

1. Introduction

This paper proposes an alternative interpretation of theme and rheme from a cognitive psychological perspective and constructs a model that complements the Hallidayan framework (see Halliday, 1994). It takes, as its starting point, the Hallidayan conception of theme as a clause-initial element, but departs from it by focusing on other considerations that are felt to be central to the idea of a message structure. Underlying the proposed model are schema theory and the role of inferences during language processing. I shall attempt to show how these concepts in cognitive psychology are useful as an alternative means to delimit theme, and what they reveal regarding the message structure of the clause. The central argument of this paper is that the cognitive psychological standpoint is able to both explain and provide valuable insights on the nature and function of theme and rheme.

This paper is divided as follows. A brief overview of the Hallidayan framework and the justification for an alternative theme-rheme model are presented in Section 2. The main components of the proposed model are outlined in Sections 3 and 4. The model is itself presented in Section 5 and evaluated in Section 6. The main points of this paper are summarised in Section 7.

2. The Hallidayan framework

In his influential thesis of 1844, Weil made a penetrating observation about an important structural division within the clause:

There is [...] a point of departure, an initial notion which is equally present to him who speaks and to him who hears, which forms, as it were, the ground upon which the two intelligences meet; and another part of discourse which forms the statement (*l'énonciation*), properly so called. This division is found in almost all we say.

(Weil, 1844, p. 29)

This division – what Weil calls *point of departure* and *enunciation* – are known today by a host of names and are interpreted in diverse ways. Topic and comment, for example, focusing on the notion of aboutness, are familiar labels in American linguistics and are used in the writings of Dahl (1974a, 1974b), Sgall (1974, 1975), Dezsö and Szépe (1974a, 1974b), Bates (1976) and Sgall and Hajičová (1977), among others. Other variations include topic-focus (Hajičová, 1994; Lambrecht, 1994; Peregrin, 1996; Koktová, 1996) and topic-dominance (Erteschik-Shir, 1988).

Theme and rheme, on the other hand, are favoured by Halliday (1967a, 1967b, 1968, 1994) as well as several Prague school linguists, notably Firbas (1975, 1986, 1987, 1992) and Daneš (1970, 1974, 1989), although their views on both labels are dissimilar. Whereas Firbas and others define theme in terms of communicative dynamism, Halliday regards it as a position-bound, clause-initial element that is delimited in accordance with the metafunctional categories of his systemic-functional grammar. The Prague school and Hallidayan approaches to linguistics, particularly their functional orientation, are compared in Davidse (1987). An excellent summary of the Prague School heritage is given in de Beaugrande (1991a, 1991b).

In their extended form, Halliday's views on theme and rheme first appeared in a series of articles in the 1960s (Halliday, 1967a, 1967b, 1968). His theoretical position since then has remained largely unchanged (Halliday, 1994). Although borrowing the Prague school terminology, Halliday departs from the general approach of Firbas and others by adopting the simple theme-rheme division rather than the multiple divisions of theme, theme-proper, diatheme, transition, transition-proper, rheme and rheme-proper (see Davidse, 1987, p. 65; Firbas, 1992, pp. 80-81). Specifically, 'one element in the clause is enunciated as the theme;

this then combines with the remainder so that the two parts together constitute a message’ (Halliday, 1994, p. 37).

In the Hallidayan framework, clause-initial elements are analysed as textual, interpersonal or topical themes, in line with the broad metafunctional categories of his systemic-functional grammar. The components of each theme type are set out in Table 1.

(Table 1 about here.)

The topical theme, the most important theme type, is the first element that has a function in transitivity. It comprises only one experiential element and ends the thematic portion of the clause. Halliday (1994, p. 53) argues that without the topical theme, ‘the clause still lacks an anchorage in the realm of experience.’ Topical themes may or may not be preceded by textual or interpersonal themes, but if all three theme types do appear, they typically follow the textual^interpersonal^topical order, as follows:

- | | | | | |
|-----|-----------------------|-----------------|---------------|----------------|
| (1) | On the other hand, | perhaps | he | could make it. |
| | Text. Theme | Int. Theme | Top. Theme | Rheme |
| | (conjunctive adjunct) | (modal adjunct) | (participant) | |

As compared to Halliday (1967b, 1967c, 1970), we may take note of two revisions. The first concerns the analysis of polar interrogatives. In his present framework, the unmarked theme includes the finite verb and subject:

- | | | | |
|-----|-------------------|---------------|----------------|
| (2) | Can | you | come tomorrow? |
| | Int. Theme | Top. Theme | Rheme |
| | (finite operator) | (participant) | |

In Halliday (1967c, p. 180), however, he states that ‘since it is the finite element of the verbal group that carries the realization of polarity, this element, and this element alone, is marked out as the theme of the clause and therefore precedes the subject.’ This position is repeated in Halliday (1970, p. 162; 1977, pp. 182-183) where it is maintained that only the polarity-carrying element in polar interrogatives is regarded as the theme.

The second concerns the analysis of adjuncts in thematic position. In Halliday (1994, p. 52), it is held that ‘the Theme always contains one, and only one, [...] experiential [element].’ This is in contrast with his earlier view which states:

It is possible however for more than one adjunct to appear in thematic position in the clause [...] examples such as *the other day in Sheffield I watched an interesting new process* (or *in Sheffield the other day [...]*) show that the function of theme, restricted elsewhere to single clause elements, can in the case of adjuncts extend over two or more.

(Halliday, 1967b, p. 219)

A complication arises with clauses such as (3):

(3) Yesterday, in the park, I met an old friend of mine.

Following Halliday’s present approach, only *Yesterday* qualifies as the topical theme but not *in the park*. Some linguists have not been comfortable with this and have reverted to Halliday’s original concession on the possibility of multiple topical themes. Martin’s (1995, p. 255, footnote 5) approach, for example, permits ‘multiple marked Themes (i.e. up to and including the first topical Theme and any additional marked Themes).’

Of interest to this paper are the following questions regarding Halliday’s framework:

(a) Can the framework be used to explain, from a theme-rheme angle, whether a clause is well-formed?

- (b) Does the framework clarify the manner in which an initial element identified as the theme of the clause is functioning as such?

Addressing the first question, let us turn to our conventional knowledge of language and language use. Essentially, this knowledge guides us in accepting or rejecting linguistic inputs. As it is used here, the notion of *acceptability* is interpreted widely in terms of our perception of reality or a particular worldview and, to this end, involves more than mere semantic acceptability. Consider, for example, the following (assuming normal context):

- (4) John kicked the ball. (acceptable)
- (5) *John laid an egg. (unacceptable)
- (6) ?The machine turned itself on. (questionable)
- (7) The pane the ball John kicked hit broke. (difficult to comprehend)

As it has never been Halliday's intention to account for the acceptability of linguistic constructions, his framework cannot be used to clarify whether a clause is well-formed, unacceptable or dubious. It is possible, for that matter, for a thematic analysis to be performed on a clause such as (5) where *John* is the topical theme. I wish to say, however, that such an analysis should be resisted, for if even unacceptable clauses are deemed to have a thematic structure, it would be difficult to see how theme and rheme could organise the clause as a message. To explain the (un)acceptability of clauses from a thematic standpoint, therefore, we would need to complement the Hallidayan framework with an additional apparatus. This is the objective of the proposed model that is presented in Section 5.

Turning to the second question, our attention is drawn to the function of the thematic element itself: how an element identified as a textual, interpersonal or topical theme is functioning, specifically, as a thematic element. It might be noted that identifying some initial

element, say, as a topical theme does not reveal much about its thematic function. What it does state is that the element has some function in transitivity. According to Halliday's framework, it is not enough to conclude that it is topically thematic because of its clausal position alone since this is not how theme is functionally defined (Halliday, 1994, p. 38). It is also not enough to state that it offers an anchorage in the realm of experience since it is not always the case that the first experiential component is encoded as the topical theme.

Consider, for example, (8):

(8) Is he well?

Halliday's framework does not analyse *Is* as the topical theme, although it is an (intensive) relational process. Instead, the pronoun *he* is considered topically thematic. The relational process in (8), in other words, is bypassed as the topical theme in favour of the participant, the reason being that it is the finite element that is taken into account rather than the relational process itself (see Matthiessen & Martin, 1991, p. 48).

The analysis of existential clauses, such as (9), also pose a similar problem:

(9) There is a man.

The empty subject *There* is regarded as the topical theme even though it is semantically empty and is not assigned any representational function in transitivity analysis (Halliday, 1994, p. 142). If so, the empty subject cannot be topically thematic since it contravenes the criterion for topical theme identification. But because it is nevertheless analysed as the topical theme in Halliday's framework, it raises a problem which is difficult to resolve on grounds of consistency. For this reason, Thompson (1996, p. 138) has suggested that 'it [...] makes sense to include the process in Theme.' Other writers such as Fries (1981, 1995a, 1995b, 1995c) and

Vande Kopple (1991), on the other hand, regard *there+be* as well as the entity or phenomenon construed existentially as part of theme.

3. A cognitive psychological approach

The above discussion on the Hallidayan framework motivates the need for an alternative look at theme and rheme. The cognitive psychological approach proposed in this paper directs attention away from the lexicogrammatical orientation of Halliday's framework to more perceptual concerns. It views the theme-rheme notions from the language user's standpoint and recognises a multitude of factors that enter into language processing. Of importance are context and the individual's knowledge structures, including knowledge of pragmatic principles (conduct of conversation) and the conventions of language itself (such as phonology, syntax, semantics and so on). We shall be centrally concerned with the individual's *total cognitive environment*, described as follows:

An individual's total cognitive environment is the set of all the facts that he can perceive or infer: all the facts that are manifest to him. An individual's total cognitive environment is a function of his physical environment and his cognitive abilities. It consists of not only all the facts that he is aware of, but also all the facts that he is capable of becoming aware of, in his physical environment. The individual's actual awareness of facts, i.e. the knowledge that he has acquired, of course contribute to his ability to become aware of further facts. Memorised information is a component of cognitive abilities.

(Sperber and Wilson, 1995, p. 39)

As functional labels, theme and rheme have specific roles to perform in the clause. However, due to the remarkable speed at which language is processed by the mind, these roles may not be readily apparent. One way of resolving this is to see what would happen if the theme-rheme pair were to be deliberately mismatched. Conceivably, this would result in an odd or bizarre message. The question to raise, then, is: at what point in the clause could such a situation be averted? Here, our focus is on locating a specific point in the clause where the

message can proceed in a number of directions but is constrained to move in only one or a restricted number. This constraining force, clearly, must be effected by some initial element by virtue of its clausal position. It lends weight to what Halliday (1970, p. 161) refers to as ‘the peg on which the message is hung.’

As we begin to probe how language is processed and how it creates certain effects within us, we move gradually away from syntactic concerns to more perceptual ones. To get a feel of this, consider (10):

(10) John’s father is a poet. ?As the son of a poet, John loves golf.

Iser (1974, p. 278) notes that ‘individual sentences not only work together to shade in what is to come; they also form an expectation in this regard.’ As a concept of initialness, a reasonable claim about theme is that it not only reorientates the reader to what has gone on before, but prepares him or her for what will follow. If this is not fulfilled (that is, if the expectation is dashed), the decoder will be forced to either revise the earlier expectation or reject the construction. The second sentence in (10), for this reason, is odd because the expectation that is generated by the initial element – *As the son of a poet* – is not matched by the rest of the clause, unless it is an established fact that the male offspring of poets love golf.

Two notions in cognitive psychology have been particularly helpful in enabling us to formalise the proposed model more explicitly. The first is schema theory, first articulated in Kant (1787) and later expanded in Head (1920), Bartlett (1932) and Piaget (1955). The second concerns inferences, the activation of information derived from background knowledge or memory (van den Broek, 1994, p. 557).

3.1. *Schema theory*

Schema theory is a powerful yet flexible account of the way we store and process our knowledge of the world, whether in terms of processing language or making sense of events. The widespread use of the term, however, has led to it being defined and applied differently by different writers (e.g. Glucksberg and Danks, 1975; Winograd, 1977; Rumelhart, 1980, 1984; Eysenck and Keane, 1990; Whitney and Waring, 1991; Matlin, 1994). For our purpose, a schema is regarded as follows:

A schema [...] is a data structure for representing generic concepts stored in memory. There are schemata representing our knowledge about all concepts: underlying objects, situations, events, sequences of events, actions, and sequences of actions.
(Rumelhart, 1984, p. 2)

It is 'a structure of knowledge about some topic [...] [which] guides both information acceptance and information retrieval; it affects how we process new information and how we retrieve old information from memory' (Leahey and Harris, 1997, p. 203). When activated, a schema provides the relevant background knowledge or context that is needed for goal-oriented action, interpretation or the generation of inferences (Hall, 1989, pp. 392-393). In particular, we shall focus on Rumelhart's analogy of schemata as theories:

Theories, once they are moderately successful, become a source of predictions about unobserved events. Not all experiments are carried out. Not all possible observations are made. Instead, we use our theories to make inferences with some confidence about these unobserved events. So it is with schemata.
(Rumelhart, 1980, p. 38)

Here, a schema functions 'as a kind of informal, private, unarticulated theory about the nature of the events, objects, or situations that we face' (Rumelhart, 1980, p. 37). That is to say, we rely on our schemata to account for some aspect of a new experience. The processing of any incoming input, therefore, is akin to 'hypothesis testing, evaluation of goodness to fit, and parameter estimation' (Rumelhart, 1980, p. 38). Whenever a particular schema fails to account

for the new experience, it is either accepted in a modified form or rejected in search for another possibility.

On the terminological front, other labels such as *frame* and *script* have also been used by researchers working in different fields of enquiry, particularly artificial intelligence. Minsky (1975), for example, developed frames as packets of information embedded in a retrieval network such that if one frame were to be accessed, other relevant frames would become available as well (see also Maida, 1992). Scripts, on the other hand, relate to sequences of events and role relations (Schank and Abelson, 1977; Dyer, 1992). Some writers, such as Yule (1985, p. 112) and Huckin (1983, p. 92), treat frames and scripts as different types of schema. Van Dijk (1977, pp. 18-23), on the other hand, equates Bartlett's schema with frame, regarding it as a type of higher-order organising principle comprising collections of concepts that are typically related. For simplicity, we shall regard frames and scripts as different types of schema in line with the broad definition presented earlier.

An important point to note, too, is that schema theory in no way marginalises language as a social phenomenon. It does not confine our field of investigation to the human mind only but recognises that relevant contextual and other factors have a bearing on how a particular input, linguistic or otherwise, is processed by the individual. As Nuyts notes:

Cognition does not at all exclude the social dimension of linguistic behavior, quite to the contrary. It stands beyond doubt that human beings are both individuals and social beings. There is no opposition between these facets, they are complementary and inextricably linked together like two sides of one coin. There cannot be a social context without individuals constituting it, but individuality only exists against a social background. One cannot meaningfully discuss individuality without considering the social dimension, and vice versa.

(Nuyts, 1992, p. 11)

Another concept which is useful for our purpose is that of *prototype* (Posner and Keele, 1968; Reed, 1970; Rosch, 1973). More precisely, ‘the prototype model proposes that the perceiver creates a prototype to represent each category and classifies a novel pattern by comparing it with the category prototypes, finding which prototype it most closely resembles, and selecting that category’ (Reed, 1992, p. 196). Very informally, we may understand prototype in terms of average or central tendency (Reed, 1992, p. 188; Rosch, 1973, p. 143), typicality (Taylor, 1995, p. 66; Langacker, 1987, p. 371), default representation (Deane, 1992, p. 212) or, simply, something which is ‘naturally most salient, most often thought of, most likely to be chosen as representative of the category’ (Langacker, 1987, p. 492). In relation to schema theory, Rumelhart remarks:

A schema theory embodies a *prototype* theory of meaning. That is, inasmuch as a schema underlying a concept stored in memory corresponds to the *meaning* of that concept, meanings are encoded in terms of the typical or normal situations or events that instantiate that concept.

(Rumelhart, 1980, p. 34)

3.2. *Inferences*

An inference is ‘any piece of information that is not explicitly stated in a text’ (McKoon and Ratcliff, 1992, p. 440). This includes both transient activations of information, word-based inferences and any information that is derived from background knowledge or memory (van den Broek, 1994, p. 557). However, because inferences strike at a long-standing controversy on the psychology of language processing, scholars are far from united in their views on the types of inferences that are formed during language comprehension.

There are essentially two views on inference activation. The first is a constructionist view where inferences are thought to be automatically encoded during language processing. According to this view, inferences are constructed as a necessary step to represent the

situation described in a text (van Dijk, 1977; Kintsch, 1977; van Dijk and Kintsch, 1983; Graesser and Clark, 1985b; Clark, 1985; Graesser and Kreuz, 1993). Various models of text processing are constructionist in nature, for example, the situation model of van Dijk and Kintsch (1983) and Johnson-Laird (1983), and the script-based model of Schank and Abelson (1977). Among other things, these models suggest that decoders make forward-looking inferences during language processing. This position has met with some empirical support in various experiments (Haberlandt and Bingham, 1982; Millis, Morgan and Graesser, 1990; Morrow, Bower and Greenspan, 1990; Murray, Klin and Myers, 1993; Keefe and McDaniel, 1993; Fincher-Kiefer, 1993, 1994; Calvo and Castillo, 1996). Other studies have refuted the hypothesis, arguing that even if such inferences are made, they are at best generated weakly (McKoon and Ratcliff, 1986, 1992; van den Broek, 1990; Keenan, Golding, Potts, Jennings and Aman, 1990; Swinney and Osterhout, 1990). Swinney and Osterhout (1990, p. 17) remark that ‘there is little evidence of ‘automatic’ generation of certain ‘forward-looking’ or ‘elaborative’ inferences’ and that ‘inferences involving certain likely causal consequences [are] ‘weakly generated’.’ Keenan, Golding, Potts, Jennings and Aman (1990, p. 310), however, caution that the seeming lack of evidence should not lead one to the conclusion that predictive and elaborative inferences never take place since ‘other kinds of elaborative inferences may occur, and even these inferences may occur in other experimental situations.’

The second, contrasting view is often termed the minimalist position. This claims that very few inferential processes are actually generated on-line (McKoon and Ratcliff, 1986, 1992). As for those that are activated automatically during language processing, only two types are acknowledged – those that establish local coherence (causal antecedent inferences) and those that rely on text details that are quickly and easily available (predictive inferences)

(Singer, 1993). The former is based on information that connects instances of the same concept, pronominal reference and causal relations. The latter is based on general knowledge that something will happen next if ‘what will happen next is very predictable, [...] highly typical, and so on’ (McKoon and Ratcliff, 1992, p. 441). The minimalist position is empirically supported in various independent studies (e.g. McKoon and Ratcliff, 1986, 1992; Magliano, Baggett, Johnson and Graesser, 1993; Millis and Graesser, 1994).

In constructing the proposed model, we shall make the basic assumption that ‘inferences are obviously generated when individuals comprehend text’ (Graesser and Clark, 1985a, p. 1; see also van den Broek, Fletcher and Ridsen, 1993, p. 169). However, the issue of what inferences are generated on-line and what are activated off-line is still unresolved and a mature theory has yet to surface, despite decades of study (Kintsch, 1993, p. 193). Given the conflicting views and experimental results, both predictive and causal antecedent inferences are accommodated in the proposed model, unless we are presented with convincing reasons that we can do without one or the other. In application, we shall use the simpler labels of *forward* and *backward* inferences to refer to predictive and causal antecedent inferences, respectively (van den Broek, 1990, 1994; van den Broek, Fletcher and Ridsen, 1993).

4. Knowledge structures revisited

As Kant (1787, p. 25) notes, ‘that all our knowledge begins with experience there can be no doubt.’ Accepting this, our knowledge of the world is an inventory of our knowledge of topics, actions, and so on. This inventory covers all aspects of what we know. Arbib aptly notes that ‘in a general setting, there is no fixed repertoire of basic schemas’ (Arbib, 1992, p. 1428) and that ‘there is no single set of schemas imposed upon all persons in a uniform

fashion' (Arbib, 1995, p. 209). Broadly, the knowledge structures (or schemata) that are consciously activated during language processing may be grouped under three categories (compare with Goatly, 1997, p. 137):

- (a) *World knowledge*: an inventory of our generic knowledge of concepts, abstract or otherwise, in our long-term memory.
- (b) *Knowledge of context*: our awareness of the range of relevant contextual factors, including co-text, that have a direct or indirect bearing on the discourse.
- (c) *Knowledge of pragmatics*: this alerts us to the discourse strategies that are used in the communicative encounter. The knowledge of such strategies is a part of world knowledge and provides information as to why language is used in a particular way (see Seifert, 1990).

4.1. *Language schema*

In addition to these knowledge structures, it is submitted that language processing also draws upon our knowledge of the language concerned or, in different terminology, our linguistic competence. Since our knowledge of the world is an inventory of schemata, and language acquisition is conditioned by external factors, our language schema, comprising what we know about language, cannot be independent of this inventory but is a part of it. The language schema can be viewed from numerous angles (whether a particular sound is possible, how words are put together, and so on). Bybee and Slobin (1982), for example, investigated the use of English irregular verbs among people of different age groups and found that a specific form of language schema aided in the identification of the past forms of such verbs. Here, we shall be concerned with our knowledge of the lexicogrammatical structure of language at the level of the clause. We shall refer to the language schema as S_1 and all other schemata

(hereafter *other schemata*) that come to bear on our interpretation of any clausal message as S_2 . In terms of consciousness, it is surmised that S_1 tends to operate at a lower level than S_2 . There is an apparent ease by which we are able to produce and comprehend novel constructions. As Wingfield (1993, p. 201) remarks, these are ‘automatic processes over which we exert little control.’

At the level of the clause, S_1 is an umbrella term for the following clause-level schemata and their prototypes:

- (a) *Declarative schema*: where the clause is introduced by a subject. Declaratives, by this schema, impart some message to the addressee.

(11) **John** kicked the ball.

- (b) *Interrogative schema*: where the clause is either introduced by a finite element and the grammatical subject (for polar interrogatives) or a wh-element (for content interrogatives). Interrogatives perform the key function as a request for information or clarification.

(12) **Did John** kick the ball?

(13) **Which ball** did John kick?

- (c) *Imperative schema*: where the clause is introduced by an instructional verb. Imperatives are requests for action or reaction on the part of the addressee.

(14) **Kick** the ball!

- (d) *Exclamative schema*: where the clause is introduced by a wh-element followed by a nominal group. Exclamatives are an emotional expression relative to some action or state (Eggins, 1994, p. 177).

(15) **How cheerfully** he seems to grin.

(Halliday, 1994, p. 45)

- (e) *Negated adjunct schema*: where the clause is introduced by a negated adjunct and followed by an auxiliary or the *be* verb and an accompanying nominal group. Such constructions, a type of declarative, has a highly predictable structure.

(16) **Never in his life** was he free to take my calls.

(17) **Not once** have I received a compliment from him.

- (f) *PP/AG schema*: where the clause is introduced by a prepositional phrase (PP) or adverbial group (AG). Our knowledge of language imposes upon us to expect that the main clause will follow such PPs or AGs, even though its exact form may not be certain. So long as the main clause remains unarticulated, the decoder will not be able to ascertain both the representation of the process and the participant(s) involved in the process. Such PP/AG elements serve as a cue that some process and participant will be announced shortly.

(18) **In the next election**, John will support her campaign.

Whenever a clause is encountered, it is matched against the prototype of a relevant language schema for goodness of fit. Any construction which deviates from the prototype is considered marked.

4.2. *Other schemata*

Other than S_1 , various other schemata are also activated during language processing. As remarked earlier, these are knowledge structures to do with the world in general, context and pragmatics. It is unlikely, however, that these schemata are activated at the subconscious level. They serve as anticipators for some future event or development and are constantly

brought to our consciousness. Clearly, no anticipation can take place if language users have no prior knowledge to work from. For instance, presented with a foreign phrase, one would be at a loss as to what to expect next. But given (19):

(19) The school teacher [...]

we could reasonably expect a declarative and some relevant message to follow. We know enough, however, not to expect that the school teacher will melt like ice or reproduce like an amoeba. Indeed, how we make sense of the clausal message, or lack of it, depends greatly on our S_2 . As Ferris (1983, p. 28) observes, ‘it remains true that the elements of human language are more or less directly related to the world in which we live; they are ‘designed’ to serve us in that world and they get their general values from their relationships to parts of that world.’

5. Inference-boundary model

We are now in a position to piece together our discussion so far on schema theory and inferences in relation to theme delimitation. It is proposed that a useful way of interpreting theme is to understand it as an element that determines a boundary within which it is permissible for the rheme to occur. It is further proposed that the primary function of theme is not simply to introduce the rheme but to do so within a frame of acceptability so that the clause makes sense only if both its theme and rheme are considered together.

By this formulation, when a clause is processed, there is an interplay of knowledge structures related to language and the world in general. Together with the prevailing context, these schemata establish a boundary of acceptability within which it is permissible for the rheme to occur. Since the lexicogrammatical form of language is highly typical, forward inferences in S_1 tend to be specific. Halliday (1970, p. 162) remarks that ‘in English, there is a

definite awareness of the meaning expressed by putting in first position in the clause.’ Based on this, Clark and Clark (1977, p. 68) propose the following strategy for language processing: ‘use the first word (or major constituent) of a clause to identify the function of that clause in the current sentence.’

However, since language cannot be meaningfully processed independently from S_2 , the interpretation of any linguistic input requires the operation of both S_1 and S_2 in tandem. The activated schemata are guided ‘both by the local clues and by consistency among the various levels of analysis’ (Rumelhart, 1980, p. 46). This returns us to Rumelhart’s analogy of schemata as theories (see Section 4.1); we are constantly engaged in hypothesis-testing on the goodness of fit of the input to the activated schemata. As compared to S_1 , it is unlikely for specific inferences to be generated in S_2 (although they are not to be precluded). Rather, in S_2 , we infer that the message will proceed in a constrained but non-specific way. A backward inference occurs when the decoder reaches the end of the clause to relate the rheme to the theme, establishing the appropriateness of the theme-rheme relationship. Different types of backward inferences have been suggested by van den Broek, Fletcher and Risdén (1993) and van den Broek (1994). For our purpose, we shall be concerned with *connecting inferences* which take place when a stretch of language and its antecedent co-occur in short-term memory. When this happens, the decoder connects the two stretches of language as a coherent whole. Usually, connecting inferences are discussed at the text level between one sentence and another (e.g. Shiro, 1994). There is no strong reason, however, why such inferences cannot also occur clause-internally (see van den Broek, 1994, p. 557). Within the clause, specifically, it is submitted that backward inferences operate on the premise that there is a degree of appropriateness that links the rhematic portion of the clause with the theme that governs it.

These prompt the decoder to either accept or reject constructions on the basis of this relationship and serve as a check to prevent unacceptable rhemes from surfacing.

If this is indeed a crudely accurate representation of how clausal messages are processed, it offers a clause-based explanation of the conflicting results as to the type of inferences generated during language processing. Forward inferences tend to be difficult to pick out since specific inferences are (usually) generated only in S_1 where the linguistic structures are highly predictable. In S_2 , inferences are unlikely to be specific; it would take up too much processing time for the decoder to continually generate specific predictions for every clause. Singer (1990, p. 170) calls this situation *inferential explosion* where the individual becomes simply lost in thought.

The postulated theme-rheme model (hereafter *inference-boundary*, or IB, model) is summarised schematically in Figs. 1 and 2.

(Insert Figure 1 here.)

The ellipse in Fig. 1 represents the boundary of acceptability generated by the thematic element. Of the possible rhemes within the boundary, only one is eventually selected as the actual rheme. Rhemes which fall outside the boundary are blocked from co-occurring with the theme since this would result in an unacceptable clause.

(Insert Figure 2 here.)

We shall take note of three points regarding Figs. 1 and 2:

- (a) There are two broad factors which shape the boundary of acceptability activated by the thematic head. These are the relevant contextual (including co-textual) details and activated schemata.
- (b) The relevant schemata that are generated comprise the most updated knowledge structures. These include our knowledge of the conduct of conversation – that it is essentially a cooperative activity where the information that is exchanged between or among the discourse participants is relevant.
- (c) The interplay of context and schemata helpfully allows us to extend the IB model to non-literal uses of language, as in make-believe worlds (e.g. science fiction and fairy tales), irony, meiosis, and so on. The following introductory paragraph from a children’s tale shows the adjustments that need to be made in terms of what is permissible (and what is not) as regards inanimate toys:

- (20) In Eileen’s nursery the toys were very busy each night. They held a sewing-meeting and each toy borrowed a needle from Eileen’s work-basket, threaded it with cotton, and began to sew hard. They were sewing tiny flannel coats for the pixies who lived in the daffodil beds below the nursery window.
(Blyton, 1966, p. 78)

5.1. Principle of acceptable message development

Based on the IB model, an interesting fact about the behaviour of the thematic portion of the clause becomes evident. Because it activates a boundary which excludes impossible rhemes, it constrains what can come after it. For want of a better name, we shall refer to this as the *principle of acceptable message development* (hereafter AMD principle). More precisely:

The AMD principle dictates that the thematic head of a clause must be acceptably developed by the rheme in the context of the interactive encounter, whether in the written or spoken mode.

Insofar as theme is capable of activating a boundary of acceptability, it carries with it the potential of being *unacceptably* developed by an inappropriate rheme. We seldom, however, see the actualisation of this potential because exploiting this potential offers no apparent benefit to the language user. The AMD principle turns out to be a useful test for delimiting theme. Using well-formed clauses, the line separating theme and rheme may not be easy to discern. However, since the thematic element has the potential of being unacceptably developed, we could approach the problem from another angle and find out what would happen if we were to flout (as used in the technical sense in Grice, 1975) the AMD principle. Specifically, what would happen if we were to form an unacceptable construction by retaining the initial element of the clause? We are reminded, again, that acceptability is interpreted widely in terms of our perception of reality or a particular worldview. We might discover, at first, that it is not possible for an unacceptable clause to be formed based on the clause-initial element. If so, that element cannot be regarded as being fully thematic since we have not yet been able to locate an unacceptable rheme. What needs to be done, then, is to keep flouting the AMD principle for each succeeding element until we are able to form an unacceptable clause comprising a theme-rheme mismatch. That stretch of language that is AMD-floutable is the thematic portion of the clause. We may constrain this procedure further by requiring that the mood and the verb form (including aspect and voice) of the clause in question be retained.

We have seen that the Hallidayan framework categorises themes by way of the broad textual, interpersonal and experiential metafunctions of language (see Section 2). Unlike Halliday, however, the emphasis here is on locating an initial-element that is able to enter into a theme-rheme mismatch. To avoid any terminological confusion, we shall cease to use the

textual, interpersonal and topical theme labels, and resort to the more general *head* and *non-head* distinction. This acknowledges, as does Halliday, that there is an internal structure within the theme, but it also emphasises the idea of thematic prominence, of some element being more (or less) able than another to satisfy the flout-AMD procedure. Thematic heads and non-heads are separated as follows:

The thematic head of a clause is that element that is able to generate a boundary of acceptability within which it is permissible for the rheme to occur such that:

- (a) The boundary is obtained through the interplay of forward inferences in S_1 and S_2 ;
- (b) The boundary is narrow in that it excludes rhemes that are in conflict with the theme; and
- (c) It is possible to form a favourable backward inference relating the rheme of the clause to the theme.

Any thematic element either preceding or following the thematic head is a thematic non-head and is termed a thematic pre-head or post-head, respectively.

Thematic non-heads – both pre-heads and post-heads – provide textual, judgemental or stative information on the thematic head. These include modal and conjunctive adjuncts and, in the case of post-heads, included segments as well, such as non-downranked elaborative clauses. In line with the wave-like effect of thematic prominence (see Halliday, 1994, p. 337), thematic post-heads still retain some thematic flavour but are at the ebb of the wave. Such elements, therefore, should also be regarded as thematic but only weakly so:

- (21) a. John, **however**, came to class. (textual information)
b. John, **fortunately**, came to my rescue. (judgemental information)
- (22) John, **lazy as ever**, came to class anyway. (information on thematic head)

5.2. *Flouting the AMD principle*

Let us now examine how the AMD principle may be flouted to delimit the thematic portion of the clause. In the examples that follow, unacceptable and dubious constructions are

marked with an asterisk (*) and a question mark (?), respectively. Consider (23a) (assuming normal context):

(23) a. John kicked the ball.

It is easy for us to construct an unacceptable clause using *John* as the initial element:

(23) b. ***John** laid an egg.

This element, therefore, is minimally enough for an unacceptable clause to be formed and is functionally the thematic head.

Next, consider (24a):

(24) a. Fortunately, John kicked the ball.

Somewhat mechanically, we might proceed to form (24b) and conclude that the AMD principle is floutable using *Fortunately* as the minimal element:

(24) b. ***Fortunately**, John laid an egg.

Examining (24b) carefully, however, we soon realise that it is odd not because *Fortunately* is unacceptably developed by *John laid an egg*, but because *John*, as a human being, cannot lay eggs. That is to say, a theme-rheme mismatch is not yet possible using *Fortunately* as the minimal element in the flout-AMD procedure. This indicates that thematic heads must be sufficiently robust to serve as the peg on which the message is hung. It is submitted that modal and conjunctive adjuncts (see Halliday, 1994, p. 49) do not appear to possess this robustness and have only an indirect influence on the flow of the message proper. Similar comments may also be made for other elements categorised as textual and interpersonal themes in Halliday's framework. Monaghan (1979, p. 133), in fact, regards such elements as *non-cognitive themes* since

‘they only draw attention to the relation of the [clause] as a whole to something else’ and ‘do not prevent a cognitive thematic choice [from] being made in the same clause.’

But how is thematic robustness determined? My proposal is that we view it in terms of how well the candidate for thematic head is integrated within the clause. On a note of caution, this should not be confused with the *obligatoriness-optionalty* distinction since conjunctions and adjuncts are optional elements in clause structure. By integration, rather, I mean that the initial element ‘is integrated to some extent in clause structure if it is affected by clausal processes’ (Quirk, Greenbaum, Leech and Svartvik, 1972, p. 421). There are two ways by which this may be established.

The first involves the use of negated declaratives. Because adjunct thematic heads are closely connected with the process and provide circumstantial information, they are blocked from appearing initially in clauses where the process is negated:

- (25) a. **Expertly**, John fired the gun.
b. ***Expertly**, John did not fire the gun.
- (26) a. **Fortunately**, John fired the gun.
b. **Fortunately**, John did not fire the gun.
- (27) a. **Therefore/However**, John fired the gun.
b. **Therefore/However**, John did not fire the gun.
- (28) a. **And/Or/But** John fired the gun.
b. **And/Or/But** John did not fire the gun.

An obvious drawback of this criterion is that it works well with manner adjuncts but considerably less so with other types of circumstantial adjuncts (of time and place), as follows:

- (29) a. **On Tuesday**, John fired the gun.
b. **On Tuesday**, John did not fire the gun.

- (30) a. **In the office**, John fired the gun.
 b. ?**In the office**, John did not fire the gun.

To counter this problem, we resort to another criterion to separate robust from non-robust thematic elements. Since adjunct thematic heads are integrated in clause structure and are therefore important to the clause-internal message, they provide circumstantial information that is unique to the message concerned. This makes it possible for them to be contrasted with another similar adjunct in alternative negation, as in (31a-b). This, in contrast, is generally not possible for non-robust adjuncts and conjunctions, as evident in (31c-d):

- (31) a. **On Tuesday**, John did not go to school, but on **Wednesday**, he did.
 b. **As a child**, he loved to catch spiders, but **as an adult**, he detested it.
 c. ***Amazingly**, John did not go to school, but **surprisingly**, he did.
 d. ***However**, John did not go to school, but **in recollection** he did.

An interesting complication now presents itself in the form of existential clauses due to the numerous forms they may take. The existential *there* takes not just the verb *be* and its auxiliaries, but also verbs such as *exist*, *come*, *ride*, among others. It might be observed that a few such verbs are able to generate a sufficiently narrow boundary of acceptability by flouting the AMD principle, but not others (such as *be* and *exist*).

- (32) There **must be** something wrong.
 (33) There **exist** similar medieval crosses in different parts of the country.
 (34) There **may come** a time when Europe will be less fortunate.
 (35) There **rode** two men in uniform in front of the carriage.
 (Quirk and Greenbaum, 1979, pp. 418-422)

For existentials, then, an element-by-element analysis is proposed for theme identification.

The flout-AMD procedure will be applied as the only test for each element in the clause:

- (36) a. There is a man in the room.
 b. *There is a man in Mary's stomach.
 Theme → **There is a man** (pre-head = **There is**; head = **a man**)

- (37) a. There lives a man without love and friends.
 b. *There lives a table with a price tag.
 Theme → **There lives** (pre-head = **There**; head = **lives**)

By applying the same procedure to imperatives and interrogatives, we obtain:

- (38) a. Will John paint the wall?
 b. *?Will John bloom this spring?
 Theme → **Will John** (pre-head = **Will**; head = **John**)

- (39) a. What can you do?
 b. *What does it go?
 Theme → **What** (head = **What**)

- (40) a. Come here!
 b. *Come there!
 Theme → **Come** (head = **Come**)

A problem that might be encountered in the flout-AMD procedure arises in make-believe worlds where almost anything is possible. To get round this problem, it is proposed that context be viewed in two broad forms. The first, *primary context*, applies to the general situation of the real world. This is the world that we are familiar with and comprises the smaller, restricted context of the communicative encounter. The second, *secondary context*, is the make-believe world where reality is distorted. Secondary context, however, does not immediately apply to all fictional communicative encounters, but only to those where the make-believe world has been endowed with some unique characteristic that is far-fetched or impossible in the present world. The children's tale in (20), for example, represents a situation of secondary context. The flout-AMD procedure in this situation must therefore result in a clause that is unacceptable in relation to the adjustments that have to be made in the secondary context. For example, from the second sentence in (20):

- (41) a. They held a sewing meeting [...]
 b. *?They shed skin [...]

6. Evaluating the IB Model

6.1. Strengths of the IB model

The IB model acknowledges that language processing is a complex affair and involves a multitude of factors. It explicitly takes into account the cognitive environment of the language user and gives full consideration to both the thematic and rhematic portions of the clause. The underlying AMD principle suggests that theme plays an important functional role in the message structure of the clause. We see why this is important because if the principle is not met, we would be left with gibberish or clauses that are contextually unacceptable.

Beyond a certain point in a clause, the development of the message may proceed in a number of directions. It is fulfilment of the AMD principle in the theme-rheme pair that ensures that the intended message is well developed and, therefore, conveyed. As it turns out, the flout-AMD procedure – that which determines where it is first possible for the message to be distorted in relation to some clause-initial element – serves as a useful test for the identification of the thematic head.

The IB model also explains why clausal messages are sometimes difficult to process.

Figs. 1 and 2 attribute this to any one or a combination of the following factors:

- (a) *Interference from context.* Such interferences take a number of forms. They include noise, a badly-printed page, and so on. Despite such interferences, however, it is still often possible for communication to proceed between two parties. This is because the decoder has at his or her disposal some relevant schema(ta) (e.g. the redundant features of language) that allow him or her to fill in the missing slots with a fair degree of confidence.

- (b) *No appropriate or less elaborate schema(ta)*. The decoder who does not have the appropriate schemata will find the comprehension process a difficult one. This can be tested fairly easily by attempting to read a technical dissertation on an unfamiliar topic; we would frequently need to resort to a specialised dictionary or some reference-aid to expand our insufficient schema(ta) of the topic. Without the activation of a sufficiently-elaborate schema or schemata, forward and backward inferences will be impossible or very difficult to generate.
- (c) *Theme-rheme problems*. Theme-rheme mismatches distort the clausal message. The flout-AMD procedure seeks precisely to achieve this situation to demonstrate that the theme is pivotal in the development of the message within the clause. Unacceptable clauses force us to look at language to try and understand what has gone wrong (Colomb and Williams, 1985, p. 89). More subtly, they also helpfully provide a hint of the dynamics involved in language processing that would otherwise have remained hidden if well-formed clauses were used instead.

6.2. Restrictions of the IB model

As the IB model is centrally concerned with the thematic structure of the clause, it becomes less useful in explaining how language inputs that do not lend themselves easily to thematic analysis succeed in conveying messages, for example:

- (42) Hock Huat Construction and Engineering Services
(43) Exit

The IB model also becomes less useful when less reliance is needed on the thematic structure of language for successful communication to take place. This happens, for example, when language is used as an exclusion device (code) to prevent outsiders from participating in a restrictive discourse. Nevertheless, even this can be explained by way of the IB model – codes serve precisely their function because their users bank on outsiders not being able to activate an appropriate schema or schemata and, therefore, form inferences.

7. Conclusion

The discussion in this paper is summarised as follows:

- (a) Theme activates specific forward inferences in S_1 on the lexicogrammatical form of the clause and (typically) non-specific forward inferences in S_2 on message content. The context and forward inferences in S_1 and S_2 together shape a boundary of acceptability within which it is permissible for the rheme to occur. Acceptability is interpreted widely in terms of the language user's perception of the world as shaped by contextual (including co-textual) factors.
- (b) Only thematic heads are best able to activate a sufficiently narrow boundary of acceptability. The head serves as an anchor that constrains how the message will proceed. It abides by the AMD principle but carries with it the potential of being unacceptably developed. The deliberate flouting of the AMD principle serves as a useful test to identify the thematic head.
- (c) Backward inferences relate rheme to theme, establishing a degree of appropriateness between them. These inferences serve as a check to prevent unacceptable rhemes from co-occurring with the theme.

The proposed IB model, incorporating the AMD principle, draws our attention to fairly fundamental concerns. It tells us why a thematic element is what it is and how it might be delimited. To reiterate, this paper argues that the theme of the clause is that which guides, in context, the development and direction of the clausal message. It is important because it anchors the message in this way. For as Halliday himself puts it, it is the peg on which the message is hung.

References

- Arbib, M. A. (1992) Schema theory. In *Encyclopedia of Artificial Intelligence*, ed S. C. Shapiro, Vol. 2, 2nd ed, pp. 1427-1443. John Wiley, New York.
- Arbib, M. A. (1995) The schema theory of minds: Implications for the social sciences. In *Rethinking Knowledge: Reflections Across the Disciplines*, eds R. F. Goodman and W. R. Fisher, pp. 207-217. SUNY, Albany.
- Bartlett, F. C. (1932) *Remembering: A Study in Experimental and Social Psychology*. Cambridge University Press, Cambridge.
- Bates, E. (1976) *Language and Context: The Acquisition of Pragmatics*. Academic, New York.
- de Beaugrande, R. (1991a) The heritage of functional sentence perspective from the standpoint of text linguistics (1). *Linguistica Pragmatisia* **34** (1), 2-26.
- de Beaugrande, R. (1991b) The heritage of functional sentence perspective from the standpoint of text linguistics (2). *Linguistica Pragmatisia* **34** (2), 55-86.
- Blyton, E. (1966) *The Blue Story Book*. Granada, St. Albans.
- van den Broek, P. (1990) Causal inferences and the comprehension of narrative texts. In *Inferences and Text Comprehension*, eds A. C. Graesser and G. H. Bower, Vol. 25, pp. 175-196. Academic, San Diego.
- van den Broek, P. (1994) Comprehension and memory of narrative texts: Inferences and coherence. In *Handbook of Psycholinguistics*, ed M. A. Gernsbacher, pp. 539-588. Academic, San Diego.
- van den Broek, P., Fletcher, C. R. and Ridsen, K. (1993) Investigations of inferential processes in reading: A theoretical and methodological integration. *Discourse Processes* **16** (1-2), 169-180.
- Bybee, J. L. and Slobin, D. I. (1982) Rules and schemas in the development and use of the English past tense. *Language* **58** (2), 265-289.
- Calvo, M. G. and Castillo, M. D. (1996) Predictive inferences occur on-line, but with delay: Convergence of naming and reading times. *Discourse Processes* **22** (1), 57-78.
- Clark, L. F. (1985) Social knowledge and inference processing in text comprehension. In *Inferences in Text Processing*, eds G. Rickheit and H. Strohner, pp. 95-114. Elsevier, Amsterdam.
- Clark, H. H. and Clark, E. V. (1977) *Psychology and Language: An Introduction to Psycholinguistics*. Harcourt, New York.

- Colomb, G. G. and Williams, J. M. (1985) Perceiving structure in professional prose: A multiply determined experience. In *Writing in Nonacademic Settings*, eds L. Odell and D. Goswami, pp. 87-128. Guilford, New York.
- Dahl, Ö. (1974a) Topic-comment structure revisited. In *Topic and Comment, Contextual Boundness and Focus*, ed Ö. Dahl, pp. 1-24. Buske, Hamburg.
- Dahl, Ö. (1974b) Topic-comment structure in a generative grammar with a semantic base. In *Papers on Functional Sentence Perspective*, ed F. Daneš, pp. 75-80. Mouton, The Hague.
- Daneš, F. (1970) One instance of Prague school methodology: functional analysis of utterance and text. In *Method and Theory in Linguistics*, ed P. L. Garvin, pp. 132-140. Mouton, The Hague.
- Daneš, F. (1974) Functional sentence perspective and the organization of the text. In *Papers on Functional Sentence Perspective*, ed F. Daneš, pp. 106-128. Mouton, The Hague.
- Daneš, F. (1989) Functional sentence perspective and text connectedness. In *Text and Discourse Connectedness*, eds M.-E. Conte, J. S. Petöfi and E. Sözer, pp. 23-31. Benjamins, Amsterdam.
- Davidse, K. (1987) M. A. K. Halliday's functional grammar and the Prague school. In *Functionalism in Linguistics*, eds R. Dirven and V. Fried, pp. 39-79. Benjamins, Amsterdam.
- Deane, P. D. (1992) *Grammar in Mind and Brain: Explorations in Cognitive Syntax*. Mouton de Gruyter, Berlin.
- Dezsö, L. and Szépe, G. (1974a) Contribution to the topic-comment problem. In *Topic and Comment, Contextual Boundness and Focus*, ed Ö. Dahl, pp. 65-93. Buske, Hamburg.
- Dezsö, L. and Szépe, G. (1974b) Two problems of topic-comment. In *Papers on Functional Sentence Perspective*, ed F. Daneš, pp. 81-86. Mouton, The Hague.
- van Dijk, T. A. (1977) Semantic macro-structures and knowledge frames in discourse comprehension. In *Cognitive Processes in Comprehension*, eds M. A. Just and P. A. Carpenter, pp. 3-32. Erlbaum, New Jersey.
- van Dijk, T. A. and Kintsch, W. (1983) *Strategies of Discourse Comprehension*. Academic, California.
- Dyer, M. G. (1992) Scripts. In *Encyclopedia of Artificial Intelligence*, ed S. C. Shapiro, Vol. 2, 2nd ed, pp. 1443-1460. John Wiley, New York.
- Eggins, S. (1994) *An Introduction to Systemic Functional Linguistics*. Pinter, London.

- Erteschik-Shir, N. (1988) Topic-chaining and dominance-chaining. In *The Prague School and Its Legacy in Linguistics, Literature, Semiotics, Folklore, and the Arts*, ed Y. Tobin, pp. 145-153. Benjamins, Amsterdam.
- Eysenck, M. W. and Keane, M. T. (1990) *Cognitive Psychology: A Student's Handbook*. Erlbaum, East Sussex.
- Ferris, C. (1983) *Understanding Semantics*. Alexa, Devon.
- Fincher-Kiefer, R. (1993) The role of predictive inferences in situation model construction. *Discourse Processes* **16** (1-2), 99-124.
- Fincher-Kiefer, R. (1994) The effect of inferential processes on perceptual identification. *Discourse Processes* **18** (1), 1-17.
- Firbas, J. (1975) On the thematic and the non-thematic section of the sentence. In *Style and Text: Studies Presented to Nils Erik Enkvist*, ed H. Ringbom, pp. 317-334. Skriptor, Stockholm.
- Firbas, J. (1986) On the dynamics of written communication in the light of the theory of functional sentence perspective. In *Studying Writing: Linguistic Approaches*, eds C. R. Cooper and S. Greenbaum, pp. 40-71. SAGE, Beverly Hills.
- Firbas, J. (1987) On the delimitation of the theme in functional sentence perspective. In *Functionalism in Linguistics*, eds R. Dirven and V. Fried, pp. 137-156. Benjamins, Amsterdam.
- Firbas, J. (1992) *Functional Sentence Perspective in Written and Spoken Communication*. Cambridge University Press, Cambridge.
- Fries, P. H. (1981) On the status of theme in English: Arguments from discourse. *Forum Linguistica* **6** (1), 1-38.
- Fries, P. H. (1995a) A personal view of theme. In *Thematic Development in English Texts*, ed M. Ghadessy, pp. 1-19. Pinter, London.
- Fries, P. H. (1995b) Themes, methods of development, and texts. In *On Subject and Theme: A Discourse Functional Perspective*, eds R. Hasan and P. H. Fries, pp. 317-359. Benjamins, Amsterdam.
- Fries, P. H. (1995c) Patterns of information in initial position in English. In *Discourse in Society: Systemic Functional Perspectives*, eds P. H. Fries and M. Gregory, Vol. L, pp. 47-66.. Ablex, New Jersey.
- Glucksberg, S. and Danks, J. H. (1975) *Experimental Psycholinguistics: An Introduction*. Erlbaum, New Jersey.
- Goatly, A. (1997) *The Language of Metaphors*. Routledge, London.

- Graesser, A. C. and Clark, L. F. (1985a) *Structures and Procedures of Implicit Knowledge*. Ablex, New Jersey.
- Graesser, A. C. and Clark, L. F. (1985b) The generation of knowledge-based inferences during narrative comprehension. In *Inferences in Text Processing*, eds G. Rickheit and H. Strohner, pp. 53-94. Elsevier, Amsterdam.
- Graesser, A. C. and Kreuz, R. J. (1993) A theory of inference generation during text comprehension. *Discourse Processes* **16** (1-2), 145-160.
- Grice, H. P. (1975) Logic and conversation. In *Syntax and Semantics*, eds P. Cole and J. L. Morgan, Vol. 3, pp. 41-58. Academic, New York.
- Haberlandt, K. and Bingham, G. (1982) The role of scripts in the comprehension and retention of texts. *Text* **2**, 29-46.
- Hajičová, E. (1994) Topic/focus and related research. In *The Prague School of Structural and Functional Linguistics: A Short Introduction*, ed P. A. Luelsdorff, pp. 245-275. Benjamins, Amsterdam.
- Hall, J. F. (1989) *Learning and Memory*. 2nd ed. Allyn, Boston.
- Halliday, M. A. K. (1967a) Notes on transitivity and theme in English (part 1). *Journal of Linguistics* **3** (1), 37-81.
- Halliday, M. A. K. (1967b) Notes on transitivity and theme in English (part 2). *Journal of Linguistics* **3** (2), 199-244.
- Halliday, M. A. K. (1967c) Theme and information in the English clause. In *Halliday: System and Function in Language*, ed G. R. Kress, pp. 174-188. Oxford University Press, Oxford.
- Halliday, M. A. K. (1968) Notes on transitivity and theme in English (part 3). *Journal of Linguistics* **4** (2), 179-215.
- Halliday, M. A. K. (1970) Language structure and language function. In *New Horizons in Linguistics*, ed J. Lyons, pp. 140-165. Penguin, Harmondsworth.
- Halliday, M. A. K. (1977) Text as semantic choice in social contexts. In *Grammars and Descriptions: Studies in Text Theory and Text Analysis*, eds T. A. van Dijk and J. S. Petöfi, pp. 176-225. Walter de Gruyter, Berlin.
- Halliday, M. A. K. (1988) On the language of physical science. In *Registers of Written English: Situational Factors and Linguistic Features*, ed M. Ghadessy, pp. 162-178. Pinter, London.
- Halliday, M. A. K. (1994 [1985]) *An Introduction to Functional Grammar*. 2nd ed. Arnold, London.

- Head, H. (1920) *Studies in Neurology*. Frowde, London.
- Huckin, T. N. (1983) A cognitive approach to readability. In *New Essays in Technical and Scientific Communication: Research, Theory, Practice*, eds P. V. Anderson, R. J. Brockmann and C. R. Miller, pp. 90-108. Baywood, New York.
- Iser, W. (1974) *The Implied Reader*. John Hopkins, Baltimore.
- Johnson-Laird, P. N. (1983) *Mental Models: Towards a Cognitive Science of Language, Inference, and Consciousness*. Harvard, Massachusetts.
- Kant, I. (1787) *Critique of Pure Reason*. 2nd ed. J. M. D. Meiklejohn (trans.) (1934). J. M. Dent, London.
- Keefe, D. E. and McDaniel, M. A. (1993) The time course and durability of predictive inferences. *Journal of Memory and Language* **32** (4), 446-463.
- Keenan, J. M., Golding, J. M., Potts, G. R., Jennings, T. M. and Aman, C. J. (1990) Methodological issues in evaluating the occurrence of inferences. In *Inferences and Text Comprehension*, eds A. C. Graesser and G. H. Bower, Vol. 25, pp. 295-312. Academic, San Diego.
- Kintsch, W. (1977) On comprehending stories. In *Cognitive Processes in Comprehension*, eds M. A. Just and P. A. Carpenter, pp. 33-62. Erlbaum, New Jersey.
- Kintsch, W. (1993) Information accretion and reduction in text processing: Inferences. *Discourse Processes* **16** (1-2), 193-202.
- Koktová, E. (1996) Wh-extraction and the topic-focus articulation of the sentence. In *Discourse and Meaning: Papers in Honor of Eva Hajičová*, eds B. H. Partee and P. Sgall, pp. 255-271. Benjamins, Amsterdam.
- Lambrecht, K. (1994) *Information Structure and Sentence Form: Topic, Focus and the Mental Representations of Discourse Referents*. Cambridge University Press, Cambridge.
- Langacker, R. W. (1987) *Foundations of Cognitive Grammar*. Vol. I. SUP, California.
- Leahey, T. H. and Harris, R. J. (1997) *Learning and Cognition*. 4th ed. Prentice-Hall, New Jersey.
- Magliano, J. P., Baggett, W. B., Johnson, B. K. and Graesser, A. C. (1993) The time course of generating causal antecedent and causal consequence inferences. *Discourse Processes* **16** (1-2), 35-53.
- Maida, A. S. (1992) Frames. In *Encyclopedia of Artificial Intelligence*, ed S. C. Shapiro, Vol. 1, 2nd ed, pp. 493-507. John Wiley, New York.

- Martin, J. R. (1995) More than what the message is about: English theme. In *Thematic Development in English Texts*, ed M. Ghadessy, pp. 223-258. Pinter, London.
- Matlin, M. W. (1994) *Cognition*. 3rd ed. Harcourt, Fort Worth.
- Matthiessen, C and Martin, J. R. (1991) A Response to Huddleston's review of Halliday's Introduction to Functional Grammar. *Occasional Papers in Systemic Linguistics* **5**, 5-74.
- McKoon, G. and Ratcliff, R. (1986) Inferences about predictable events. *Journal of Experimental Psychology: Learning, Memory, and Cognition* **12** (1), 82-91.
- McKoon, G. and Ratcliff, R. (1992) Inference during reading. *Psychological Review* **99** (3), 440-466.
- Millis, K. K. and Graesser, A. C. (1994) The time-course of construction knowledge-based inferences for scientific texts. *Journal of Memory and Language* **33** (5), 583-599.
- Millis, K. K., Morgan, D. and Graesser, A. C. (1990) The influence of knowledge-based inferences on the reading time of expository text. In *Inferences and Text Comprehension*, eds A. C. Graesser and G. H. Bower, Vol. 25, pp. 197-212. Academic, San Diego.
- Minsky, M. L. (1975) A framework for representing knowledge. In *The Psychology of Computer Vision*, ed P. H. Winston, pp. 211-277. McGraw-Hill, New York.
- Monaghan, J. (1979) *The Neo-Firthian Tradition and its Contribution to General Linguistics*. Max Niemeyer Verlag, Tübingen.
- Morrow, D. G., Bower, G. H. and Greenspan, S. L. (1990) Situation-based inferences during narrative comprehension. In *Inferences and Text Comprehension*, eds A. C. Graesser and G. H. Bower, Vol. 25, pp. 123-135. Academic, San Diego.
- Murray, J. D., Klin, C. M. and Myers, J. L. (1993) Forward inferences in narrative text. *Journal of Memory and Language* **32** (4), 464-473.
- Nuyts, J. (1992) *Aspects of a Cognitive-Pragmatic Theory of Language: On Cognition, Functionalism and Grammar*. Benjamins, Amsterdam.
- Peregrin, J. (1996) Topic and focus in a formal framework. In *Discourse and Meaning: Papers in Honor of Eva Hajičová*, eds B. H. Partee and P. Sgall, pp. 235-253. Benjamins, Amsterdam.
- Piaget, J. (1955) *The Construction of Reality in the Child*. Routledge, London.
- Posner, M. I. and Keele, S. W. (1968) On the genesis of abstract ideas. *Journal of Experimental Psychology* **77** (3), 353-363.
- Quirk, R., Greenbaum, S., Leech, G. and Svartvik, J. (1972) *A Grammar of Contemporary English*. Longman, Essex.

- Quirk, R. and Greenbaum, S. (1979) *A University Grammar of English*. ELBS ed. ELBS, Essex.
- Reed, S. K. (1970) Decision processes in pattern classification. Technical Report 32, Perceptual Systems Laboratory, UCLA.
- Reed, S. K. (1992) *Cognition: Theory and Applications*. 3rd ed. Brooks/Cole, California.
- Rosch, E. H. (1973) On the internal structure of perceptual and semantic categories. In *Cognitive Development and the Acquisition of Language*, ed T. E. Moore, pp. 111-144. Academic, New York.
- Rumelhart, D. E. (1980) Schemata: The building blocks of cognition. In *Theoretical Issues in Reading Comprehension: Perspectives from Cognitive Psychology, Linguistics, Artificial Intelligence, and Education*, eds R. J. Spiro, B. C. Bruce and W. F. Brewer, pp. 33-58. Erlbaum, New Jersey.
- Rumelhart, D. E. (1984) Understanding understanding. In *Understanding Reading Comprehension: Cognition, Language, and the Structure of Prose*, ed J. Flood, pp. 1-20. IRA, Delaware.
- Schank, R. C. and Abelson, R. P. (1977) *Scripts, Plans, Goals and Understanding: An Inquiry into Human Knowledge Structures*. Erlbaum, New Jersey.
- Seifert, C. M. (1990) Content-based inferences in text. In *Inferences and Text Comprehension*, eds A. C. Graesser and G. H. Bower, Vol. 25, pp. 103-122. Academic, San Diego.
- Sgall, P. (1974) Focus and contextual boundness. In *Topic and Comment, Contextual Boundness and Focus*, ed Ö. Dahl, pp. 25-51. Buske, Hamburg.
- Sgall, P. (1975) On the nature of topic and focus. In *Style and Text: Studies Presented to Nils Erik Enkvist*, ed H. Ringbom, pp. 409-415. Skriptor, Stockholm.
- Sgall, P. and Hajičová, E. (1977) Topic-comment articulation and negation in a functional generative description. *Prague Studies in Mathematical Linguistics* 5, 297-308.
- Shiro, M. (1994) Inferences in discourse comprehension. In *Advances in Written Text Analysis*, ed M. Coulthard, pp. 167-178. Routledge, London.
- Singer, M. (1990) *Psychology of Language: An Introduction to Sentence and Discourse Processes*. Erlbaum, New Jersey.
- Singer, M. (1993) Global inferences of text situations. *Discourse Processes* 16 (1-2), 161-168.
- Sperber, D. and Wilson, D. (1995 [1986]) *Relevance: Communication and Cognition*. 2nd ed. Blackwell, Oxford.

- Swinney, D. A. and Osterhout, L. (1990) Inference generation during auditory language comprehension. In *Inferences and Text Comprehension*, eds A. C. Graesser and G. H. Bower, Vol. 25, pp. 17-33. Academic, San Diego.
- Taylor, J. R. (1995) *Linguistic Categorization*. 2nd ed. Clarendon, Oxford.
- Thompson, G. (1996) *Introducing Functional Grammar*. Arnold, London.
- Vande Kopple, W. J. (1991) Themes, thematic progressions, and some implications for understanding discourse. *Written Communication* 8 (3), 311-347.
- Weil, H. (1844) *De L'ordre des Mots dans les Langues Anciennes Comparées aux Langues Modernes*. C. W. Super (trans.) (1978). Benjamins, Amsterdam.
- Whitney, P. and Waring, D. A. (1991) The role of knowledge in comprehension: A cognitive control perspective. In *Understanding Word and Sentence*, ed G. B. Simpson, pp. 199-216. North-Holland, Amsterdam.
- Wingfield, A. (1993) Sentence processing. In *Psycholinguistics*, eds J. B. Gleason and N. B. Ratner, pp. 199-235. Harcourt, Fort Worth.
- Winograd, T. (1977) A framework for understanding discourse. In *Cognitive Processes in Comprehension*, eds M. A. Just and P. A. Carpenter, pp. 63-88. Erlbaum, New Jersey.
- Yule, G. (1985) *The Study of Language: An Introduction*. Cambridge University Press, Cambridge.