple word combination? The assignment given may have been drawn too broadly. The example can be analysed at a different level of granularity, by focussing the description in terms of Wiggins' septuple to a different level of linguistic decision. Consider the following alternative assignment of definitions:

- U the set of all possible definitions of the meanings for the words and sentences of Spanish (including partial definitions)
- R the set of rules that describe the particular meanings assigned to Spanish words and sentences at the time the poem was written
- T the compositional algorithm for constructing the meaning of a sentence from the meanings of

the words used to construct it (as employed by Lorca)
- E the criteria used by readers to evaluate the resulting sentence

In this case, it may be possible that the T applied by Lorca results in a different set of (surviving partial) meanings within the context of this sentences for the words he actually employs. this interpretation fits better with our perception of poetry and its effect on us. However, it has severe implications on the feasibility of formalising meaning, and on long standing assumptions such as the principle of compositionality of language.

5. Conclusions

Various levels of linguistic decision have been shown at play in two examples of creativity. The first example showed how creative behaviour does not occur in the same degree across all levels. Rather, a conservative approach in some levels is required for a successful interpretation of creative innovations at other levels. Creativity at a linguistic level can be counterproductive for communication if abused. This suggests that different levels of linguistic decision should not be exploited creatively at the same time. With respect to the question asked at the beginning of the paper, the creativity of a sentence may be evaluated at the different levels of linguistic decision.

For each set of examples, the analysis of the creative behaviour in terms of exploration of a conceptual space has been used. In order to capture the peculiarities of creative behaviour intuitively associated with the examples, the conceptual spaces involved must be restricted to the domains of application presented by the level of linguistic decision being creatively exploited.

To formalise this idea, a different conceptual space would have to be used for each different level of linguistic decision. The overall representation for the conceptual space of language use would involve the union of the different concepts. This fits in with the idea that there is no homogeneous theory of language, but rather a set of theories, each one governing a different level of linguistic decision.

An additional problem that would have to be tackled is the extent to which the interaction between the theories for the different levels complicates the picture significantly. Intuition suggests that it will to a considerable extent. Creativity may operate at each of the levels of decision involved in linguistic production, but it may interact between different levels in ways that are not evident. As it has been shown in the ingenious use of phonetic restrictions to support lexical invention in Carroll's poem, an additional level of creativity comes about

when some form of interplay between different levels of creativity appears - whether consciously or unconsciously, as explained by the author's misgivings as to the validity of his own explanations of his effects (Graham, 1981).

It is important to consider that, because of the nested structure of the levels of decision described, creativity at a certain level may imply creativity at the level below it. For instance, inventing a new word may be done according to the accepted rules of word formation (even if the valid particular combination of valid syllables had not been used in the language before) or, because it is new, it may be done while breaking accepted rules of syllable construction. This last example would involve creativity at the lexical and the phonetic level. At a finer level of analysis, the creation of words in Jabberwocky involves exploratory creativity at the phonetic level and transformational creativity at the lexical level. The creation of words involving new rules of syllable construction would count as transformational creativity on both levels. There is a possibility that it also involve transformational creativity at the semantic level, if a meaning that could not be represented in the language before is now represented by this word. There may be transformational creativity at the syntactic level if a new syntactic category is invented.

Another aspect that is at play in determining whether a sentence is creative is the effect of the point of view of the evaluator. Three issues must be considered: whether the speaker or writer considers he has been creative in producing that sentence (Boden's P-creativity), whether other people consider the sentence creative (related with Boden's H-creativity and Wiggins's E function), and whether the sentence can be considered a valid sentence of the language (related to Wiggins' R rules). This question acquires particular importance in the study of linguistic creativity, since there are neither universally agreed rules for establishing the validity of a language expression, nor recognised ways of establishing consensus between speakers of a language that are consistently used when accepting a new word or meaning into the language. It is still an open issue whether a conceptual space is deemed to have been transformed if somebody uses a new word or whether this can be taken to have happened only if somebody uses it successfully (i.e. manages to convey the intended meaning to somebody else). The extreme criterion would be to consider such creativity to have taken place only if the new word becomes generally accepted and used in the language.

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