Target Article, *Theoretical Linguistics*, 28(3), 2002, p.229-290

THE THETA SYSTEM - AN OVERVIEW[1]

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This paper presents an overview of a larger project in progress on the concepts interface. In part, it is based on the findings in Reinhart (2000), where several of the problems are discussed in greater detail. However, many aspects of the system have been further developed, or changed, since that manuscript.

The general picture I assume is that the Theta system (what has been labeled in Chomsky's Principles and Parameters framework 'Theta theory') is the system enabling the interface between the systems of concepts and the computational system (syntax) and, indirectly (via the syntactic representations), with the semantic inference systems.

In the modular view of Fodor and Chomsky, the cognitive systems operate independently of each other, and generally, the information processed in any given system is not legible to the others. But for the interface to be possible, each system should contain also some information that is legible to other systems. Possibly, a system can also pass on information that is not legible within that system, but which is legible to others. We may assume that for each set of systems, there is some central system that gathers information that may be legible to the other sets of systems, and it is this system that enables the interface. The theta system can be viewed, then, as the central system of the systems of concepts.

The Theta system consists of (at least):

a. Lexical entries, which are coded concepts, with formal features defining the θ-relations of verb-entries.
b. A set of arity operations on lexical entries, which may generate new entries, or just new options of realization.
c. Marking procedures, which 'prepare' a verb entry for syntactic derivations: assign an ACC(usative) feature to the verb in the relevant cases, and determine merging properties of arguments (technically obtained by indices).

The outputs of the Theta system are the inputs of the CS (syntax) (lexical items selected from the

[1]This paper was formed through extensive discussion and joint work with Marc Ariel Friedemann and Tali Siloni. I also wish to thank Idan Landau for extremely helpful comments on the previous stage of this study.

Theta system). The CS outputs are representations legible to the Inference (semantics), Context, and Sound systems. The θ-features are legible to the Inference systems (semantics), and hence they are not erased in the CS, but are passed on through the derivation. Other outputs of the θ-system, like merging indices or the accusative case are legible only to the CS, and not to the inference systems, hence, they are erased in the derivation.

I will first present a synopsis of the full system, and then turn to a more detailed case-study of experiencing derivations.

PART 1: A SYNOPSIS OF THE THETA SYSTEM.

1. θ-features.

1.1. The features system*.

For the outputs of the Theta system to be legible to the two relevant other systems (CS and Inference), they need to be formally coded. I have argued that to obtain this, it is necessary to take a move similar to that taken in phonology (a long while ago) from phonemes to features. Rather than viewing the thematic roles as primitives, we may search for a system of formal features that compose θ-roles, and govern θ-selection and linking (mapping)[2]

Among the empirical motivations for this move was a problem of θ-selection noted in Reinhart (1991, 1996): The standard assumption about θ-selection is that the lexical entry specifies not just the number, but also the type of thematic roles a verb selects. Some commonly assumed roles are **agent**, **cause**, **experiencer**, **instrument**, and **theme**, among others. This works nicely for many verbs. E.g. the verbs in (1) select an agent as their external argument, and nothing else is compatible with the verb. However, there is also a very large set of transitive verbs that defy this system. Thus, *open* allows an agent as its external θ-role, as witnessed in (2a) by the purpose-control. But it also allows an instrument (2b) and a cause (2c). The same is true for the sample of verbs in (2d-h).

1 a) The father/*the spoon/*hunger fed the baby.
b) Max / *the leash / *hunger walked the dog to his plate.

* In the published version, this section appeared as an appendix and the main text included just a summary of this section.

[2]The idea has been around, of course. In a way, this is what Jackendoff (e.g. 1987) has assumed. The actual feature system I am using here is rather different than Jackendoff's (and others') inspiring proposals, but space considerations do not allow me to survey here the differences.

c) The baby/ *the spoon /* hunger ate the soup
d) Lucie / ??The razor /*the heat shaved Max.
e) Lucie / *the snow / *the desire to feel warm dressed Max

2 a) Max opened the window (in order to enter).
b) The key opened the window (*in order to be used).
c) The storm opened the window (*in order to destroy us).

d) The painter / the brush / autumn reddened the leaves.
e) Max / the storm / the stone broke the window.
f) Max / the heat/ the candle melted the ice.
g) Max /exercises /bicycles developed his muscles.
h) Max / the storm / the hammer enlarged the hole in the roof.

The verbs in (2) are sometimes described as causative, but this does not help us very much, since those in (1a,b) are also causative. If all we have, to account for θ-selection, is what has been assumed so far, then a verb like *open* must be listed as three entries, each selecting a different external θ-role.

This small puzzle of θ-selection tied in with a more central problem. At the early nineties, the question of the analysis of unaccusative verbs was reopened. The prevailing assumption before was that unaccusative verbs are basic lexical entries, namely, they are listed as such in the lexicon. It had been observed that many of the unaccusative verbs have also a transitive alternation, known as the *causative -incohative* alternation, but the standard approach to such alternations was that the transitive (causative) entry is derived from the basic unaccusative entry. This also appeared consistent with the semantics of this alternation. Thus, Dowty (1979) argued that, semantically, the unaccusative *break* is composed of an abstract stative adjective (like *broken*) to which a *become* operator applies. The transitive entry is derived by applying a *cause* operator to this entry. However, Levin and Rappaport (1992) and Borer (1994) pointed out that this view, by which the set of unaccusative verbs is just listed individually in the lexicon, raises certain learnability problems. Unaccusative and unergative verbs have dramatically different syntactic realizations, so it is crucial for the child to determine which one-place verbs are unaccusative, and the question is how this knowledge is acquired. This is particularly noticeable in languages where there is no morphological or auxiliary marking of unaccusativity (like English and Spanish, which do not distinguish the derivations by the auxiliary.)

In a seminal paper Chierchia (1989) argued that it should be the other way around - the transitive entry is basic, and the unaccusative entry is derived from it by a lexicon operation of reduction. A major argument was that this might explain the morphological similarity found in many languages between unaccusative and reflexive entries. For reflexive verbs it had been widely assumed that they are derived by a lexicon operation reduction from a transitive entry. So if unaccusatives are derived the same way, reflexive morphology can be viewed as marking that a reduction operation took place. However, Chierchia does not define the conditions under which unaccusative reduction takes place.

While his system correctly generates a derivation like *The window broke*, for the verb entry in (2e), it would equally generate **The baby fed*, for the entry in (1a), or **The soup ate* for (1c). This means that the learnability problem is not solved yet by this analysis. The child still needs to know which transitive verbs allow an unaccusative alternate.

I argued (in Reinhart 1991, 1996) that nevertheless, Chierchia's shift of perspective enables a solution to the problem of defining the set of unaccusative verbs. Previous attempts at a definition focused on the outputs of reduction and looked for properties shared by the unaccusative entries themselves, like aspectual properties. But they were not successful, because there is no reason why the outputs should share any property. (I show there in some detail why the aspectual analysis, which assumes, roughly, that all unaccusative predicates are telic, cannot work. Note that even in our small sample, the unaccusative verbs *develop* and *enlarge* corresponding to (2g, h) are not telic.) But if we look instead at the transitive source of unaccusative verbs, then the shared property is immediately available: The verbs in (2) are a representative sample of transitive alternates of unaccusative entries. All such alternates show precisely the same problem of θ-selection; they all allow **agent, cause**, and **instrument** as their external argument. (I will return to Levin and Rappaport's (1995) objections to this claim of Reinhart (1991).) To see how the reduction operation could be defined to capture correctly the set of unaccusative verbs, we need an answer to the θ-selection problem above, namely, to the question what it is that these three roles (in (2)) share.

Let us see first the intuition underlying the feature system I propose. What we are concerned with here is the linguistic coding of causal relationships. Much study has been devoted to the relations between θ-roles and aspectual properties of verbs (and sentences). The seminal work in this area is Jackendoff's (1990), who established the fact that two systems are interacting in what is perceived as the thematic structure of verbs. In his implementation of this insight, he assumes that the division is inside the theta system, and he distinguishes those roles that fall in the 'actor tier' from those belonging to the 'thematic tier' (which governs 'paths'). It is only this aspect of his system which I question. There is no apriori reason to assume that both these systems are captured by thematic roles. My view is that θ-roles and Aspect are two independent systems that, obviously, must have some interface (causality being relevant for both), but one should not attempt to capture properties of the one system within the other. So I focus on identifying the features that must be assumed for the θ-system, which codes the basic causal relations, or, in Jackendoff's terminology, on the 'actor tier'. But certain roles identified by Jackendoff as belonging to the aspectual ('thematic') tier, like **goal,** do belong to the minimum necessary inventory of θ-roles. What is left open here is their interactions with Jackendoff's paths, which I assume should be captured in the system of Aspect. [3]

[3]Grimshaw (1990), who also attempts to capture aspect within the system of thematic roles, assumes a different division of the two role-systems than Jackendoff's. She takes the thematic roles to include **agent, experiencer, goal, source, location**, and **theme**, while **cause** is her major aspectual role. This is based on a common approach which attempts to reduce aspect to causal relations (or hidden causal predicates). I share her belief that the **cause** role (or, more precisely, the feature /+c in my system below) plays a crucial role in determining the eventive (telic) nature of predicates, although I cannot enter this question in the present paper. However, I do not think that

Focusing first on just the few basic θ-roles mentioned so far, we may observe that in causal terms, there is an overlap between the roles **cause** and **agent** - If an argument is an agent of some change of state, it is also a cause for this change. We may label the feature whose value they share */c - cause change*. The difference is that agency involves some mental properties of the participant, which we label */m - mental state*. The same property distinguishes the **experiencer** role from **theme** or **patient**. Note that (as is standard) [/+m] entails animacy, but not conversely. An animate patient of an event (say someone who got kissed) may have all kinds of mental-states associated with that event. But the linguistic coding does not consider these mental-states relevant for the argument structure. The specifics of the mental state involved vary with the features-combination. Occurring with /+c (namely in the **agent** role), it is taken generally to entail volition. But combined with a /-c feature (**experiencer** role) it is associated with various emotions, depending on the verb.

Assuming binary features, the possible combinations of these two features define four clusters: [+c+m], [-c+m], -[+c-m] and [-c-m]. [+c+m] corresponds directly to the **agent** role, as we just saw. [-c+m] is a faithful formalization of the perception of the **experiencer** role in linguistics. A participant standing in that role-relation to the event is not perceived as causing a change (or standing in a **cause** relation with the event), but the event concerns this participant's mental state. We should note, however, that the familiar roles do not always need to correspond uniquely to a θ-features cluster. There are instances where different interpretations of the same cluster are governed either by lexicon or semantics generalizations, or by other properties of the lexical semantics of the verbs.

The cluster [+c-m] is consistent with both the **instrument** and the **cause** role**.** In both cases, the bearer of the role causes a change, and no mental state is involved. The difference is that an instrument never does it alone, but in association with an agent. There is, however, no reason to assume additional features for capturing this difference, since it can be derived across the board by a lexical generalization like (3).

3) A **[**+c-m] cluster is an instrument iff an **agent ([+c+m])** role is also realized in the derivation, or contextually inferred. (Reinhart 2002, (54), section 3.2, slightly modified here.)

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capturing this requires postulating two distinct θ-roles systems. Rather, aspectual computation should be able to read the θ-features, and combine this information with other semantic properties of verbs and of their complements, which are independent of the thematic properties. Grimshaw's crucial arguments for the **cause** role belonging to the aspectual system comes from experiencer alternations, on which, as well, I take a different line, in part II of this paper.

The features system also does not distinguish **theme** and affected **patient**, which both correspond to [-c-m]. But it is not obvious that this distinction must be a property of thematic roles. Rather, these two construals of the [-c-m] cluster may follow contextually (e.g. from the question which other clusters the verb selects), or from an independent typology of verbs (e.g. affecting or non affecting verbs). Other instances where the precise construal of a given feature cluster is determined contextually will be mentioned briefly below.

Now we can return to the θ-selection problem illustrated in (1) and (2). So far we considered only combinations of two features, but the system allows also for unary clusters, which are specified only for one feature. One such cluster is [+c], which contains the feature shared by the roles **agent, cause** and **instrument.** While the verbs in (1) (*feed, eat)* select an agent [+c +m] as their external role, the verbs in (1) (*open, break*) select a [+c] argument. I assume that when a verb selects a role specified only for one feature, this means that it can be interpreted with any value for the other feature. Thus, in (2), the external role can be interpreted as either a [+c +m] argument, namely an agent, or a [+c -m] argument. As we just saw, the interpretation of this second construal is determined by the generalization (3), namely it can be an instrument or a cause, depending on whether an (unrealized) agent role must be contextually inferred.

This, then, provides the clue to the unaccusative question: The lexicon reduction operation which generates one-place unaccusative entries from transitive entries applies only to verbs selecting a [+c] role. (I return to the technical aspects in sections 2 and 3, but this will entail that we cannot derive, e.g. **The soup ate,* based on the transitive entry *eat*, since this verb does not selects a [+c] cluster). This lexicon reduction is a fully productive operation. Universally, all verbs with this feature cluster (and a **theme** [-c-m] cluster) have an unaccusative alternate, as in *The window broke*.[4]

It is nice to observe that this generalization correlates with the lexical-semantics characterization that Levin and Rappaport (1995) offer for (a large set of) unaccusative verbs. They argue that these unaccusative verbs can be characterized by the properties of the eventualities they denote. These eventualities are a. "externally caused" and b. "can come about spontaneously, without the volitional intervention of an agent" (p. 102). Put in terms of the verb-entries they are derived from, rather than in terms of properties of eventualities, these verbs require a **cause** -[+c], but not /+m, which would have entailed that the event could not have 'come about' without an agent. Levin and Rappaport accept Chierchia's line that unaccusative verbs are derived from a transitive entry (for at least a large set of unaccusatives). But they believe that the properties just mentioned are always visible also at the derived entry, and it is these properties that enable the child to observe that the entry is derived. I don't think this is necessarily always the case. In our small sample in (2), this is not true for the

[4] I know only of very few exceptions (namely of verbs which select a [+c] argument but do not have an active unaccusative entry). Idan Landau points out that *destroy* and *hit* do not have an unaccusative form in English. But *destroy* does have an unaccusative entry in Hebrew (*neheras*) and in French (*se-detruire*).

unaccusative entries of the verbs *develop* and *enlarge*, and I turn directly to other instances. But the eventualities denoted by the transitive source of the unaccusative entry always meet Levin and Rappaport's description. So I believe our different analyses rest essentially on the same basic intuition. They furthermore identify the same two basic properties that are crucial in the interpretation and classification of verbs: (external) causation and volitionality (or other mental properties). This is precisely what we would want. The θ-features should correlate with interpretative generalizations discovered in lexical semantics. On the present view, these features provide the basis for the causal interpretation that speakers associate with sentences, a topic on which lexical semantics provides many insights.

Nevertheless, there is an issue of how this basic intuition is coded in language. Levin and Rappaport (L&R) argue against the features-based approach (as presented in Reinhart, 1991), and offer some arguments for their position that the relevant generalization can only be stated in terms of world knowledge, and properties of eventualities (L&R p. 105). If true, this raises some puzzles of legibility. The computational system (syntax) must determine for each one-place verb it selects from the lexicon whether an unaccusative or an unergative derivation should apply. It is not obvious how this blind and mechanical system that doesn't speak English can use descriptions like "external causation" or "volitional intervention". (In the system I propose below, the CS does not read the content of the features, but only their +/- values.) Leaving such questions aside, let us check if it is indeed possible to state the relevant generalization in terms of properties of events in the world.

L&R define 'external causation' by comparing it to the complement property of 'internal causation', which is typically found with unergative verbs: A one-place verb describes an internally caused eventuality if "some property inherent to the argument of the verb is 'responsible' for bringing about the eventuality "(p.91). If we are talking indeed about properties of events in the world, then many unergative verbs would not meet this description. Thus, the event described by the unergative derivation *the diamond glowed* could not have just come about without some source of light - the "external cause" of the glowing. It is true that diamonds also have some internal property that enables them to glow, but that does not distinguish a glowing event from an event of a glass breaking - the glass has some fragility property that enables it to break. So, in this case, it is not just a problem for the stupid computational system. Even a human child, with an innate system of inference, would not be able to decide whether *glow* is unergative or unaccusative, based on his knowledge of the world. More generally, what we are concerned with here is not properties of events - the conditions under which they can take place in the world - but their linguistic coding. Though a breaking event and a glowing event require both some external factor initiating the process, language codes the cause for the event of breaking, but not for the event of glowing. The linguistic coding of concepts, I argue, is captured by feature-clusters of verbs.

Unlike some other debates on such issues, the matter at hand can also be decided empirically, thanks to the fact that L&R's work meets the condition of being strictly falsifiable - an elementary condition in science, which is not always adhered to in lexical semantics:

While a partial alternation of transitive and unaccusative verbs has always been acknowledged (as I

mentioned), I argue that one-place unaccusative verbs are never basic entries, but are always derived in the lexicon from a [+c] verbs (with a **theme** as the second argument). Following Chierchia (1989), this does not entail that we should always find active alternates in all languages. It is possible that the a verb got frozen in its unaccusative form in the lexicon of given language. But the fact is that (with very few exceptions -expected in the area of the lexicon) all one-place unaccusative verbs have a transitive alternate with a [+c] role in one language or another. E.g. in Hebrew, the transitive alternate for *come* (*ba*) is *bring* (*heb'i*).[5]

In L&R's analysis, by contrast, the set of unaccusative verbs is determined, as we saw, by the properties of the situations they may denote in the world. In many cases, unaccusative verbs derived from a [+c] entry correspond indeed to externally caused events, but there are others where they do not (like the case of *develop* and *enlarge* mentioned above). This is probably due to the interactions of the thematic and the aspectual systems. L&R note, indeed, the existence of a substantial set of unaccusative verbs which can only be perceived as 'internally caused'. This is their group of "existence and appearance" with verbs such as *exist*, *happen, come*, *arise, remain*. They conclude, therefore, that we need two types of unaccusative verbs: the "externally caused" type which indeed derives from a transitive entry, and is identified by the child as unaccusative, based on world knowledge, and the "internally caused" type which must be listed individually in the lexicon as unaccusative basic entries, and is just learned as a list.

We should note that some of the verbs L&R list in the second set are two place unaccusative verbs like *appear*, or *stand* (in the L&R's 'simple position' reading, as in *The statue stood *(in the corner).* I will argue, in sections 1.2.4 and 3, that these are indeed basic unaccusative verbs. However, they don't have to be listed as such in the lexicon, since this follows from their feature composition. But sticking to one-place unaccusatives, can we decide whether "inherently caused" unaccusatives are basic or derived? In their careful and responsible manner, L&R provide the criterion for decision (without which the theory will be unfalsifiable), namely they accept Chierchia's (1989) criterion that if an unaccusative entry is derived, it should have an active transitive alternate in one language or another. They proceed to argue that the verbs in this set do not have a transitive entry in any language. This, then, is a straightforward empirical Question. Space considerations do not allow dwelling further on this point here, but I showed in Reinhart (2000, section 3.4.1) that virtually all these verbs have a [+c] transitive alternate in Hebrew. E.g.: ***x*o*l*el/hit*x*o*l*el** *(bring about/ happen)*, ***k*i*y*e*m*/hit***k***a*y*e*m** *(carry out)/ take-place, exist)*, *he**r**i**m* / hit**r**o**m**em (raise /arise).* The transitive entries underlying such verbs do, in fact, meet L&R's description of denoting an externally caused, but not necessarily an agentive event, because these are the properties entailed by [+c] verbs. We may conclude that the set of unaccusative verbs is defined by the linguistic properties of the basic verb they are derived from, and not by properties of the situations that unaccusative verbs denote in the world.

The last empirical question ties in with a broader question of the concept of the lexicon. Two (extreme) views can be identified in the spectrum of approaches. The one views the lexicon,

[5] The verb *arrive* is an exception in all languages I know.

essentially, as a list of exceptions or idiosyncrasies, which lists everything in language that syntactic or other generalizations cannot derive. The other is that the lexicon is the information storage of everything needed for speakers to actually use language to describe the world. In some sense, everything comes from the lexicon. This view entails also that lexicon information is largely universal (except, of course, for the sound coding), has minimum idiosyncrasy, and is governed by generalizations that are relevant also for the computational system. I argued in Reinhart (1996) that in linguistics practice, the second view in fact prevails. E.g. although we could, in principle, assume many separate verb entries for the same verbal concept, linguistic practice is guided by the principle of Lexicon Uniformity, which states that each verb-concept corresponds to one lexical entry with one thematic structure, and entails that the various thematic forms of a given verb are derived by lexicon-operations from one thematic structure (Reinhart, 1996, (7)). Thus, most linguists don't view a passive verb as an entry independent of its active alternate and listed separately in the lexicon..

Both L&R and I work within this second view of the lexicon. The question that arises now is how to deal with exceptions, within this view. It is often the case that any theory must leave large parts as exceptions, listed individually in the lexicon. Some of these are indeed idiosyncrasies that are frozen in the lexicon of a specific language. Others may be instances where we are not able yet to define the governing generalization. Decisions in this area (as in any other area of science) must rest on comparing available competing theories. A theory that provides a generalization for large part of the facts, and leaves other large parts as exceptions, is superior to a theory that leaves everything as just lists. But this is so only as long as there is no other theory that reduces substantially the number of exceptions. In the present example, L&R's analysis accounts for a huge number of unaccusative verbs, but leaves a substantial set as exceptions. In the feature-based approach I proposed, the set of exceptions is minimal, and most of them are just as we should expect in the theory of the lexicon - language specific idiosyncrasies, or frozen elements.

With this summary of some of the motivation for assuming θ-features, we may turn now to a brief survey of the full system. The two binary features: +/-c = *Cause change* and +/-m = *Mental state* define the nine feature clusters in Table 1. As mentioned, the correspondence of these clusters to the known θ-roles is not always one to one. Many of the feature clusters have varying contextual interpretations. In this respect, this system follows Dowty's (1991) insight that the meaning of θ-roles is often contextually determined. As often in the past, I view much of what I am doing here as an attempt to implement as many of his intuitions as I can. Nevertheless, it is convenient to have some proto-names for the clusters, so I label them by the role that they are most typically related to.

Table 1.

a)	[+c+m]-	**agent**
b)	[+c-m] -	**instrument** (...)
c)	[-c+m] -	**experiencer**
d)	[-c-m] -	**theme** / **patient**
e)	[+c] -	**cause** [6]
f)	[+m] -	**sentient** (?)[7]
g)	[-m] -	**subject matter** /**locative source** (Typically Oblique)
h)	[-c] -	**goal** / **benefactor**(Typically Dative (or PP))
i)	[ ] -	**Arb(itrary)**[8]

Notation:

[α]	=	Feature cluster α.
/α	=	Feature (and value) α. (E.g. the feature /+m occurs in the clusters [+c+m], [-c+m] and [+m])
[/α]	=	A cluster one of whose features is /α. (E.g. [/-c] clusters are [-c+m], [-c-m] and [-c].)
[+]	=	A cluster ALL of whose features have the value +. (E.g. [-] clusters are [-c-m], [-c], [-m].)

[6] In Reinhart (2000) I associated the label **cause** with the cluster [+c-m], namely, this cluster was labeled both **instrument** and **cause.** [+c] was assumed to be a special, unnamed, cluster, consistent with various construals. However, I did not find subsequently any verb that selects an argument that is obligatorily only a **cause** (i.e. cannot be realized also by an **instrument** or an **agent**). Hence, it appears that the role **cause** actually corresponds in natural language to the cluster [+c]. The construal [+c-m] is still the one that captures the semantic properties of this role, but this is obtained for **cause** arguments only via the cluster [+c].

[7] This cluster has not been identified as an independent θ-role before. I label it **sentient**, in the present draft, just to give it a name. Arguments with this feature-cluster are the subjects of verbs like *love*, *know*, *believe*, which have been viewed as instances of the **experiencer** role before. In its semantic interpretation, this role may be hard to distinguish from the **experiencer** role, but it has very different syntactic realization (linking): It always merges externally, unlike the standard **experiencer,** which has varying realizations, as we shall see. Other candidates for bearing this cluster are arguments of verbs like *laugh*, *cry*, and *sleep*. These verbs require an animate argument, but do not involve necessarily agency or a causal relation with this argument.

[8] Logically, the system should contain also this [ ] cluster (unspecified for both /c and /m). For a while, there didn't seem to be an actual role corresponding to this cluster (which would be a problem). But Marelj (2002, and her forthcoming Utrecht PhD dissertation) discovered that it is operative in middle-formation. She distinguishes languages where this operation applies in the lexicon and in the syntax. In Lexicon languages (including English), the operation involves a change in the feature composition of one of the clusters (as is the case also with the causativization lexicon operation, to be discussed in section 2). She shows that the resulting [ ] cluster corresponds in its interpretation to the ARB(itrary) variable that Chierchia (1995) identified in impersonal constructions.

The clusters (a-d) are fully specified, with a value for both features. The [+] (all plus) cluster (a) has a fixed θ-role interpretation as **agent**, and the [-] (all minus) cluster (d) also corresponds stably to what has been labeled the **theme** and **patient** roles. (But these roles have been anyway used already to cover several different contextual realizations.) The mixed-value clusters (b,c) are somewhat more varied in their role interpretation. They most typically correspond to the **instrument** and **experiencer** role, respectively, but they also have some related uses which are not covered by any of the existing θ-role labels (and which will be exemplified briefly later). The underspecified clusters in (e-h), which I will refer to as *unary clusters*, have even greater interpretative freedom. We saw already that a verb selecting a [+c] (**cause**) cluster can realize also with an **agent** or **instrument** interpretation of this argument. The unary [-] clusters (g-h) have the widest range of thematic realizations. They always merge as internal arguments (as we shall see), and they require a preposition (or the dative case) for their thematic specification. The syntactic correlate is that a DP realizing such clusters cannot check accusative case.

Recall that the information coded in the θ-system is relevant for two different systems - CS (syntax) and Inference (semantics). The information relevant for the CS falls into two types: First, the formal properties of the feature clusters should enable determining the order of merging (external or internal - the linking/mapping problem.) Note, e.g. that just the fact that we identified unaccusative verbs as deriving from [+c] transitive alternates, does not yet explain why the remaining **theme** argument needs to merge internally, unlike, say, the **theme** argument of basic one-place verbs like *glow*. This is among the questions that the order of merging component should capture, and which I discuss in section 3. Next, I will argue that the θ-clusters determine certain aspects of the case system. A central assumption in linguistics is that internal arguments of the verb receive either the structural Accusative case, or an inherent case mediated by a preposition or dative. However, not much is known regarding how this choice is formally determined, and to a large extent, this information is assumed to be listed individually for verb entries in the lexicon (or at least all verbs assigning a case other than Accusative must be individually listed). In a more optimal setting, this information should be determined in a unified way for all verbs, based on their feature composition, and in section 3, I turn to the way this can indeed be done. Further aspects of the view of the accusative case within the Theta system are discussed in Reinhart and Siloni (2003), who argue that a distinction is needed between the structural and the thematic properties of case.

But the same θ-features play also a crucial role at the semantics interface. We have been viewing them as a formal coding of the information associated with thematic roles, which determines many aspects of the interpretation of syntactic derivations. I assume that the feature-clusters are passed to the inference system (semantics) through the syntactic derivation. (Technically, once a θ-cluster is assigned to an argument, the cluster is copied to this argument, and, thus, is available to the semantics.) Although my primary concern in this paper is the properties of these clusters that are relevant to the CS, it is crucial that they be interpretable. Let me, therefore, summarize, briefly, their interpretative properties (which are discussed in greater detail in Reinhart (2000, chapter 4).

I assume standard event-semantics representations of thematic roles (as, e.g. in Parsons, 1990).

Given a verb entry like (4a), and a syntactic derivation (4b), the semantic representation is (4c) (coached here in the notation easiest to read).

4) a. Verb entry: *wash* [Agent] [Patient]
   b. Max washed the child.
   c. ∃e (wash(e) & Agent(e)=Max & Patient(e)=the child))
   d) ∃e (wash(e) & [+c+m](e)=Max & [-c-m](e)=the child))

In (4c), Max is said to stand in the Agent relation to the event e, and some debate evolves around the question whether this relation can/should be further decomposed. Given that θ-roles are replaced in the present system with θ-clusters, the actual representation which is derived for (4b) is (4d), and the question is how representations like (4d) are interpreted.

In interpretative terms, what θ-features code are the basic causal relations expressed by the verb-concept. As is well known, causality (unlike entailment) is not a logical relation, but it is a relation imposed by human perception on the world. This is the source of difficulty in formalizing lexical semantics. Understanding the contribution of these features to the inference system requires at least some tools for describing our perception of causality. (Note that this is not a problem specific to the present system. Standard lexical semantics uses capitalized CAUSE predicates, but as widely acknowledged, their meaning is no less opaque.)

Shen (1985) (in a study of the perception of the relations between events in narrative discourse, relying on research in Artificial Intelligence) defines three causal relations that humans use to organize their perception of events: The relation **enable** holds when one event is perceived as a necessary condition for the occurrence of the second. If Max entered the pool and then he drowned, his entering the pool is a necessary condition for the drowning, but it is not a sufficient condition - many people enter swimming pools without drowning. The relation **cause** holds when the first event is conceived as a sufficient condition for the second. Given two events of a glass falling followed immediately by its breaking, the causal perception is that the first is also a sufficient condition for the second, keeping in mind that this is a perception-driven, and not the logical concept of sufficient conditions. (**cause** holds also when one event is both a necessary and a sufficient condition for another.)[9] The relation **motivate** holds when either **enable** or **cause** hold, and in addition, a mental state mediates the events (e.g. if Max wanted to eat, so he started to cook.)

I proposed that a /+c feature is associated with a participant whose relation to the event denoted by

[9] Ehrich (this volume) mentions that Hume's definition of the relation 'cause' (further developed by Lewis) is that "a given event e_1 is to be considered the cause of a second event e_2, iff - *ceteris paribus* - e_2 wouldn't have happened, unless e_1 hadn't happened before". In other words, cause is defined as a necessary condition. Note that in the present system this corresponds to the *enable* relation. My point is that in our actual perception of causality, we would not describe this relation as cause (e.g. we would not say that Max's entering the pool caused him to drawn), unless the first event is also perceived as a sufficient condition for the second.

the verb is perceived as providing (by its existence or actions) a sufficient condition for that event taking place. A /+m feature is associated with a participant whose mental state is relevant for the event. As in the case of **motivate**, it does not, itself, determine the causal relation of the argument to the event (whether it provides a sufficient condition). The crucial question in identifying the θ-role (cluster) of an argument is whether it could serve as a **cause**, namely, form a sufficient condition or be a member of a set of such conditions. The later instance arises in the case of the **instrument** role, which, as we saw, can never provide a sufficient condition alone. However, the set {**agent, instrument**} forms together a sufficient condition. The relation **enable** does not correspond to any feature: All selected arguments can be viewed as providing necessary (enabling) conditions for the event.

Returning to the feature clusters in Table 1, the most puzzling, and context-dependent are the two unary [-] clusters: [-c] and [-m]. In interpreting them (or in deciding which of these two a verb selects), the crucial question is the one I just mentioned, whether the argument could be viewed (in an appropriate context) as providing a sufficient condition for the event, i.e., as a cause. An argument is [-m] if in principle it could have also been a sufficient condition. In section 6, we will see that the role **subject matter**, discovered by Pesetsky (1995) is such a role. In *Lucie worries about her health*, the argument *her health* could, in principle, represent also the cause of the worry. Whether it is interpreted as the cause or not, depends on whether other causes are mentioned. (Possibly, e.g. it is the doctor that made Lucie worry about her health). If an argument cannot be interpreted as a sufficient condition, as is the case e.g. with **goal**, it must be [-c].

Further questions arise regarding how this basic intuition of causal interpretation is implemented, particularly the roles **cause** and **agent**. (These as well are not specific to the system presented here, but are general topics of debate regarding the representation of lexical meaning and θ-roles.) In lexical semantics, it is common to assume that capturing lexical meaning requires abstract semantic representations that contain predicates invisible in the overt structure. This is based, (among other things) on the view that **cause**, **agent,** etc. cannot be viewed as a relation between an event and one of its participants, but they must represent a relation between events. Thus, in the tradition of Dowty (1979), Levin and Rappaport (1995), assume that transitive *break* has a semantic representation like *[[y do something] CAUSE [x become BROKEN]]*. The same is assumed, in different semantic styles, by many others. Although I am not sure this is the correct approach to the problem at hand, I argued (2000, chapter 4) that it is possible to translate the information coded in the θ-clusters into such representations, at the semantics interface. But in any case, there is no justification to coding these abstract predicates also in the syntactic derivations, as is popular in some frameworks, because the information provided by the θ-clusters is sufficient for this translation.

1.2. Some classes of two-place verbs:

The cluster composition of verbs defines several classes with distinct syntactic realization. Let us review quickly the verb classes mentioned so far, and examine a few others.

1.2.1. [+c] subjects.
As we saw, the characteristic property of verbs selecting a [+c] argument is that they allow this argument to realize as either an unspecified **cause**, or as an **agent** or **instrument**, as in (2), partially repeated.

These verbs are further distinguished by their internal role. In the set (2), it is a **theme** ([-c-m]).

2 *V([+c], [-c-m])* - *break, open...*
a) The wind /Max /the key opened the door
b) The storm /Max /the stone broke the window.
c) The heat/ Max / the candle melted the ice.

Universally, all verbs with this feature cluster have an unaccusative alternate, as in The window broke.[10] The converse also holds: All one-place unaccusative verbs (with very few exceptions) have an active alternate with a [+c] role in one language or another[11].

Another set of [+c] verbs select an **experiencer** ([-c+m] as their second argument, as in (3).

3 *V ([+c], [-c+m]* - worry, amuse, scare, surprise... ,
a) Max / the noise / the gun scared Lucie.
b) Fred/ Fred's behavior /the discussion surprised Lucie
Fred/ Fred's gedrag /de discussie verbaasde Lucie.

Verbs with this feature cluster also have a one place alternate ('Subject Experiencer'). In English, examples like (4a) are rare. (Commonly, the English alternate is in a passive form.) In other languages it is very productive, and with few exceptions, as with the Dutch (4b).

4 a) Max worries
b) Max verbaast zich (Max was surprised).

Unlike the alternates of (2), the experiencer alternates of (3) are unergative. This is argued in detail in Reinhart (2000), but for here suffice it to note that verbs occurring with zich in Dutch allow only an unergative derivation (-The subject merges externally).

[10] As mentioned, I know of very few exceptions (namely of verbs which select a [+c] argument but do not have an active unaccusative entry). See footnote 4.

[11] Note that the claim is not only that one-place unaccusative entries have a transitive alternate, but that this alternate is a [+c] verb. Again, exceptions are hard to find, but one I know is the verb grow. In many languages, the transitive alternate of the unaccusative grow takes agent but no instrument or cause (which suggests that it selects a [+c+m] argument). Possibly the same holds for cook. The verb *drown* varies across languages on whether it allows **cause**, or just an **agent,** in its transitive entry.

1.2.2. [+c+m] subjects

The varying interpretation of the external role is found only with [+c] verbs. Verbs selecting an agent ([+c+m]) have fixed interpretation, as illustrated in (5). The feature /+m present in this cluster entails that the argument must be human or animate (though, as is well known, machines, and particularly computers, behave linguistically as if they were human).

5 *V ([+c+m], [-c+m]*

a) The baby/ *the spoon /* hunger ate the soup.
b) Lucie/ *The razor/*the heat shaved Max.
c) Lucie/ *the snow/ *the desire to feel warm dressed Max

d) Max shaved/dressed.

A small subset of these verbs have a reflexive one-place alternate universally, as in (5d). The definition of this subset is still a mystery. In Reinhart and Siloni (2002), we argue that the derivation of reflexive verbs is unergative.

1.2.3 'Manner verbs'

Levin and Rappaport (1995) noted the peculiar behavior of 'manner verbs' like peel, cut, screw, sow, drill, [sterilize -?]. They allow either an **agent** or an **instrument** subject, as in (6), but unlike the groups in (2) -(3), they do not allow **cause**, as in (7). They also do not have a reduced (unaccusative) entry.

6 a) Max peeled the apple (with the knife)
b) The knife peeled the apple.
c) *The heat peeled the apple.

7 a) *The apple peeled.
b) *The hole drilled. (Max drilled a hole.)

What defines this set is that the verbs include a reference to a specific instrument (-The event denoted could not take place without that instrument.) In interpretative terms of causality, this means that the verb is associated with a set of two conditions which together are sufficient - it selects two [/+c] roles. In standard **agent** verbs, as in (5), an **instrument** is always allowed optionally, but it is not directly selected by the verb. (This is a general entailment licensed by the **agent** role, which need not be listed for each individual entry.) But in the case of 'manner verbs' they select an **instrument** as part of their grid. So their entry is (8).

8) drill/peel ([+c+m], [-c-m], [+c-m])
agent, patient, instrument

When a verb selects two [/+c] roles, only one is obligatorily realized. (and the other may be present only in the semantics). The mapping generalizations we turn to directly will determine that if both **agent** and **instrument** are realized, then the **agent** must be the external argument,as in (6a). But if only the **instrument** is realized, as in (6b), it must be the external one.

Idan Landau pointed out that the set of manner verbs is much wider than those selecting an instrument. Verbs like fill are also associated with a set of two conditions which are sufficient only together (- the filler and the water in (9), which can be both viewed as causing the pool to fill).

9 a) Max/the hose/ the storm filled the pool with water.
b) The water$_{[+c-m]}$ filled the pool.

c) fill ([+c], [-c-m], [+c-m])

d) The pool$_i$ filled t_i with water.

Though water in (9) would not be labeled an **instrument**, its relation to the verb is the same as in the instrument-verbs in (8). So it is also a [+c-m] cluster. But the external cluster differs here. fill is compatible with an **agent**, an **instrument** and a **cause** role, as in (9a). I.e. the verb selects a [+c] cluster, rather than the agent [+c+m]. Its entry, then, is given in (9c).

Again, assuming that of two [/+c] roles, one can be unrealized syntactically, we obtain also (9b), analogously to (6b). But since this is a [+c] verb, we expect to find also an unaccusative realization (obtained by reduction, to which we turn directly). Indeed we find it in (9d). That (9d) is a derived (reduced) form, but (9b) is not, can be witnessed in Hebrew which marks such processes in the morphology: In (9a,b) the verb is mile, while in (9d) it is hitmale (reflexive morphology, common also with unaccusatives).

Other manner verbs, with the same θ-clusters and syntactic properties are the family of stain, lixlex (dirty).[12]

[12]Interestingly, the semantic complements of the fill/stain type verbs - empty and clean - differ minimally in their θ-selection. Rather than a [+c-m] cluster, they select a [-c] cluster (which corresponds here roughly to a **source** role), as in (i).

i) empty/clean ([+c], [-c-m], [-c])

1.2.4 [-] verbs (two-place unaccusatives).

A set of unaccusative verbs with specific properties is those selecting two internal arguments: Levin and Rappaport (1995) discuss verbs selecting a locative as their second argument: live, appear (and stand, lie, in their 'simple position' use). But this is a much broader set, not restricted to locative arguments: escape, piacere/appeal, elude, occur, belong, lack, miss, suffice. A typical property of these verbs is that they do not have an alternate with a [+c] role, and they always realize only as unaccusative. (The unaccusative properties of the later set are discussed in detail in Pesetsky (1995).)

In terms of their feature clusters, what they share is that they select only [-] arguments. In the present system this entails, as we shall see, that their arguments must realize internally, and that they cannot assign an accusative case. But identifying their specific clusters, and the various subclasses in this set, still requires work.

A property found with many of these verbs is that they allow an amazing array of interpretative options. E.g. in terms of the standardly assumed thematic roles, it is hard to see what role is shared by the internal arguments in the two escape sentences in (10).

10 a) The solution$_i$ escaped t_i Max.
b) Max$_i$ escaped t_i the police /from prison.

In (10a), Max has been viewed as bearing an **experiencer** role, which does not find any correlate in (10b), where the argument is of the **goal/source** (location) type. This variation, however, is easily captured in the present system. **Goal-source** arguments are [-c]. (**goal** -always. The '**source**' label is

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ii a) Max/ha-milxama/ha-manof roken et ha-xanuyot mi-kol ha-mlai.
Max/the war/the crain emptied the stores of all the stock.

b) *ha-mlai roken et ha-xanuyot
*The stock emptied the stores.

c) ha-xanuyot$_i$ hitroknu t_i me-kol ha-mlai
The stores$_i$ emptied t_i of all the stock.

This entails a difference in their possible syntactic realizations: Like fill, they can realize the [+c] role, as in (iia), or have it reduced, as in (iic). But what they cannot have is the derivation (iib), which is parallel to (9b), namely the derivation where [+c] is neither reduced nor realized. This is so because a [/+c] cluster is optional only in the presence of another [/+c] cluster. This condition is not met here, so nothing licenses the non-realization of the [+c] role in (iib).

used for a large category, possibly conflating several clusters.) A [-c] cluster only specifies that the argument cannot be a cause, but it is consistent, in principle, with an **experiencer** - [-c+m] interpretation. Indeed a **goal-experiencer** fluctuation is found also in other instances and it follows if **goal** is [-c].

Assuming that the remaining argument in (10) is a **theme** (as is standard), the entry for escape is given, then, in (11).

11 escape([-c-m] [-c])

There are further interpretative mysteries posed by many verbs in this set. E.g. when the **experiencer** interpretation of the [-c] argument is not available, as in (10b), the remaining argument appears to show volitionality properties, similar to those of agents. (Compare also the idea appealed to Max and Max appealed to the judge). This cannot follow from the feature clusters in (11), but I leave such questions open at the present.[13]

A (small) subclass of the [-] verbs allow only an **experiencer** interpretation, like the Italian and French piacere -plaire(roughly: appeal), or the Hebrew maca xen (same). In the present system, we cannot allow them to select a [-c+m] cluster in their base entry, since then the mapping procedures we turn to in section 3 will force the argument with this cluster to merge externally. So for the time being, I still assume for them the analysis in (11).

[13]One option to consider is that in each of the derivations in (10) a different argument moves, as in (i):

i a) The solution$_{[-c-m]i}$ escaped t_i Max$_{[-c]}$.
b) Max$_{[-c]i}$ escaped the police$_{[-c-m]}$ t_i.

Recall that the [-c] role is interpretable as a [+m-c]. In (ia) this yields the standard **experiencer** interpretation we observed. But there may be other interpretations of the [+m-c] cluster (one of which is mentioned below in the discussion of causativization). It entails that the bearer of the cluster (Max) is not the cause of the event, but still his mental state is involved (e.g. the wish to escape).

2. Operations on the Theta grid.

I assume that the verb entries in (2), (3) and (5) (with **cause** or **agent** subjects) are the basic entries listed in the lexicon, and that their unaccusative, experiencing and reflexive alternates are derived from them by a lexicon operation (of reduction).

More broadly, there are three types of operations that can apply to the verb's grid: Saturation, reduction and expansion.

2.1. Saturation:

Saturation, which applies e.g. in passive formation, existentially closes one of the arguments, which will, then, not be realized syntactically. It's application is illustrated in (12):

12 a) wash ($\theta 1$, $\theta 2$)
b) Saturation: $\exists x$ (wash (x, $\theta 2$)
c) Max was washed $t \equiv \exists x$ (x washed Max)

The saturated argument is still present in the semantic interpretation (as stated in (12c)), but the operation has the effect of eliminating the accusative case. I assume that middle-structures also involve some sort of saturation.

2.2. Reduction (arity) operations.

Reduction reduces the verb's arity by one. It applies only to verbs with (at least) two arguments, one of which is external (marked as 1 by the marking procedure in section 3). E.g. it cannot apply in the [-] two-place verbs of (9) and (10). Reduction and saturation exclude each other (only one can apply at a given entry).

There are two reduction operations, depending on whether the internal or the external argument is reduced.

2.2.1 Reflexivization: Internal reduction.

A lexicon operation that has been widely assumed derives a reflexive entry from a transitive one. I assume it operates as in (13).

13 Reflexivization: Reduction of an internal role -SELF-function.
a) V_{acc} (θ_1, θ_2) ---> $R_S(V)$ (θ_1)
b) $R_S(V)(\theta_1) = (\lambda x\ (V\ (x,x)))(\theta_1)$

14 a) $\underline{\text{shave}}_{acc}([+c+m]_1,[-c-m]_2$: Lucie shaved him.
b) $\underline{R_s}(\underline{\text{shave}})([+c+m]_1)$: Max shaved.

The internal role reduction reduces θ_2 of (13a), creating a new one-place verb. The semantic interpretation of this verb is reflexive. $\underline{R_s}$ is defined as the SELF (identity) - function. Following Chierchia and others, I assume that the interpretation of an $\underline{R_s}$ verbs is as in (13b). For concreteness, the basic and the reduced form of the verb shave is given in (14).

Reduction (of both kinds) eliminates the accusative case (which I assume is assigned to the verb in the lexicon, see section 3).

There are two parametric options associated with reflexive reduction:

a. Reduction can apply in the lexicon or in the syntax-LF (Reinhart and Siloni (2002)). In the second case (common in clitic languages), reflexivization is free, and it is possible into ECM subjects. Dutch and English are of the first type, German and Romance languages are of the second.[14]

b. The accusative case can be weak or strong. Weak case is eliminated fully; strong case is eliminated only partially, leaving a case residue which needs to be checked. In the later option, some additional marking (or checking device) is required in the syntax. Typically, this is capture by special inflectional features, whose presence is manifested when an auxiliary occurs - they force a selection of the auxiliary be. Among the Romance languages, French and Italian are of the strong accusative type, so the auxiliary be is found with all reduction outputs. Spanish is of the weak type - Since no case residue is left, it uses have with reduction outputs[15].

When reflexivization applies in the lexicon, it is restricted to a subset of (agentive) verbs, which amazingly appears to be the same in many unrelated languages. But the thematic definition of this set is still a mystery.

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[14]Note that German and Dutch have very similar reflexive-marking: they both use the SE anaphor zich/sich when reflexive reduction applies. Nevertheless, they differ on this parameter: In Dutch reflexivization reduction applies in the lexicon, hence only a restricted set of transitive verbs allow reflexivization with zich (See Reinhart and Reuland 1993). In German it applies in the syntax, hence all transitive verbs allow reflexivization sich.

[15]There are other means of checking the accusative residue: Both Dutch and German use the auxiliary *have* with reflexivization. Nevertheless, their accusative is strong. In the case of reflexivization, the accusative residue is checked by the *zich/sich* argument, which is a defective element capable of checking weak accusative (see Reinhart and Reuland, 1993). In the case of unaccusative verbs, derived by expletivization reduction, to which we turn directly, the remaining argument must originate internally. Hence, *zich/sich* cannot be inserted, and the accusative residue still requires checking. In this case, both languages use the auxiliary be.

2.2.2. Expletivization: External reduction.

The second reduction operation applies to the external role. In Reinhart (2000) I assumed that it is a free operation, applying to any external role, but it is subject to a special condition that [/+m] roles cannot be reduced. However in practice, this operation only applies to [+c] arguments. Hence we may as well skip the special condition and build this fact into the definition of the operation, in (15).[16]

15 -Expletivization: Reduction of an external [+c] role (semantically null function)

a) $V_{acc}\ (\theta_{1[+c]}, \theta_2)$---> $\underline{R_e(V)}\ (\theta_2)$

b) $\underline{R_e(V)}\ (\theta_2) = V(\theta_2)$

External role reduction differs from the internal (reflexivization) reduction in its semantics. The argument reduced by reflexivization is still present in the interpretation (See (13b)), while expletivization eliminates the argument altogether. R_e can be viewed as a semantically null function, as in (15b). The reduced entry denotes just the property corresponding to a one place verb with the remaining argument.

External reduction applies in precisely the same way to all [+c] arguments (with no known restrictions). Thus, two of its outputs are illustrated in (16).

16 a) $\underline{open_{acc}}$ ([+c], [-c-m] ---> $\underline{R_e(0pen)}$[-c-m]

b) $\underline{worry_{acc}}$ ([+c], [-c+m] ---> $\underline{R_e(worry)}$[-c+m]

But these two reduced entries have dramatically different syntactic realizations: (16a) is unaccusative, while the experiencer (16b) is unergative. This difference will follow, independently of reduction, from the mapping procedures in section 3.

[16]There is also an empirical reason for this change: As I mentioned, in Romance and other languages, reflexivization reduction applies in the syntax, at LF, and it also allows an ECM subject to be reduced, as in (i). (See Reinhart and Siloni (2002) for the technical details).

i) Jean se voit [laver Marie] (Jean saw himself wash Mary)

The argument reduced in (i) is the original agent of laver (wash). Reinhart and Siloni assume that at LF a complex predicate (voit-laver (see-wash)) is formed and reduction applies to this predicate. However the verb laver selects an agent, namely what is reduced here is a [/+m] argument. If there was a general prohibition on the elimination (reduction) of [/+m] arguments, it should have blocked it in (i) as well.

2.2.3. Summary: Properties of the reduction operations.
The discussion above assumed three properties (or conditions) shared by both reduction operations, which are summarized in (17). (A more detailed discussion of these properties can be found in Reinhart (2000).)

17 a. Reduction can apply only in a two-(or more)-place entry one of whose roles is external (a [+] cluster, see section 3 below).
b. Reduction reduces also the accusative feature of the verb (fully or partially).
c. Reduction and saturation (passive) are exclusive (only one can apply at each entry).

2.3. Expansion: Causativization.

A widely assumed lexicon operation is causativization, which expands the verb's grid (adds an argument). The relevant operation applies only in the lexicon, and it can be viewed as a concept-formation operation. (Syntactic causativization, which is also common across languages, is known to have very different properties). Lexicon causativization can apply to a one place verb, as in (18a,b), or to a two place verb, as in the Hebrew (18c,d).

18) a) They ran / galloped /walked ----> She ran /galloped /walked them.
b) They worked hard ---> She worked them hard.

c) Danny axal bananot. ---> aba he'exil et Danny bananot.
Danny ate bananas. ---> Daddy fed (acc) Danny bananas.

d) Danny lavash meil. ---> aba hilbish et Danny meil.
Danny wore (a) coat. ---> Daddy dressed (acc) Danny a coat.

In the well studied instances of causativization, it always adds an **agent**-[+c+m] role, and not a **cause**-[+c] role. This can be checked in (19).

19 a) Max / *the leash / *hunger walked the dog to his plate.
b) Max / ?the whip / *the rain galloped the horse to the stable..
c) The father/*the spoon/*hunger fed the baby. (In Hebrew)
d) *The cold weather dressed him with a coat. (In Hebrew)

20 a) The rain made the horse gallop to the stable.
b) The cold weather made him wear a coat.

It is not some inherent (semantic) property of the verbs in (19) that disables adding a (non agent) causer: the Syntactic causativization in (20) allows such a causer. I assume that it is a defining property of the lexicon operation of causativization, that it adds an agent, and that this holds universally. (A better name for this operation, then, would be 'agentivization').

This departs from common views of causativization, which are more liberal[17]. Pesetsky (1995) assumes a much broader range of causativization: He derives the transitive alternate of unaccusative, reflexive and experiencer verbs from the one place entry, by causativization. Some problems this raises are: a. The operation has to add an agent to the basic reflexive entries (and to the verbs in (18), but a **cause**-[+c] to the unaccusative and experiencer entries. b. As pointed out by Friedemann, French does not have lexical causativization. E.g. (18a,b) are impossible in French. How would we explain, then, that it allows this operation to apply just in the case of unaccusative, reflexive, and experiencer entries?

Turning to the details of the operation itself, causativization is a complex procedure. In the cases exemplified here, it involves, in fact, the two operations in (21). (22) illustrates the combined results of the causativization operations in deriving the verb feed in Hebrew.

21 Causativization.

a) *Decausativize:* Change a /+c feature to a /-c feature.
walk([+c+m]) ---> walk([-c+m])

b) *Agentivize:* Add an agent role.
walk([-c+m]) ---> walk([+c+m],[-c+m])

22) axal (eat) ([+c+m], [-c-m]) ---> he'exil (feed) ([+c+m], [-c+m], [-c-m])

The new feature cluster derived by (21a) -[-c+m] - is identical to that of the experiencer role. But this cluster is interpreted as an experiencer only in the context of an experiencing (psychological) verb. In the present context, the remaining /+m feature accounts for a well-known puzzle of causativization outputs: The demoted subject still retains some 'agentive' responsibility for the act, though it is no longer its cause.

(21a) only needs to apply when the original verbs includes a [+c] or a [+c+m] role. (The reason is that no two [+] roles are allowed in a given entry, as we will see in the discussion of the mapping system in section 3.) E.g. in many languages, causativization can apply to verbs selecting an experiencer external role, such as love([+m],[-c-m]), in such cases only (21b) is necessary.

[17]A standard assumption is that causative morphology always indicates that a causativization operation applied. However, I argue in Reinhart (2000) (based on Hebrew) that the morphology cannot be a sufficient indication, since it can also go the other way around: Causative morphology is selected when the verb has a [/+c] role (**cause** or **agent**).

3. The mapping/linking System.

A crucial problem of the theta system is the mapping from the lexicon information to syntax - the order of merging of the verbs arguments. (This is generally faced with thematic hierarchies, or more complex linking rules.)

In this area, the present draft departs most radically from my earlier proposals in Reinhart (2000), so I will discuss it with some more detail.[18]

3.1. Some illustration of the problem.

To illustrate the type of relevant problems, let us look at the following sets of one-place verbs (based on the lists in Levin and Rappaport, 1995).

23) *Unaccusatives* V[-c-m]:
break, open, fall, freeze, melt, grow, develop, drown, defrost, spin, slide, swing, blush, wither, redden, age, alter, awake, blur, change, collapse, decompose, decrease, degrade, diminish, dissolve, die.

24) ***Theme*** *unergatives* V[-c-m]:
glow, shine, beam, glare, glimmer, sparkle, babble, flash, buzz, click, whistle, squeal, stink, bleed, drip, sweat, radiate (L&R's 'emission verbs'); shudder, tremble, flower.

25) ***Agent*** *unergatives* V[+c+m]:
walk, run, march, gallop, hurry, wander, dance, work.
Other unergatives (V[+m?]):
Laugh, cry, sleep.

The unaccusative verbs in (23) force a syntactic derivation dramatically different than that of the unergative sets in (24-25), and the question is where this information is coded, or how the computational system knows whether to merge the verb's argument internally or externally. If all unergative verbs were of the agentive type in (25), then a simple thematic hierarchy could suffice: merge **agent** arguments externally and **theme** arguments internally. The problem is that there is a set of unergatives, listed in (24), which also take a **theme**-[-c-m] argument. Hence it is thematically indistinct from (23) and the question remains how the CS distinguishes (23) and (24). (That these two group have indeed different derivations is well established by syntactic tests. See e.g. Levin and Rappaport (1995).)

[18]Several people pointed out problems with my previous mapping assumptions, but I am particularly indebted to Marc-Ariel Friedemann.

This well known problem (for all approaches[19]) is not solved yet in the present system. A difference between (23) and (24) is that while the verbs in (24) are basic, those in (23) are the output of reduction (so their entry is R_e(V)[-c-m]). But this is not sufficient to derive their different merging properties: As mentioned in the discussion of (16), repeated, Subject-experiencer entries are also derived by reduction from a transitive entry, but their syntax is nevertheless unergative.

16 b) $\underline{\text{worry}}_{acc}$ ([+c], [-c+m] ---> $\underline{R_e(\text{worry})}$[-c+m]

26 a) The doctor$_{[+c]}$ worried Max$_{[-c+m]}$.
cause **experiencer**
b) Max$_{[-c+m]}$ worried.
experiencer

If the basic entry in (16) is realized, we obtain a derivation like (26a), where the **experiencer** merges internally. But if the reduced entry is realized, the same argument merges externally. (That derivations like (26b) are unergative, contra Pesetsky (1995), is shown in Reinhart (2000).) This, then, is another instance of the mapping problem. The questions it poses for the present framework are, first, what distinguishes reduced unaccusatives from reduced experiencing verbs, and next, what enables the same **experiencer** argument to merge both internally and externally.

Needless to say, these are just fragmented examples of the many problems that should be covered by the mapping system, to which I turn now.

3.2. The mapping generalizations.

I follow the notation of Williams (1981), where the mapping instructions are built into the lexical entry by indices (1 marks an external role, 2 an internal one). Obviously, however, this should not be idiosyncratic information listed individually for each verb. Rather, I assume marking procedures which apply uniformly to all verbs, assigning an index to its arguments (feature clusters). Another information that needs to be coded already in the lexicon is the accusative feature of the verb. I argue that whether the verb carries this case-feature is determined by its feature clusters. Hence, this should also be handled in a systematic way by the marking procedures.
Let me first give the full picture - the marking procedures and other generalizations I am assuming for the mapping problem, and then explain their operation in the areas discussed so far.

[19]Of course, various solution to this problem have been proposed in other approaches. Some of their shortcomings are discussed in Reinhart (2000).

Notation, repeated:

[α]	=	Feature cluster α.
/α	=	Feature (and value) α. (E.g. the feature /+m occurs in the clusters [+c+m], [-c+m] and [+m])
[/α]	=	A cluster one of whose features is /α. (E.g. [/-c] clusters are [-c+m], [-c-m] and [-c].)
[+]	=	A cluster ALL of whose features have the value +. (E.g. [-] clusters are [-c-m], [-c], [-m].)

27 Lexicon marking

Given an n-place verb-entry, n>1,

a. Mark a [-] cluster with index 2.
b. Mark a [+] cluster with index 1.
c. If the entry includes both a [+] cluster and a fully specified cluster [/α,/-c], mark the verb with the ACC feature.

28 Relevant generalizations of lexical operations:

a. Saturation and reduction apply to the marked entry (i.e. after marking).
b. (=17b) Reduction eliminates the accusative feature of the verb (fully or partially).

29 CS merging instructions.

a. When nothing rules this out, merge externally.
b. An argument realizing a cluster marked 2 merges internally; An argument with a cluster marked 1 merges externally.

The various thematic hierarchies that have been proposed attempt to define a ranking (hierarchy) for all theta arguments, a project which has encountered many difficulties. The basic idea here is that there are feature-clusters which obligatorily merge externally or internally only, but also others which are not marked, hence they are free to merge in either position, depending on availability of a position, or other CS requirements (such as the accusative case).

The feature clusters fall into the three classes in (30).

30 [-] clusters: [-c-m] (**theme**)
[-c] (**goal**,..)
[-m] (**subject matter**,...)

[+] clusters: [+c+m] (**agent**)
[+c] (**cause**)
[+m] (**sentient** (**?**))

'mixed clusters: [-c+m] (**experiencer**)
[+c-m] (**instrument**)

By (27), the minus ([-]) clusters are marked 2. Hence, they must merge internally. The plus ([+]) clusters are marked 1, i.e. they are obligatorily external. Since there is only one external position, it follows that no lexical entry can realize both an **agent** and a **cause** (or a [+m]) role - a non controversial consequence. The marking system does not impose any further merging order among the internal [-] roles (which are all marked here with the same index 2, regardless of how many of them the verb has). However, other considerations of the CS may do so: Recall that in the present system, the unary [-] clusters ([-c] and [-m]) require inherent case: Preposition or Dative. Hence, they cannot check the accusative case. This entails, then, that given a set of internal arguments of a given verb, only the one with a fully specified cluster ([/α/β]) is able to check the accusative case. So this may dictate the merging position of this argument. I leave it as an open question here whether further ordering, or marking, of internal arguments is needed.

However, there are two feature clusters in (30) which have 'mixed' values, namely those corresponding to **experiencer** and **instrument**. Since these are neither [-], nor [+] clusters, they are not assigned any index by (27). This means that these roles may have varying syntactic realizations.

This provides the basis for explaining the experiencer's puzzle we noted in (26), repeated. The question was what allows the **experiencer** to merge in different positions in (26a) and (26b).

26 a) The doctor$_{[+c]}$ worried Max$_{[-c+m]}$.
cause **experiencer**
b) Max$_{[-c+m]}$ worried.
experiencer

Let us, first, look with more detail at how the marking procedures apply to the basic verb entry of worry.

31 a) Base entry: worry ([+c], [-c+m]...)
b) Marking: worry$_{(acc)}$ ([+c]$_1$, [-c+m]...)
c) Reduction: R_e(worry) ([-c+m])

By (27b), the [+c] (**cause**) cluster is marked 1. But the [-c+m] (**experiencer**) cluster is not marked. On the other hand, it is responsible for marking the verb with the ACC feature, given (27c), repeated.

27 Lexicon marking
Given an n-place verb-entry, n>1,
c. If the entry includes both a [+] cluster and a fully specified cluster [/α,/-c], mark the verb with the ACC feature.

The verb is marked ACC iff it is a two (or more) place verb, it has a [+] role, and one of its clusters is: a. fully specified for both /c and /m, and b. it contains a /-c feature. (I.e. it is a [/α/-c] cluster).

There are two such clusters: the **theme** argument ([-c-m], and the **experiencer** - [-c+m]. These, then, are the two clusters that introduce the accusative feature in the present system. For ECM structures, I assume that the complement IP itself realizes the feature cluster [-c-m], which introduces the ACC feature on the verb. The question how the ACC feature is introduced on the verb, and how it is checked in the CS are not necessary the same. Nothing precludes, in fact, the option that any case-free DP (i.e. DP not bearing inherent dative or prepositional case) can do the job. If so, then the feature cluster of the ECM clause introduces the ACC in the lexicon, and its subject DP checks it in the CS.

The results of marking the verb worry, then, are represented in (31b) -$\underline{\text{worry}}_{(\text{acc})}$ ($[+c]_1$, [-c+m]...) . The CS mapping instruction (29b), determines, now, that the [+c] argument (bearing the index 1) must merge externally. Since the external position is occupied in this derivation, the free (not marked) **experiencer** must merge internally. (The **experiencer** argument must also check the accusative case in the syntactic derivation.) Thus, only the derivation in (26a) is allowed for this entry (*The doctor*$_{[+c]}$ *worried Max*$_{[-c+m]}$).

If reduction applies to (31b), we obtain the entry in (31c) - R_e*(worry) ([-c+m])*. (Recall that reduction eliminates the ACC feature, by (28b).) This entry now contains no marking. This is sufficient to derive that the remaining **experiencer** argument does not have to merge internally, but not yet that it must merge externally. (So far we predict just complete freedom for this argument.) This is where (29a), repeated, plays a role.

29 CS (syntax) generalizations:
   a. When nothing rules this out, merge externally.

The intuition behind (29a) could be viewed as an instance of economy: Since the external position must always be filled eventually (say, for checking the EPP), it is less economical to derive this in two steps, when one-step derivation is also allowed. However, this is relevant only if there is nothing in the system which requires the argument in question to merge internally, or which requires another argument to merge externally. Neither is the case here, so (29a) determines that external merging is the only option, as in (26b).

The other cluster not marked as either 1 or 2 by (27a,b) is [+c-m] (**instrument**). Indeed, varying merging options are found also with **instrument** roles. As noted in the discussion of 'manner' verbs, in section 1.2.3., this role realizes internally if the **agent** is realized, as in (6a), but externally if it is not, as in (6b).

6 a) Max peeled the apple with the knife.
   b) The knife peeled the apple.

As noted there, manner-verb derivations differ from cases like (32).

32 a) open ([+c], [-c-m])
b) Max$_{[+c]}$ opened the car's door$_{[-c-m]}$ with his knife$_{[+c-m]}$.
c) The knife$_{[+c]}$ opened the car's door$_{[-c-m]}$.

The verb open selects a [+c] (**cause**) role, as in (32a). This role has an open interpretation which, in the appropriate context, is consistent also with an **agent** or an **instrument** interpretation. The subjects in both (32b,c) realize this [+c] role. In (32b) the contextual interpretation of the cluster is as **agent**. Hence, as always with agents, this licenses an optional **instrument** role. (Though the verb does not select an instrument as part of its feature clusters, a general lexicon convention enables an **instrument** in the presence of an **agent**, and requires an (explicit or implied) **agent** if an **instrument** role is realized.) In (32c), the contextual interpretation of the [+c] knife is as an instrument (and an **agent** participant is implied).

Manner verbs differ in two respects: They select an **agent** cluster, rather than [+c], as in (33a); and they select an instrument as part of their feature clusters (grid). As we saw, this distinguishes them from standard agent verbs, like eat, where an instrument can be inferred, but is not part of the verb's grid.

33 a) Basic entry: peel ([+c+m], [-c-m], [+c-m])
b) Marking: peel$_{acc}$ ([+c+m]$_1$, [-c-m]$_2$, [+c-m])

Lexicon marking applies to such verbs, as in (33b). The **instrument** role is not marked by (27). But since the **agent** is marked 1, it must merge externally, leaving the **instrument** only the internal option, as in (6a) (*Max peeled the apple with the knife*). However, we assumed that when two [/+c] clusters are found in the verb's grid, as here, only one is obligatorily realized. (The other is present in the interpretation, but optionally, does not realize syntactically). If we choose not to realize the **agent** role, (29a) determines that the only argument that can merge externally, namely the **instrument**, must do so. We thus obtain (6b) (The knife peeled the apple).

Let us now turn to the mapping problem with one-place verbs, which was illustrated with (23)-(25), repeated.

23) *Unaccusatives* V[-c-m]:
break, open, fall, freeze, melt, grow, develop, drown, defrost, spin slide, swing, blush, wither, redden, age, alter, awake, blur, change, collapse, decompose, decrease, degrade, diminish, dissolve, die.

24) ***Theme*** *unergatives* V[-c-m]:
glow, shine, beam, glare, glimmer, sparkle, babble, flash, buzz, click, whistle, squeal, stink, bleed, drip, sweat, radiate (L&R's 'emission'); shudder, tremble, flower.

25) ***Agent*** *unergatives* V[+c+m]:
walk, run, march, gallop, hurry, wander, dance, work.
Other unergatives (V[+m?]):
Laugh, cry, sleep.

We start with the unergative sets in (24) and (25). These are verbs which originate in the lexicon with only one argument (feature cluster). Note that (27), repeated, does not apply to one-place verbs.

27 Lexicon marking
Given an n-place verb-entry, n>1,
a. Mark a [-] cluster with index 2.
b. Mark a [+] cluster with index 1.
c. If the entry includes both a [+] cluster and a fully specified cluster [/α,/-c], mark the verb with the ACC feature.

As defined, the marking procedures in (27) apply to n-place verb entries, such that n is greater than 1. Namely, it applies only to entries with at least two arguments. This means that the basic entry, illustrated in (34a), remains unchanged and unmarked. Although the argument of glow is a [-] cluster, its merging status ends up here precisely the same as in other cases where the argument is not marked: (29a) determines that since nothing prevents merging the argument externally, this is the only option.

34) a) Base entry for (24): E.g. glow([-c-m])
b) Marking: inapplicable (one place entry)
c) Merging: External by (29a). E.g. The diamond glowed.

In fact, it is precisely the same in the cases of (25), where the argument is a [+] cluster. Still, marking does not apply, and this argument merges externally for the same reason as in (34). In sum, one place verbs are always unergative. and their feature composition is irrelevant for merging (though it is relevant for their interpretation).

More complex is the case of the reduced, unaccusative, entries in (23). So let us follow their derivational history, in (35).

35) a) Base entry for (23): E.g. freeze([+c], [-c-m])
b) marking: freeze_{acc} $([+c]_1, [-c\text{-}m]_2$
c) Reduction: R_e(freeze) $([-c\text{-}m]_2)$
d) Merging: Internal, by (29b): The water_i froze t_i

The basic entry is (35a), with both a [+] and a [-] argument. Since this is a two-place verb, the marking procedures in (27) apply, as in (35b). If nothing else happens, the entry can be used for a syntactic derivation such as *Felix/ the wind froze the water*. However, expletive reduction can apply to the [+c] argument, yielding (35c). Reduction eliminates the ACC feature (see 28b), but it has no

effects on the remaining arguments. Hence, the **theme** [-c-m] role is still marked 2. This is an obligatory instruction to merge this verb internally (by 29b). So this is the only option, even though this argument may have to move later to satisfy the EPP.

Note that this presupposes that reduction applies after marking, as stated in (28a), repeated.

28 Relevant generalizations of lexical operations:
a. Saturation and reduction apply to the marked entry (i.e. after marking).

I assume this as a universal definition of the structure of lexicon procedures[20]. But it holds only for saturation and reduction. Recall that the lexical operations fell into two types: Causativisation (expansion) is a concept-formation operation - it creates an altogether new concept. But reduction and saturation only affect the arity of an existing concept (and consequently, some aspects of the interpretation of its entry)[21]. The basic intuition is that each verb entry, which corresponds to a

[20]The general objection to ordering assumptions rests on considerations of expressive power. (If operations can be ordered, this generates a richer set of possible languages than we may want.) But this is irrelevant if what we are talking about is a fixed universal order, similar to order of 'levels' operations.

[21]An interesting test for this difference is the option of referring to a reduced argument. Levin and Rappaport (1995) noted that reduced unaccusatives can occur with a phrase like by itself in (i).

i) The vase broke by itself.

In their framework, this is an indication to the fact that the concept still entails reference to an external cause (so by itself is used to deny the existence of another cause, by expressing identity of that external cause and the subject **theme**.) In the present framework this means that the feature composition of the underlying verb (the [+c] role) is still available at a conceptual level, though it has no realization. Note however, that the original composition of a causativized verb is not available anymore. So we cannot refer to the original **agent**, as in (iia). by himself in (iia) could perhaps be interpreted as 'alone', but not as 'of his own' - an interpretation it can have in (iib)), where no lexicon operation applied.

ii a) *I walked the patient by himself.
b) I made the patient walk by himself.

Another correlation of this difference is that, as mentioned, reduction and saturation can apply either in the lexicon or in the syntax. However, there is no such parametrization regarding where causativization, as defined in (21), can apply. As a concept formation operation, it applies only in the lexicon. If a language does not realize the option of lexicon operations, it can still apply reduction and saturation in the syntax, but for causativization, it would use syntactic causativization, (e.g. of the form in (iib), which has very different properties. One of the differences happens to be illustrated

concept, first gets marked for its relevant derivational properties. In the case of causativization, this applies to the new concept (and entry) that it forms. In technical terms of ordering, then, causativization applies before marking (and thus feeds both the assignment of the ACC feature and the merging order); reduction and saturation apply after marking. This is consistent with the fact that saturation and reduction can apply to the outputs of causativization[22]. (I.e. neither saturation nor reduction excludes causativization, though, as mentioned in (17), they exclude each other.)

Let us now turn to the two place unaccusative verbs, as in (11), repeated. As we noted in the discussion of (11), such verbs have no alternates with a [+c] role.

11 escape([-c-m] [-c])

36 escape($[-c-m]_2$ $[-c]_2$)

37 The solution$_i$ escaped t_i Max.

Unlike the one place verbs with a [-] cluster, these verbs select two arguments, so the marking

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in (ii), where the syntactic causativization structure retains all the original roles, hence may refer to the **agent**.

[22]This is obvious for saturation, as in (i).

i) The patient was walked by the therapist.

Regarding reduction, note that expletive reduction is impossible, by definition, since causativisation introduces an **agent** role, but expletive reduction is defined to apply only to [+c] roles. Reflexive reduction seems possible. As we saw, the Hebrew hilbish- dress in (iib) is derived by causativization from lavash-wear, in (iia). Now the reflexive entry hitlabesh-dress, in (iiia), must be derived from the causativized form in (iib), as it means (iiib), and not (iiic).

ii a) Max lavash meil
Max wore a coat
b) Aba hilbish et Max (meil)
Daddy dressed Max (with a coat)

iii a) Max hitlabesh
Max dressed.
b) Max hilbish et acmo
Max dressed himself.
c) *Max lavash et acmo
*Max wore himself.

procedures in (27) does apply here. Since all the arguments are [-], they are marked 2, as in (36). This is an obligatory instruction to the CS to merge both internally, so only an unaccusative derivation, like (37), is possible. The generalization captured is that unaccusative entries which are not the output of reduction are only found with two place verbs. As just mentioned, verbs originating as one-place verbs are always unergative. (See footnote 5, for Levin and Rappaport's discussion of this issue.)

The defining property of unaccusative verbs is that they do not assign the accusative case. So far we only looked at unaccusative verbs obtained by reduction, where this followed from the fact that reduction eliminates the accusative case. But note that the accusative marking procedure (27c), repeated, is stated to apply only to a cluster pair of [+c] and [/α/-c].

27 Lexicon marking
Given an n-place verb-entry, n>1,
c. If the entry includes both a [+] cluster and a fully specified cluster [/α,/-c], mark the verb with the ACC feature.

There is no such pair in (36), since the verb lacks a [+] cluster (which would realize as the external role). So the accusative feature is not assigned. This formulation of the procedure (combined with the reduction effects) now captures fully the insight of Burzio's generalization: If a verb does not assign an external role, it does not assign the accusative case[23].

[23]For English, it may seem that verbs like escape are counter examples to the that two place [-] verbs never assign the accusative case. However, dative and accusative case are not morphologically distinguishable in English, so there is no way to tell whether in The solution escaped him, the object bears accusative or dative case. (In other languages, like German, it is clearly dative.)

But Idan Landau pointed out a counter example to Burzio's generalization, or (27). The verb ka'av (hurt, pain) in Hebrew looks like an appeal (piacere)- type experiencer verb. Still it allows one realization with the accusative case, as in (ii):

i Ha-kishalon ka'av le-Max
The failure hurt/pained to Max

ii Max ka'av et ha-kishalon
Max 'pained'(was hurt by) ACC the failure.

Though counter-examples may be found, it still seems that the generalization holds for an overwhelming majority of two place [-] verbs.

PART 2. EXPERIENCING DERIVATIONS[24]

4. The problem

As we saw, experiencing verbs allow different syntactic realizations. This was illustrated in (26), repeated. The **experiencer** argument surfaces as the object (in 26a), and as the subject (in 26b).

26 a) The doctor$_{[+c]}$ worried Max$_{[-c+m]}$.
cause **experiencer**
b) Max$_{[-c+m]}$ worried.
experiencer

As mentioned, in English, the alternation in (26) is restricted to just a few verbs, while the others use various passive forms for (26b). But in many languages it is fully productive. In Hebrew, e.g. all object-experiencer verbs have also a subject-experiencer alternate, as in (38) and (39).

38 a) ha+olam hirgiz et Max.
The world angered (acc) Max.
b) Max hitragez
Max angered+reflexive
(Max got angry)

39 a) ha+olam hid'ig / rigesh / hivhil et Max.
The world worried/ excited / scared (acc) Max.
b) Max da'ag / hitragesh / nivhal
Max worried / excited / scared

Another peculiarity of English is that the verb always has the same morphology in the object and the subject experiencer derivations. In Hebrew, they are morphologically distinct. In (38), the same verb-root (rgz) occurs in different templates. In the object alternate (38a), it occurs with causative morphology (hif'il) , and in the subject alternate it occurs with reflexive morphology (hitpa'el). But other morphological alternations exist as well, and are illustrated in (39). (Precisely the same morphological alternations are found in Hebrew with transitive-unaccusative verb pairs.) In Romance languages, the Subject (b) alternate usually occurs with the reflexive clitic si/se, and in German and Dutch, it often surfaces as a sich/zich verb.

I presented already the essence of my analysis of such alternations. I argued that the basic verb entry

[24] This part is based on a Paper presented in SALT XI, New York, 2001 (Reinhart 2001). An earlier version was presented in IATL, Tel Aviv, June 2000.

is the one used in the object experiencing structures (a), and the verb entry in the subject-experiencer (b) structures is derived in the lexicon from that base entry, by expletivization reduction. The surviving experiencer cluster must merge externally, given the marking and merging instructions discussed. However, (26) and (38) are just a partial illustration of the many problems posed by derivations with experiencing verbs.

Note, first, that along with the alternation in (26), we find pairs like (40), where it appears that the verb realizes the same two thematic roles in both derivations. The same is true for the Hebrew examples in (38-39), where a PP complement can be similarly added to the (b) alternate.

40 a) Something worries Lucie.
experiencer
b) Lucie worries about something.
experiencer

If this is so, it would seem implausible to assume that the verb in (40b) is reduced (since it has the same number of thematic roles). So it remains a mystery why it allows the experiencer to surface as the subject. This ties in with several other mysteries regarding the status of the internal argument in (40b), so let us look briefly at the history of the research of experiencing derivations, in order to state the remaining problems that need to be solved.

Belletti and Rizzi (1988) assumed indeed that the thematic structure of the two derivations in (40) is identical, and the DP something realizes the **theme** role in both. This, then, poses a problem to any approach to the mapping (linking) from lexicon to syntax. They proposed, as a solution, that the two derivations have, in fact, the same underlying structure - the one in (41), where both arguments originate internally. If the **theme** arguments moves to IP, we obtain (40a), and if the **experiencer** moves, (40b) is derived. Under this analysis, then, experiencing verbs are unaccusative (since both arguments originate internally).[25]

41) DS of both (40a) and (40b): [$_{IP}$ e [$_{VP}$ [worry something] Lucie]]
theme experiencer

The most impressive argument of Belletti and Rizzi for this analysis was the anaphora patterns of object-experiencing derivations, e.g. that bound anaphora is permitted in (42a,b). (As has been observed before, in Reinhart 1983, there is a clear contrast between these sentences and, say, (42c), which is a standard weak-crossover violation.)

[25]This may seem puzzling, given that in (38a) the verb seems to assign the accusative case (Max worried her;) This is even clearer in Hebrew, where the verb requires et, which is standardly associated with the accusative case. But Belletti and Rizzi, who focused their analysis on Italian, argued that at least in the Italian cases, this is not a real accusative. (As we shall see, some of the cases they discuss are indeed unaccusative verbs.)

42) a) [His$_i$ health]$_j$ worries e$_j$ every patient$_i$.
b) [His$_i$ solution]$_j$ appealed e$_j$ to every student$_i$.

c) *[His$_i$ doctor]$_j$ visited every patient$_i$.

This anaphora pattern follows, since in their system the subject originates as the internal **theme** argument, and in its original position (illustrated in (41)), it is c-commanded by the **experiencer**, which is higher in that VP.

However, Pesetsky (1995) showed that there exist, in fact, two classes of experiencing verbs, with very different syntactic properties: The large worry (preoccupare) set does not show any unaccusative properties. A smaller set of the appeal (piacere) type does show indeed unaccusative syntax. Belletti and Rizzi conflated these two types, and a careful examination shows that their analysis is relevant only for the appeal set. Let us verify this difference with just one of the diagnostics used by Pesetsky: Unaccusative verbs do not allow passive, but the worry type verbs do allow it, as in (43).

43) preoccupare (worry) type:
a) The news worried / surprised /excited Max.
b) Max was worried/ surprised /excited by the news.

44) piacere (appeal) type.
a) The solution appeals to me /escapes me.
b) *I am appealed by /escaped by the solution

The piacere verbs, by contrast, confirm this unaccusativity diagnostics and disallow passive, as in (44). In terms of the analysis presented here, these verbs belong to the group of two place [-] verbs, which are indeed always unaccusative. (See the discussion of (11), (36) and (37).)

Next, Pesetsky shows that it is not the case that the two derivations of the worry type verbs in (40), illustrated again in (45), have identical thematic structure. While both include an **experiencer** argument, they differ in their second argument. In (45a) the doctor bears the **cause** role. In (45b), it is the role Pesetsky discovered and labeled **subject matter**.

45) a) The doctor worried Lucie.
cause **experiencer**
b) Lucie worried about the doctor. (45a does not entail 45b.)
experiencer **subject-matter.**

To show that the members of pairs like (45) are not thematically identical, Pesetsky points out that they differ in their truth conditions. (45a) does not entail (45b): (45a) can be true if the doctor made Lucie worry about something else, say her health. But (45b) may be false in this situation.

In conclusion, then, there is no basis to assume an unaccusative analysis, along the lines of (41), for the worry type verbs. In principle, since the thematic roles in (45a) and (45b) are distinct, the road is open to maintain the view that the verb entry in (45b) is derived in the lexicon from the verb entry in (45a), as we shall see directly. If so, then for all we saw, the derivations in (45) are independent syntactically, and the arguments can merge directly to their final positions, as I argued before.[26]

But this, then, leaves us again with the anaphora problem in (42), repeated in (46).

46) a) [His$_i$ health]$_j$ worries e$_j$ every patient$_i$.
b) [His$_i$ solution]$_j$ appealed e$_j$ to every student$_i$.

We see that regarding anaphora, there is no difference between the two types of verbs: The worry and appeal derivations equally allow it. For the unaccusative appeal case, we may still assume a derivation along the lines represented in (46b) (that can be easily restated within contemporary views on the structure of VP). So the anaphora facts still follow. But the worry type emerges now as a mystery, as we have just dismissed the unaccusative analysis represented for it in (46a).

It appears, then, that *worry* type verbs show both unaccusative and unergative properties. To address this puzzle, we have to get more specific about their different derivations, and the properties of the **subject matter** role.

5. Basic experiencing derivations

Let us first return in more detail to the basic derivations involving experiencing verbs, such as (40), repeated in (47).

47 a) Something worries Lucie.
cause **experiencer**
b) Lucie worries (about something)
experiencer **subject matter**

As we just saw, following Pesetsky 1995, the thematic roles in the object-experiencer and subject-

[26]Pesetsky, in fact, argues that worry type verbs are listed as unaccusative (one-place) verbs: The object-experiencer derivation (45b) reflects, thus, the basic verb entry, and the subject originates internally. (45a) is derived by a causativization operation from (45b). But these aspects of his analysis are debatable. In Reinhart (2000) I argue, first, that derivations like (45b) show unergative rather than unaccusative properties, and, next, that the familiar causativisation operation cannot derive (45b) from (45a).

experience derivations are not identical, so the various realizations of the verb allow together three thematic roles: **cause**: [+c], **experiencer:** [-c+m] and **subject matter**, which as I argue directly, corresponds to [-m]. In the present system, this means that all three roles are specified in the basic verb entry, though they need not (in fact, cannot) be all realized in one derivation. (I return directly to the issue of their realization options.) As one of the roles is [+c], reduction can apply to derive a two place verb out of the basic three-place one, which enables the derivation in (47b).

For convenience, I repeat here the marking and merging instructions I assume, which were stated before in (27)-(29) and discussed in section 3.

48 Lexicon marking
Given an n-place verb-entry, n>1,
a. Mark a [-] cluster with index 2.
b. Mark a [+] cluster with index 1.
c. If the entry includes both a [+] cluster and a fully specified cluster [/α,/-c], mark the verb with the ACC feature.

49 Relevant generalizations of lexical operations:
a. Saturation and reduction apply to the marked entry (i.e. after marking).
b. (=17b) Reduction eliminates the accusative feature of the verb (fully or partially).

50 CS merging instructions.
a. When nothing rules this out, merge externally.
b. An argument realizing a cluster marked 2 merges internally; An argument with a cluster marked 1 merges externally.

Though I gave already a schematic overview of how these procedures and instructions determine the type of syntactic derivations that worry verbs allow, it may be useful for my subsequent arguments to check this again, step by step. It is convenient to illustrate this with an example from Hebrew, since the basic and the reduced entries have a different morphology.

51) a) Entry: hirgiz (anger)([+c], [-c+m] ([-m]))
(cause, experiencer, subject matter)
b) Marking: hirgiz (anger)$_{acc}$ ([+c]$_1$, [-c+m] ([-m]$_2$))

52) Merge: ha+olam$_{[+c]}$ hirgiz$_{acc}$ et Max$_{[-c+m]}$.
The world$_{[+c]}$ angered$_{acc}$ (acc) Max$_{[-c+m]}$.
cause **experiencer**

The basic entry is (51a), where the **subject matter** role is optional (hence marked here with parenthesis). The output of the marking procedures, repeated in (48), is (51b): The all minus [-m] cluster is marked 2, by (48a), the all plus cluster [+c] is marked 1 by (48b), but the mixed [-c+m] is

assigned no merging index. The conditions for accusative marking are met, as the cluster contains both a [+] cluster ([+c]) and a fully specified [/-c] cluster ([-c+m]). Hence (48c) marks the verb with ACC. (The **experiencer** cluster, thus, licenses the ACC feature, although it does not get a merging index.)

If the basic entry is selected for merging, we obtain the derivation in (52), where we ignore for the time being the optional **subject matter** role. By the merging instruction stated in (50b), the argument realizing the cluster marked 1 must merge externally. The unmarked **experiencer** must then realize internally. This will enable it to check the ACC case in the subsequent derivation.

Alternatively, the basic entry in (51), repeated, may undergo expletivization reduction in the lexicon, as in (53).

51) a) Entry: hirgiz (anger)([+c], [-c+m] ([-m]))
(**cause, experiencer, subject matter**)
b) Marking: hirgiz (anger)$_{acc}$ ([+c]$_1$, [-c+m] ([-m]$_2$))

53) Reduction:
R_e(hirgiz) (=hitragez)([-c+m], ([-m]$_2$))
(R_e(anger) (**experiencer, subject matter)**

54) Merge (by (50a): $Max_{[-c+m]}$ [$_{vp}$ hitragez (al ha-ma'amar$_{[-m]}$)]
$Max_{[-c+m]}$ [$_{vp}$ angered (about/at the-article$_{[-m]}$)]
(Max got angry...)

As mentioned, reduction in Hebrew effects a change in the verb's morphology - the reduced verb in (53) bears reflexive morphology (hitpa'el), which is found in many instances of expletive reduction. As stated in (49) above, reduction eliminates the ACC feature of the verb, but it does not effect the merging indices of the arguments.

Given the marking of the reduced entry, only one merging is possible at this stage: The unmarked **experiencer** ([-c+m]) must merge externally, by (50a). (Since nothing blocks this external merging, it is the only permitted option.) If the [-m] argument is realized, as in (54), it must merge internally, by (50b), since it is marked 2.

This captures, then, the basic properties of the worry type verbs. In a language like English, which never marks reduction morphologically (also in the case of reflexive reduction), the two realizations of worry look identical. Nevertheless, (47a), repeated, realizes the basic entry, parallel to (51), while (47b) is the output of reduction, parallel to (54).

47 a) Something worries Lucie.
cause experiencer
b) Lucie worries (about something)
experiencer subject matter

Syntactically, the two derivations in (47) are completely independent, and neither involves any movement operation. The fact that the **experiencer** role of the basic entry realizes internally in (47a) and externally in (47b) poses no problem in the present system: This is allowed, since **experiencer** is one of the two mixed clusters which are not assigned a fixed merging index by the marking procedures of the lexicon.

This still leaves us with the anaphora problem unanswered. I will argue that, in fact, sentences like (47a) (or (52)) have also another derivation, which does involve movement. But establishing this requires looking in more depth into the properties of the **subject matter** role.

6. The subject-matter problem

Pesetsky (1995) observed an intriguing puzzle posed by worry type experiencing verbs. Although there is ample evidence that these verbs select both the **cause** and the **subject matter** θ-roles, as stated in (51), these two roles can never be realized together. This is illustrated in (55).

55 a) *The article angered Bill at the government.
b) *The doctor's letter worried Lucie about her health.

56 a) The article made Bill angry at the government.
b) The doctor's letter made Lucie worry about her health.

Logically, the two roles are compatible, and the content intended in (55) can be easily expressed with different structures, as in (56). So there must be some linguistic generalization ruling (55) out. Pesetsky offers a syntactic account in terms of conditions on movement. However, this rests on a radical change in the view of syntax, assuming a dual system, where derivations are processed in parallel trees. Leaving this broader issue aside, it is not obvious to me that the problem at hand is syntactic. Let us explore how it could be handled in the feature system developed here[27].

I assumed already that the **subject matter** role corresponds, in the present system, to the cluster [-m], but let us examine further the intuition behind this decision. Although our focus here is on the formal properties of the feature clusters, they obviously also play a role in the interpretation. In section 1.1., I argued that they code basic causal relations expressed by the verb-concept. A /+c feature is associated with a participant (role) perceived as forming a sufficient, and not just a necessary, condition for the event, namely a cause of the event. We assumed that the unary

[27]Pesetsky mentions briefly the option of capturing this problem with feature restrictions (footnote 60), and dismisses it on theory internal grounds, which are irrelevant within the assumptions of the present framework.

specification leaves unspecified the value of the argument with respect to the other feature. If a [/+c] cluster is unspecified with respect to the /m feature, it is left open whether the 'mental state' condition also holds. Hence the verb is consistent with either a **cause** or an **agent** interpretation of the relevant argument. What is specified in a unary cluster is just the feature that defines the cluster, namely must be assumed in all interpretative realizations of the cluster.

Let us look now at the relation a **subject matter** role bears to the event represented e.g. in Lucie worries about the state her health. An obvious feature her health has is /-m (the mental state of a **subject matter** participant is never relevant). But what is its /c status? Although this role is distinct from cause, it is still possible to view Lucie's health as a cause for her worrying. Having some state of health is a necessary (enabling) condition for worrying about it. But it can also be a sufficient condition - the direct cause for worry. More broadly, in our perception of the world it is possible that the subject matter of emotion is itself the cause of this emotion. Whether it is or not for a given situation depends just on whether there is another condition we perceive as causing it. In feature terms, this means that the **subject matter** role is only specified as /-m, namely, it is [-m].

In feature terms, then, the descriptive generalization suggested by (55) is that a [+c] and a [-m] cluster cannot be both realized in a given derivation.

Once [-m] is recognized as a cluster defining a set of roles, we may expect to find other instantiations of this cluster, namely other role-interpretations for it. **Locative source** is one. Doron (1999) noted that the same pattern we observed with worry-type experiencing verbs is also found with Hebrew verbs selecting a **locative source**. An example is verbs of providing nutrition or living: kiyem (maintain/sustain), pirnes (provide/support), hezin (nurture).

57 a) ha-ikar pirnes et mishpax-to.
The-farmer supported (acc) his-family

b) ha-mishpaxa hitparnesa me-ha-sade.
The-family supported [itself] from-the-field (made its living of the field).

c) *ha-ikar pirnes et mishpax-to me-ha-sade.
*The-farmer supported (acc) his-family from/of-the-field

Under the present analysis (which differs from Doron's), the morphology marks the verbs in (57b) as the reduced (unaccusative) form of (57a). This reduced form takes a **locative-source** complement. This means that this role must be part of the θ-specification of the underlying verb (in (57a)). But still this argument cannot occur in the non-reduced form, as witnessed in (57c). So the pattern is precisely the same we observed with worry (in (55), though no **subject matter** role is involved. (Other verbs with this pattern, listed by Doron, are hishir (shed leaves), hizil (drip), hidif (emanate).)

Doron notes that the locative-source is interpretable similarly to a cause. This is, again, analogous to what we saw with worry. It means that this role is not specified for /c, and whether it is viewed as a

cause or not, depends on whether another [/+c] role is realized. So this is another instance of a [-m] role[28]. The verbal entry under consideration, then, is (58a).

58) a) pirnes/hezin (provide/nourish) ([+c], [-c-m], [-m])
(**cause, patient, source**)

b) $\underline{\text{pirnes/hezin}}_{\text{acc}}$ ($[+c]_1$, $[-c\text{-}m]_2$, $[-m]_2$)

The marking procedures apply as in (58b). Unlike the experiencer cases, the second cluster of the verb is marked as obligatorily internal, which entails that the derivation based on the reduced verb, in (57b) is unaccusative, with the subject originating internally. But the pattern of realization of the [-m] cluster is the same here as with the worry type verbs: Since the external role of these entries is [+c], the descriptive generalization we observed prohibits the realization of the [-m] role in (57c). But when the [+c] role is reduced, as in (57b), the [-m] role is allowed to be realized.

A remaining question is why the [+c] and the [-m] role cannot be realized together. In Reinhart (2000), I proposed that this may reflect a broader restriction on the realization of feature clusters. A generalization which is largely assumed is that the same θ-role cannot be realized twice (i.e. a verb cannot realize two identical clusters). Kremers (1998) proposes to restate this generalization as the distinctness requirement in (59a).

59 Cluster distinctness:
a) Two indistinct θ-clusters cannot be both realized on the same predicate.
b) Distinctness: Two feature-clusters α, β, are distinct iff a. they share at least one feature, and b. there is at least one feature or value which they do not share.

The option that (59a) opens is that a verb selects several (non identical) clusters, but nevertheless, they cannot all be realized in one derivation, because they are not sufficiently distinct. The question, then, is what counts as distinct θ-clusters. I propose the definition in (59b) (which differs from the definition in Reinhart (2000)). The intuition behind (59b) is that identifying distinctness requires some shared basis for comparison. An entailment of (59b) is that indistinct clusters which are not identical can be found only with pairs of two unary clusters: When at least one cluster of a given pair is fully specified, the two clusters always have some shared feature - /c, /m, or both - which is the basis for comparison. Hence, the only way in which they can turn indistinct is by clause (b) of (59b), namely they are identical. (E.g. [+c+m] shares with [-m] the feature /m, and they differ in all the rest. It shares with [+m] the feature and value /+m, and they differ in the rest, etc.) With Unary features this is not so: A unary [/c] cluster never shares any feature with a unary [/m] cluster, so they are always indistinct by clause (a) of (59b). The only unary clusters that can be realized together are,

[28]Given the two instances of a [-m] role we observed, a plausible hypothesis is that a role with this feature is interpreted as 'subject matter' with verbs selecting a [/+m] complement (experiencer), and as a source otherwise.

then, <[+c], [-c]> and <[+m], [-m]>.

It follows from (59) then, that if a verb selects both a [+c] and a [-m] argument, as argued for the worry and the nourish types of verbs, these clusters are indistinct and hence, cannot be both realized in the same predicate, as we saw in (55b) and (57c).

Further illustration for (59), involving the [+c] cluster, is given in a footnote[29]. Other clusters

[29]As further illustration of this generalization, note that there is a subset of both the worry and the provide type verbs which has peculiar properties: Verbs like interest and convince appear to allow their [-m] cluster to realize in the non-reduced verbal form, as in (ib), which contrasts with (55b), repeated.

55 b) *The doctor worried Lucie about her health.

i a) Lucie/the article interested Max.
b) Lucie interested Max in linguistics.
c) */? The article interested Max in linguistics.

But this is only possible when the external argument is animate - (ic) is much worse. The same is found with the Hebrew verb kiyem (sustain), which in all other respects belongs to the provide group. Again, (iia) is much better than either (iib,c) or (57c), repeated.

57 c) *ha-ikar pirnes et mishpaxt-o me-ha-sade.
*The-farmer supported (acc)-his-family from/of-the-field

ii a) ha-ikar kiyem et mishpaxt-o me-ha-sade.
The-farmer sustained (acc)-his-family from/of-the-field.

b) *ha-sade kiyem et ha-mishpaxa me-ha-tiras.
*The-field sustained (acc) the-family from/of the corn.

c) *ha-xisaxon kiyem et ha-mishpaxa me-ha-ribit.
*The saving (account) sustained the family of the interest.

This would follow from (50), if we assume that interest and kiyem-sustain select, along with their [+c] cluster also a [+m] cluster. (Generally, the [+m] cluster, which is unspecified for /c, allows, but does not force, a volitional or 'agentive' interpretation. In all other respects, the analysis will work just the same if the added cluster is an **agent** - [+c+m], rather than [+m].) The verbs' entries are then, as in (iii).

iii a) $\underline{\text{interest}}_{acc}$ ($[+c]_1$, $[+m]_1$, [-c+m], $[-m]_2$)
b) $\underline{\text{kiyem (sustain)n}}_{acc}$ ($[+c]_1$, $[+m]_1$, $[-c-m]_2$, $[-m]_2$)

realizations prohibited by (59) are <[-c] [-m]>, <[+m] [-c]> and <[+m] [+c]>. The last pair is also prohibited independently, as the marking procedures assign the index 1 to both clusters, but only one external argument can be realized per derivation. Some evidence supporting this outcome of (59) for the other two pairs is provided in Botwinick-Rotem (2001). Nevertheless, it may be still premature to conclude decisively that (59) is indeed relevant for all unary clusters. What has been clearly established is that the distinctness requirement holds for the [+c] cluster, namely the generalization in (60).

60) A [+c] cluster cannot be realized with indistinct clusters (as defined in (59b).

In section 9, I will return to further substantiation of this generalization.

7. The anaphora pattern

The verbal pattern in (57) includes one more member, which we have not yet considered.

61) ha-sade pirnes/kiyem et ha-mishpaxa.
The-field$_{[-m]}$ supported/sustained acc-the-family$_{[-c-m]}$.

62) ha-ec hishir et al-av.
The-tree$_{[-m]}$ shed (acc)its-leaves$_{[-c-m]}$.

The verb morphology in (61) is the same as in the causative (transitive) form of (57a,c). This, in our terms, means that no reduction took place. Still, the argument that surfaces in external position is the internal [-m] role. This is even clearer in (62) (from Doron 1999).

Upon closer examination, this pattern is found also with experiencing verbs selecting the [-m] role. So far we assumed that in object-experiencing derivations the subject always realizes the external [+c] role of the verb, as in (63a).

The [+c] and the [+m] clusters can never realize together: They are indistinct by (50b), but independently, as [+] clusters, they are both assigned the index 1, and only one argument can realize externally. So the actual derivation selects only one of these clusters for realization. If the [+c] argument is selected, we get the same pattern as with the standard worry or provide verbs, namely, the [+c] and the [-m] clusters cannot be both realized. But the [+m] cluster is defined as distinct from the [-m] cluster (as they share a feature and differ in its value). So if this cluster is selected for the derivation, the [-m] cluster can be realized as well. The [+m] cluster, however, can only be realized with an animate DP. (This is a general restriction found with all [/+m] clusters, like **agent** and **experiencer**.) So, only in (ib) and (iia) it is possible to construe the subject as realizing the [+m] cluster.

63 a) The article angered Bill.
cause experiencer
b) Bill was angry at/about the article.
experiencer subject matter

This was based on Pesetsky's observation that (63a) does not entail (63b), since it is possible to construe (63a) such that the article made Bill angry at something else (rather than at some properties of the article itself, which is the only construal of (63b)).

Nevertheless, it is also possible to construe (63a) as equivalent to (63b), namely that Bill got angry about some properties of the article itself. The sentence, then, has two semantic construals, depending on whether the article is viewed as the **cause** ([+c]) or as the **subject matter** ([-m]). Contextual considerations may enforce disambiguation of the two construals. E.g. in (64a) it is easiest to interpret Lucie's health as the subject matter of her worry, while in (64) the **cause** construal is more natural, namely that the doctor's letter made Lucie worry about something else.

64 a) Her health worried Lucie.
subject matter[-m]
b) The doctor's letter worried Lucie.
cause [+c]

This already suggests that experiencing verbs allow also a derivation more on a par with (61-62), namely that in (64) her health realizes the internal [-m] argument. But there are also more robust indications in this direction, which brings us back to the question of anaphora:

It is widely believed that backwards bound anaphora, as in (65a), is always found with object-experiencing derivations. But, in fact, it is worse in (65b) than in (65a).

65 a) His_i health worried every $patient_i$.
b) ??His_i doctor worried every $patient_i$.

The contrast in (65) is not fully decisive, because it is not impossible to construe (65b) with the subject (his doctor) as the subject matter of the patients' worry (Patients can worry about their doctors). The point is, however, that anaphora is enabled only if the subject is construed as the [-m] argument, namely, it is the doctor that every patient worries about, rather than the situation where the doctor made every patient worry about something (like the patient's health).

In section 9, we will see more direct evidence for this anaphora pattern. But for here, we may note that it is further confirmed by the entailment patterns. We saw that in (63), repeated, the object-experiencing (63a) does not entail the subject experiencing (63b) (because the article is construed with two different roles in the two sentences). But this does not hold when the relevant anaphoric dependence is involved, as in (66): (66a) does entail (66b).

63 a) The article angered Bill ~---->
cause **experiencer**
b) Bill was angry at/about the article.
experiencer **subject matter**

66 a) His$_i$ grade angered every student$_i$ ---->
subject matter **experiencer**
b) Every student was angry about his$_i$ grade.
experiencer **subject matter**

This is so, since anaphora in (66a) is permitted only if his grade is construed as the **subject matter**. In this case, the thematic composition is identical in (66a) and (66b), so the sentences are equivalent.

Note now that the same generalization is witnessed also with the provide type verbs:

67 a) ha-sandwich shelo$_i$]$_{[-m]}$ hezin kol yeled$_i$ e bemeshex shavu'a
[His$_i$ sandwich]$_{[-m]}$ nourished e every child$_i$ for a week.
source$_1$ (t_1) **patient**

b) ima shelo$_i$]$_{[+c]}$ hezina kol yeled$_i$ bemeshex shavu'a
*/?[His$_i$ mother]$_{[+c]}$ nourished every child$_i$ for a week.
cause **patient**

With these verbs, it is easier to distinguish between the [+c] and the [-m] (**source**) roles, and only (67a) is readily interpreted with the subject as the **source**. Indeed, anaphora is much easier in (67a) than in (67b). (Note that (67b) is an instance of 'weak-crossover' which is usually weak, namely not that bad in all contexts.)

In the present system the [-m] cluster, which is marked 2, must merge internally (by the merging generalization (59b)). So the fact that it can also surface externally suggests that movement takes place in these derivations, namely that an analysis along the lines of Belletti and Rizzi (1988) must be available for worry type verbs (in their object-experiencer realization). This would also capture, then, the anaphora facts, which, as mentioned, were the strongest argument for their analysis.

As we saw in section 4, Belletti and Rizzi's unaccusative analysis could not work for the standard worry derivations, where the **cause** role is realized as subject, because these derivations do not show any unaccusative properties. (E.g. they allow passive.) But here we are considering only derivations realizing the **subject matter** role externally, namely a subset of the object-experiencing derivations.

8. A movement derivation.

In fact, the present system entails that another derivation of experiencing verbs should be possible. So far we observed, in section 5, one derivation based on the basic entry, and one based on the reduced entry. But the basic entry allows two derivations.

Let me illustrate this, again, with Hebrew, where the morphology indicates whether reduction took place. (51), repeated, is the basic entry for anger. The verb selects both a [+c] and a [-m] clusters, but the feature-distinctness generalization (59) (or 60) determines that only one of them can be realized. So far we assumed that [+c] is the one that realizes, and, thus, we obtained the derivation in (52), where the [+c] argument merges externally.

51) hirgiz (anger)$_{acc}$ ([+c]$_1$, [-c+m], [-m]$_2$)
cause experiencer subject matter

52) Merge: ha+olam$_{[+c]}$ hirgiz$_{acc}$ et Max$_{[-c+m]}$.
The world$_{[+c]}$ angered$_{acc}$ (acc) Max$_{[-c+m]}$.
cause experiencer

However, no principle dictates that it must be the [+c] cluster that realizes. Let us now check what happens if we choose to realize the [+m] cluster instead. Assuming some V-shell structure (without entering its details), the derivation proceeds as in (68). For convenience, the merging instructions of (50) are repeated below.

68 a) [$_v$ angered$_{acc}$ the article$_{[-m]}$]
b) [$_v$ Max$_{[-c+m]}$ [$_v$ angered$_{acc}$ the article$_{[-m]}$]
c) [$_v$ angered$_{acc}$ [$_v$ Max$_{[-c+m]}$ [$_v$ t$_{angered}$ the article$_{[-m]}$]
d) [$_{ip}$ the article$_{[-m]}$ [$_{vp}$ angered$_{acc}$ [$_v$ Max$_{[-c+m]}$ [$_v$ t$_{angered}$ t$_{article}$]]]]

50 CS merging instructions.
a. When nothing rules this out, merge externally.
b. An argument realizing a cluster marked 2 merges internally; An argument with a cluster marked 1 merges externally.

The [-m] argument, marked 2, must merge internally, by (50b), which means here that it merges first, as in (68a). The **experiencer** argument has no merging index. In principle, it could merge externally. However, the derivation will then crash, as there will be no DP to check the ACC case-feature. (Recall that in the present system only fully specified clusters can check the ACC case and the underspecified unary features require dative or a preposition in VP internal position.) (50a) would force this argument to merge externally only if nothing rules this out, but case considerations rule this option out in this derivation. So the argument can merge as in (68b) (or the derivation crashes. (As noted in the discussion of (50), (50a) has an economy flavor.) The verb then moves in (68c), as is standard in V-shell analyses. In this configuration Max can check the ACC case of the

verb. Next, the [-m] argument (the article) moves to satisfy the EPP, as in (68d).

As further evidence that derivations like (68) must exist for worry- type experiencing verbs, note that when the [-m] role is realized by a clause, these verbs allow expletive subjects, as in (69). The same is found in Hebrew, with an empty expletive, as in (70).

69) It angered/surprised/scared/excited him [that he failed]$_{[-m]}$.

70) 0 hirgiz et Max [she+hu nixshal]
[It] angered (acc) Max [that he failed].

These little studied derivations appear to pose a serious problem to Burzio's generalization: The verb clearly assigns the accusative case, and still no external role is realized. As noted in section 4, under Belletti and Rizzi's (1988) analysis, the derivation of experiencing verbs is indeed unaccusative, so the expletive is not a surprising option. But, unlike some other cases in Italian, it is obvious that the verb here does assign accusatives (witnessed in Hebrew by et), so this remains a violation of Burzio's generalization, and a mystery.

In the present system, no problem arises here. The accusative feature is licensed at the full basic entry, where a [+c] (external) role is present. Since no reduction operation applied, this feature stays and needs to be checked, regardless of whether [+c] or [-m] are selected for realization. If the [-m] cluster is the one realized, the VP phase of (69) parallels that of (68c), as in (71a).

71 a) $[_{vp}$ angered$_{acc}$ $[_{v}$ him$_{[-c+m]}$ $[_{v}$ t$_{angered}$ [that he won]$_{[-m]}$]
b) $[_{ip}$ it $[_{vp}$ angered$_{acc}$ $[_{v}$ him$_{[-c+m]}$ $[_{v}$ t$_{angered}$ [that he won]$_{[-m]}$]

At this stage, either the embedded [-m] clause moves, or an expletive is merged to satisfy the EPP, as in (71b)[30].

The derivations under consideration here, then, are not strictly unaccusative, as the accusative case is present. Nevertheless, they share properties with unaccusative derivations - the movement of an internal argument. Though I cannot elaborate on this here, the arguments we surveyed in section 4 against Belletti and Rizzi's analysis (such as the availability of passive) hold only for derivations realizing the [+c] role, and not for those where the argument is clearly [-m].

The anaphora facts now follow directly: Bound anaphora is possible in the movement derivation, as in (72a). As seen in greater detail in (72b), the pronoun copy (trace) is c-commanded by the quantified antecedent, so at this stage, the c-command requirement on bound anaphora is met.

[30]An independent question, the answer to which I do not know, is why this expletive is only possible if the complement is a clause.

72 a) $[His_i\ health]_{j[-m]}$ worried every $patient_i$ e_j
subject matter$_j$ **experiencer**

b) $[_{ip}$ his $health_{[-m]}$ $[_{vp}$ $worried_{acc}$ $[_{v}$ every $patient_{[-c+m]}$ $[_{v}$ $t_{worried}$ $t_{his\ health}]]]]$

73) ?$[His_i$ doctor's letter$]_{[+c]}$ worried every $patient_i$.
cause **experiencer**

But, as observed in section 7, this is only possible if the subject is construed as the **subject matter**. This follows now, since only if the subject is the [-m] argument the derivation involves movement. If the subject is construed as the **cause**, as in (73), it merges directly externally, and at no stage is the c-command requirement met.

The movement analysis is available, as we saw, only for the [-m] argument of a worry type verb. For English, it appears that most verbs which select both a [+c] and a [-m] cluster can equally realize any of them. But Friedemann (2000) notes that there are verbs which allow only the [-m] realization, e.g. fascinate. I assume that these verbs originate nevertheless as standard worry verbs, but the realization option is fixed (frozen) in the lexicon. (In the present system, this explains why the accusative case is still realized in the derivations.) Friedemann points out that there are many such verbs in French. E.g. worry has two entries: inquieter, which behaves like the English worry, and preoccuper, which allows only [-m] realization.

9. Minimal pairs.

The movement experiencing-derivation rests crucially on the conflict of the [+c] and [-m] clusters, which enables suppression of the [+c] role. We may observe now that not all experiencing verbs select precisely these clusters, and that a minimal difference in the cluster selection of verbs entails a substantial difference in the set of syntactic derivations which they permit.

It was noted by Pesetsky (1995) that some experiencing verbs do allow all their three θ-roles to be realized in their non reduced form (object-experiencing), and, in fact, some even require this. This is illustrated in the (i) sentences of (74).

74 a i) The press biased the judge (against the defendant).
ii) The judge was biased against the defendant.

b i) This alienated her from her colleagues.
ii) She was alienated from her colleagues.

c i) ze hirgil oto le-oni. (This accustomed him to poverty.)
ii) hu hitragel le-oni. (He accustomed to poverty.)

If the external [+c] role is reduced, the result is the two place (subject-experiencing) entry, exemplified in the (ii) sentences. As we noted for the other experiencing verbs, in English, the reduced form is hardly available, and a passive form is used instead. But in Hebrew these verbs do have a reduced form. In (74c), we see that the reduced form bears the morphological marks of reduction, as with the other experiencing (and unaccusative) verbs.

Other examples of such three-place verbs, listed by Pesetsky (p.216), are: <u>arouse</u>, <u>incline</u>, <u>provoke</u>, <u>stimulate</u>, <u>estrange</u>, <u>habituate</u>. In Pesetsky's framework, these pose a problem which necessitates a certain amount of stipulations. In the features approach, we should search the answer in the properties of the θ-roles of these entries.

Unlike the <u>worry</u> verbs, the third argument in the (i) entries cannot be naturally construed as a potential cause (sufficient condition) of the reported state of mind. This can be checked by comparing the pair in (63), repeated again, to (75).

63 a) The article angered Bill.
cause - [+c]
b) Bill was angry at/about the article.
subject matter-[-m]

75 a) The press biased the judge.
cause - [+c]
b) The judge was biased against the press.
? ([-c])

The (a) sentence in both is derived from the basic entry, and the (b) sentence - from the reduced one. In (63), it took some effort to prove that the sentences are not equivalent, while in (75) the option does not even arise, as they are so clearly different. The reason (63) requires thought is that the roles the article bears in the two derivations are potentially related, and are, thus, hard to distinguish. But in (75), they are clearly distinct: the press in (75b) cannot be construed as a potential cause, which means it must have the /-c feature.

Intuitively, the third (?) role in the bias type verbs resembles more the **goal** role (or perhaps Pesetsky's **target**), than the **subject matter** goal. In the present system, **goal** is [-c], and as we diagnosed already the **?** cluster as containing a /-c feature, I assume it is, like **goal**, a [-c] cluster[31].

The basic entry for **bias** verbs is, then, given in (76), which includes already the output of the marking procedures.

76) bias_{acc} ($[+c]_1$, [-c+m], $[-c]_2$) (**cause, experiencer, goal/target**

77) worry_{acc} ($[+c]_1$, [-c+m], $[-m]_2$) (**cause, experiencer, subject matter**)

The bias verbs, thus, differ minimally from the worry verbs in (77): They differ only in whether the third argument is [-m] or [-c]. However, this minimal difference entails substantial differences in the syntactic realizations the verb permits.

First, this difference explains the realization problem we started with (in (74)). Recall the cluster distinctness definition in (59), repeated.

59 Cluster distinctness:
- a) Two indistinct θ-clusters cannot be both realized on the same predicate.
- b) Distinctness: Two feature-clusters α, β, are distinct iff a. they share at least one feature, and b. there is at least one feature or value which they do not share.

By (59b) the cluster [+c] is indistinct from [-m], but it is distinct from [-c]. Hence, (59a) (or 60) allows only two clusters of worry to realize in a given derivation. But for the bias verbs, it allows all three clusters to realize together, which, as we have just observed, is indeed the case.

This has further implications: As we saw in section 8, in the worry verbs, the realization of the [+c]

[31][-c] clusters allow in some contexts a /+m interpretation (see Reinhart 2001). But this depends on the verb, and is not the case with the present role. In the cases allowing this, like escape. the verb concept has mental properties, but no **experiencing** cluster.

role is optional. Hence, the verbs allow a movement derivation, based on realizing only the [-m] role. However, this option is licensed only by (59a): since the verbs select the indistinct pair <[+c], [-m]>, one of them is not realized. Nothing else in the system permits arbitrary non-realization of the [+c] cluster[32]. Hence, this option is not available for the bias verbs.

The first implication of this difference regards expletive subjects. As we saw, the worry verbs allow derivations like (78a), based on realizing the [-m] cluster. Since bias verbs do not allow such realization, we expect them not to allow an expletive subject, which is indeed witnessed in (78b).

Expletives:

78 a) It worried/surprised/scared Max that he was always winning.
b) *It biased/alienated/habituated/estranged/inclined Max [that he was always winning] / [to always win].

Next, we saw that the derivation based on realizing only the [-m] cluster is what enables backward anaphora in worry verbs, as in (79).

anaphora:

79) His_i health worried every $patient_i$.

80 a) */? His_i upbringing biased every $juror_i$ (against the defendant).
b) ?/*His_i musical taste alienated every $pianist_i$ from the audience.

Since the bias verbs do not have such derivation, nothing licenses this type of anaphora. Indeed the sentences of (80) are just standard instances of weak cross-over, namely, they are worse than (79).

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[32]There is, in fact, another condition which allows a [+c] cluster not to be realized (discussed in Reinhart (2001)): When a verb selects two [/+c] clusters, one of them is optionally not realized: This holds for [+c], [+c+m] and [+c-m]. Verbs which select both a [+c-m] cluster (roughly **instrument**) and either a [+c] or a [+c+m] arguments are, most notably, 'manner verbs'. In such cases it is possible to realize only the **instrument**. However, this role will realize externally, given the mapping conditions above.

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