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The Interpretation of Terminological Constructions: The Case of Technico-Scientific Nominal Compounds

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Abstract

The analysis and interpretation of nominal compounds (NCs), defined as lexicalised noun phrases, have proven to be a recalcitrant problem from a syntactic-semantic perspective, owing mainly to two properties: compound *recursion* (i.e. productivity) and compound *technicalization* (i.e. semantic compactness). The paper therefore analyzes a set of concomitant, multifarious difficulties and problems associated with interpreting some English technico-scientific NCs arabicized by Jordan Academy of Arabic Language. To resolve the problems arising from two-element NCs, we developed a synthetic approach by drawing on four already existing principles, namely, Marchand's taxonomizing *determinant / determinatum dichotomy* (1969); the principles of *headedness*, *percolation*, and *Right-hand Head Rule* proposed by Selkirk (1982), Katamba (1993), Di Sciullo & Williams (1987), among others.

On the other hand, interpretation problems arising from multi-element NCs are also addressed by drawing on the already proposed synthetic approach which proposes three techniques viz. *syntactic recovery, slicing & pairing*, and *building up or constructing patterns (i.e. productivity of patterns)***.** *Syntactic recovery* is concerned with providing a rephrasing or an interpretation that exceeds the basic phrasal/genitive construct level (i.e. it provides sentential interpretation) as to recover covert syntactic and semantic links. *Slicing & pairing* is concerned with breaking the NC in question down into pairs; then it links the pairs up as to rebuild the NC's complex meaning. *Building up or constructing patterns (i.e. productivity of patterns)***,** the less reliable method, is concerned with predicting or sorting out the head element of an NC on the basis of the principle of frequency of occurrence of the constituents of the NC in question. The most frequent element is predicted to be the head or centre and the rest of elements are relegated to an inferior position of premodification.

Introduction

For the purpose of this investigation, a nominal compound (henceforth NC) is defined as a lexicalised noun phrase, e.g. *air pressure*, *assembly line*, *amplitude modulation*, *effective antenna height*, *automatic chrominance control*, etc. However, we opt to use the label 'nominal compound' here as this usage is consistent with most work done by other linguistics and translation scholars (e.g. Jones 1995, Maalej 2002). In this vein, Sager et al. (1980: 266)

outline that compounds are constructed from regularly occurring collocations and "convert phrases into fully lexicalized or terminologised units", e.g.

A stud for clamping- clamping stud
An eye-shaped bolt with a collar- eyebolt with collar
A bearing with needle rollers- needle (roller) bearing

The analysis and interpretation of NCs have proven to be a recalcitrant problem for linguistic semantics and applied translation studies (Jesperson 1942, Downing 1977, Warren 1987, Maalej 2002, & Al-Kharabsheh 2003, among others), and their parsing has presented a serious challenge for natural language processing systems (Finin 1980, McDonald 1982, Isabelle 1984, Hobbs et al.1993, Jones 1995, & Pustejovsky 1995, among others). In fact, numerous studies made by prominent scholars (e.g. Katamba 1993, Bauer & Renouf 2001) approached NCs from diverse angles and perspectives; yet these attempts have their own strengths and limitations, depending on the model subscribed to. Such wealth or multifariousness resulted in inconsistencies and in problems of classification labels, dichotomies, and opposed poles. According to Pym's z-curve, it may be said here that there will always be "the crazies in the black tails" (quoted in Olohan 2004: 8).

Indeed, some scholars have addressed NCs according to purely semantic criteria (e.g. Bauer 1990, Katamba 1993, Costello & Keane 1996, Bauer & Renouf 2001); some according to purely syntactic criteria (e.g. Lieber 1980, Selkirk 1982, Williams 1981 Lieber 1983, Beard 1996, Bongartz 2000 & 2002, Roeper 1988), and some according to admixture of both where they interchangeably used syntactic and semantic labels in a loose and ad hoc fashion (e.g. Adams 1973, Marchand 1963). To illustrate the latter, Adams (1973: 61), for instance, presents a taxonomic list of the types of semantic relations holding between the constituent members of any given NC; yet in the author's own words, this is "not a 'tidy' one" (ibid.: 61) and is obviously based on very heterogeneous criteria. Within that list, for example, IX uses word class membership alone, while I and II combine this with syntactic function. V and VI could either be viewed as involving semantic content alone or a combination of it with syntactic function as an adverbial complement (of instrument and place). The remaining groups of interpretation are mainly based on semantic considerations. Finally, the inconsistency in Adams's analysis is clearly evidenced by the confusion over the class of some compounds for which she proposes the label *Other*.

In addition to the existence of overlapping views which gave rise to 'twilight zones' in the analyses of NCs, the difficulty in interpreting is also believed to stem from *compound technicalization*; that is, compounds in general are motivated by the tendency towards linguistic economy and thus contribute to compactness of expression in scientific and technical discourse, e.g. *asphalt-base aluminium coating heat-resisting flat plate glass*, To this effect, Sager et al. (1980: 265-66) neatly states that compounds in special languages "are created more systematically and regularly to fit into terminological systems." Connected to the problems of *technicalization* is the fact that compounding is *recursive* in principle which is likely to further complicate the overall process of interpreting. Technicalization and recursion will be taken up later in more details.

Accordingly, this paper is not really concerned with the factors that govern the emergence of such compounds, nor with the factors that account for the preference of using a certain combination of words (that enter into the formation of compounds) to another. Rather it will attempt to 1) investigate the difficulties and problems that may be encountered in 'dissecting' or decomposing NCs; 2) synthesize and build on existing partly working models; namely, Marchand's taxonomizing theory (1969) which is based on the determinant/determinatum dichotomy; the principles of headedness and percolation proposed by Selkirk (1982), Williams (1981), Katamba (1993) among others; and the Right-hand Head Rule suggested by Di Sciullo & Williams (1987) as to obtain meaningful compound-interpreting guidelines which, from an applied point of view, should conveniently help produce adequate translations and be of use in translation teaching and practice, and from a theoretical point of view, contribute towards closing the existing systematic gaps in this respect.

To achieve this, some technico-scientific NC examples have been taken from three scientific fields that have been arabicized by the Jordan Academy of Arabic language (henceforth JAAL). These are Civil and Architectural Engineering, Air-conditioning, Cooling and Sanitary Ware, and General Electricity, T.V. and Radio. The choice of using the products of JAAL was driven by the fact that these accomplishments can be strongly regarded as being *official* as they have been produced in collaboration with scientific and technical specialists and Arabic linguists according to the proper conventions of the language as to ensure high quality and utmost clarity and accuracy. In other words, the examples used in this study are completely lexicalized and standardized compounds.

Discussion

1. Difficulties and Problems in interpreting NCs

It must be said from the outset that this paper is inspired by the generally- hypothesized cognitive role of compounds related to informativeness (Grice, 1975); that is a novel compound construction should convey its meaning unambiguously. The NC class in specific can be regarded as one of the most predominant classes in English compounding that expands the everyday vocabulary needed to communicate our experiences, thoughts and to describe our surroundings and the world at large (cf. Bongartz, 2002). Almost on a daily basis, novel terminological nominal constructions are being coined in most branches and sub-branches of knowledge and become common parlance, e.g., *notebook computer* (a small portable computer), *galvanized steel, alignment too*l, *polystyrene foam, chlorinated rubber paint, , communications satellite, colour television camera, rib-lath sheet, cantilever action, synthetic resin admixture, compression reinforcement,* etc.

Considering the fact that any given compound should convey its meaning unambiguously in a wide spectrum of contexts, it can be said that its translation should equally exhibit a similar degree of clarity if it figures in corresponding contexts. Meeting this requirement may be harder than what it first seems to be because a novel noun-noun construction and longer NCs will often prove difficult to be interpreted as we shall see later on, e.g. *prestressed pre-tensioned concrete* (see also Costello & Keane, 1996 for more details). The primary question then is how to deal with the semantics of nouns? Since the semantics of any structure depends partially on the syntactic networking of that structure, exploring the syntactic makeup of NCs can be essential in this study. On the other hand, meaning can be also resolved in connection with the knowledge of the world which plays an integral part to linguistic knowledge.

Technicalization as indicated before can be one of the most important factors that can give rise to difficulty. To clarify, communicating a new idea or concept in scientific writing may often require the employment of a multi-word construction, especially if the meaning is complex as in *bead-type thermistor resistor, reinforced plastic mortar pipe.* Thus, Technico-scientific NCs which are supposedly designed to efficiently permit specialized knowledge transfer, lend themselves to more complication, owing to the fact that they can be considered

important vehicles that exhibit different varying degrees of technicalization yielding various complexly-packaged structures, i.e., NCs normally encapsulate condensed information in short structures; or they hold maximum information in minimum linguistic structures.

On this basis, it can be said that NCs are extricably bound to present different interpreting difficulties and complexities, i.e., *structural ambiguities*. Hence, the word *structural* specifically indicates morphological and grammatical ambiguity; rather than an indication to the known 'sentential ambiguity'. This property may also account for the heavy and remarkable utilization of nominal compounding as to generate new terminological constructions which can encapsulate massive conceptual contents across different scientific domains, e.g. *surface spread flame test; finite-difference method*; *sound transmission test*. (cf. Clark et al.1986 & Pinker 1999 for more details).

A second problem that can especially complicate the process of interpreting emanates from the *recursion* (or *productivity)* property of nominal compounding. This property provides the chance of allowing a process to feed itself *ad infinitum,* and as a result there is no logical (i.e. linguistic) limit to the length of such compounds; that is to say NCs can display varying degrees of *lexicalization*, e.g. *baseband, baseband frequency, push toggle switch, sawtooth wave, valve holder socket, monochrome display tube, series-parallel connection, carrier wave frequency, earthed-base configuration, nickel-iron alkaline cell, zinc-mercury oxide cell, delayed automatic gain control,* and consequently varying degrees of *technicalization* (or idiosyncrasy), e.g. *pressure head, dead ground connection, dead earth connection, crocodile clip, colour failure, field flyback period.* Thus, the structural ambiguity of a certain NC would grow exponentially upon extension. Observe the following two examples:

1. *capacitor start*
   capacitor start induction
   capacitor start induction run
   capacitor start induction run motor.
2. *plastic cat*
   plastic cat food
   plastic cat food cover
   plastic cat food cover retail
   plastic cat food cover retail manufacturer
   plastic cat food cover retail manufacturer rebate
   plastic cat food cover retail manufacturer rebate offer.

Indeed, this process can be relatively constrained by cognitive considerations which boil down to the general tendency of language users to produce cognitively-trackable, -comprehensible or -processable linguistic utterances and that explains why speakers or specialists refrain from verbalizing too long NCs. Despite the fact that all the NCs used here are entirely lexicalized, it should be pointed out that, generally speaking, the vast majority of NCs are not lexicalized items and thus dictionaries cannot catch up with the increasing number of NC neologisms and so can offer no help in most cases. This lexicalization problem can be attributed to two basic reasons: the first is pertinent to the unprecedented growth of NCs as a concomitant result of technological progress and scientific advancement and the second can be linked to the difficulty that lexicographers, terminologists, translators and language planners find in catching up with the fast-growing number of compounds nowadays.

The overriding question that begs an answer here is how can we determine the right intended interpretation of any NC, given the semantic density and sometimes the wide spectrum of possible syntactic readings (bracketings). The type of semantic relationships that hold between the constituents of an NC in English is usually unspecified and implicit and this has a paramount effect on interlingual language processing (cf. Roberts & Roussou, 1999). Therefore, we ought to incorporate the makeup of an NC to other compositional processes. We therefore argue that decomposing compound structures involves the identification of the syntactic links that connect the components of an NC which in turn would help pinpoint the semantic content. Paraphrasing can be here a practical and useful strategy that can assist in the retrieval of the implicit prepositions, relative pronouns or any other syntactic devices that can fit in an appropriate slot. The most pressing concern after identifying the syntactic links is to recover the covert semantic links that hold between the constituents.

While some compounds show transparency in their semantics, others are quite idiosyncratic and idiomatic. There is no structural reason, for instance, why one could not understand NCs such as *wave antenna* as 'an antenna that keeps waving' or by *computer code* as 'a code which looks like a computer'. An entirely idiomatic compound, on the other hand could be regarded as an independent lexeme. For example, *crocodile clip* has nothing to do with that monstrous animal described by the first component, nor by the sense indicated by *clip*, rather there is a new lexeme that makes the semantic fabric of the compound. At this point, Kooij (1968: 253) concludes that both full idioms and relatively transparent compounds show a feature of

'arbitrarization', e.g. *Portland blast furnace slag cement*; or 'specialization', e.g., *thermal shock resistance test* & *chrominance control*.

A third substaitial problem, as indicated earlier, is to identify the underlying syntactic-semantic relationships that the communicator intends to hold between the constituents of an NC. In fact, this problem can be a multi-faceted one per se for a variety of reasons, the first of which is that the relationship is not always evident and overt in the surface structure of the NC. Take for example the compound *standard jack plug*. The correct interpretation of this compound depends on our encyclopeadic knowledge. We must know, for instance, the proverb 'jack of all trades, and a master of none' or 'a vehicle's jack used for replacing tyres' as to figure out that *jack* in this compound *means mobile and/or moveable.* Likewise, to understand exactly what is meant by the lebel *Vodafone mobile phone*, we should kno*w* that *Vodafone* is a name of a leading British mobile company that sells its own handsets.

A second point to be made is that the syntactic-semantic relationships that an NC exhibits are multifarious (cf. Roeper 1988 & Smirniotopoulos et al. 1998). For instance, from a semantic viewpoint, the compounds *junction box*, *jack panel*, *heat sink*, *headphone*, *converging lens*, *packing box*, *slewing crane* show a locative relationship, and in *band-stop filter*, *field generator*, *electrical humidity controller*, *flow nozzle* and *full-wave rectifier* show an instrumental one; whereas in *driving circuit*, *staining material*, *damping coil*, *modulating signal*, *field-blanking pulses* the relationship is subject-verb, and in *fault finding*, *fault tracing, field scanning, peak clipping, groove pointing, surface burning* it is verb-object. An interpretation of some of these examples requires finding out their idiosyncratic semantic relations via syntactic devices as shown below (based on parahrasing technique):

a. *flow nozzle*	is a nozzle **through which** liquids flow
b. *driving circuit*	is a circuit **that drives** something to happen
c. *modulating signal*	is a modulation made **by** a signal
d. *surface burning*	is burning **of** surface

This type of interpretation attempts to link the modified element with the modifying element according to the characteristic activity that features between them, e.g., ***toolbox*** (box as the instrument where tools can be kept). This interpretation depends on recovering a relative clause that can accentuate one possible relationship over another.

A third aspect of the overall problem is the general lack of syntactic clues. At the sentential level, the interpretation can go smoothly by detecting the subject and its predicate, not excluding other related syntactic properties such as direct/indirect object, tense and aspect, marker, subjunctive, dynamic/ static verb, etc. Indeed, none of these clues are at work when it comes to NCs. It is at this level of interpretation that the technique of paraphrasing is badly needed to disclose the covert syntactic clues. Fourthly, even when the components are unambiguous, the resultant NC can give rise to multiple interpretations.

For example, a *copper cord* can signify two relationally clashing ideas: 'a cord that is made of copper' or 'a cord that can be used for copper'. The compound, simultaneously, implies two relations of substance or composition and object, which is indicative of the complication in the characterization of compounds in general. Obviously, the confusion regarding what sense to go for is not so perplexing, yet there are other cases which call for special attention. For example, is *deflection plates* 'plates that cause deflection' or 'plates to stop deflection'? And by the same token, is *gamma correction* 'a correction made by gamma' or 'correction of gamma itself'? And is a *phantom circuit* 'an appalling and spooky circuit' or is it just 'a hypothetical or unreal circuit'? The answer can be provided from outside the compound, i.e., from extra-linguistic knowledge.

2. Compound-Interpretation Guidelines Supported by Linguistic Models

There have been many attempts suggesting rigid rules that can help understand the semantics of NCs. Most of these attempts are lexically and syntactically-based treatments (cf. Bongartz 2000, Pustejovsky 1995, Rally et al.1998, Longobardi 1994 and Downing 1977, among others). The semantic aspect which is of paramount importance to sound rendition of compounds has not been well-explored. Therefore, this study is going to provide a number of rules, though not exhaustive but highly suggestive.

NCs can be classified according to the degree of syntactic-semantic transparency they show. Thus, NCs can be either idiomatic such as a *banana plug*, that is a 'plug taking the shape of banana' or unidiomatic, e.g. *serviceability limit*. Indeed, there can never be a clear-cut division as some compounds can fall in between since idiomaticity is a gradable notion per se. Compare, for instance, *picture ghost* with *banana plug*. Normally, the idiomatic type

totally depends on two types of complementary knowledges. These are the extra-linguistic knowledge (world knowledge) and specific-domain knowledge (specialized knowledge).

One of the rules that concerns the unidiomatic type is taking the syntactic characterization as a precondition to a correct semantic interpretation process. Thus, it can be said here that nominal compound-interpretation is an interactive process that takes on board both the syntactic and semantic templates of the NC in question (for more details on the characterization of nominal compounds cf. McDonald 1982 & Isabelle 1984).

To achieve this, we adopt here a synthetic approach that can account for two-component NCs viz. Marchand's taxonomizing theory (1969) whose explanatory power stems from the determinant/determinatum dichotomy; on the notion of *headedness* (e.g. Selkirk 1982); on the principle of *percolation* (e.g. Katamba 1993); and on the *Righthand Head Rule* (henceforth RHR) put forward by Di Sciullo & Williams (1987).

1. The Binary Analysis based on Marchand's Model

Marchand's theoretical assumption (1969: 10-13) is that English compounds are created on a determinant/determinatum basis and the reverse of this formula would result in combinations that cannot entertain the status of compounds but rather would be considered lexical phrases. It follows that every compound should be analyzed as containing a *determinant* and *determinatum*. Semantically, the former restricts the latter in semantic range, i.e., in a two-element compound, the *determinatum* represents the "element whose range of applicability is limited by the determinant" (ibid.: 10-13). For instance, in *surface friction* the word *friction* is the element that undergoes a semantic restriction or determination and thus has been called the "determinatum." In other words, the applicability of *surface* is limited to *friction*.

Syntactically, the latter determines the word class of the whole combination, i.e., both concepts are defined as grammatical terms where the determinatum is that element of the syntagma (a morphologically two-word unit coined on the basis of this equation) which is dominant in the sense it can represent the whole syntagma in all positions (ibid: 12). Thus, it can be said that the determinant/ determinatum relation applies both to the semantic and to the syntactic level:

> A *steamboat* is basically a *boat*. But whereas *boat* as an independent unit can be used with reference to an unlimited variety of boats, the applicability of *steamboat* is limited to those, which are provided by steam, excluding those, which are not steamboats. We might say that this exclusion in steamboat of 'non-steamboat' things constitutes the determination of *boat* as performed by the first element *steam*, which has therefore been called the determinant. *Boat*, as the element undergoing a semantic restriction or determination, has been called the determinatum. However, as a syntagma is a grammatical, not a semantic entity, we could say that the terms determinatum and determination should be defined as grammatical terms. Grammatically speaking, the determinatum is that element of the syntagma that is dominant in that it can stand for the whole syntagma in all positions,…(ibid:11).

Accordingly, every syntagma (including complex lexical items) can be subjected to a binary analysis into two immediate parts.

From the grammatical point of view the 'determinatum' is the dominant part, since it is responsible for the word class category of the whole construction and it is linked directly with inflectional morphemes. Semantically, the determinatum can usually stand for the whole structure: thus a *magnetization curve* is basically a *curve* while *curve magnetization* is a *magnetization process*. By the same token, reversing the constituent elements of *resonance curve* and *resonance circuit* would lead to considerable semantic differences. The difference between *oil pressure* vs. *pressure oil; insulation resistance vs. resistance insulation; oil filter vs. filter oil; relaxation oscillator vs. oscillator relaxation; voltage regulation vs. regulation voltage; suspension cord vs. cord suspension* also show the semantic dominance of the determinatum.

On the basis of such a binary analysis, Marchand developed a theory of *type of reference* where he offers an exhaustive description of the types and subtypes of compounds coupled with exemplifications and comments on its historical development. The two-noun compounds *line transformer, gas purifier, noise suppressor, noise eliminator, phase invertor, plug adaptor,* and *pulse generator* (JAAL's), clearly show the importance of the 'determinant/ determinatum' distinction and the explanatory power of the *type of reference*. The elements are nouns in all cases, and the relationship between them is the same, a *causative* one. The first element in each of these examples is regarded as the *cause* and the predominant constituent, i.e., the determinatum.

From this Marchand (ibid: 31-32) goes on to generalize

> That we can explain any morphologic composite grammatically from syntactic relations underlying it in a sentence (it will in the following be called underlying sentence) should be clear…Morphologic composites (= compounds, suffixal derivatives, prefixal combinations) are 'reduced' sentences in substantial, adjectival, or verbal form and as such explainable from 'full' sentences; *washing machine* sb from '(we) wash with the machine', *color-blind* adj. from '(he is) blind with regard to colors', *rewrite* vb from '(we) write again', *stone* vb from '(we) kill with stones'.

The key to an adequate understanding of the relationship between such complex lexical items, seen as reduced syntagmas, and corresponding underlying sentences, i.e., the full syntagmas, lies in Marchand's assumptions that: "one grammatical part of the sentence is taken to be known: the subject, the object, the predicate complement, or the adverbial complement, and it is this part of the sentence that becomes the determinatum of the composite" (Marchand, ibid: 32). As an illustrative example Marchand discusses is that in

> …the sentence 'we eat apples' : each of the grammatical parts is eligible, the subject, the predicate, and the object. The subject (S) type yields apple EATER, the predication (Pr) type apple EATING, the Object (O) type eating APPLE. The name of each type of reference thus indicates which part of the sentence is made the determinatum of the morphological composite (ibid: 32).

Indeed, this scheme of classification is considered the real innovation of Marchand's work. However, Marchand (1969: 45) highlights the heterogeneity of the semantic relations of compounds and in his analysis of noun compounds in particular, for instance, he provides several examples, the following are some of them:

> *Oil well* is similar to oil **producing** well
> *Steamboat* is similar to steamed **powered** boat
> *Garden party* is similar to **we hold** a party in the garden

Heterogeneity in semantic relations across different compounds should not be viewed as a sign of unsystemacity as Marchand hinted. On the contrary, this should be viewed positively as compounds express different conceptual bits that require different semantic relations. Technico-scientific NCs are by no means different as they display a variety of semantic relations between their constitutive components. Observe the examples below (JAAL's) with a special focus on the boldtyped parts in their relevant underlying sentences:

Electron emission:	is the emission **of the** electron
Gamma correction:	is a correction **made by** gamma
Ground wave:	is a wave **sent from** ground
Gas trap:	is a trap **for** gas
Bottle trap:	is a trap **in the shape** of a bottle
Combination fixtures:	are fixtures **used for** combining

The variety of interpretations for such structurally parallel compounds back up the hypothesis that compounding is a process built on and governed by semantic relations. This poses problems in both the classification of compounds and in working out their semantics. To this effect, it should be indicated that the given semantic networks are arbitrarily woven since understanding them often requires the intervention of our own world knowledge.

2. Headedness and Right-hand Head Rule (RHR)

Recent research into the syntactic and morphological head status, inaugurated by Selkirk (1982) and continued by a substantial number of studies in their wake, highlights the central theme *Head* and its immediate importance and relevance to compounding (for more information on heads see Beard 1996, Pustejovsky 1995, Pollard 1994, McDonald 1995, Dikken & Beukema, 1991, Speas 1991, Bauer 1990). Saldler & Arnold (1994: 208) comment that lexical subtrees are right-headed in English, while *headedness* must be defined in a more complicated way for non-lexical/ syntactic constructions. Therefore, *headedness* can be considered one of the most significant notions in the description and characterization of the semantics of compounds.

This is particularly true when we treat two-element NCs as having the head standing for the nucleus of the compound and the non-head constituent as a modifier. The vast majority of English compounds are headed (e.g. *electron emission)*, while those unheaded, usually referred to as *exocentric*, are very restricted in number as in *coder-decoder*. The label *exocentric* is used here to suggest that an *unheaded* NC cannot be reduced to one of its single constituents. Thus, neither *coder* nor *decoder* in the above example can stand for the whole compound as the two elements have equal status. It has been recognized for a long time that headed compounds, which are referred to as *endocentric compounds*, represent a predominant class of compounds with the head normally on the right, while *exocentric compounds* are less in quantity (cf. Lyons 1977, Selkirk 1982, Marchand 1969, Katamba 1993). On such grounds, the semantic argument in English two-element endocentric compounds is the second

constituent, e.g., *code* in *computer code*, since *computer code* is a kind of a *code* (characterizable by its connection to computer), but *computer* in *code computer*, since a *code computer* is a kind of *computer* (one somehow restricted to *code*).

It follows that, from a semantic standpoint, an endocentric compound signifies a sub-grouping within the class of entities that the head denotes. Thus, *interference elimination* is a kind of a elimination, *an input impedance* is a kind of impedance, and a *inductance bridge* is a kind of bridge. The first element here acts as a modifier of the head which determines and identifies the meaning of the head in a more precise manner. Syntactically, the head is the dominant part of the entire compound word. Depending on the notion of headedness, Katamba (1993: 304) classifies compounds according to two criteria:

(i) Whether or not they have a head
(ii) If they have a head,
a. The word class of the head
b. Whether the head appears at the left or at the right of the compound.

Therefore, the role of the head in compounding is the same as in syntax; in syntax the head determines the category and plurality of the phrase, among other things. To this effect, we can take advantage of a general principle, called *Percolation*; the principle by which morphosyntactic feature specifications are transmitted to an expression from its constituents (cf. Lieber 1981, Williams 1981, Kiparsky 1982, & Selkirk 1982 among others). Such a principle requires that the category of a construct and the category of its head be identical. Scholars have often asked which morphological constituent in a word formation rule will bear the phonological marks of inflection? In fact, proponents of *percolation* in morphology claim that morpho-syntactic locus in English is the rightmost element in compounding. In fact this is what others (e.g. Di Sciullo & Williams (1987: 24), Williams (1981: 248) and Katamba (1993: 311) refer to as the RHR.

According to this rule, the head of a morphologically complex word is defined to be the righthand member of that word, e.g. *torsional rigidity*, *deflected tendon*, *flexure stress*. They argue that the category of each compound is determined by the righthand member (e.g. rigidity, tendon, & stress, respectively). Bauer (1983: 30) identifies the 'grammatical head' in endocentric compounds as "the element marked for number, and also, in languages which have grammatical gender, the element that determines the gender of the compound." The use

of percolation to determine the category of the construct in word formation requires that the head for the purposes of morphological percolation be the morphological determinant; the morphological constituent that intuitively 'dominates' its co-constituents and so 'determines' the category of the construct. So, the percolation proposal in morphology uses the notion of *head* that combines the morphosyntactic locus and the morphological determinant.

In the same vein, Katamba (1993: 303) stresses that one of the main properties of the head in a compound is that it assigns its category features to the constituents of which it is the head. The determinant, on the other hand, denotes the criterion for the subdivision of the category. Thus, *tension reinforcement* serves as a pattern for *torsion reinforcement, shear reinforcement, shrinkage reinforcement, main reinforcement, secondary reinforcement, compression reinforcement* and *light diffusion* provides a pattern for *light reflection, light resistance, light transmission*, etc.

Likewise, several subcategories or terminological sets can be created by keeping the head element constant and variously determining it as in *slide switch, , rocker switch, rotary switch, float switch, electronic switch, on-off switch, cut-out switch, cradle switch, manual switch, main switch, key switch, solenoid switch, mercury switch*; or by keeping the non-head element constant and adding different heads as to create subject or operation related sets of terms, e.g. *concrete core, concrete cover, concrete floor, concrete kerb(s), concrete slab; colour amplifier, colour analysis, colour balancing, colour bars, colour broadcast, colour burst, colour coder, colour decoder, colour distortion, colour failure, colour saturation, colour synchronization, colour tilt control, colour-picture tube, colour stability, colour subcarrier, colour signal, colour film, colour filter, colour fringes, colour killer, colour pattern, colour picture, colour television system, colour television camera, colour display tube, colour difference signals*, etc. (for a lengthy discussion on different semantic patterns see Warren 1987 Sager et al. 1980: 268 & Sager 1990).

There are however numerous counter-examples that undermine the percolation proposal. There are still instances in which the morphosyntactic locus and morphological determination do not coincide. *Exocentric* compounds, as indicated above, is a case that violates and undermines this principle, e.g., *four-track* (tape), *three-way* (system), *pulse-position* (modulation), *early-warning* (radar) *expansion-pressure* (cycle), etc. Other sets of exocentric

compounds are verbal phrases such as *fuse into, switch off,* where the left part, the verb, is the head. Again, this category and its subcategories are not of much interest to us here.

On the basis of what has been discussed so far, a working interpreting scheme for binary NCs (i.e. two-component NCs) can be said to work adequately if it rests on Marchand's dichotomy (determinant/determinatum). The principles of headedness and percolation and RHR come into play to consolidate this theory. The principle of *headedness* and the RHR interact and can be integrated with Marchand's equation when they highlight and mark the second component of an NC as the CENTRE of the whole structure; thus emphasizing Marchand's framework which crystallizes the dominance of the determinatum. Percolation, on the other hand, smoothly integrates with Marchnand's equation when it puts maximum emphasis on the rightmost element of an NC to be the recipient of all inflections and the holder of the structure's class, i.e. it gives the rightmost element, which linearly can be predicted to be the second, a central position. Incorporating such an insightful, integrated scheme in the analysis of NCs is a pre-step to the paraphrasing process which is bound to reveal all covert syntactic and semantic relationships. So, paraphrasing should not be carried out prior to subjecting the NC in question to this multi-faceted scheme.

To spell out the limitations of the afore-mentioned scheme, it can be said that this scheme is exclusively applicable to two-element NCs. It indeed falls short of handling multi-element NCs. In other words, Marchand never questioned multi-element compounds and so his binary approach can be modified. Three techniques can be suggested here to resolve the problem of interpreting multi-element compounds. In order of importance, these are *syntactic recovery, slicing* & *pairing,* and *building up or constructing patterns (i.e. productivity of patterns).* The interpreter (in the sense of anyone involving himself/herself in analyzing compounds) can at his/her discretion employ either one or the three in one go. Let us illustrate these techniques one by one with some examples.

Syntactic recovery, that is the first suggested technique, involves recovering the NC's underlying structure above the phrase level and/or the genitive construct level. It is useful before proceeding to briefly explain what is meant by phrase/genitive level interpretation. A phrase-level recovery is here used to indicate a rephrasing of the underlying structure of an NC using exclusively its constituent elements and relevant genitive particle(s), e.g. *colour televsion system* 'system of colour telvsion'; *on-off switch* 'switch for switching on or off';

sound transmission test ' a test of sound transmisson'; *finite-difference method* 'a method for finite difference'; and *thermal shock resistance test* 'a test of thermal shock resistance'. Syntactic recovery however takes the interpretation process a step further as it concerns itself with providing a full underlying structure that amounts to a sentence or clause level. Accordingly, the following NCs can be syntactically recovered as follows:

colour television system 'a system designed specifically for colorful televsions'
on-off switch 'a switch that can be used for both switching on and off'
sound transmission test 'a test that can measure the trasnmission of sounds'
finite-difference method 'a method that is exclusively used for finite differences'
thermal shock resistance test 'a test to measure the resistance of thermal shocks'

It should be indicated that this technique was used by Marchand under the label 'underlying structure' to analyze specifically two-element compounds. However, *syntactic recovery* applies to both short and long compounds and also ventures much further beyond the basic phrase level interpretaion. In other terms, recovering syntactic structures along these lines can be considered an extension of Marchand's basic underlying structure paraphrasing.

The second strategy is *slicing & pairing* whereby the compound is broken down into pairs. The linear progression in slicing the NC here starts from the leftmost element and ends up with the rightmost element. On this basis, any long NC can be viewed as a compound embbeding (a) compound(s), as each pair constitutes a compound within the whole NC. Let us illustarte how an NC can be anlayzed according to this method: for instance, the NC *heat-resisting flat plate glass* can be dissected into pairs: *heat-resisting*, *flat plate* and *glass*. Now after that each of the pairs can be easily analyzed in terms of modification or by implementing Marchand's equation (determinant/determinatum). Thus, *heat-resisting* can be analyzed as 'resisting heat'; *flat plate* as 'a plate that is flat'; and glass as the *head*. Thus the sub-compound *heat-resisting* is a premodifier for the sub-compound *flat plate* which itself premodifies the the head *glass*.

By the same token, the NC *capacitor start induction run motor* can be broken down into *capacitor start*, *induction run*, and *motor*. In the next step, the first pair *capacitor start* should be dealt with as one semantic unit that premodifies the subsequent pair *induction run* which, in turn, functions in the same way as a premodifier for the mostright element *motor*, the head. It is clear now that we decompose in order to compose; that is we decompose the complex

meaning in order to bulid it up again. It is crucial to point out here that, similar to the previous method, the *slicing & pairing* tecnhique can be said to employ Marchand's binary analysis after slicing the NC under analysis into pairs. In the subsequent stage Marchand's binary analysis ignores connecting the adjacent pairs within a compound. Thus, this technique comes to utilize the binary analysis at a certain stage then it goes beyond that to account for linking the compound *pairs*.

The third technique *building up or constructing patterns (i.e. productivity of patterns)* is the less reliable one and so it is by no means a rigid startegy as such. However, this can be a supplementary technique that can be recoursed to if the situation calls for. This technique is virtually concerned with predicting and specifying the head element on the basis of frequency of occurrence of words in the language. For example, the second component in the NCs *torsion reinforcement*, *solenoid switch*, *flexture stress*, and *inductance bridge*, can be predicted to be more frequent than those occuring in the intial position and so they are more likey to function as head elements rather than postmodifiers. Likewise, in *surface spread flame test* we can predict that the words *surface*, *spread*, and *flame* are less frequent than *test* and so the latter should be regarded as the head; and in *Portland blast furnace slag cement*, we can assertedly claim that *Portland* and *slag* are the least frequent elements, though one can argue that the latter (i.e. slag) is a frequent element. In fact, this argument may hold true in informal contexts and registers but it cannot be so in formal ones. *Blast* appears to be more frequent than *furnace* and *cement* seems to be the the most frequent element which should be nominated to occupy the head position while the rest of elements should be relegated to a premodification position.

Conclusion

This paper has reviewed the notion of English nominal compounding and through analyzing different technical and scientific examples, it exposed a bundle of multifarious difficulties and problems associated with interpreting some English technico-scientific lexicalized NCs arabicized by JAAL. All NCs have been dealt with compositionally and this necessitated developing a synthetic interpretation approach that can be applied exclusively to two-element NCs. This approach was grounded on Marchand's (1969) dichotomy of determinant/determinatum; the principle of headedness; the principle of percolation; and the

RHR proposed by Selkirk 1982 & Katamba 1993, among others. Within this approach, we showed how these theoretical pillars can be linked to each other so that they interact and be integrated into a synthetic scheme. In investigating technico-scientific NCs the main focus was on the endocentric type whereas the exocentric one was excluded as the latter type violates the selected linguistic principles.

Building upon four available models for interpreting two-element NCs, the synthetic approach proposed in this paper suggests three techniques viz. *syntactic recovery, slicing & pairing,* ***building up or constructing patterns (i.e. productivity of patterns)*** for interpreting multi-element NCs**.** The first of these is *syntactic recovery* which is bound to extend beyond basic phrasal/genitive construct level interpretation and to extend Marchand's basic underlying structure paraphrasing. It amounts to provide a more exhaustive interpretation at the sentential or clause level. The second is *slicing & pairing* which is concerned with splitting the NC up into pairs, each of which is composed of a head and a modifier, then these pairs are linked up as to rebuild the NC's complex meaning properly. The third technique that is the less reliable one is ***building up or constructing patterns (i.e. productivity of patterns)*** which sort out the head element and the premodifying elements on the basis of the principle of frequency of occurrence of constituent ingredients of the NC in question. The most frequent element is predicted to be the head or locus and the rest of elements are relegated to an inferior position of premodification. Indeed, this paper showed that NCs interpretation is not an ad-hoc move rather it is a systematized way that consisted of a series of interacting theoretical pillars that were assimilated to yield convenient, synthetic interpreting approaches and/or schemes

Finally, this paper has not addressed the interpretation of technico-scientific NCs in terms of their relevant contexts; rather it addressed the notion from a decontextualized syntactic-semantic perspective. The approach described here may be integrated with further aspects to narrow down the range of interpretations. Sentential and discursive context constitutes one important aspect that can help pinpoint the most relevant interpretation of any given compound within this class.

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