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Context in Dynamic Modelling

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ABSTRACT

This paper explores the nature of dynamic context, particularly in regards to how it is used in dynamic modelling of interaction. The role of context is considered in two parts: how context constrains behaviour potential at each point of a social process; and how the context is changed as the result of behaviour. Various Systemic approaches to each of these questions are compared. The paper then turns towards the major problem of all of these approaches, that of prescriptivism, and points towards some solutions.

1. INTRODUCTION

Traditionally linguistics has regarded context as an object that is fixed over an interaction, what can be called global or static context. However, in recent years, researchers in many fields have become more interested in how context changes *throughout* an interaction, a concern with *dynamic*, rather than static, context. This paper will explore several aspects of dynamic context.

One of the earliest papers to follow this concern was Ruqaiya Hasan's *What's going on: a Dynamic View of Context* (Hasan 1981). This paper explores, in a very thorough way, how certain contexts are open to negotiation by the participants, and thus evolves as a result of the unfolding interaction. I will take her paper as the theoretical base for the present paper. However, while Hasan discusses dynamic context at a *theoretical* level, I will explore how dynamic context can be used in *formal* models of interaction -- how we can incorporate dynamic context into 'grammars' of interaction.

Throughout this paper I will assume we are primarily talking about *interaction*, rather than written text. It is in interaction that dynamic modelling of context becomes most important. Because interaction may involve both verbal and non-verbal action, I will talk of the contextual constraint of *behaviour*, rather than of language. However, keep in mind that written texts can also be modelled in terms of a dynamically evolving context, each sentence changing the reader's perception of what is going on.

Section 2 will introduce dynamic context and dynamic modelling. Section 3 will introduce the first step in dynamic modelling -- the contextual activation of behaviour potential at each point of an interaction. Section 4 will look at the second requirement of a dynamic model -- the modification of context as the result of action. In both these sections, various approaches within Systemics and without will be compared. Section 5 will then discuss one of the major problems for these approaches, that of prescriptivism, and offer some solutions. Section 6 will then conclude the paper.

2. DEFINING DYNAMIC

The term *dynamic* is ambiguous in Systemics in that it plays a part in two dichotomies. Firstly we have *dynamic vs. static context* -- context which is changeable over an interaction, versus context which is fixed over the interaction. The second distinction, introduced in Lemke (1984, first written 1979), involves *dynamic vs. synoptic models* -- models which represent the unfolding of the interaction element by element (process perspective), versus those models which show what kinds of completed interactions we can produce (product perspective).[1] The rest of this section will explore these two distinctions.

2.1 Dynamic vs. Static Context

In a static model of context, the context is assumed fixed over the interaction. This means that the field, tenor and mode are assumed to be constant for the text or interaction as a whole -- the text/interaction reflects a constant register (the patterns of linguistic selection).

However, we can see that register is not fixed over the text as a whole. One way in which it varies is that each element of the generic structure reflects a different purpose, so that the field, tenor and (sometimes) mode may vary between elements (cf. Martin 1992, p505).[2] So, since the register of a text changes throughout a text, then the context must be changing, i.e., dynamic.

Gregory and Malcolm (1981) introduce the notion of delicacy when modelling registerial consistency. In their model, a *phase* is a stretch of discourse exhibiting at least partial registerial consistency, and, as Gregory (1985, p204) points out, the number of phases in a text is a matter of delicacy: how much registerial variation do we require before we mark a change of phase? Their model allows for subtle changes in register throughout a discourse, in contrast to the more drastic registerial shifts predicted by a schematic structure approach.

I myself would take this notion to the extreme, allowing for the situation to change between each speech-act or nonverbal act, i.e., that when we push delicacy to the fullest, the minimal phase is a single speech-act.[3] This angle will be pushed throughout this paper.

Petie Sefton (e.g., Sefton 1995) illustrates the dynamic-static continuum with figure 1. Some parts of context (the mountains) appear relatively stable to the cyclist, while others move by quickly (the fence-posts), and yet others fall in between these extremes.

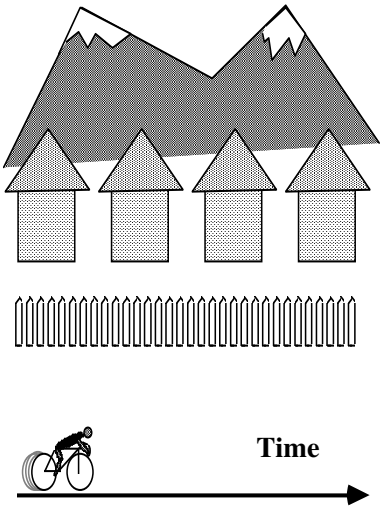

Figure 1 The Dynamic-Static Continuum (from Sefton).

One important implication of this diagram is that as we choose a larger time frame, even the so-called static context can be seen to be changeable. If we cycle for long enough, the mountains do move by. Also for text, nearly all elements of field, tenor and mode are at risk of changing within a text or interaction. An author may start off formally, but gradually move to an informal tenor. Or a conversation may start in spoken mode, but shift to writing.

This is not to say that all of context *does* change through an interaction. More to the point, it is *at risk* of changing. We can only judge context as static in the post-mortem, by looking back at a text/interaction and seeing what held constant. So, in summary, I will take the radical position and say that all context is dynamic, that seemingly global context is an artifact of looking at short intervals of time, and also of post-mortemising.

2.2 Dynamic vs. Synoptic Modelling

The term 'dynamic' is also used in relation to types of models: 'dynamic' models model the interaction as it unfolds, while 'synoptic' models represent the overall shape of an interaction in a single pass. The first attempts to model the process of interaction, while the second attempts to model the products (Martin 1985).

The concern within Systemics for modelling the process of text rather than the product began perhaps with Lemke's (1979/84) paper, although around that time, various other systemicists were exploring the issue (e.g., Berry (1981a, 1981b, 1981c); Gregory & Malcolm (1981); Ventola (1983, 1987); Halliday (1984); Martin (1985)). Others have followed this lead (O'Donnell (1986, 1990); Fawcett *et al.* (1988); Bateman (1989); Eggins (1990); Ravelli (1993, 1995); Matthiessen (1993b); Sefton (1995); etc.). This paper will attempt to generalise over the models provided in these papers, showing how they relate to each other.

	Synoptic	*Dynamic*
The question answered	What types of interaction can we have?	What can we do next?
What is modelled	The shape of the interaction as the result of a single decision process	The choices made at each point of the interaction
The options represented	The options open to the analyst in classifying the interaction structure.	The options open to the participants at each decision point throughout the interaction.
The object of analysis	The linguistic product (text)	The linguistic process

Table 1 Differentiating Synoptic and Dynamic Models

2.3 Synoptic Modelling

To demonstrate this distinction, lets first look at a synoptic model. I will use a modified version of the network proposed by Berry (1981c), for modelling basic exchanges (this model will also be the basis of many of the dynamic models presented later). Berry's original labels were present tense ('initiate exchange', 'select A event', etc.), reflecting her underlying dynamic approach. I have substituted past tense (product) labels for these features, which is more in line with a synoptic account. Figure 2 shows this network.

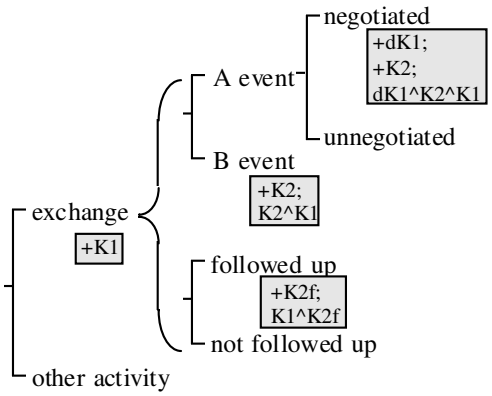

Figure 2 A Synoptic Model of Exchange (from Berry 1981c).

I do not mean to imply here that Berry's exchange work was synoptic, on the contrary, her work was the earliest dynamic work on exchange structure. In her 1981 papers, Berry presents the exchange options open at *each point throughout an exchange*, an approach which is undoubtedly dynamic. However, Martin (1985) picked up only on a particular diagram in Berry 1981c, which had a synoptic interpretation, and this synoptic account has become accepted as the *lingua franca* for exchange work within the Sydney school. Fawcett *et al.* (1988, p122) also focuses only on Berry's synoptic account. A careful reading of Berry's papers shows this synoptic diagram to be a rare exception to her dynamic account.

The network distinguishes between two types of products: exchanges and other activities (which are not modelled). *A-event* and *B-event* (cf. Labov 1972) refer respectively to exchanges initiated by the primary knower (examples 1 and 3 below), and those initiated by the secondary knower (example 2). A *negotiated* exchange is one where the primary knower attempts to elicit the other participant's state of knowledge before providing the information themselves (example 3). Each of these are shown with the

follow-up option selected (where the secondary knower voices their acceptance of the primary knower's completion of the proposition).

1.	*K1*	*T:*	*Elisabeth II is the Queen of Britain.*
	K2f	*S:*	*Oh.*
2.	*K2*	*S:*	*Who is the Queen of Britain?*
	K1	*T:*	*Elisabeth II.*
	K2f	*S:*	*Oh.*
3.	*dK1*	*T:*	*Who is the Queen of Britain?*
	K2	*S:*	*Elisabeth II?*
	K1	*T:*	*Correct.*
	K2f	*S:*	*Oh.*

Realisation rules link system features to their structural realisation. The realisation rules of figure 2 demonstrate two types of structural operators:

(i) *insertion* e.g., +K1 -- the element is required in the structure.

(ii) *concatenation* e.g., K1 ^ K2f -- the elements must appear in the indicated order.

The selection of features [*exchange: A-event: negotiated: followed-up*] from the network produces a structure of the form:

dK1 ^ K2 ^ K1 ^ K2f

There are various problems with synoptic modelling of exchanges (see O'Donnell 1990 for discussion). A major problem is that synoptic approaches generate structures without regard as to who makes the decisions within the process. This does not allow us to see who is primarily responsible for the shape of the interaction. Dynamic models, introduced in the remainder of this section, are better suited for this, since they present the options open to each participant at each point.

2.4 Context of Situation vs. Context of Text

One shift of orientation I make is away from the explanation of the broader selection propensities (e.g., register studies), to the explanation of how each individual choice within a text or interaction is made. Making this shift, our notion of context needs to change, since some of the factors which explain individual choices are not fixed over the text as a whole, but are dynamically changing.

When one attempts to explain why particular interactional choices are made, what has happened before in the discourse becomes important. Within Systemics, this has been termed the *context of text.* In computational linguistics, the term *discourse history* is used. Instances of prior discourse conditioning choice include: *theme* (which entities have already been introduced into the discourse?); *reference* (e.g., has the entity already been introduced?); *nominalisation* (the option to nominalise partially depends on the prior introduction of the fuller form, cf. Halliday 1988; Fuller 1996.

As we move from text to interaction, the term the *context of interaction* is preferred over *context of text.* Issues of what tasks can be done in what order are important here (cf. O'Donnell & Sefton 1995). Once greetings have been exchanged, they should not be exchanged again. The context of interaction also conditions speech-function -- following a question, we are most likely to provide an answer, or deny knowledge. Non-linguistic behaviour may also be conditioned by the interaction history -- after a command, we are likely to perform the requested action.

If we are to describe the factors conditioning our interactional choices as 'context', then we need to modify our notion of context to include the context of interaction/text. I will thus distinguish between the *context of situation* of a text/interaction, and the *context of text* (or context of interaction). The first refers to factors of the interaction outside of the text itself, such as field (the institutional focus of the interaction; general subject matter, etc.), tenor (relations between participants, attitudes etc.) and mode (the medium of communication, level of preparation, etc.). The second refers to what actually occurs in the text/interaction, a record of what is said or done, what has been achieved, what entities have been introduced, etc.

The context of text/interaction is more central in a discussion of dynamics, since by its very nature it changes as the interaction unfolds. For this reason, many of the models presented in this paper focus on discourse history to the exclusion of context of situation. However, keep in mind that it is not only the context of text/interaction which is dynamic, it forms only the 'fence posts' of context. The more

traditional situational variables of field, tenor and mode may be amongst the 'houses' of the model, at risk of change.

2.5 Levels of Dynamic Modelling

As stated above, this paper will be concerned with the role of dynamic context in formal models of interaction. Figure 3 represents schematically several approaches to modelling the relation between context and text/interaction. Figure 3a represents the typical static model of context, where the context is assumed constant for the text as a whole, as typically used in register studies.

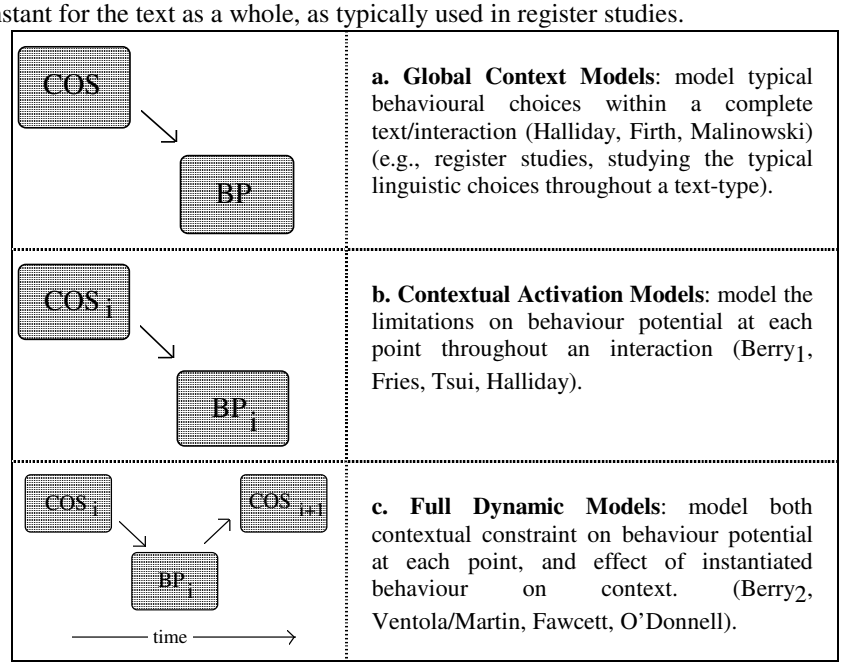

Figure 3 Degrees of Dynamicity in Interaction Models.

A dynamic model is required to model an interaction as it unfolds. To do this, one requirement is that the model must show what options are available to the participants at each point of the interaction. Figure 3b shows schematically this approach. It represents a context at some point of time *i*, which activates a specific behaviour potential at that point. It allows us the notion that we can have a sequence of contexts within an interaction, each activating distinct behaviour potentials.

However, Martin (1985) points out that, to be fully dynamic, a model needs also to show how we move between points of the interaction, or, in other words, how does the context change as the result of the selected action, or events outside of the interaction. Figure 3c adds this element to the schematic, showing that a new context results from the performance of the selected act. The schema is then assumed to be applied recursively, the new context becoming the activator of a new behaviour potential.

In other words, to be fully dynamic, a model needs to show two things:

i) for a given context, what behavioural options are available? (what can happen next?)

ii) how does the context change as a result of the realised action?

Together, these allow us to model an interaction as the dynamic co-evolution of text and context. In the words of Hasan:

> "When the context is co-operatively negotiated, the text and context evolve approximately concurrently, each successive message functioning as an input to the interactants definition of what is being achieved" (Hasan 1981, p118).

...and similarly from Halliday:

> "The social context of any conversation is continually being created and modified, by the course of the conversation itself as well as by other processes that may be taking place; and those involved unconsciously assess its ongoing semiotic potential, using this information not only to interpret the meanings of others but also to project the likely scope and interpretation of their own subsequent acts of meaning." (Halliday, 1984, p8).

For the next few sections, we will assume model 3c. The next section will look at the relationship between context and our behaviour potential (activation). Section 4 will look at the relation between our selected action and the change in context which results from it. One further step in modelling, the removal of prescriptivism, will be discussed in section 5 of this paper.

3. CONTEXTUAL ACTIVATION OF BEHAVIOUR

This section will look at the first requirement for a dynamic model: to represent what we can do next. Various Systemic approaches to this question are examined.

3.1 Single Point Potentials

One major step forward in dynamic modelling was the move away from constituency models of interaction (e.g., what kinds of interactions can we have?) towards representing the behaviour potential available at each point of an interaction (e.g., what can we do now?).

Berry (1981a) presents a dynamic model for the same data as her synoptic model. Part of this model consists of a set of descriptions of the options available at points of the exchange. For instance, at *ai* (a label for the first slot in the exchange), the participant can choose from the network in figure 4. The options for the rest of the exchange are also shown (Berry actually models exchange choices in terms of the three metafunctions, ideational, interpersonal and textual. This figure represents only the textual choices throughout the exchange).

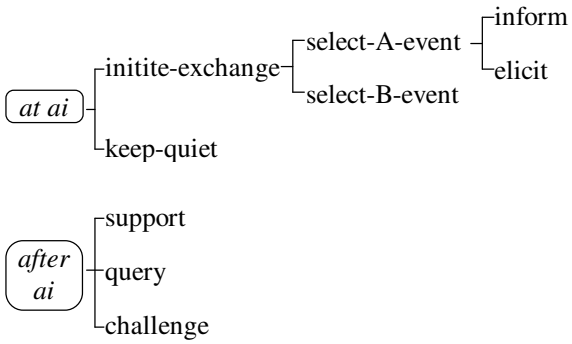

Figure 4 Single Point Potentials (Berry 1981a).

Amie Tsui (Tsui 1989) also uses this method of modelling the exchange in terms of the options available at labelled points within the exchange.

The key point of this work is that of representing behaviour potential as a set of distinct networks, each one representing the potential at a particular point of time. Various other approaches also depend on this single-point potential approach, including flowcharts and transition networks, which will be introduced in section 4.

3.2 Contextual Constraint on a Generalised Potential

One of the major differences between Hallidayan and Firthian linguistics was the movement away from the *polysystemics* of Firth (providing a system for the choice available at each place in structure) towards *monosystemics* (the use of a single network to represent all possible elements at that level of analysis). In the grammar, Firth would provide a system detailing the paradigmatic alternatives for each element of structure, while Halliday provides a grammar network setting out all possible grammatical structures. The actual selection from this general grammatical potential is then restricted by preselection statements, which constrain the choice to only those possible for the environment.

Applying this distinction to behaviour, we can see that single-point potentials follow the polysystemic approach -- describing an interaction in terms of a set of networks, one for place in the interaction structure. Halliday on the other hand pushes for the monosystemic approach, using a generalised behaviour potential, of which sub-potentials are activated by the situation:

> "The semiotic features of the situation activate corresponding portions of the semantic system, in this way determining the register, the configuration of potential meaning that is typically associated with the situation type." (Halliday 1978, p117).

He exemplifies this approach in relation to dialogue in Halliday (1984). He shows how the selection from a network representing social context (figure 5) is realised as activation of semantic options (figure 6).

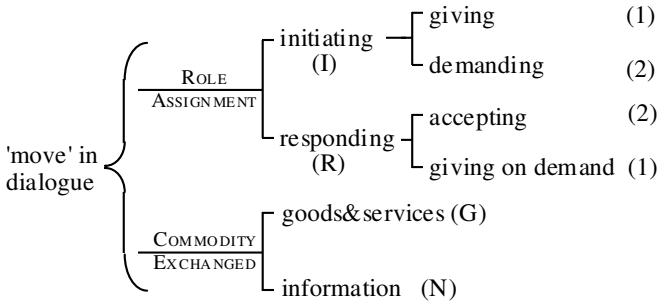

Figure 5 Social Context Network for Dialogue (Halliday 1984).

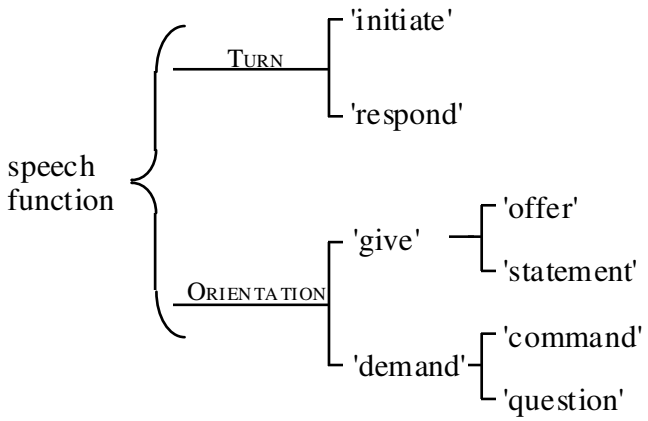

Figure 6 Speech Function (Semantic) Network for Dialogue (Halliday 1984).

To show which speech-functions are appropriate to which social context, he associates configurations of categories of the social context with speech-functional selections. The paper only shows the *congruent* realisations -- the speech-function which is most typical. Other speech-functional selections for a given social context are also possible. Examples of the congruent mappings are:

(I 1 G) 'initiate : offer'
(I 1 N) 'initiate : statement'
(I 2 G) 'initiate : command
(I 2 N) 'initiate : question'

Fries (1983) also makes use of a generalised behaviour potential, this time for bidding in the card game, Bridge. He describes a player's bidding options as a subset of the overall potential, constrained by factors including the previous highest bid, what one's partner has bid, etc.

A more detailed example of contextual constraint on a generalised potential can be found in O'Donnell's exchange work (O'Donnell 1986, 1990, 1991). Here, an explicit representation of the dynamic context is provided in terms of a system network of the *possible states of exchange development* (see figure 7). These contextual states constrain the generalised move potential (figure 8), to produce the potential available for each point of the exchange.

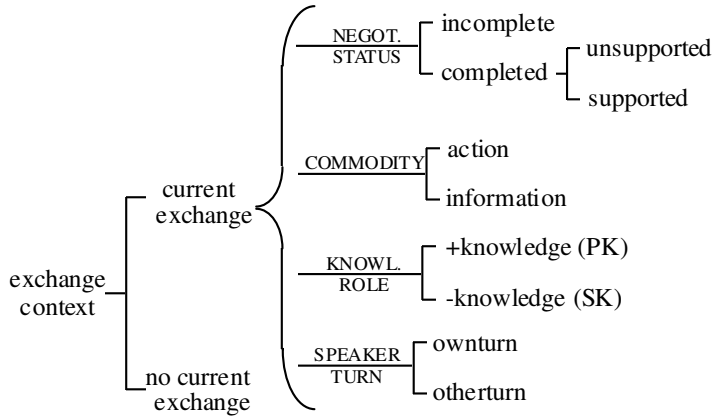

Figure 7 Dynamic Exchange Context (O'Donnell 1991).

This speech-functional model is based on a negotiatory model -- that an exchange is the unit in which a single proposition[4] (or proposition-complex) is negotiated between the participants. The context network represents four sorts of information about an ongoing exchange:

- *Negotiatory Status*: the level of development of the proposition/proposal being negotiated. These states were derived from Berry's ideational slot labels: PB: incomplete; PC: unsupported; PS: supported.
- *Commodity*: the commodity being negotiated, action or information.
- *Knowledge Role*: the role adopted by the participant: being the primary knower in respect to the proposition being negotiated (PK), or the secondary knower (SK). For simplicity, I am ignoring the innapropriacy of the term *knower* when talking about action exchanged here -- *actor* would be more appropriate.
- *Speaker Turn*: whose turn is it to speak in regards to the current exchange. The options are *ownturn* (the turn of the participant making the behavioural decision), or *otherturn* (the other participant). Note that this system does not refer to the turn to talk per se, but only to the turn in regards to the currently negotiated proposition/proposal.

The systems *Knowledge Role* and *Speaker Turn* reflect the individual nature of this contextual network - each participant makes a distinct selection from these systems. Typically, the participants will make the complementary choices for role and turn, though occasionally mix-ups will occur when both participants make the same choice (e.g. both participants choose to be PK).

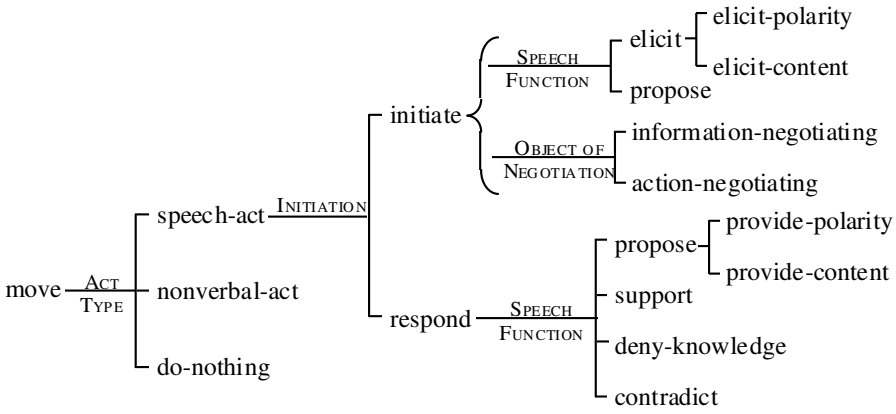

Figure 8 Generalised Move Potential (O'Donnell 1991).

As outlined in O'Donnell (1990), each exchange has its own context, recording whose turn it was to contribute, the level of propositional negotiation reached, what knowledge role each participant has adopted, etc. When we start a new exchange before completing the present one, a new exchange context is initiated. On completion of that exchange, the prior exchange context can be re-entered. For instance, figure 9 shows an application of the model above, in a case involving an embedded query. To ease

identification of exchange contexts, I have provided each context with a unique label (the PROPOSITION element).

Pre-State	*Selection*	*Move*	*Post-State*
no-current-exchange	*initiate* *elicit-polarity* *action-negot.*	*John*: Want to go to the movies?	PROPOSITION: *goto-movies* COMMODITY: *action* NEG-STATUS: *incomplete* TURN: *Pete* KN.ROLES: SK: *John*[5]
<new exchange context>	*initiate* *elicit-content* *info-negot*.	*Pete*: What's on?	PROPOSITION: *whats-on* COMMODITY: *information* NEG-STATUS: *incomplete* TURN: *John* KN.ROLES: SK: *Pete*
PROPOSITION: *whats-on* COMMODITY: *information* NEG-STATUS: *incomplete* TURN: *John* Kn.Roles: SK: *Pete*	*respond* *propose* *provide-content*	*John*: Return of the Jedi.	PROPOSITION: *whats-on* COMMODITY: *information* NEG-STATUS: *unsupported* TURN: *Pete* KN.ROLES: PK: *John* SK: *Pete*
PROPOSITION: *goto-movies* COMMODITY: *action* NEG-STATUS: *incomplete* TURN: *Pete* KN.ROLES: SK: *John*	*respond* *propose* *provide-polarity*	*Pete*: Sure, sounds good. (responding to earlier context)	PROPOSITION: *goto-movies* COMMODITY: *action* NEG-STATUS: *unsupported* TURN: *John* KN.ROLES: PK: *Pete* SK: *John*

Figure 9 Handling Embedded Exchanges

3.3 Methods of Activation

There are various means within Systemics to represent how behavioural options are conditioned by context (cf. Halliday (1973, p62-65); Martin (1984, p64), Plum (1986, p78), Matthiessen (1993a, p242-250). These approaches fall into three classes:

(i) *potential-creating approaches*: initially, all options are 'inactive' or 'dormant', and are 'activated' by the presence of various contextual features.

(ii) *potential-restricting approaches*: initially, all options are 'active', but some are 'deactivated' by the presence of particular contextual features.

(iii) *potential-skewing approaches*: initially, each option is assigned an inherent probability (its 'context-free' probability), which is 'skewed' (made more or less likely) in the presence of various contextual features (Martin 1984, p64).

For my exchange work, I chose a potential-creating approach: contextual states are thus seen as the preconditions for the performance of various behavioural options (see section 5 where I challenge this assumption). Activation can be *probabilistic* (activated options being more or less likely), or *categorical* (options on or off). I use categorical activation, for simplicity, although the probabilistic approach is more realistic.

Approaches differ as to where the context-behaviour constraint is associated: as a realisation of a contextual feature; as a constraint on a behavioural feature; or as a separate resource mapping contextual configurations onto behavioural configurations. In the first approach, contextual features can be provided with a realisation constraining behaviour. Preselection is not quite appropriate here, because it is rare that context forces us to do a particular act. For this reason, O'Donnell (1990) introduced *activation rules*, which activate designated behavioural features. Two instances of these rules are shown in table 2.

Context	*Activated Options*	*Gloss*
no-current-exchange	[initiate, do-nothing]	When no exchange in progress, we can initiate a new one, or do nothing.
unsupported	[support; contradict; do-nothing]	When the other participant has completed the proposition, we can either support it, contradict it, or accept it by tacit silence.

Table 2 Activations of Contextual States (O'Donnell 1990).

The second approach associates the constraint with the behavioural options, rather than with the context. For instance, table 3 shows four behavioural options, and the constraint which must be true for that option to be used. This approach allows for complex constraints on behavioural options, as shown by the constraint on the *deny-knowledge* option, where the constraint is a conjunction of states. Constraints can use any combination of *and, or* or not or contextual states. I moved to this approach in O'Donnell (1991), after seeing its convincing use in Perrault & Allen (1980).

Option	*Condition*	*Gloss*
act	<anytime>	Non-verbal action allowed anytime.
respond	ownturn	respond if negotiation under-way and our turn.
propose	incomplete	Can complete proposition in your turn if not completed yet.
deny-knowledge	(and incomplete -knowledge)	Alternatively, can deny-knowl. if you don't know the answer.

Table 3 Conditions on Move Options (O'Donnell 1991).

The third approach allows complexes of contextual states to be associated with complexes of behavioural ones (moving the context-behaviour association outside of the networks themselves). Halliday's social-context realisations above fall into this approach. John Bateman pushes this approach also, and demonstrates it for mapping between semantics and grammar in Bateman *et al.* (1992).

3.4 Logogenetic Networks

Matthiessen (1993b) extends over the idea of a fixed generalised behaviour potential and explores the notion of a behaviour potential which grows throughout the interaction. One of his applications involves referential potential. He shows how the introduction of each new entity extends the system representing our referential potential. Our semantic potential is to some extent created by the unfolding discourse. It is not simply a matter of activating previously dormant options. This work has interesting implications which need to be explored.

3.5 Summary

This section has introduced two ways in which the options available at each point of an interaction can be presented. We first considered the *single-point potential* approach, whereby the options available at each point are presented as separate networks. We then presented the *generalised behaviour potential* approach, whereby the options available at each point of an interaction are derived via the contextual constraint of a context-free behaviour potential.

The model of context in the single-point potential approach is relatively poor, being represented only in terms of position in the interaction (the named slots of Berry's approach, or the position in the flowchart or transition network). Berry, by allowing three levels of labelling of points of exchange development, improves on this factor somewhat. The generalised potential approach allows a more detailed representation of context, in terms of a system network.

The single-point potential approach works best when each of the potentials is very different from the others. When the interaction allows for states with only minor differences in behaviour potential, a problem can arise involving *the proliferation of single-point potentials*. For instance, take Mitchell's Cyrenacian auction procedure, where attendees at an auction are allowed to inspect the item being sold at any point from the opening of the item's sale, to the completion of the sale. However, let's introduce a variation in that each participant can only inspect the goods once. So, we need to present two potentials at each point of the auction, one allowing the inspection of goods, the other not. The problem is that behavioural options are conditioned by different contextual factors, and while the bulk of contextual factors may stay the same, some others may change.

When modelling real interaction, the number of these independently conditioned behavioural options increases, to such an extent that a huge number of single-point potentials are required. The generalised potential approach does not suffer from this problem, because it allows the context to be represented in terms of a system network, which can represent a number of independently variable contextual systems.

4. THE MODIFICATION OF CONTEXT

Up till now we have only captured how context effects behaviour. We now need to consider how we can represent the effect of behaviour on context -- how we relate selected behavioural options to the change of context which results from their enactment. I will outline here the main approaches which have been used within Systemics.

4.1 Berry's Transformational Model

As stated in the last section, the single-point potential model ascribed to Berry in the last section was only part of her dynamic model of exchange. We need to show here how the single-point potentials are connected together. The mechanism is centered around the selection made in the initial slot of the exchange (the *ai* slot). This move predicts a structure for the exchange, in terms of which of the elements *dK1, K2* and *K1* will occur, and sets their order (see figure 10). Subsequent moves are expected to instantiate these elements. If the participant chooses the support option in each of these slots, the structure will unfold as predicted, with answers following questions, support following statements, etc. Berry calls this the 'polite consensus-collaborative' model.

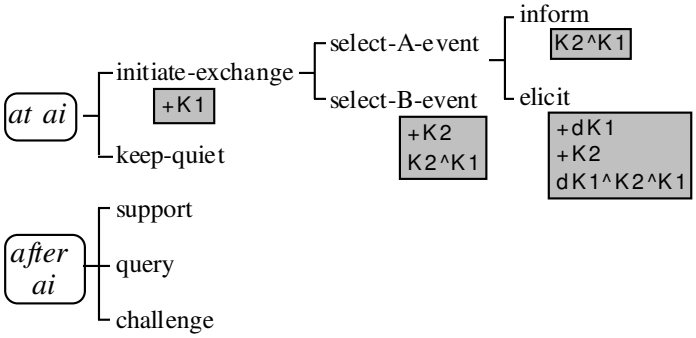

Figure 10 Berry's Dynamic Model

When the participants do not choose *support* in any slot, the socially-expected pattern is broken. The structural prediction made by the first move need to be modified. Berry uses *transformations* to correct the prediction. She outlines (in prose rather than in any formal way) some of the transformations which are needed. For instance, example 4 shows an exchange produced as the result of selecting *query* in the slot where a K2f was predicted. A rule would be needed to replace the K2f element with a K2 ^ K1 sequence.

4.	*dK1*		*Q:*	*in England, which cathedral has the tallest spire?*
	K2		*C:*	*is it Salisbury?*
	K1		*Q:*	*yes.*
	~~*K2f*~~	*K2*	*C:*	*is it?*
		K1	*Q:*	*yes.*

4.2 Transition Networks (Winograd & Flores, Fischer)

While not used within Systemics, transition networks represent one of the best examples of a dynamic model, and have been used for decades for language modelling (e.g., Woods 1970), but only more recently for interaction modelling (e.g., Winograd & Flores 1986; Fischer *et al.* 1994). Winograd describes a transition network as follows:

> "A transition network consists of a set of states, connected by arcs. Each arc represents a transition between two states. ... each transition along an arc corresponds to a single [element] in the sequence. The pattern is used by 'stepping through' the transitions from state to state, following the arrows." (Winograd 1983, p55).

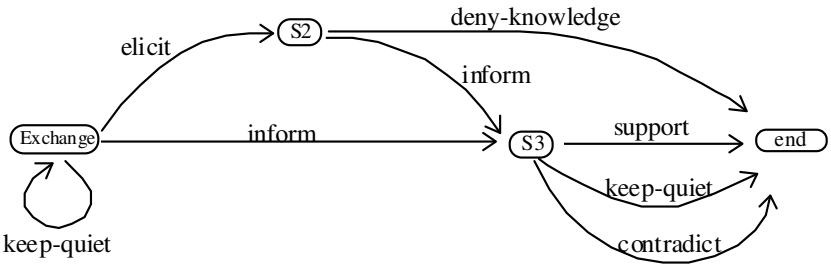

Figure 11 A transition network for exchange.

Figure 11 shows a simple transition network for information-exchange structure. At the start state, the participants have three options, to elicit, inform or keep-quiet. If they choose to keep quiet, then the same options remain available to them. Otherwise they move to a new state, with a further behaviour potential.

The states in the network represent contexts: each one is a distinct level of development within the interaction. The arcs out of a state can be seen as the behaviour potential activated by that context. The selection of an arc causes a transition from one state to another, and consequently, a change in behaviour potential. Selecting 'elicit' causes a transition from state S2 to state S3. In terms of the discussion in the prior session, a transition network is a set of single-point potentials linked together by transition arcs.

Woods (1970, p592) adds a second way of incorporating contextual constraints into the network: each arc of the transition network can carry an arbitrary condition which must be satisfied in order for the arc to be followed. For instance, we could associate a condition on the *inform* arc of the form *+knowledge*, e.g., only a participant who believes they know the information can take that arc.

In effect, this mechanism allows two states which otherwise would have to be treated as separate states (because of the difference in outgoing arcs) to be treated as one state. Thus, two states representing the same situation but different roles can be merged. We are in effect allowing states to represent 'situation types' with arc conditions representing the situation particulars.

Transition networks can be recursive, in that the label on an arc can represent the label on another transition network. This allows for a level of constituency in representation. For instance, we might allow for embedded queries within the exchange structure by allowing for the transition network to call itself.

4.3 Flowcharts (Ventola, Martin)

Ventola also started modelling interaction dynamically, using *flowcharts* to represent the movement throughout the interaction. A flowchart is similar to a transition network, but allows more explicit labelling of the decision process. The flowchart makes use of two components: *diamonds*, representing choices, and *squares*, representing the realisation of a component. Figure 12 represents a re-representation of Berry's model using Ventola's flowchart formalism (Martin 1985 provides a flowchart extending on Berry's basic model).

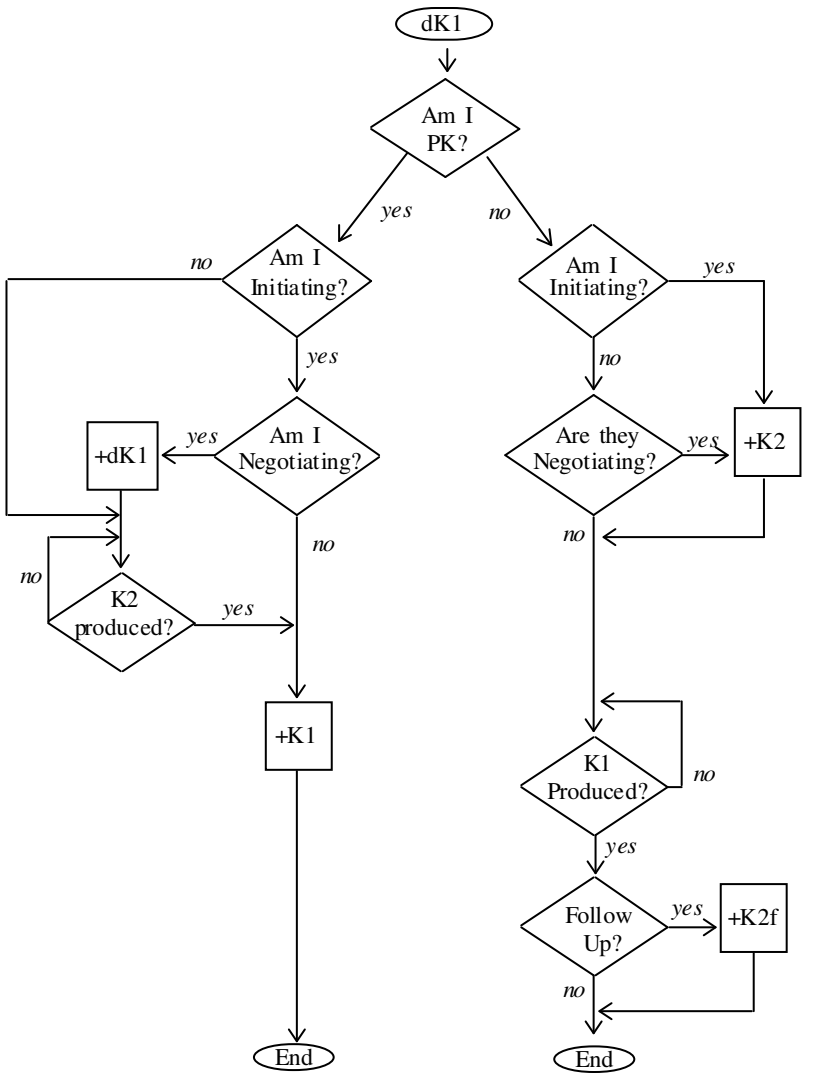

Figure 12 A flowchart model of exchange.

The choices represented in the decision diamonds are of two types: they may represent questions as to the context (e.g., *has K2 been produced yet?*); or they may represent actual behavioural decisions (e.g., *do I want to negotiate?*). This non-distinguishing of contextual and behavioural choices is perhaps, from a Systemic point a view, a lack in this formalism. However, flowcharts improve over transition networks in that any number of decision diamonds can be placed in sequence, representing more complex decisions.

This flowchart attempts to separate each participant's decisions and realisations onto separate sides of the flowchart (after Ventola 1983, 1987). The participant who chooses to be primary knower uses the left-hand side of the network, while the secondary-knower uses the right-hand side. At certain points, the flowchart forces the participant to wait until the other participant realises a move. They are thus reasonably good at representing who is responsible for the overall shape of the interaction.

4.4 Systemic Flowcharts (Fawcett et al.)

Fawcett *et al.* (1988) introduce a formalism which combines the principles of flowcharts into the systemic model, what they call *systemic flowcharts*. Basically, they allow small system networks, representing the choices available at a particular point of an exchange, to be linked together by lines called *flowchart relations*. Figure 13 shows the systemic flowchart (slightly abbreviated) from their paper (p125). I will not discuss the model too deeply here, see their paper for details.

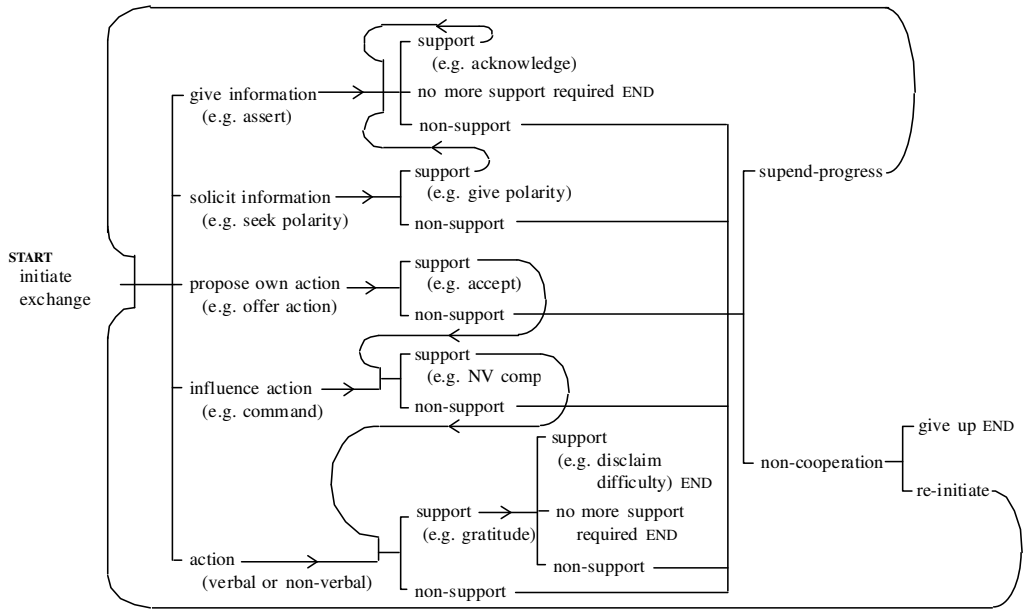

Figure 13 Systemic Flowchart (Fawcett *et al*. 1988).

Some of the lines connecting systems here are marked with an arrow, indicating that they are *flowchart lines*, thus involving a move between speaker turns (points of the exchange). The unmarked lines between systems merely reflect more delicate options, e.g., all *non-support* options lead to a further choice as to the *type* of non-support. In their words: “flowchart lines express the SYNTAGMATIC relationship of SEQUENCE, while system networks express PARADIGMATIC relations of CHOICE” (p123).

The diagram has similar expressive power to the usual flowcharts. For instance, it allows recursion: selecting "suspend progress" (an embedded exchange, such as a clarification), the participant's re-enter the network to generate the embedded exchange. However, this network does not explain how the participant's resume the original exchange after the embedded exchange.

Systemic flowcharts show that an interaction is constructed as the result of decisions by both participants: the flowchart represents a sequence of speaker turns, and each flow-line represents a change of turn. The path through the network is the result of the chain of decisions by both parties. However, the diagram itself does not show clearly who is deciding at each point: the analyst needs to keep track of turn-changes. Ventola's interactive flowchart is better in this regard.

Another problem with this network is that the same option (e.g., *support, non-support),* needs to be offered in several places, even though the selection of at least the *non-support* option always leads to the same further options. This is a case of the problem of proliferation of potentials, mentioned in section 3.

Another problem is that the choices at each point are conditioned only by the choice made at the last point. If we wished to, say, represent an option which is disabled if it has been selected once already somewhere in the prior discourse, then this network would need to offer two alternative paths -- one with the option available, the other with the option not available.

One advantage of this approach over the normal flowcharts is suggested by the authors: "Both the diamond boxes and systems provide choices. The difference is that system networks provide for much more complex sets of choices".

In terms of the types of models set up in section 3, systemic flowcharts use a single-point potential approach. Sets of these potentials are connected together by flowlines. The same is true for both normal flowcharts and transition networks. Below we introduce a dynamic systemic formalism using a generalised behavior potential approach.

4.5 Dynamic-Systemic Approach (O'Donnell)

During the mid-eighties, I started trying to make sense of all these disparate approaches to modelling the dynamics of interaction. I liked Berry's model of exchange, but disliked the transformational

component of the model. The flowcharts of Ventola and Martin improved on this, but had no clear model of context. At the time, I was exploring Halliday's notion of a generalised behaviour potential, and I found it more natural to explore the dynamics of interaction within this model. The Hallidayan model was, however, lacking any means to show how we move from one point of the interaction to the next. The main contribution of my earlier work was to introduce a means to do this.

I introduced a new type of realisation operator, called *context modification*. Each behavioural feature can be associated with the change in context which will result if that option is selected. Note that this is not a preselection operation. Preselection assumes that there is initially no choice made in the preselected object, and the preselection forces a choice for that object. With modification, there is assumed to be an existing selection expression (the set of contextual states before the move is enacted), and the selection is changed as a result of the application of the modification rule. Apart from the designated change, the selection expression is left as it was before. The context can thus be seen as an object which is continuous, with parts been modified over time (a 'phase' perspective). For instance, a "don't know" move will leave the exchange context unchanged except for the change in turn. Some of the context modifications I used for the exchange model introduced in section 3 are shown in table 4.

(i) Role Assignment	**Context Modification**	**Gloss**
initiate: propose	*Speaker*: +knowledge	*Initiating with propose implies the speaker is adopting a PK role.*
elicit	*Speaker*: -knowledge	*Initiating with elicit implies the speaker is adopting a SK role.*[6]
deny-knowledge	*Speaker*: -knowledge	*Answering a question with "I don't know" indicates the speaker adopts an SK role in relation to the proposition.*
(ii) Turn Allocation		
speech-act	*Speaker*: otherturn *Listener*: ownturn	*Speaking changes the turn within the current exchange.*
(iii) Propositional Development		
elicit	incomplete	*Eliciting changes the context to proposition incomplete.*
propose	completed:unsupported	*Proposing changes the context to proposition completed but unsupported.*
support	completed:supported	*Supporting produces a state of proposition completed and supported.*
deny-knowl.	incomplete (no change)	*Denying knowledge leaves the state of propositional negotiation unchanged.*
(v) terminating by silence		
ownturn/do-nothing	no-current-exchange	*One can terminate an exchange by keeping quiet.*

Table 4: Context Modification Rules

This model allows complex modelling of behaviour in context. It is particularly good at handling the phasal availability of options (some options staying activated while other parts of our behaviour potential are switched on and off). This is because context is separated out into different systems, each of which can constrain behaviour independently.

4.6 Summary

We have shown how various formalisms handle the problem of relating the selected action to the change in context which results from that action. In many of these, it is simply a matter of having a flow-line connect together single-point potentials (flowcharts, systemic flowcharts, transition networks). In the final case, we saw a system which models context in more detail: the dynamic context is modelled in terms of a system network, with each possible point of the exchange corresponding to a particular instantiation of this network.

The first four formalisms introduced in this section (Berry's model, flowcharts, systemic flowcharts, and transition networks) are all systems using single point potentials which are connected together in some way. The fifth (dynamic systems) is the only dynamic model based on a generalised behaviour potential approach.

One of the important things for a dynamic model to show is *who makes the decisions* in the formation of an interaction. In a synoptic model, the options are presented in what Peter Sefton calls a *super-subjective* manner, as if by a single decision-maker (an organism composed of the collective participants). A dynamic model allows us to separate out each of the decision points, and show responsibility for those decisions. Some of the dynamic models outlined here take better advantage of this possibility, by explicitly labelling the decision maker at each point (e.g., Ventola's flowcharts).

In terms of useability, flowcharts and transition networks are easier for the eye to follow. However, these get overly complex as we extend our model to handle real-life possibilities. We thus have a trade-off between modelling power and ease-of-use. Linguists on the more applied side tend to resist the formalistic approach, preferring the more iconic models of exchange.[7] However, various people taking a more theoretical approach to exchange modeling have found the dynamic systems approach useful.

In computational linguistics, where power often outweighs ease-of-use as a factor, the system has also proven useful. For instance, within work funded by Telecom Australia (Rowles *et al.* 1993; King *et al.* 1992), a prototype system was developed which allowed humans to speak to a computer in natural language to obtain information about motor vehicle services. The computer used the above model of exchange structure to handle dialogue. A model of task structure (similar to *generic structure*) was based on the same formalism (see O'Donnell & Sefton 1995).

5. REMOVING PRESCRIPTIVISM

Over the last few years, I have become increasingly dissatisfied with the dynamic models presented so far. The dissatisfaction stems from the prescriptive nature of the models -- they limit the interactants to only those actions which are activated for the current context. Cloran points at this problem:

> "Just how free are we to do and say what we like in any given situation? ... Indeed, can an individual say -- or refuse to say -- anything at anytime in any place to anybody?" (1987, p85)

Prescriptivism prevents us from modelling the following types of contextually-inappropriate behaviours:

- *Intentionally Inappropriate behaviours*: an individual can choose to act in ways which are inappropriate to the situation as they perceive it, e.g., asking a bus driver for a pound of sausages[8]; asking a question when no one else is present.
- *Creative behaviours*: performance of an action which is atypical to that context but nethertheless produces a desired end, e.g., stripping off in a restaurant may scare away the clientele, as desired. We need to account for all ‘first time’ solutions.
- *Pretense*: performing actions which are typical of one context in another context where they are not, but the strong contextual association of the actions manage to bring into the minds of the other interactants that other context, e.g., speaking in a court-room register even though sitting in the pub, discussing the relative merits of football players.
- *Negotiating new contexts*: we often act in a way not reflecting the current context, but rather the context we desire -- as a step towards bringing it into being.

In all of these, we have a case of the participant choosing to act in a way not usually associated with the perceived context. To handle such cases, the rest of this section will propose some revisions to our model.

5.1 A First Step

Figure 3c is most appropriate from an analyst's perspective -- the analysis can look at each act in turn, attempt to identify the pre-context of the act (COS_i), and the post-context (COS_{i+1}). However, I am more interested in modelling the interactant's perspective, the view of the interactant as they decide what to do. For a more realistic model, two changes are necessary:

1. *Subjective vs. Objective Context*: The model as presented in figure 3c suggests that the context is objective, undifferentiated for the various interactants. However, as Hasan points out (in response to the question "what is going on?"):

   > "The reality captured by the answer is filtered reality, and the active agent is the interactant -- it is his focus that informs the answer, so, although the answer is rooted in the objective, its point of departure is the subjective one." (Hasan 1981, p106).

   Participants differ in what they bring into an interaction -- they have different experiences and goals, so they may enter the interaction with different perceptions of the situation. And

subsequent to that, they may attach different values to the verbal and non-verbal action, and so evolve their contexts in different directions (although one role of dialogue is to bring these divergences back into line). Having possibly divergent models of context, each participant may thus perceive different actions as appropriate or inappropriate to the current point of time. As a consequence of this, I re-label the activating context of action as the *perceived context*, to indicate that it is a subjective view.

2. *Uncertain Consequences of Action*: When choosing what act to perform, we cannot know absolutely what consequences our act will have. There is only a probabilistic relation between an act and the effect on context we think will ensue. In some cases, we can be relatively sure of the consequences: turning on a light switch will produce light, at least in 99% of the cases, unless the bulb is broken, or the power is off. In other cases, we can be less sure of the results: asking someone to make us a cup of tea may get us a cup, or it may not.

   Because of this, we cannot model the post-act context as a concrete object, rather it needs to be presented as a possible result. For this reason, I have renamed the post-act context as *target context*, the context which the action is expected to achieve, but not the context which is necessarily achieved by the act.

5.2 Functionalism vs. Activation

A second step in avoiding prescriptivism involves replacing the notion of *activation* with *functionality*. It is prescriptive to say that an act is activated only for a particular context. It is more accurate to say that the act is *functional* in that context. By functional I mean that the act *brings about a desired target context*. Taking this view, almost any act can be performed in any context, but the desirability of performing the act is limited to particular contexts.

The "almost any" in the prior sentence is necessary because the performance of some acts is *not* possible in some contexts. We need to distinguish between contextual constraints on the *possibility* of action and contextual constraints on the *effectiveness* of action. For instance, we cannot fire a gun if we do not have one, the possibility is constrained by certain essential pre-conditions. However, given we have a gun, the effect on the context will differ on where we are, e.g., in a crowded restaurant *vs.* on a firing range. In both these contexts, the option to fire a gun is available. However, in the first we may not consider the act *functional*, in that it may lead to the social chastisement of the restaurant patrons, management, and perhaps the police.

In terms of modelling, we need to re-organise the schema presented in figure 3c to something more like figure 14. In terms of writing a 'grammar' of interaction, we can detail, for each act, the change of context which results from the act (what could be turned the *function* of the act). A number of such changes may be provided for each act, because the effect of an act is often contextually dependent (as for the firing of a gun above). We are, in effect, describing each act in terms of the *contextual transformations* it can produce.

So, while an act can be performed in (almost) any setting, it will only be functional if:

- one of the pre-contexts of the act (COS_i, COS_j, etc.) matches the presently perceived context;
- the post-context associated with that pre-context is a desired state.

If none of the contextual transformations of the act meet these criteria, then the act is possible, but not functional. We have thus removed the prescriptive element.

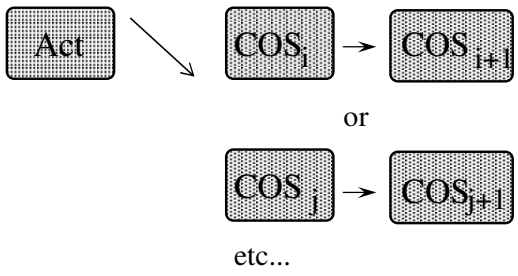

Figure 14 Actions as Contextual Transformers.

Note however that for an act to be functional, it need not change the context. Indeed, many of our acts are intended to reinforce the current context, reiterating our social roles in respect to each other. In such cases, the pre-state of the contextual transformation would be the same as the post-state.

5.3 Projected Context

In the prescriptive model, there is an assumption that the context precedes the action, that context constrains what we can do. However, in some cases, a participant does not act in relation to the perceived context, but rather in relation to some situation which they wants to bring about. For instance, take a situation of two colleagues, between which there is reasonable social distance. If one of them wishes to lessen the social distance he may start to speak and act in ways more associated with the lower distance. He acts in accord to his own desired situation rather than in regards to the tenor which is established and understood by the participants.

Several reactions to this attempt to change the situation are possible. Firstly, the other party could accept it, and shift to the new level of social distance. Alternatively, they could ignore it, and continue to act in accordance to the established view of the relationship. A third choice is to react against it, imposing more social distance as a punishment for over-familiarity (perhaps with the understanding that the original balance can be restored when the over-familiarity ceases). All of these alternatives are strategies in the negotiation of new contexts (see Cloran 1987 for good discussion). They can be expressed in terms of a negotiatory model: offer&acceptance, offer&rejection, offer&counter-offer.

An implicit assumption in the above example is that the participants are not acting in accord to the perceived, established, situation, but rather, using their action to project alternative situations, as part of a strategy of establishing a new situation. Our ability to do this rests within the strong contextual appropriacy of language and action, in that in using behaviour in contexts not normally associated with that behaviour, we can construct, in the mind of the other participants, the alternative situation. In other words, our behaviour *projects* a situation.

In the general case, the situation projected by our behaviour has strong correspondence to the actual situation, we use our language and action to reinforce the situation. However, we can use divergences between projected and actual situation to negotiate new contexts. Figure 15 represents a first attempt at the classification of these strategies. The usual option is to *reinforce-situation*, in which case our projected situation corresponds to the actual situation (or our perceptions of it). If we choose *attempt-to-alter-situation*, we project a situation different from the actual. This could be a *sincere-projection* (where we project the situation we actually want), or an *insincere-projection* (where we project a situation we do not want).

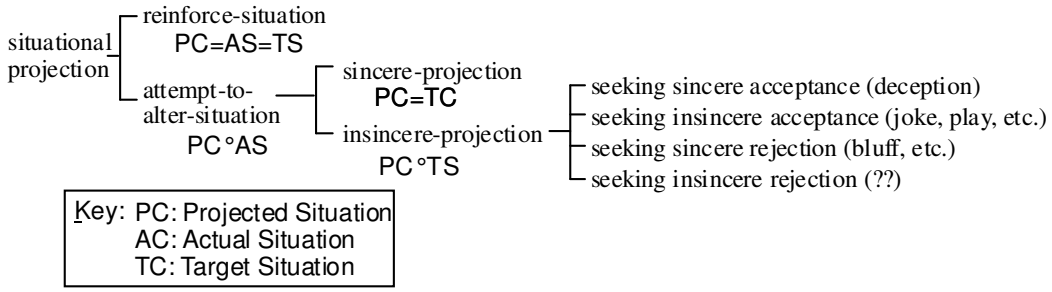

Figure 15 Initial move in context negotiation.

There are several reasons for insincere projection, for example:

- *Deception*: we project a situation which we know not to be actual, with the intention that the other party accepts it as true. For example, if our language or behaviour suggests (either explicitly or implicitly) that we are rich in order to take advantage of the other.
- *Play*: we project a situation which is perhaps fantasy, with the intention of the other joining us in this fantasy world, e.g., talking in a courtroom register even though in a pub, projects a courtroom situation at least partially onto the current situation.

We can categories these reasons in terms of how we want the other to respond -- do we want them to accept the offered projection as real, or do we expect them to reject it? And also, do we expect them to realise that the projection is insincere, or not?

Possible reactions to an offered re-negotiation of context are shown in figure 16. The offer can be accepted (by choosing to project the same situation), or rejected (by not modifying ones actions to conform to the projection). If we choose to reject the projection, we can react weakly (ignoring the projection), or contrarilly (as in the example above, of choosing to project increased social distance in response to a projection of closer social distance). Our response can be sincere (adopting the projection as the new actual situation) or insincere

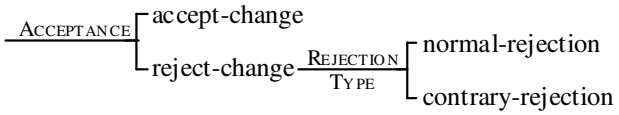

Figure 16 Responses to an attempt to alter the context

This subsection has been pointing out one problem with the prescriptive model, the assumption that we can model the situation that precedes action, and relate the selected action to that context. More realistically, the actor is not constrained to the currently perceived context when choosing how to act. They can choose from the range of situation-types which their society, and personal history, provides them with. While our linguistic potential does include information about the contextual appropriacy of action, this association can be used in either direction, sometimes to work out what acts are appropriate to our current context, but also as a means of negotiating new contexts. It is through the skillful manipulation of behavioural inappropriateness that we work towards the change, rather than the maintenance, of our social context.

6. SUMMARY & CONCLUSIONS

This paper has attempted to explore the nature of context as we move into the dynamic modelling of text/interaction. As we shift from explaining general selectional propensities in text, to the explanation of each behavioural decision, we need to extend our notion of context from the static to the dynamic, context as an object which changes over time. Importantly, we need to represent the context of text/interaction, as well as the context of situation. What has happened before in the discourse conditions our unfolding potential.

The paper has explored dynamic context in terms of the formal modelling of interaction. We have seen that context plays two roles in the model, as the activator of what we can do, and as an object affected by action. Only models which represent both of these action-context interactions can be considered fully dynamic.

Of the various formalisms, most depend on the use of single-point potentials, and a relatively inexplicit representation of context. However, those models which rely on a generalised behaviour potential approach provide a richer representation of context, in terms of a system network of the possible contextual states. This approach also allows better handling of phasally-available options, which may be turned on and off while the rest of the behavior potential may remain constant. However, these models, while theoretically more explicit, may be less useful to the applied linguist, due to their lower iconicity.

Another conclusion I draw is that dynamic models need at least some aspects of context separate from the here and now. The discourse history should encapsulate what has already happened, without actually recording in what order things happened. Some of the systems we have looked at keep no memory of what has happened earlier, they only record where we are *now*. It is important to represent discourse history not just as "what happened last", but also somewhere to store what has already happened, in a time-independent way. Flowcharts allow this in that decision diamonds can voice questions about the past, although this is too powerful, as their is no constraint on the questions asked. Berry's ideational (PC, PB, PS) and interpersonal (K2, K1, etc.) slot labels also represent a time-free representation of the context, representing the level of ideational development independent of the path which was taken to My own dynamic formalism provides the most explicit representation of the discourse history, in terms of the network for the exchange states.

The final conclusion I draw is that dynamic models in the future will have to change out of their prescriptive orientation. All the models discussed in section 3 and 4 prescribe action, while it is clear we need models which allow for participants selecting contextually inappropriate options. Some suggestions towards this end have been provided.

[1]. Note however, that these two uses of 'dynamic' are linked -- a dynamic model of interaction requires dynamic context to work.

[2]. I am adopting Jim Martin's approach here, as opposed to Ruqaiya Hasan's, in that I assume genre determines register, and each element of generic structure may vary in register. See Martin (1992, p 504-5) for discussion.

[3]. Indeed, on one interpretation of Ravelli (1993), who looks at dynamic modelling within the sentence, context could be taken to change even within the speech-act.

[4]. While Halliday distinguishes both *proposition*s (information-negotiating) and *proposals* (action-negotiating), I use the single term *proposition* to describe both. The information/action distinction is captured in the *Commodity* system.

[5]. The model does not automatically assign the addressee of a question the PK role. It is up to them to choose their role in relation to the proposition, by either answering it (adopting PK), or denying knowledge (adopting SK).

[6]. This is a divergence from Berry's model of exchange, which allows primary-knower elicitations. In such cases, I would rather say that the participant, while actually having access to the information, chooses to project a secondary knower role for rhetorical reasons.

[7]. Note for instance, that many people use the synoptic model within Berry (1981a-c), but most ignore her more powerful, but less up-front, dynamic model.

[8]. A colleague has noted that in remoter parts of Scotland, the bus driver *is* the person you would ask when wanting a pound of sausages.

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