Chapter 10:
Concluding Remarks

10.1 Overview - grammatical blending in sentence processing

This study proposes an analysis of linguistic utterances (basic clause structures) as an outcome of conceptual operations of *mapping* and *blending* (Fauconnier, 1997; Fauconnier & Turner 1994, 1996). To generate a sentence, in the view of this thesis, is to conceptually *blend* partial aspects of the event to be communicated with a chosen integrating syntactic construction. To interpret a sentence is to reconstruct a set of correspondences (a mapping pattern) between the linguistic form and a possible event in the world. The lexical forms in a sentence represent particular aspects of the communicated event, and the role of the language user is to realize how they all tie together: i.e., which aspect of the event each lexical item denotes, and how these aspects are all linked together to represent an actual (probable) event. The role of grammar is to provide guiding clues for the language user in the reconstruction operation.

The study analyzes in particular the cognitive blending operations underlying the use of the Hebrew *binyanim* system, as one example of an elaborated grammatical system to mark linguistic blends. The analysis suggests that each *binyan* is associated with a single *blending schema*: a blending configuration between a conceived event and an integrating syntactic construction. The blending schemas associated with the different *binyanim* complement each other, and together form a unified system for formally marking conceptual and linguistic blending operations.

The study compares and contrasts the blending configurations underlying the Hebrew *binyanim* system with those underlying instances of the Caused-Motion syntactic construction in English (studied in detail by Goldberg, 1995, and later analyzed in

Fauconnier & Turner, 1996). The analysis of Hebrew *binyanim* suggests that a generic conceptual schema of causation underlies the prototypical use of most *binyanim* (including passive, middle, and reflexive stems). The same generic causative schema also underlies the generation of English caused-motion sentences. The blending analysis thus provides a common ground upon which to study grammatical systems which superficially seem very different (such as English and Hebrew grammar), and to analyze in a similar way the expression of causality at different linguistic levels (*morphological* as in Hebrew *binyanim*, and *syntactic* as in the English caused-motion construction).

The analysis of Hebrew and English also suggests that very similar blending configurations underlie both the standard, highly-structured forms in a language (as in Hebrew *binyanim*-root combinations which form the standard Hebrew lexicon), and more creative instances of a language (as in some of the English caused-motion sentences discussed in chapter 2 and 8[1]). Entrenched and novel (creative) linguistic blends are suggested to lie on a continuum, where novel blends can become conventionalized over time.

Finally, the comparison of English and Hebrew demonstrates that the *same* generic cognitive operation underlies the generation and interpretation of sentences across languages (current research with Gilles Fauconnier suggests that similar blending configurations also underlie Romance languages such as French, Mandelblit and Fauconnier, in preparation). The comparison of blending instances in English and Hebrew also points to ways in which languages *differ* from each other. The examples analyzed in the thesis suggest that:

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[1] For more examples of creative instances of the caused-motion construction in English, see Goldberg, 1995, and discussion in Fauconnier & Turenr, 1996. The important point to note in all these examples is that exactly the same type of blending operation underlies all these sentences: from the most simple entrenched ones, to the most novel and creative ones.

(1) Languages differ in the grammatical "tools" that have evolved to mark blending operations. For example, Hebrew possesses an elaborate morphological system (the verbal *binyanim* system) to mark the mapping of *predicates* from the conceived event onto the main verbal slot of the integrating construction. In English, formal marking of predicate mapping is scarce (exceptions are English verbal suffixes such as-*en* or -*ify*, as in *whiten* or *falsify*, which mark the blending of a causal sequence of events into a single clause structure, with the verb stem denoting the effected predicate in the causal sequence). Hebrew and English, on the other hand, have both evolved a distinct grammatical system to mark the mapping of *participants* onto the main nominal slot (subject slot) of the integrating syntactic construction (the active:passive constructions in English, and the active:passive *binyanim* in Hebrew, both mark whether a causal agent or an affected patient has been mapped onto the subject slot of the integrating syntactic construction).

(2) Languages differ in the inventory of integrating syntactic constructions available for novel (creative) blending operations. For example, the caused-motion syntactic pattern [NP V NP directional-NP] is available in English for the linguistic integration of novel caused-motion event sequences into a single clause structure (see examples in chapter 2). In Hebrew, the parallel syntactic argument structure, though used with standard lexical caused-motion verbs (e.g., *pa'al* verbs such as *daxaf* - 'push' and *zarak* - 'throw', or *hif'il* verbs such as *hixnis* - 'allow to go in', 'bring in') has not evolved (so far) to an independent existence as an integrating syntactic construction for expressing *novel* caused-motion event sequences (i.e., ones which are not already represented by a single verb in the standard lexicon)[2].**(3) Languages differ in their**

[2] With regard to other syntactic constructions discussed in the thesis, such as the Hebrew Transfer construction (section 4.1.2), evidence exists for their creative use in the linguistic integration of novel event sequences. Examples are found in colloquial Hebrew (e.g., *hextif*, discussed in section 4.3) as well as in literary, journalistic, and biblical texts. Consider, for example, the biblical non-standard use of the Transfer construction in example (i) from Rubinstein (1976). In (i), a non-prototypical transfer event (transferring an

conventions of blending. Languages differ as to which blending configurations are most common, or prototypical (as well as in which ones are rare but acceptable, and which ones are considered unacceptable, i.e., "ungrammatical"). For example, though English grammar allows the mapping of either the causing or the effected predicate from a caused-motion sequence of events onto the verbal slot of the integrating caused-motion construction (Figures 2-2 and 2-3 in chapter 2), one mapping (the mapping of the *causing* predicate) seems to be more common across the different constructions (in terms of token frequency) than the other[3]. The analysis of translation examples of English caused-motion sentences into Hebrew and French (chapter 8) suggests that in Hebrew as well as in French, the expression of caused-motion events is commonly done by explicating the *effected* motion predicate (using an *hif'il* verb in Hebrew, or the *faire*-construction in French). Of course, conventions of blending can change dynamically during the evolution of a language, and may differ from one group of speakers to another. I suggest that speakers "pick" these blending conventions from all language instances they have encountered, and abstract a "blending schema", which they then re-use to generate novel expressions (consider, for example, the stem *hif'il* in Hebrew, discussed in chapter 4: I suggest that speakers extract the "blending schema" of this stem from all instances of *hif'il* verbs they have encountered in the language. This blending schema can then be used to

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object to God by burning it) is integrated into the Transfer construction [NP V *et* NP *le*-NP]. The main verb in example (i) *saraf* refers to the causing predicate in the transfer sequence (in the standard lexicon, the verb *saraf* is a two-participant *pa'al* verb meaning 'to burn'; its semantics has no component of transfer).

(i) *vesarafta (s.r.f-pa'al) ba?esh et ha'ir . . . leyehova elohexa*
And-you-shalt-burn in-fire ACC the-city DAT-the-Lord-thy-god
'And you shalt burn the-city to the Lord thy god'.

[3] Goldberg (1995:65) defines a hierarchy of relation types between the event type designated by the verb (V) and by the construction (C). The most prominent one across different syntactic constructions in English is where V is an instance of C (in the blending terms of this dissertation: where the semantics of V integrates the whole causal semantics of the construction). The next one is where V designates the means of C (in the blending terms of this dissertation: where the semantics of V designates the causing predicate). And the third one is where V designates the result of C (in the blending terms of this dissertation: where the semantics of V designates the effected predicate).

generate novel *hif'il* forms and sentences[4]).

As Fauconnier has suggested so often in his work (e.g., Fauconnier 1985, 1997), and as the analysis in this thesis further demonstrates, language typically provides only minimal instructions for reconstructing a communicated event. The blending operation underlying both the Hebrew *binyanim* examples discussed in this thesis, and the caused-motion sentences in English, involve the mapping of only *partial* information from the conceived event onto the integrating syntactic construction. Moreover, grammar only marks *partial* aspects of the blending (or mapping) configuration itself. An interpretation of a linguistic utterance hence involves both a reconstruction of the blending configuration (beyond the instructions the grammar provides), and the imposition of additional semantic structure on the reconstructed event.

In the analysis of blending examples in this thesis, (at least) three types of blending reconstruction operations were identified:

(1) Reconstruction of the mapping configuration: In examples such as the English caused-motion sentences (chapter 2), the grammar underspecifies the *mapping pattern* of predicates from the conceived event into the integrating construction. It is up to the hearer to decide which predicate from the conceived event the verb communicates (i.e., which predicate has been mapped onto the verbal slot of the integrating syntactic construction).

(2) Reconstruction of unspecified events (as "guided" by the grammar): In the Hebrew *binyanim* system, the *binyan* clearly marks the blending pattern of predicates. The *binyan* blending schema may also mark the existence of other predicates not specified in the blend (as in the case of *hif'il* and *pi'el* which denote that their root represents only one part of a larger event sequence). The language user is thus "instructed" by the grammar (by the

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[4] Note that the generation of novel blends in Hebrew is much more restricted than in English, for example, due to the morphology of the language. The combination of tri-consonantal roots with a limited set of morphological patterns in Hebrew imposes phonological restrictions on the formation of novel morphological blends.

binyan) to reconstruct those aspects of the event which are left implicit.

(3) Reconstruction of implicit information not marked by the grammar: This level of reconstruction includes all the semantic structure the hearer imposes on the blend in the process of interpretation. The imposition of additional structure is triggered not by the grammar, but rather by the pressure of background knowledge and expectations defined by the context. Included in this category are the imposition of a "passive" vs. a "middle" reading on *nif'al* sentences in Hebrew (a reconstruction which is explicitly marked in the grammar of many other languages, but not by the *binyanim* in Hebrew, see section 6.3). Included in this category are also the imposition of particular force-dynamics relations on causative events (in a physical, social, or mental domain, see discussion in chapters 2 and 5). Finally, included in this category are also the imposition of innumerable forms of semantic structure not marked in the grammar of any language (and hence not commonly discussed in linguistic analysis) but which are an integral part of the interpretation of any linguistic expression[5].

The important point to note, however, is that in principle (from a cognitive point of view), there is no difference between the levels of blending reconstruction operations described above (1-3). The only difference is in the extent and format in which grammar guides the language interpreter in the reconstruction process.

10.2 Suggestions for Future Research

10.2.1 Theoretical Linguistics: applying the "grammatical blending"

[5] Memorized instances of events in the world (and their abstraction to prototypes schemas) seem to play a central role in event reconstruction (see chapter 8 for a discussion on the role of prototypical events in imposing structure on translation). The interpretation of a linguistic blend therefore seems to involve "mental simulation" of prototypical event structures (for discussion of such mental simulation, see Rick Grush' notion of *conceptual emulation*: Grush, 1995, demonstrates that in the domain of motor control, there is good evidence that the brain constructs models, or emulators, of musculoskeletal dynamics. Grush suggests that similar mechanisms underlie linguistic competence as well).

framework to analyzing additional grammatical systems.

Though the analysis in this chapter focused on Hebrew and English grammatical forms only, the principles of grammatical blending discussed in the thesis are language independent and are assumed to reflect basic cognitive skills and conceptual pressures. It is thus expected that these principles apply to grammatical systems of other languages as well. The blending framework has already proved useful in providing new insights into the Hebrew *binyanim* system (see summary in chapter 7). It also provides an effective framework for analyzing the *interaction* between various grammatical constructions in a single sentence, as the outcome of a single generic cognitive operation (for example, the blending approach provides a unique way for studying of the *interaction* between *morphological binyanim* constructions and *syntactic* constructions in Hebrew).

10.2.2 Psycholinguistics: the psychological reality of blending operations

An important issue for future research (which has not been addressed in this thesis) is the psychological reality of the mapping and blending operations discussed in the manuscript. One direction of research may be in studying the cognitive process of *translation*. In chapter 7, the grammatical blending operations underlying translation data were analyzed. When the source and target languages have different conventions of grammatical blending (i.e., in what is considered a prototypical blend, and what is considered an ungrammatical blend), a word-for-word translation produces unacceptable target texts. In such cases, a conscious reconstruction of the source sentence blend is required of the translator, followed by a new blending operation of the constructed mental representation into the target language's integrating constructions. Translation, thus, provides an opportunity for analyzing the *conscious activation* of even very entrenched linguistic blends.

In Mandelblit (1995a), the activation during translation of entrenched *metaphorical* mapping was investigated. Just like grammatical blends, linguistic metaphors lie on a continuum from the most entrenched metaphors ('dead' metaphors) to novel extensions of entrenched metaphors (cf. Lakoff, 1993). In Mandelblit (1995a), I suggest that translation can activate a conscious processing of entrenched metaphors: if the source and target languages conventionally use different metaphorical mapping systems, then a word-for-word translation of a metaphorical expression into the target language may result in an unacceptable (or incomprehensible) target text. In such cases, the translator must consciously reconstruct the source text metaphor (i.e., retrieve the conceptual source analog and find a set of correspondences between elements in the source and target domains), and then map the reconstructed representation onto a target domain in the target language, based on conventional metaphorical mapping systems in the target language.

The hypothesis in Mandelblit (1995a) is that lack of correlation between the conceptual mapping systems used in the source and target languages to express similar events (or feelings) would be a source for further difficulty in the translation process. If the two languages conventionally use different metaphorical mappings to express the same idea, then translation would involve not only a transfer process from lexical items and idioms in one *language* to another but also a transfer from one *conceptual mapping system* to another. The translator who encounters a metaphorical expression might be fixed on the source language's conceptualization (mapping conventions), and thus be temporarily unable to conceptualize and verbalize the idea based on the target language's entrenched mappings. This will show up in the longer time it would take for the translator to find a translation. The alternative hypothesis (the *non-cognitive* view of metaphors) is that metaphoric idioms are stored as arbitrary strings of symbols in the lexicons of the source and target languages (and not as conceptual mapping systems). In the latter case, translation of literal expressions and metaphorical idioms should not be any different. That is, the content of the

conceptual metaphorical *mapping* should have no bearing on the translation process.

The experiment in Mandelblit (1995a) assessed the translation time of idiomatic metaphorical expressions from French to English: some of the conventional counterpart idioms in the source and target languages (i.e., idioms conventionally used to express the same event) were based on the same metaphorical mapping system (but with different wording in the source and target languages), others were based on different underlying metaphorical mapping systems (again with different wording), and yet others involved no metaphorical content. The study shows a significant difference in translation time - translation time was longest for translations based on different metaphorical mapping systems.

10.2.3 Language Acquisition

The grammatical blending view suggests that mastery of language involves not only mastery of lexical and grammatical constructions (their linguistic form and their associated semantic schema), but also mastery of complex cognitive skills, including mapping among conceptual structures, finding analogies, abstracting instances of perceived events into general schemas, and extending them to new events, blending novel events with prototypical schemas and integrating them into new linguistic structures, and more. The analysis in this thesis suggests that the role of grammatical structures (such as Hebrew *binyanim*) is to *mark* these conceptual operations in language. It follows then that mastery of such conceptual operations must *precede* the correct use of grammatical forms.

Consider, for example, the following data from Berman's (1982) study on the acquisition of Hebrew *binyanim* by children. At the age of two-years-old, Israeli children still fail to use the correct morphological *binyan*. Marked improvement is shown only at the age of three to four years old. However, the following data from Berman's own child (between the age of 2;6 and 2;11) suggests that even though the child was not yet able to generate the correct *binyan* of the verb, she was able to perform the correct *blending*

operation, expressing *a whole observed causal sequence of events* in a single basic clause structure and a single predicate, and mapping correctly the participants in the observed event onto grammatical slots in the construction (examples 1-2 below). The only problem seems to be that the child has not mastered yet (at that age) the correct grammatical (*binyan*) marking for the blending operation she performed.

(1) *ra?iti(r.?.h-pa'al) et haciyurim leaba.*
I-saw ACC the-drawings DAT-daddy.
'I **saw** the drawings to Daddy' (meaning: 'I **showed** the drawings to Daddy')

(2) *ima oxelet(?.x.l-pa'al) oti hayom.*
mother is-eating ACC-I today.
'Mother is **eating** me today' (meaning: "mother is **feeding** me today").

The child in examples 1-2 incorrectly used *binyan pa'al* rather than *hif'il* in the main verb. Otherwise, the sentences are syntactically correct, with appropriate word order, marking of tense, number, person, and gender on the main verb, and correct case marking of nouns (the child correctly assigned a dative marker for the *recipient* 'father' in 1, but an accusative marker for the *patient-recipient* - 'me' in 2, see discussion of the Hebrew Transfer vs. the Bitransitive constructions in section 4.1). Note that the error in the actual verb form (root+*binyan*) used by the child suggests that these sentence patterns (1-2) were not simply an imitation of adult language (since probably no adult has ever uttered something like 'see to father' or 'eat me'). We are thus led to the conjecture that the child generated these two sentence by herself (i.e., creatively performed the blending operation of a causal event sequence into a single integrating clause structure).

10.2.4 Extending the mechanism of grammatical blending

The principal form of linguistic creativity discussed in the dissertation is the use of mapping schemas extracted from entrenched blends to generate novel linguistic expressions based on the same mapping configuration (e.g., see examples of novel *hif'il* verbs, section 4.3). Another type of linguistic innovation may be in the *composition* of two (or more) entrenched blending schemas to create a new blending schema with novel semantics. An interesting example of such composition of blending schemas is found in Israeli Hebrew: a new morphological verbal pattern has evolved in colloquial Hebrew - the pattern hitCuCaC (*hitp'ual*). *Hitpu'al* is in fact a phonological composition of two standard *binyanim*: hitCaCeC (*hitpa'el*, section 6.4), and CuCaC (*pu'al*, section 6.2). The formal (phonological and morphological) composition of the two *binyanim* reflects a conceptual composition of the blending schemas associated with each *binyan*. (the blending schemas of *pi'el* and *hitpa'el* were defined in chapter 6, and are illustrated in Figure 10-1 below).

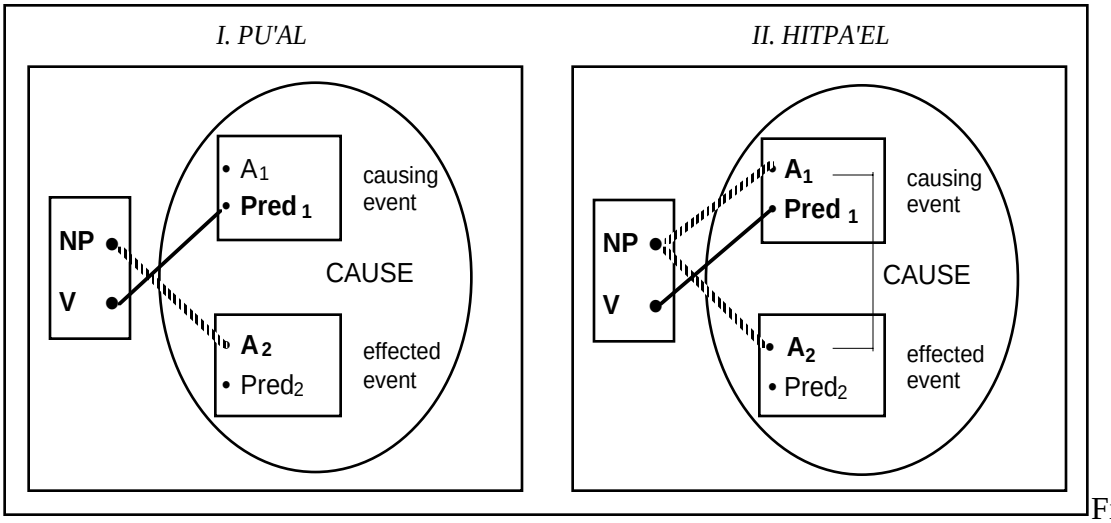

Figure 10-1: The *pu'al* and *hitpa'el* blending schemas

Note that the blending schemas of *pu'al* and *hitpa'el* overlap to a large extent. In both schemas, a causal sequence of events is integrated into the Intransitive syntactic construction [NP V]. In both schemas, the *causing* predicate is mapped onto the verbal slot

of the integrating construction[6]. And in both schemas the *affected entity* is mapped onto the NP (subject) slot in the integrating construction. The only difference between the two schemas is with regard to the *causal agent*: In the case of *hitpa'el*, the causal agent and the affected entity are understood to constitute the same physical entity (and it is suggested that both are conceptually mapped onto the subject NP slot of the integrating construction). In the case of *pu'al*, the causal force and the affected entity are construed as two distinct entities. A composition of the two conceptual schemas in Figure 10-1 would thus reflect either an *ambiguity* (or *vagueness*) with regard to the identity of the causal force (the causal force may be either internal or external to the affected entity), or it may reflect the *addition* of both causal forces (forces initiated both by the affected entity itself and by an external agent).

Consider now the use of this new pattern (hitCuCaC) in colloquial Hebrew. The most prominent example is with the root *p.t.r*. In combination with the *pi'el* stem (*piter*), it means 'to fire (from job)'. In *pu'al* (the 'regular' passive of *pi'el*), it means 'to be fired'. And in *hitpa'el*, it means 'to resign' (i.e., 'to fire oneself'). The colloquial form *hitputar* denotes an action of resignation which was in fact enforced on the subject (i.e., the subject was really fired, or forced to resign). As predicted by the composition of the two blending schemas in Figure 10-1, the form *hitputar* denotes an affected entity (a fired employee) where the causal agent (who did the firing) is intentionally (or ironically) left ambiguous.

The example of *hitputar* is an interesting instance of a conceptual pressure to grammatically integrate two facets of a common recurring event (‘an enforced resignation’) into a single predicate. The linguistic integration is motivated by the shared phonological structures as well as associated conceptual schemas of the two composing *binyanim*.

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[6] In section 6.5, it was noted that the root of the pattern *hitpa'el* may profile either the causing or the effected predicate, but more frequently (in the majority of verbs in the standard lexicon) it profiles the *causing* predicate.

10.2.5 Linguistic blending operations and general cognition

The "blended spaces" proposal of Fauconnier and Turner, and the "grammatical blending" analysis developed in this dissertation, suggest a highly dynamic view of language processing. Generation of linguistic utterances involves extensive on-line operations of mapping across conceptual structures and integration of conceptual and linguistic forms based on observed patterns of *correlation* (or similarity). The main cognitive component of language interpretation, in this view, is the detection of analogical connections across conceptual structures. The language provides only partial information about these connections, and the language user completes and extends the reconstructed mapping schema with additional content (emergent semantics). This view of language processing contrasts with traditional linguistics approaches which link linguistic forms directly to pre-defined semantic structures and truth conditions. An interesting question is how much the blending view of language processing share with accounts of other cognitive processes, and with what we currently know about the brain.

In Mandelblit & Zachar (in press), recent conceptual developments in different sub-domains of cognitive science are analyzed. The analysis suggests that the characteristics of language processing as reflected in the "conceptual blending" approach share many structural properties with current alternative views on cognitive operations at different levels of analysis (at the level of neural processing, at the level of mental representation, and at the level of distributed social cognition). The alternative approaches to cognition also share features with epistemological developments in modern Physics, as well as with underlying computational assumptions of Connectionism and the study of Complex Dynamic Systems. As the analysis in the paper suggests, a conceptual change in cognitive science occurs from the traditional definition of cognitive constructs as having rigid properties inherent to the components composing the construct, to a dynamic definition of cognitive constructs as context-sensitive and based on changing patterns of *correlation*

across the composing elements. Under different environmental set-ups, different patterns of correlation may occur, thereby delineating different cognitive constructs. These constructs also frequently have *emergent* properties which are not present in the substrate of the composing elements.

Linguistic and conceptual blends share properties with this alternative definition of cognitive constructs: they are based on perceived *pattern of correlation* across input structures and their formation is inseparable from the contextual setting (in different contexts, different correlation patterns are conceived across conceptual structures and different blends arise). Finally, blends like other dynamic cognitive constructs have a richer and more developed semantics which is not reducible to a simple composition of the semantics of the composing elements.

In another project (Grush & Mandelblit, in press; Mandelblit & Grush, in preparation), neurophysiological data (including aphasia data), which have been interpreted as supporting traditional syntactic operations, are reinterpreted in light of the "grammatical blending" hypothesis. The issue of interest is: what is needed (in neurophysiological terms) to support blending operations? For example, to support mapping (or projection) across structures, neurological binding mechanisms are required (such as synchrony binding mechanisms - Singer, 1995); To support representation of blends with inherited structure from input domains, neurological "convergence zones" are required (such as the ones proposed by Damasio & Damasio, 1994).