Introducing *(Parallel) Pattern Matching Analysis* ((P)PMA) as a Friend, if not a Variant, of Construction Grammar*

—PMA of English Resulatives—

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1 Introduction[1)]

Kuroda [13, 14] proposed a framework called (PARALLEL) PATTERN MATCHING ANALYSIS (PMA henceforth) as a connectionism-compatible alternative to syntactic theories endorsed in many variants of Generative Grammar. [2, 5, 3, 4, 17]. Though developed independently, it turned out that PMA was compatible with Construction Grammar (CG, henceforth) [7, 9, 10, 16] in many respects. This paper tries to elaborate on their convervences, with reference to the resultative construction.

2 PMA Account of English Resultatives

2.1 Goldbergian Account

Goldberg [10] proposed five "argument structure" constructions. Resulative Construction is one of them, illustrated by examples like (1):

(1) Bill hammered the metal flat.

Sentences like (1) are said to be instances of Resulative Construction because "resulative predicates" such as *flat* are licensed despite the fact that they are not licensed by matrix verbs like *hammer*. Goldberg claims that the fact is best accounted for when we assume that sentences like (1) are interpreted by making reference to a super-lexical "pairing" of a form F to an abstract meaning M in (2):

(2) a. F: Subj: x V: v Obj: y Xcomp: z
  b. M: x CAUSES y TO BECOME z [10, p. 3] (BY v-ING)

2.2 PMA Account

PMA provides a somewhat different, if not incompatible, picture of the phenomenon, by reinterpreting the core idea in Goldbergian constructions. Before elaborating our points, in §2.2.1 let us specify basic assumptions of PMA based on (1).

The specification in Figure 1 is the PMA of (1). In tables like this, the *i*th (sub)pattern, p_i, encodes the syntax and semantics of *i*th segment of p_0, called "base pattern." Segmentation need not be word-based: it can be morphologically based, or phrasally based.

A subpattern has the following properties:

(3) A word (e.g., *hammer*) with a specific sense is mentally represented as a subpattern (e.g., "S *hammer** O") that instantiates a "surface-true" schema for a given language, meeting the Surface-True Generalization Condition (Hooper [11]). For example, words are represented as patterns of the form SRO for English, and as patterns of the form SOR for Japanese, reflecting respective canonical word orders.

(4) Each subpattern consists of two kinds of components: a "body" and its glues. Body refers to a word form w to be encoded by a subpattern, indicated by w^* and placed in orange cells. Glues are abstract, "invisible" elements like S (for subject, or external argument), O (for object, or internal argument(s)), P (for preposition and postposition), V (for verb), $R = \{V, P\}$ (neutralization between V and P). They are placed in yellow cells. "—" in white cells indicates "null" specification.

(5) Glues have their own semantics, by which "selectional restrictions" can be specified for a word. With the help of glues, each pattern is associated to "semantic frames" [8]. For space reason, details are omitted.

(6) The syntax and semantics of a sentence (e.g., *Bill hammered the metal flat*) is given as the "integration" of relevant subpatterns.

Integration of subpatterns is roughly a column-wise, vertical unification (but with certain kinds of "adjustments" allowed), whose operator is indicated by ξ. For example, the syntactic-semantic specification for (1) is given roughly as:

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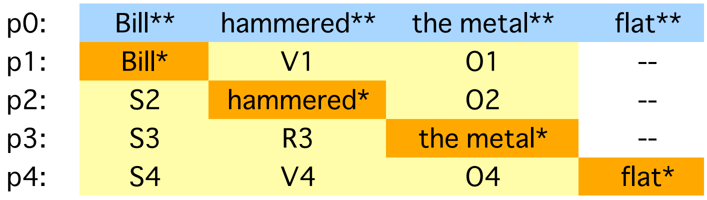

p0:	Bill**	hammered**	the metal**	flat**
p1:	Bill*	V1	O1	--
p2:	S2	hammered*	O2	--
p3:	S3	R3	the metal*	--
p4:	S4	V4	O4	flat*

Figure 1: PMA of (1)

(7) [Bill^{**}] [$\mathit{hammered}^{**}$] [$\mathit{the\ metal}^{**}$] [flat^{**}], where

a. $\mathit{Bill}^{**} = \xi(\{\,\mathit{Bill}^{*}, S_2, S_3, S_4\,\})$,

b. $\mathit{hammered}^{**} = \xi(\{\,V_1, \mathit{hammered}^{*}, R_3, V_4\,\})$,

c. $\mathit{the\ metal}^{**} = \xi(\{\,O_1, O_2, \mathit{the\ metal}^{*}, O_4\,\})$, and

d. $\mathit{flat}^{**} = \xi(\{\,-, -, -, \mathit{flat}^{*}\,\})$.

The diagram in Figure 2 illustrates how subpattern integration goes for (1). With this, it is easy to see the base pattern as a “blend” of subpatterns in the sense of Blending Theory [6], though it might be the case that PMA’s resemblance to “blending” is rather superficial than essential. The sine-qua-non property in PMA is multiple inheritance from multiple sources of information implemented by “constructional” units called subpatterns.

In short, every word or morpheme is assumed to have its “own syntax” (in terms of subpatterns like $p_1, p_2, \ldots$), as well as its own semantics. This embodies the view of grammar as a “distributed system”. It claims that both syntax and semantics of a sentence is “distributed” over a network of words and morphemes, and that words have “optimally redundant” representations in the mental lexicon. See Kuroda [13] for relevant details.

2.2.1 Remarks

PMA does not posit any theoretical constructs like (2). The relevant effect can be accounted for if the meaning of (8) is imported to the meaning of (1) in some systematic way:

(8) Bill made the metal$_i$ flat (by doing something to it$_i$).
Bill made the metal flat.

But the point is, How is it done?

The crucial information is specified in PMA automatically. To see this, look at the PMA of (8) given in Figure 3. The comparison of the PMAs in Figures 1 and 3 would make the point.

As p_2 in Figure 3 indicates, *make* has its own subject, object and predicate (S_2, O_2 and A_2) as its proper arguments. $p_2 = S_2\ \mathit{made}^{*}\ O_2\ A_2$, or more specifically A_2, licenses the occurrence of *flat* in (8). By contrast, as p_2 in Figure 1 indicates, the argument structure of *hammer* lacks the counterpart of A_2 in Figure 3. This is a crucial difference.

Under this, PMA allows us to account for the resultative reading in (1) as follows:

(9) Sentence (1) is licensed when p_4 in Figure 1 is implicitly elaborated so that the meaning of V_4 is approximated by made^{*}, as is induced by $\mathit{Bill}^{**}\ V_4\ \mathit{the\ metal}^{**}\ \mathit{flat}^{**}$, partial integration of $\{\,p_1, p_3, p_4\,\}$. This is a good example of **implicit pattern completion** as a typical property of neural networks, especially, Hopfield nets. [12].

2.2.2 Derivative claims

The account above gives us interesting predictions such as the following:

(10) Resultative construction, for one, and Goldbergian “argument structure” constructions in general, are both “lexically” and “collocationally” conditioned in that no such effects can be manifest unless a specific word or phrase with a specific sense is associated with a specific lexical context. In this sense, the account provided by PMA is basically compatible with findings and claims in Boas [1]. Also, many properties suggested in Stefanowitsch and Gries [18] would follow from the PMA account.

(11) More specifically, only APs (and PPs if any) that appear in the context “S make O __” show the resultative construction effect: any other APs (and PPs) don’t: In other words, the resultative reading for (1) is “induced” by the “argument structure” of *flat* that encodes an effect of causation.

(12) Any “purely semantic” account of the argument structure elaboration effects (in terms of LCS [15]) would fail, because the phenomenon is also collocationally based.

(13) Argument structure constructions are “emergent” rather than just in a “component” of (a) grammar.

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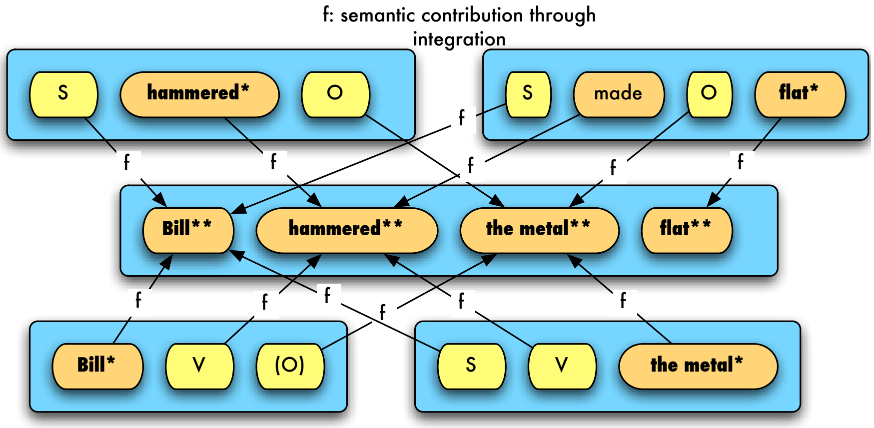
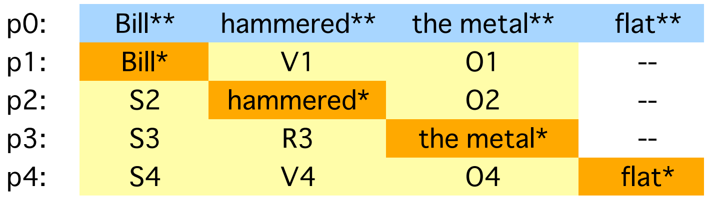


Figure 2: PMA of (1) graphically represented



p0:	Bill**	hammered**	the metal**	flat**
p1:	Bill*	V1	O1	--
p2:	S2	hammered*	O2	--
p3:	S3	R3	the metal*	--
p4:	S4	V4	O4	flat*

Figure 3: PMA of (8)

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