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COMPOSITIONALITY AND NON-COMPOSITIONALITY IN MORPHOLOGY.

> "Quand on lit Bopp et son école, on en arriverait à croire que les Grecs avaient apporté avec eux, depuis un temps infini, un bagage de racines, thèmes et suffixes, et qu'au lieu de se servir des mots pour parler, ils s'occupaient de les confectionner."
> (F. DE SAUSSURE, Morphologie. In: R. GODEL (ed.), A Geneva School Reader in Linguistics. Bloomington/London: Indiana University Press. 1969, p. 29)

1. *Introduction.* *

The debate about compositionality vs. non-compositionality remains one of the central issues in contemporary psycholinguistic research, as well as in linguistics proper. As is well-known, defenders of the first position hold that the mental lexicon consists of sublexical units (morphemes), which have to be combined according to appropriate phonological and morphological rules. This process occurs both in production and in comprehension: thus, speakers make use of both compositional and decompositional procedures. [1] By contrast,

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1 This statement is less obvious than it might at first glance appear. Although most scholars would agree that production and comprehension activate the same lexicon, we cannot rule out the possibility that these two procedures exploit different mental storages, or at least follow alternative paths. For instance, it is not inconceivable that there be more compositionality in comprehension than in production. Unfortunately, when we look at the available evidence, we find no way to establish a direct connection link these two perspectives, because production is mostly taken into account by inguistics, while comprehension is mostly dealt with by psycholinguistics. Neurolinguistic data concern both sides, but due to the intricate nature of the object of research, it is very difficult to draw inferences from the one to the other.

Although I am aware of these complications, I shall make the reasonable assumption, on which most scholars would agree, that there is a single mental lexicon. As to the possibility that production and comprehension activate alternative processing paths, I have no specific proposal. It is a fact, however, that psycholinguists often tend to interpret the hints at compositionality gathered in their research w.r.t. the analogous assumptions put forth within the prevailing linguistic model (the generative one). Thus,

proponents of the alternative position hold that words are stored as whole units, and are directly accessed as such.

Actually, the latter view has almost never been proposed in its most radical form (but see BUTTERWORTH [1983]). Thus, the real difference, w.r.t. the alternative view, lies in the fact that the compositional strategy is simply considered to be one possibility for accessing the lexicon, rather than the almost exclusive solution. What is really at issue, therefore, is the fixation of the boundary between compositional and non-compositional procedures. Indeed, it is reasonable to assume that at least some access procedures ought to be compositional, i.e. guided by rule.[2] However, there also seems to be massive experimental and clinical evidence that not all words are accessed compositionally. And this, of course, raises an interesting problem, because it suggests that there may be a fundamental mismatch between a linguistic and a psycholinguistic approach w.r.t. the identification of morphemic components. A word may be morphologically complex from the linguistic (diachronical) point of view, while being synchronically accessed as a monomorphemic entity. This observation is explicitly put forth by MARSLEN-WILSON et al. (1994).

In this paper, I consider the problem from the standpoint of theoretical morphology, basing my discussion on the results obtained by psycho- and neurolinguistics. In particular, I consider the diverging requirements that are

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although there is no ultimate proof that production and comprehension are just the reverse of one another, this hypothesis seems often to be implicitly made. It is precisely this hypothesis that is addressed here.

2 Here again a qualification is in order. It is not the case that compositionality necessarily involves rules; in fact, in § 5 I shall discuss the alternative path of analogical processing. However, it is a fact that whenever psycholinguists appeal to the generative model as a possible parallel in the linguistic domain, they implicitly commit themselves to the idea that this process is rule-governed. Thus, although there might be some oversimplification in my position, I do not think it severely misrepresents the facts. Obviously, given what I said in fn.1, one cannot exclude the possibility that rules are called for in production (the domain considered by generative linguistics), while some alternative processing is activated in comprehension. However, I have not found explicit claims of this sort. In general, my impression is that psycholinguists are usually quite vague (and, I believe, for good reasons) as to the actual format of the processing component. In any case, even if the strong link that I posit in this paper between compositionality and rules were rejected by some readers, the general issue addressed here (compositionality vs. non-compositionality) would still retain its relevance.

imposed on lexical access procedures by the main morphological components (cf. inflection vs. derivation) and parameters (cf. frequent vs. non-frequent words, productive vs. non-productive processes, etc.). In addition, an attempt will be made to relate these components and parameters to the varying typological properties of natural languages, showing that the precise location of the boundary between compositionality and non-compositionality may be relative to any specific language type, rather than fixed for all languages.

The paper is organized as follows. First, I briefly recall the main components and parameters within the phono-morphological domain, outlining their relevance to the present issue. Subsequently, I review some of the available experimental and clinical evidence, which yields useful indications as to the location of the boundary between compositional and non-compositional procedures. Finally, I try to relate these findings to the typological properties of natural languages.

2. *Relevant components and parameters.*

As is well-known, the main components within the morphological domain are, inflection, derivation and composition. Here, I shall disregard the last one, although there is a growing mass of studies devoted to it. As to the first two components, the fundamental difference between them may be stated in the following way (cf. SCALISE [1988], DRESSLER [1989], PLANK [1991] and WURZEL [in press] for more articulated discussion). Inflection deals mostly with morphosyntactic structure, and tends to be relatively regular and productive. Derivation, on the other hand, does not interfere directly with syntax or, to the extent that it does, it mostly takes care of paradigmatic relations within the hierarchical structure of the sentence, rather than syntagmatic ones, e.g. ensuring that the right part of speech is selected (e.g. *persuasion* instead of *persuade* or *persuasive*). In addition, derivation is much more idiosyncratic in character, and presents several accidental gaps, since not all permissible suffixes may be attached to a given root. For instance, we have *arrival*, but not *arrivement* or *arrivation*. Finally, the semantic relation between root and derived words is often unpredictable (e.g. *emerge* / *emergency*).

The latter point brings about the parameter of 'transparence' (vs. 'opacity'). There is however an additional complication, because a morphologically complex word may be opaque on two different counts: (a) in the semantic dimension (cf. again *emergency*); and (b) in the formal, or morphophonological, one (cf. *destroy / destruction* as compared to *accept / acceptance*). [3] Note that the dichotomy 'transparence vs. opacity' must not be confused with 'regularity vs. irregularity', which constitutes an independent parameter: e.g. the pair *emerge / emergency* is semantically opaque but regular, just as the pair *serene / serenity* is formally opaque and regular. The same applies to the relation that the parameter 'regularity' holds w.r.t. other parameters, such as 'productivity' and 'frequency'. A morphologically complex word may be perfectly regular but non-frequent (e.g. most scientific derived words), regular but not (any more) productive (e.g. *arrival*), or productive but not particularly frequent (e.g. the formations with *-eggiare* in Italian, which may produce a verb from any noun, yet are not as frequent as those in *-(V)zione*). The same applies again to the relations holding between (semantic and/or morphophonological) transparence on the one hand, and productivity or frequency on the other.

Thus, the picture emerging from this multifarious interplay of parameters is fairly complex. But there is more than that. Each of the above-mentioned parameters presents a wide range of variations. This is intuitively obvious with frequency and productivity, but also, although it might be more difficult to find a proper way to measure it, with transparence and regularity. For instance, as to morphophonological transparence, note that the relation between *destroy / destruction* is more opaque than that between *serene / serenity.* As to regularity, consider the case of such subregularities as the velar insertions present in some Italian and Spanish verbs (e.g. It. *venire / vengo* "to come / I come"). [4] Clearly, these cases are less regular than others, yet they are not altogether irregular, for they cover a relatively well-defined portion of the

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3 DRESSLER [1985b] speaks in this context of 'morphotactic' transparence.

4 MAIDEN [1992], discussing these subregularities w.r.t. the verbal paradigm of Italian and Spanish, observes that although they are based on an arbitrary pattern of allomorphy, their replication in a number of verbs has produced some kind of paradigmatic coherence.

verbal lexicon. Thus, in these cases we have a gradient, rather than a simple dichotomy, as might be expected. But even the dichotomy 'inflection / derivation' is not completely abrupt, for there are intermediate cases. For instance, although diminutives belong to derivation, they may share a number of properties with inflection (e.g., they do not change the word class, and in some languages may be fairly productive and regular).

Summing up, the general picture is quite variegated, so that if we consider all these factors [5] (and their variations), it becomes evident that the compositionality hypothesis, typically advanced by generative phonology, embraces a number of non-trivial assumptions. Among these, a major role is played by the assumption that decomposing a morphologically complex word always involves the retrieval of the root, i.e. the morpheme which related words have in common (hence the term 'morpheme-invariance hypothesis'). This might *prima facie* appear quite natural, considering that this hypothesis is ultimately based on the kind of knowledge that linguists have accumulated over the course of time. However, this assumption puts severe constraints on the cognitive operations performed by the speakers, for it implies that not only regular and transparent words, based on productive morphological processes, but any word (provided it is not a mere product of suppletion) should be stored in decomposed form in the mental lexicon. Although this position is perfectly legitimate, it should be clear that it cannot be accepted without careful scrutiny. Contemporary neuro- and psycholinguistics have often entertained this task; in the next section, I review some of the main findings. [6]

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5 From now on, I shall simply use the term 'factors', commonly used in the psycholinguistic literature, instead of the cumbersome locution 'components and parameters'.

6 Before coming to that, I would however put forth a caveat. Although neuro-psycholinguistic studies have the merit of collecting experimental data on this hot issue, one must be careful when assembling the results obtained. Let me provide an example concerning the notion of regularity. In their study of the nominal declension in Serbo-Croatian, FELDMAN & FOWLER [1987] call "regular alternations" the pattern of morphophonological alterations which are to be observed in the case declension of some nouns, whereas LUKATELA et al. [1987] speak plainly of "irregularities" w.r.t. the same phenomena. I believe the position of Feldman and Fowler to be more correct, inasmuch as we have to do more with subregularities than with truly irregular forms. But the point is that, by calling the same thing different names, we might run the risk of referring the experimental results to diverging categories (regularity vs. irregularity).

3. *Clinical and experimental evidence.*

I shall now try to survey the available evidence impinging on the various factors mentioned above, i.e. frequency, inflection / derivation, transparence, productivity, and regularity. I shall examine them in this order. It should be noted, though, that these factors interact in intricate ways in the experimental data, so that it is not always possible to disentangle one from the other. A certain amount of simplification will be inevitable. Besides, as we have just seen, most of these factors (with the possible exception of the pair 'inflection / derivation') are gradient phenomena. Future research will have to find out whether there exist definable thresholds, beyond which a given factor determines crucial consequences (e.g. a level of opacity beyond which it becomes uneconomical for the processing system to decompose a word into morphemes).

3.1. *Frequency.*

There is massive experimental evidence that frequency is a very powerful factor in lexical access. Frequent words are accessed faster than non-frequent ones. More specifically, it has been claimed that frequent words may be fully listed in the mental lexicon, in contrast to non-frequent ones which need to undergo morphological analysis [CARAMAZZA et al. 1988; STEMBERGER & MACWHINNEY 1988]. With special regard to derivation, it has been remarked that although in some cases (namely, with highly transparent and productive affixes) the frequency of the root seems to have an effect, there also exist cases where it is rather the frequency of the whole-word that plays a decisive role [BURANI & CARAMAZZA 1987]. The latter finding suggests that, at least under certain conditions, derived words seem to be accessed non-compositionally.

As to affix-frequency, i.e. the cumulative frequency of the lexical entries presenting a given affix, LAUDANNA et al. [in press] and LAUDANNA & BURANI [1994] have shown, w.r.t. Italian prefixation, that the orthographic confusability of a given prefix (i.e. the number of times that it appears as such, in contrast to a homophonous string of phonemes), is a much more powerful predictor of subjects' behaviour in lexical decision tasks than the affix-frequency datum.

In any case, it should be noted that frequency (whatever it is referred to: whole-word, root, or affix) interacts with all the other factors under scrutiny here. Thus, it is quite possible that, e.g., the role of frequency is not the same with inflected and derived words. As far as I know, the differential impact of this factor on the remaining ones has not yet been systematically assessed.

3.2. *Inflection / derivation.*

This issue has been repeatedly addressed, in both clinical and experimental research. From the former, we know that there are deficits which differentially affect these two components [TYLER & COBB 1987; DE BLESER & BEYER 1988; MICELI & CARAMAZZA 1988; TYLER 1992]. There is also abundant evidence to the same effect stemming from speech-error corpora [STEMBERGER 1986; MAGNO-CALDOGNETTO & TONELLI 1989], although the interpretation is less straightforward. The predominance of errors affecting inflectional affixes over those affecting derivational ones may be enhanced by morphosyntactic restoration, which propagates the inflectional error once it has occurred in one point of the sentence. In any case, the differential status of inflection and derivation has also been assessed in priming experiments using Serbo-Croatian [FELDMAN 1991] and Italian materials [LAUDANNA et al. 1992], and in lexical decision tasks based on Finnish materials [NIEMI et al., in press]. Specifically, it has been found that the priming of the root is stronger with inflected than with derived words. The converging evidence assembled in these disparate domains invites us to take the contrast between inflection and derivation as quite a robust datum, despite conflicting findings yielded by other studies (cf. e.g. FOWLER et al. [1985] and BURANI & LAUDANNA [1988])

3.3. *Transparence.*

This factor has often been addressed, in experimental research, in a rather indirect way. In fact, formal opacity is often confounded with irregularity, although the two notions do not coincide, as we saw above.

Semantic transparence has long been neglected, although it has recently been given a prominent role by MARSLEN-WILSON et al. (1994). According to their findings, this factor appears to be the major reason for the preservation of an internal morphological structure in derived words. The implications are far-

reaching. First, semantically opaque words (i.e., words synchronically perceived as such) seem to be accessed as monomorphemic entities. Second, there may be some intersubjective variability, for not all speakers have the same degree of metalinguistic knowledge. [7]

As to formal transparence, this is clearly hinted at in the distinction between neutral and non-neutral suffixes, used in the psycholinguistic literature w.r.t. English, where neutral (or transparent) suffixes coincide, to a great extent, with the Germanic formatives (e.g. *-ness*), while non-neutral suffixes tend to belong to the Romance heritage (e.g. *-ity*). TYLER & NAGY [1989] show, in a developmental study comparing various age groups, that there is a stage of hypergeneralization, at which children tend to accept all sorts of formations based on neutral suffixes. By the age of 14, however, the overwhelming majority of the subjects has learned the border between existing and non-existing words, irrespective of the type of suffix. This shows that there comes a stage at which children learn to deactivate the process of unrestricted lexical creation (an obvious hint of compositionality), and apparently access only words that they know to exist. This does not necessarily imply that they refrain entirely from using compositional strategies; however, there are abundant reasons to suppose that they abandon these strategies at least with non-neutral affixes.

Other studies relevant to this issue are those by STANNERS et al. [1979] and BRADLEY [1979], where the different behaviour of totally transparent and partly opaque derived words is observed. TYLER et al. [1993], on the other hand, find such a difference only when formal and semantic opacity add to each other, while FOWLER et al. [1985] do not find a statistical contrast, and [NIEMI et al., in press] find a rather elusive effect of morphophonological complexity. Yet, despite some conflicting findings, it seems fair to say that formal transparence does play a role. Interestingly, this seems to agree with

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7 Semantic transparence turns out to be a relevant factor also in compounds, and it is worth noting that they present evidence of morphological compositionality even when semantic transparence is only partial [Zwitserlood 1994]. However, compounds present specific properties as compared to both derived and inflected words. For lack of space, I shall not consider them here.

some neurolinguistic evidence [MIRANDA 1990], suggesting that the opacity of the morpheme-boundary affects the behaviour of aphasic patients. [8]

3.4. *Productivity*.

There are obvious difficulties in addressing this factor, so intertwined as it is with frequency and regularity. This explains the scarcity of data. A pilot study performed by BURANI & THORNTON [1992] suggests that productivity may play a role. More research on this topic is obviously needed.

3.5. *Regularity.*

We know much more about regularity, despite the less than clear definition of the intermediate cases, i.e. the various sorts of subregularities existing in highly inflected languages (cf. fn. 5). First, we know from a number of acquisition studies that only regular affixes are overapplied in an early phase (cf. e.g. PERRONI-SIMÕES & STOEL-GAMMON [1979]; LO DUCA [1990]). We also know that semi-irregular verbs in Spanish, and to an even larger extent irregular verbs in English, lend themselves quite poorly to rule-governed processes [BYBEE & PARDO 1981; BYBEE & MODER 1983]. The same applies to some fairly common word-formation processes of English and Polish [DZIUBALSKA-KOLACZYK 1992; MALICKA-KLEPARSKA 1992]. In all these cases, people do not seem to be able to consistently apply to new materials the rules hypothesized by generative analyses, to deal with simple morphological operations. And when put under time pressure while producing the past tense of English irregular verbs, speakers may even make mistakes which can only be explained by assuming that they have directly accessed (i.e. in a non-compositional way) an independently existing form, corresponding to a phonetically similar verb [BYBEE & SLOBIN 1982].

As is well-known, the English past tense issue is a recurrent topic in connectionist simulations, aiming at showing that speakers' behaviour is not

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8 Opacity constitutes also a challenge to poor readers. FOWLER & LIBERMAN [in press] note that American dyslexic subjects meet severe difficulties in a task consisting of retrieving the base form of opaque derived words. It is hard to say, however, whether this is due to a diminished morphological competence, or whether the latter is a consequence of the limited reading skill, which reduces the total experience of the lexicon. As is well-known, English spelling is very informative w. r. t. the morphological relatedness of words, even when phonology tends to obliterate it.

based on rules, but on something reminiscent of what traditional linguists used to call 'analogical processes' [cf. e.g. RUMELHART & MCCLELLAND 1987]. Significantly, the latest simulations suggest that there is a sharp difference between regular and irregular verbs: in dealing with the latter, an analogical procedure seems much more adequate [PRASADA & PINKER 1993]. [9] In § 5 below I return to the issue of analogy. Here, I would like to observe that, even in the domain of psycholinguistic experimentation, most available sources suggest that irregular forms are stored as such in the mental lexicon, in contrast to regular ones, which may be rule-generated [e.g. KEMPLEY & MORTON 1982]. Some sources claim that this is also true for Serbo-Croatian semi-irregular forms [LUKATELA et al. 1987], although there are conflicting data proposed by other scholars [FELDMAN & FOWLER 1987]. [10] Other sources even state that high-frequency regularly inflected forms are directly accessed [STEMBERGER & MACWHINNEY 1988].

Presumably, these results are not incompatible with one another. Forms which are susceptible to being rule-governed may also, if sufficiently frequent, be recognized as unanalyzed units. On the whole, however, there is good evidence that truly irregular forms are unlikely to be rule-governed.

3.6. *Provisional conclusion.*

Summing up the discussion in this section, it seems rather clear, at least to those who consider experimental investigation a substantial source of knowledge, that a model crucially based on the across-the-board application of compositional rules, such as the generative model in its various versions, fares less than optimally in this connection. Indeed, the available evidence seems to indicate the following:

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9 MACWHINNEY [1993] makes the interesting observation that there seems to be a growing convergence between connectionist and (so-called) symbolic approaches. I take this to imply that researchers are more and more convinced that the best simulations are achieved through a combination of rule-driven and analogical processes.

10 This seems to emerge also in clinical studies concerning other sorts of subregularities. JAREMA & KEHAVIA [1992] observe that French agrammatic aphasics show clear signs of independent access of the two bases of verbs such as *vendre* and *dormir*, in which the three singular persons of Present Indicative exhibit a different basis w.r.t. to the other persons of the same tense, as well as w.r.t. the other tenses.

a) derived forms are less likely to be rule-governed than inflected ones;
b) non-productive forms are less likely to be rule-governed than productive ones;
c) formally and semantically opaque forms are unlikely to be rule-governed, whereas transparent ones may be;
d) irregular forms are unlikely to be rule-governed, whereas regular ones may be;
e) non-frequent forms are more likely to be rule-governed than frequent ones.

This set of claims seems to legitimize a possible solution to the puzzle of compositionality vs. non-compositionality, according to which the borderline between these two procedures is relativized to the various factors which play a role in the morphological domain. However, it must be stressed that the formulations given above under (a-e) show that we are still at the stage of predictions, rather than at the stage of conclusive statements. There are at least two reasons for this. First, the outcome of psycholinguistic experimentation is often open to conflicting interpretations. Second, the bare dichotomy rule-governed processes (i.e. compositionality) vs. full-listing of forms (i.e. non-compositionality) looks too simplistic. There exist in principle different strategies which may be followed when accessing words in a compositional manner.

In the following two sections I shall provide some arguments concerning the two points raised here.

4. *Unresolved problems in experimental research.*

The most promising results obtained in the domain of experimental studies are based on the lexical decision paradigm, often combined with priming. However, despite the large amount of data that has been accumulated, a number of important questions still remain open.

Take, for instance, the issue of 'inflection / derivation'. In the great majority of languages, the almost exclusive device for producing inflection and derivation is affixing. However, there is a major difference between these two cases for, often, derived forms typically imply a displacement of stress

with respect to the base, while this does not ordinarily happen with inflected words. [11] On the face of this, the evidence accumulated in psycholinguistic experiments, w.r.t. the contrast between inflection and derivation (cf. § 3.2), is less than decisive. Fortunately, FELDMAN's [1991] work on Serbo-Croatian has demonstrated that the contrast between inflection and derivation may persist even when these structural differences are neutralized. Serbo-Croatian allows for a kind of contrast between base and derived forms, consisting in vowel alternations without stress shift (cf. *nosim / nosam* "I carry", perfective / imperfective respectively), which is seldom observed in English (cf. *pride / proud*). Thus, there exists at least one language for which the contrast inflection / derivation has possibly been assessed on firm grounds. However, it is fair to admit that this demonstration works only for languages such as Serbo-Croatian (Russian would be another example). As to the others, some caution should be adopted: what looks like a contrast between inflection and derivation might in fact depend also on some other structural factor.

Another case in point is the so-called 'satellite' model, first proposed by G. LUKATELA (once more for Serbo-Croatian), in which the nominative singular has been found to enjoy a privileged status with respect to the remaining declensional cases, both singular and plural. According to one version of this model, one may hypothesize that the nominative singular of non-derived words is the kernel of a constellation, so that the remaining inflections are necessarily linked to it. Moreover, if we assume there to be a contrast between inflection and derivation, then we may also view all forms derived from the base as linked to it, besides being themselves the kernel of their own declensional paradigm. This conception enables us to build a coherent modeling of a great deal of the existing experimental findings. In particular, it may be interpreted in the sense that inflections are obtained by rule from the base form, while derived words are directly accessed, being merely associated to the base form by means of formal and semantic links.

Now, however attractive this model may appear, one should not overlook a fundamental weakness that it embodies. The advantage of the

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11 A notable exception is Russian, where the difference between singular and plural may depend on stress location.

nominative singular w.r.t. the other inflected forms might simply depend on the fact that this case is the citation form of the word, so that it does not require a syntactic context in order to facilitate lexical retrieval. [12] In fact, when the appropriate syntactic priming is provided, the other inflected forms may prove to be almost equally fast as the nominative singular (cf. KATZ et al. [in press], and GÜNTHER [1988]; the latter scholar extends the comparison beyond the nominal domain, considering also the relation between the infinitive and some finite forms of the verb). [13]

Clearly, experimental investigation is often open to alternative interpretations, due to the diverging results obtained by different scholars. [14] One way to make sense of the difficulty relating to the dichotomy 'inflection / derivation' is the adoption of 'dual' models, based on the idea that words may be accessed both compositionally and non-compositionally, depending on their properties and on the particular situation. This solution has notably been adopted by A. CARAMAZZA in his 'Augmented Address Model', or (in an

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12 The advantage of the citation form has also been assessed by BURANI [1992] in a recall experiment on Italian adjectives.

13 In this context, we must also consider the study by KOSTIC [1991], which is relevant for two reasons. First, it failed to replicate LUKATELA's findings concerning the preeminence of the nominative singular. Second, it suggests that a better predictor of subjects' responses is a model which combines two numerical indexes. The first one is the frequency of each case inflection. Note that this varies from paradigm to paradigm, due to the different amount of homonymy to be observed in each (e.g., although genitive and dative are normally distinguished, they may formally converge in some particular paradigm). The second index is the number of syntactic constructions in which any given morphological case may participate, disregarding the degree of homonymy that may characterize some of the forms that manifest it. By combining these two indices, KOSTIC manages to provide what seems to be a fairly exact account of the different access latencies for the various inflectional terminations. If this model receives confirmation, it may prove to be a valid alternative to LUKATELA's one. Note, though, that this model does not make any prediction as to the dichotomy 'inflection / derivation'.

14 Although this belongs to the very nature of experimentation, this fact is often invoked by opponents of experimental methods to support their own views. However, I believe this position to be wrong. The nice thing about experimentation is that, if sufficiently explicit, it enables further control of the results, and eventually, through patient and careful replication, a clarification of the controversies. Regrettably, a similar degree of falsifiability is not always to be found in theoretical works. My position, at any rate, is that experimental and theoretical research complement each other. Both have merits and limits. A judicious combination of both approaches appears to me as the most promising path for research in linguistics.

altogether different theoretical framework) by connectionists such as J. STEMBERGER.[15] According to these views, any morphologically complex word has both paths at its disposal, and the output of the access procedure is provided by the one of the two which happens to be most suited to the case given.

Yet again there are at least two ways to understand the logic of dual models. One is to say that any word is potentially accessed in a compositional fashion, unless particular conditions occur which render the alternative procedure more economical (such as high frequency, irregularity, or opacity). Thus, according to the first view, the compositional path is always activated, although it may not always prove to be the most effective strategy. The second interpretation consists of saying that although both access procedures are actually used by the speakers, in normal situations only one of them is activated by any given word, depending on its properties. For instance, although derived words are supposedly accessed directly, rather than via their base forms, there may be situations in which a compositional strategy is preferred (e.g. neologisms). The problem here is that it is very difficult to make a choice between these two positions, which attempt at combining the merits of compositionality and non-compositionality. Consider the evidence stemming from patients with acquired dyslexia and dysgraphia, who apparently use their decomposition capacity as a rescue strategy in order to overcome their difficulties, although they tend to do so only with semantically transparent morphological cognates [BURANI & LAUDANNA 1993]. Advocates of the first view may take this as a valid piece of evidence in support of their model. However, such pathological behaviours do not necessarily reflect the behaviour of normal subjects'. And if this is so, then even the evidence stemming from aphasic patients turns out to be less than compelling. For instance, BADECKER [in press] shows that some aphasics evidently make use of compositional strategies; but, once again, it cannot be excluded that these subjects exploit these strategies more than normal subjects would, in order to compensate for their impairment. Once we admit, as all available evidence

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15 A dual model is endorsed also by SCHRIEFERS et al. [1991], among others.

suggests, that people have rescue strategies at their disposal, the real issue becomes: What do people do in normal circumstances?

Thus, despite the obvious merits of experimental psycholinguistic research, we ought to admit that, at the present stage, the answers it can provide to the issue discussed here are not conclusive. And note, in the same line of reasoning, that a further caveat might be put forth. There also exists the possibility that the intimations of compositionality, deriving from the experimental literature, over-represent the actual situation. Namely, it is possible that the very presence of an experimental setting, in which lists of morphologically related words are presented, produces a much sharper shift towards compositionality than would otherwise be the case in normal conditions. In fact, it has long been known that a simple variation in the composition of the experimental lists may have a major impact on the results. For instance, RUBIN et al. [1979] show that the 'affix-stripping' effect found by TAFT [1979] disappears as soon as the number of affixed words in the test list is appropriately reduced. [16] Similarly, BURANI & CARAMAZZA [1987] criticize BRADLEY [1979], who claims that root frequency prevails over whole-word frequency in derived forms, by showing that a more careful construction of the experimental lists points towards the reverse. Now, if subjects are so sensitive to the structure of the experiment, there is good reason to suppose that they are also sensitive to the experimental situation as such. And since the experiments are designed in order to test their morphological competence, it is quite possible that the latter is awakened to an unusual degree, just as it is unusually awakened by the encounter of neologisms, rare words, or nonce words with true morphological affixes.

To sum up the argument developed in this section, we may observe that experimental psycholinguistic investigation is somehow caught, with respect to the present issue, in a paradoxical situation. On the one hand, it may have over-emphasized the difference between inflection and derivation, providing somewhat spurious evidence of a sharp divide between compositional and non-

16 This finding has been subsequently replicated by GÜNTHER [1987]. By 'affix-stripping', we mean a decompositional procedure, according to which morphological affixes are first detached from the word, in order to recover the root, which preserves the fundamental semantic identity and serves as the main vehicle for lexical access.

compositional strategies (cf. the beginning of this section). Hence, although compositional strategies are most suitable to inflection, they may ultimately prove to be also valid for derivation. On the other hand, however, the hints towards compositionality may have been over-stated by the very usage of experimental procedures.

A careful rethinking of the whole issue seems highly desirable. And indeed some recent findings might be inducive to this. If, as suggested by MARSLEN-WILSON et al. (1994), semantic transparence is such a major factor in lexical access, then a great deal of the existing data should be reconsidered. It might be the case that some results, previously imputed e.g. to the 'inflection / derivation' dichotomy, might have been biased by the contingent (and uncontrolled for) distribution of transparent and opaque forms in the experimental materials. The contradictory outcome obtained so far might find an explanation along these lines.

5. *Analogical processes vs. rules.*

Any theory, even the most hostile to the notion of on-line rule-governed processes, must allow for the extemporaneous creation of new forms. This is indeed what we observe in neologisms, or in our capacity to understand rare words. Thus, any theory must take compositional strategies into consideration. However, as already noted above, this does not mean that rules are the only way to achieve that result: speakers may also have available the alternative strategy of 'analogical processes'.

It is interesting to note that while this notion has been extensively referred to in the psycholinguistic literature, it had until recently virtually disappeared from linguistic discussions. SKOUSEN [1989; 1992] deserves the credit of having revived the issue, trying to provide a theoretical assessment of what used to be considered a highly unformalizable phenomenon. [17]

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17 The importance of analogical processes in the phono-morphological domain has been stressed also by DERWING [1990], OHALA [1992] and ASKE [1992]. Advocates of rule-governed strategies often claim that these are typically at work in the case of speech errors consisting in the displacement of roots and affixes, or in the extemporaneous creation of morphologically legal but non existing words. However, if we admit that analogical strategies exist, it is perfectly conceivable that these may also go astray (just

One objection which has been raised against analogical processes is the following. Suppose that a new form is created by analogy with an existing one. Suppose further that you may attain the same result by applying a well-defined set of rules. Then, the argument goes, analogy and rules achieve the same goal, and they thus reduce to the same thing (consequently, since rules provide a more explicit treatment, they should be preferred). This reasoning strikes me as unconvincing. The identity of results is not the real issue: what really matters is the cognitive path along which we obtain this result. From this point of view, the difference is dramatic. Rules involve algorithmic steps and (possibly ordered) stages of derivation, while analogy may attain the final goal at once, in a single step, by simply joining a root and an affix according to some pre-established pattern. Moreover, and more decisively, rules apply in a all-or-none fashion, while analogy is compatible with the sort of fuzziness that we often observe in actual linguistic phenomena [SKOUSEN in press].

Now, on the one hand, it has long been unanimously acknowledged that speakers make analogical creations. The most typical example is the sort of metaplasms that we observe when words shift from one morphological paradigm to another. [18] But on the other hand, there are good reasons to believe that rules exist as well: even the most conservative phonological theories have to admit their presence (e.g. the rule of final devoicing which

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as rules do), producing the observed pattern of results. Again, it is very difficult, on the basis of our present knowledge, to settle the controversy.

18 Incidentally, but importantly for the present discussion, these paradigm shifts show that speakers' knowledge about the morphological structure of the words in their language, and about the rules which apply to them, is not very solid. The generative theorist might suggest, in this connection, that there may occur accidental rearrangements of the links connecting a given root with the set of rules which derive morphologically complex words. This is certainly plausible. However, it is also possible that, at least in some cases, people have rather vague ideas w.r.t. the identity of the root itself. This, indeed, is what seems to emerge from studies such as DERWING & BAKER [1979] AND OHALA & OHALA [1987], who found astonishing responses w. r. t. the existence of derivative relations between words. If the latter view is the right one, this would present a challenge to the generative model; indeed, for a rule to be consistently applied, the unit to which it applies should be clearly identifiable.

Admittedly, a plausible counterargument to the latter view could be that the explicit knowledge that subjects have about the roots of derived words does not necessarily coincide with the implicit competence on which language usage is based. This is undeniable, but it only means, in my opinion, that the whole issue should be carefully scrutinized, rather than taken for granted.

operates in many languages). So, once more the problem consists of finding a suitable borderline between two contrasting routes. The suggestion that is advanced by some phonological schools, such as 'natural' phonology (cf. DRESSLER [1985a]), is that one should distinguish between 'synchronically active' rules on the one side, typically detectable in the case of loanwords and nonce words or affecting the pronunciation of foreign words, and 'frozen' rules on the other, which (to a varying degree) tend to be morphologically conditioned, and are likely to be the historical residue of previously active phonological rules.

Fortunately, this is not only a major theoretical issue, but an experimental one. So, there is some hope that further research will help clarify the matter, provided again that theoretical linguists are willing to consider the results of experimental psycholinguistics as a matter worthy of discussion. In this context, it is also worth considering some recent results obtained by connectionist scholars, showing that the acquisition of the English verbal system may best be simulated by assuming that regular verbs are generated by rule, while irregular ones are produced by analogical processes (PRASADA & PINKER 1993).

Whatever the final solution to this fundamental puzzle is, we still have to take into account the problem of typological variation. I turn to this in the final section.

6. *Typological considerations.*

As observed at the outset, typological factors may interfere with all the morphological variables which play a role in lexical access. Thus, the typological horizon is likely to significantly enlarge the perspective of future experimental research. Consider, e.g., regularity. As is well-known, agglutinating languages tend to be much more regular than inflecting ones, even in the domain of derivation. So, while in the latter type of languages derivation is less likely to be rule-governed than inflection, it is not inconceivable that in agglutinating languages inflected and derived words may be treated the same way. There is a fairly good reason for this: it has been calculated that the number of forms which may be built on a given root,

summing up both inflected and derived forms, is extremely high in agglutinating languages (Hankamer 1989). So, while it is plausible that at least some derived words are full-listed in inflecting languages (typically the irregular, opaque and non-productive ones), it is equally plausible that in (prototypical) agglutinating languages most derived words (with the possible exception of highly frequent ones) are rule-generated.

This consideration does not only apply to the fairly traditional factors that I listed in § 3, which are part of any morphological theory (although possibly with different interpretations). It also applies to the additional semiotic parameters pointed out by 'natural' morphologists [DRESSLER 1985b]. Among these, two are especially relevant in this context: 'indexicality' and 'diagrammaticity'. A given formative is maximally indexical when it signals one and the same type of base (e.g. when it attaches only to nouns). As to (constructional) diagrammaticity, an example of optimality of this parameter would be that of a language where suffixes are the only morphological device used. As these definitions suggest, the proper domain to which these semiotic parameters belong is typology; hence, their obvious relevance to the present discussion. However, to my knowledge, these (or any other) semiotic parameters have not yet been focused on in psycholinguistic studies, although it is conceivable that they might yield interesting opportunities for analyzing linguistic materials and designing experimental tests.

Unfortunately, even if we come back to the more traditional factors, we have to admit that no systematic program of typological investigation has so far been designed w.r.t. lexical access. Besides, not much can be concluded from the available literature, because the languages scrutinized until now are very few. A further problem lies in the fact that, even within the same language type, there may be large differences (consider again the difference between Serbo-Croatian and other inflecting languages discussed in §. 4). As a consequence, the contrast 'inflection / derivation' may receive diverging interpretations even in fairly related languages.

To my knowledge, very little research has so far been conducted to test this issue in agglutinating languages. NIEMI et al. [in press], working on Finnish, found somewhat surprisingly that even in this case there is a sharp

contrast between inflection and derivation, accompanied by some hints (although slightly elusive) towards an effect of formal opacity. However, Finnish is not a prototypical agglutinating language: it exhibits declensional classes, and presents a fair amount of morphophonological processes. So, there is still the possibility that the study of a more prototypical language, such as Turkish, might provide different results. [19]

There is also some work done on Hebrew, which is claimed to have, like all Semitic languages, a 'non-concatenative' morphology, in the sense that the consonant tier provides the semantic content, while the vowel tier is used to convey morphological information. Interestingly, BENTIN & FELDMAN [1990] found priming between derived forms in Hebrew, a result orthogonal to that obtained for English by MARSLEN-WILSON et. al. [1994]. However, as BURANI [1993] suggests, this may simply reflect a typological feature of Semitic languages, due to their peculiar morphological structure, whereby roots are somehow reminiscent of bound-roots in inflecting languages. If this is the case, BENTIN & FELDMAN's results may be easily reconciled with those obtained by EMMOREY [1989], who found priming between words such as *object* and *reject*. [20]

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19 Unfortunately, I was not able to see a copy of the still unpublished work on Turkish by U. Frauenfelder and J. Hankamer. Obviously, it is also possible that the experimental results just discussed are somewhat misleading, because of the reasons already pointed out in § 4. If this is so, we might expect that even studying a more prototypical language, like Turkish, will not substantially modify the picture. Incidentally, it should be observed that NIEMI et al.'s paper provides support to LUKATELA's findings concerning the preminence of the nominative singular. But again, this type of results is *sub iudice* (cf. § 4).

20 Note however that, in the latter case, prefixes, rather than suffixes, are concerned, and this may also have a bearing on the results. This emerges also in MARSLEN-WILSON et al. (1994), where the priming of derived words by derived cognates is supported in the case of prefixed words, as opposed to suffixed ones. In general, the impression one gathers from an extensive survey of the literature is that, on the whole, prefixes yield more of a compostional strategy than suffixes. This, however, might also be due to the different distributional properties of the two types of affix: in fact, GRAINGER et al. [1991] observe that prefixes and suffixes trigger the same reactions, when the appropriate compensations are done.

Note that typological considerations are once more in order here. Prefixes do not play the same role in different languages. A strictly compositional treatment of these affixes is much more likely to occur in the German or Russian lexicon than, e.g., in Italian.

A more puzzling finding is that emerging from KATZ et al. [1990] who, using the 'stimulus onset asynchrony' technique (based on the separate presentation of different parts of a word), found no facilitation in English when the root is presented slightly before the affix, although facilitation was found by the same authors for Serbo-Croatian and by JARVELLA & JOB [1988] for Italian. Here again, typological considerations might be relevant. Since, in English, roots tend by and large to coincide with words, the delayed presentation of the affix presumably interrupts the process of lexical search once it has been triggered. The situation is of course different for Serbo-Croatian and Italian subjects. The mere presentation of the root may create a pre-alert condition, which is subsequently exploited to speed up the lexical search as soon as the appropriate affix is presented.

The purpose of these few examples is merely to prove that a full-fledged program of research, exploiting the typological diversities of natural languages, might yield rather intriguing results in the domain considered. And we may bet that, once again, languages will have the last word, over and above our theorizing.

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